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26th ISTE GUJARAT STATE ANNUAL FACULTY CONVENTION 2022 & CONFERENCE

PROCEEDINGS ON
GLOBAL EXIGENCIES FOR SMART & SUSTAINABLE TECHNOLOGIES (GESST)

APRIL 27, 2023



Editors:
Prof.(Dr.) Ishbir Singh
Dr. Payal Mehta
Dr. Ankit Sodha

JOINTLY ORGANIZED BY

INDIAN SOCIETY FOR TECHNICAL EDUCATION (ISTE) - GUJARAT SECTION
AND
INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING (IITE)
INDUS UNIVERSITY, AHMEDABAD

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Proceedings

on

"Global Exigencies for Smart & Sustainable Technologies" (GESST)

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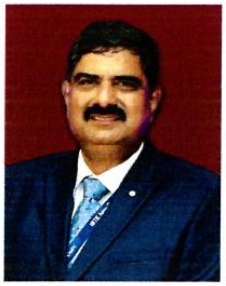
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Prof. (Dr.) Ishbir Singh
Dr. Payal Mehta
Dr. Ankit Sodha

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INDIAN SOCIETY FOR TECHNICAL EDUCATION
(Under the Societies' Registration Act XXI of 1860)



Dr. Pratapsinh K. Desai
President, ISTE

MESSAGE

It is my pleasure that the 26th ISTE Gujarat State Annual Faculty Convention and Conference on **"Global Exigencies for Smart & Sustainable Technologies"** is organizing in Indus Institute of Technology & Engineering, Indus University, Ahmedabad on April 27, 2023. I am sure that this conference will provide an opportunity to exchange ideas and knowledge, learn from each other's experiences, and work towards a shared vision of a better future.

As we witness the rapid advancements in technology, it is imperative that we prioritise sustainable development and implement innovative solutions to address global challenges such as climate change, energy conservation, and environmental protection.

The Indian Society for Technical Education is committed to promoting excellence in technical education and fostering innovation in various fields. We believe that this conference will provide a platform for all participants to collaborate and discuss the latest developments in smart and sustainable technologies.

I am confident that this conference will be a grand success, and I look forward to the stimulating discussions and outcomes that will emerge from this event.

(Dr. Pratapsinh K. Desai)

SHAHEED JEET SINGH MARG, NEAR KATWARIA SARAI, NEW DELHI-110 016
Phones : 91-11-26513542, 26963431, **Fax :** 91-11-26852421, **E-mail :** istedhq@vsnl.net, **Website :** isteonline.in

भारतीय तकनीकी शिक्षा संस्था
INDIAN SOCIETY FOR TECHNICAL EDUCATION
(Under the Societies' Registration Act XXI of 1860)

DR. SACHIN P. PARIKH
Chairman
+91 9925611525
istegujchair@gmail.com

DR. BHASKER V. BHATT
Hon. Secretary cum Treasurer
+91 9825835364
istegujsecretary@gmail.com

www.istegujarat.in

ISTE GUJARAT SECTION

It gives me immense pleasure to welcome you all to the 26th ISTE Gujarat Annual Faculty Convention and Conference on "Global Exigencies for Smart & Sustainable Technologies". We all know that technology has transformed our lives in numerous ways, and it has the potential to make a positive impact on our environment and society. This conference provides an excellent opportunity for experts, researchers, and industry professionals to come together and discuss how we can leverage technology to address the challenges facing our world today.

I urge all participants to engage actively in the discussions, workshops, and networking sessions. Your contributions and insights are crucial to identifying effective solutions that can help create a more sustainable future for our planet.

I also want to congratulate the participants for their commitment to finding innovative and sustainable solutions that can help shape the future of our world. I wish you all a productive and inspiring experience at the conference.



Sd/-
Dr Sachin P. Parikh
Jt. Director Directorate of Technical Education
Govt. of Gujarat
Chairman, ISTE Gujarat Section

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INDIAN SOCIETY FOR TECHNICAL EDUCATION
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DR. SACHIN P. PARIKH
Chairman
+91 9925611525
istegujchair@gmail.com

DR. BHASKER V. BHATT
Hon. Secretary cum Treasurer
+91 9825835364
istegujsecretary@gmail.com

www.istegujarat.in

ISTE GUJARAT SECTION

It must be an interesting through a mammoth task to handle envisaging, planning, delegating responsibilities and accomplishing the enormous quantum of tasks related to the 26th ISTE Gujarat State Annual Faculty Convention & Conference, for the Indus University sharing responsibilities to host the event. At the outset, compliments to the team at Indus University for hosting the convention and conference, with a documentation in the form of a proceeding. On behalf of the entire ISTE Gujarat Section Management Committee team, the undersigned is expressing sincere and a deep sense of gratitude with appreciation for the way efforts were made, and time limits were followed with utmost earnestness. It would be an honor for the undersigned to take note and place on ISTE Gujarat Section record about lead taken by Dr Ishbir Singh, Director with support from the Management of the institute and subordinating officers to make it happen.

The research paper invitations, receipts, reviewing, plagiarism check and ensuring quality under specific themes needs a coordinated effort with authors, reviewers, editors, and formatting-publication team. The unified flawless attempt by the Indus University is well noted and shall be remembered over long to cherish. It might be unfortunate for some authors that their papers were rejected on the grounds of various reasons. However, the quality standard would be attempted to stand against all odds encountered. Some papers seem to be unique and classic and could add value in future impact globally. The Conference Proceedings with compilation of papers will be among a great gesture of GIVING BACK to society as outcome of the event, serving the very purpose of a convention and conference.



Dr Bhasker V. Bhatt
Hon. Secretary cum Treasurer
ISTE Gujarat
Date: 18-04-2023
Place: Surat, Gujarat, India

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Dr. Nagesh Bhandari
Associate President

Message from Presidential Secretariat, Indus University



Dr. Nagesh Bhandari
Presidential Secretariat, Indus University
www.indusuni.ac.in

It gives me great pleasure to extend my warmest welcome to you all for 26th ISTE Faculty Convention and Conference on "Global Exigencies for Smart & Sustainable Technologies". This conference brings together leading experts, academicians, research scholars and professionals from various fields to discuss the latest trends, innovations and best practices in smart and sustainable technologies.

As we face an increasing need to develop sustainable solutions to global challenges, such as climate change, energy conservation and environmental protection, this conference provides a unique opportunity to share knowledge and expertise and to work towards a common goal of building a better future for all.

At INDUS University, we are committed to promoting excellence in education and fostering innovation in various fields. This conference aligns with our values & mission and we are proud to be hosting this event which aims to bring together thought leaders and practitioners to explore solutions for a sustainable future.

I would like to express sincere appreciation to the event organizers, speakers and participants for their valuable contributions to this conference. I look forward to the insightful discussions and outcomes that will emerge from this event.

Bhandari

Dr. Nagesh Bhandari
Presidential Secretariat, Indus University

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Dr. Ritu Bhandari
President

Message from Presidential Secretariat, Indus University



Dr. Ritu Bhandari
Presidential Secretariat, Indus University
www.indusuni.ac.in

It is our pleasure to extend a warm welcome to all of you for the 26th ISTE Faculty Convention and Conference on "Global Exigencies for Smart & Sustainable Technologies". As the Presidential Secretariat of INDUS University, we are thrilled to be a part of this significant event that will explore the latest trends, innovations and best practices in the field of smart and sustainable technologies.

At INDUS University, our dedication is focused on advancing the standards of education and cultivating creativity across multiple disciplines. This conference provides an excellent opportunity for experts, researchers and practitioners to come together and share their knowledge, experiences and best practices.

I believe that this conference will provide a valuable platform for all participants to collaborate and learn from each other's experiences, ultimately leading to the development of innovative and sustainable technologies.

I would like to extend my sincere appreciation to the event organizers, speakers, presenters and attendees for their invaluable inputs towards this conference.

Ritu Bhandari

Dr. Ritu Bhandari
Presidential Secretariat, Indus University

Indus University
Rancharda, Via Shilaj, Ahmedabad – 382 115. Gujarat, India.
+91 2764 350999 | +91 90999 44241
info@indusuni.ac.in | www.indusuni.ac.in
https://www.indusuni.ac.in/g20-c20.php

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Message from Executive President, Indus University



Prof. (Dr.) Sandeep Chakravorty
Executive President, Indus University
www.indusuni.ac.in

On behalf of Indus University, Ahmedabad, I extend my warmest greetings to all to the 26th ISTE Faculty Convention and Conference on "Global Exigencies for Smart & Sustainable Technologies" jointly organized by Indus University & Indian Society for Technical Education (ISTE) – Gujarat Section.

This conference provides a unique platform for researchers, academicians and industry experts to come together and share their knowledge, research findings, and insights on the latest trends and innovations in smart and sustainable technologies. With the focus on the theme "Global Exigencies for Smart & Sustainable Technologies" (GESST), it aims to encourage discussions and debates on how to address the challenges of sustainable development using emerging technologies.

I believe that the world is on the brink of unprecedented technological advancements, which hold tremendous potential for addressing global challenges such as climate change, waste management, and intelligent transport systems. This conference aims to bring together the best minds from academia, industry and government to brainstorm innovative ideas and solutions for these challenges.

I hope this conference inspires you to engage in productive discussions, exchange innovative ideas and develop new collaborations that contribute to advancing the field of smart and sustainable technologies.

Prof. (Dr.) Sandeep Chakravorty
Executive President, Indus University

Indus University
Rancharda, Via Shilaj, Ahmedabad - 382 115. Gujarat, India.
+91 2764 350999 | +91 90999 44241
info@indusuni.ac.in | www.indusuni.ac.in
www.indusuni.ac.in/g20-c20.php

OFFICIAL HOST



Professor Vedvyas J. Dwivedi

Executive Vice-President

Professor, Electronics and Communication Engineering

Feeling imbued into immense pleasure to welcome the aspirants and team on 26th STE-Convention and Conference on theme of "Global Exigencies for Smart & Sustainable Technologies" at IITE, IU. The technological innovations have the potential to revolutionize the way we think, live and work address the pressing challenges.

Producing smart technologies and gadgets for smart generations is the very 1st phase while serving smart is the dream-requirements of the 21st century. Serving smart needs the present generations to be extraordinarily smart and skilled. Only technical skills won't suffice the total-needs. Enhancing the soft skills equally pour the growth to become sustainable for long run down the line in the digital-era.

Integrating the multi-disciplinary and cross-disciplinary values in quality education towards excelling the societal development is the productive characteristic of HEIs and its stakeholders. Calibration and adaptation of the modular changes in this dynamic world are very much expected while rigidity in profession dislikes to come out of the comfort zone. This duality is required to be addressed through such conventions and conferences.

Active participation and regular practice on the updates and required updates becoming smart and sustainable before getting advanced technology get implemented for the common human society…

Best wishes for healthy and enjoying life-long-learning,

Vedvyas Jayprakashnarayanji Dwivedi

Indus University
Rancharda, Via Shilaj, Ahmedabad – 382 115. Gujarat, India.
+91 2764 350999 | +91 90999 44241
info@indusuni.ac.in | www.indusuni.ac.in
https://www.indusuni.ac.in/g20-c20.php

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Indus University Campus, Rancharda, Via Thaltej-Shilaj, Ahmedabad-382115, Gujarat, India
M : 02764-260287, +91-9909154088 E-mail : ame@wiia.org, admission@wiia.org Website : www.wiia.org

Message from Dean, Aviation & Director, Western India Institute of Aeronautics, Ahmedabad



Ms. Radhika Bhandari
Director, WIIA | Dean Aviation, IATE, Indus University

It is my pleasure to be a part of this 26th ISTE Gujarat State Annual Faculty Convention and conference on "Global Exigencies for Smart & Sustainable Technologies" (GESST).I would like to extend my welcome to all the participants who have come from different parts of the world to discuss the global challenges of sustainability and explore the latest trends and technologies in this field.

As we all know, the world is facing unprecedented challenges, and we need to adopt sustainable technologies to address them. The conference theme is very relevant, and I am confident that it will provide an excellent opportunity to exchange ideas and experiences on the best practices and strategies for creating sustainable technologies.

I encourage all participants to engage in the discussions and network with fellow participants to make the most of this opportunity. Your contributions are valuable and I am sure they will help to shape the future of sustainable technologies.

I also congratulate the participants for their commitment to create a better world through smart and sustainable technologies. I wish you all a productive and enjoyable experience at 26th ISTE Gujarat State Annual Faculty Convention and conference on "Global Exigencies for Smart & Sustainable Technologies" (GESST)

Ms. Radhika Bhandari
Director, WIIA | Dean Aviation, IATE, Indus University

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Message from Registrar, Indus University



Dr. R.K.Singh
Registrar, Indus University
www.indusuni.ac.in

I am delighted to welcome you all to the 26th ISTE Faculty Convention and Conference on "**Global Exigencies for Smart & Sustainable Technologies**". As the Registrar of the university, we are honoured to be a part of this event that focuses on the latest trends, innovations, and best practices in the field of sustainable technologies.

As we all know, the world is rapidly evolving and we need to adapt to the changes that are happening around us. One of the significant challenges we face today is the need to protect our environment and promote sustainable practices.

INDUS University is committed to promoting innovation and excellence in education and research. We believe that this conference will help to foster collaboration and inspire innovation that can contribute to green evolution. We hope that the knowledge and experiences shared during this conference will encourage participants to develop and implement sustainable technologies that benefit society and the environment. Your expertise and insights are critical to the success of this event, and we appreciate your participation and support.

I look forward to the exciting discussions and outcomes that will emerge from this event. Thank you once again for your participation and I wish you a productive and enjoyable conference.

Dr. R. K. Singh
Registrar,Indus University

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Message from Director- IITE, Indus University & Chairman - 26th ISTE Faculty Convention 2022 & Conference



Prof. (Dr.) Ishbir Singh
Director- IITE, Indus University &
Chairman - 26th ISTE Faculty Convention 2022 & Conference

On behalf of the chairs, we would like to extend a warm welcome to all of you to the 26th ISTE Faculty Convention and Conference on "Global Exigencies for Smart & Sustainable Technologies". The conference provides an excellent opportunity for us to come together and discuss the challenges and opportunities associated with smart and sustainable technologies. As we all know, the world is facing many challenges, and it is crucial that we find innovative solutions to address them.

We at Indus University, encourage all participants to actively engage in the discussions, workshops, and networking sessions. Your contributions will be invaluable in helping us to identify the best practices and strategies for creating a sustainable future. We would like to express our sincere gratitude to the organizing team for their hard work and dedication in making this event possible. We wish you all a productive and enjoyable experience.

I express my sincere thanks to Dr. Pratap K. Desai (National President, ISTE, New Delhi), Dr. Sachin Parikh (Chairman, ISTE Gujarat Section) and Dr. Bhaskar Bhatt (Hon. Secretary cum Treasurer, ISTE Gujarat Section) for showing their faith in us and giving us an opportunity of hosting 26th ISTE Faculty Convention & Conference .

I express my profound gratitude to Dr. Nagesh Bhandari & Dr. Ritu Bhandari (Presidential Secretariat, Indus University), Dr.Sandeep Chakravorty (Executive President, Indus University), Dr. Vedvyas Dwivedi (Executive Vice President, Indus University) and Dr. R.K. Singh (Registrar, Indus University) for their constant support and encouragement throughout the event.

Prof. (Dr.) Ishbir Singh
Director- IITE, Indus University & Chairman- 26th ISTE Faculty Convention 2022 & Conference

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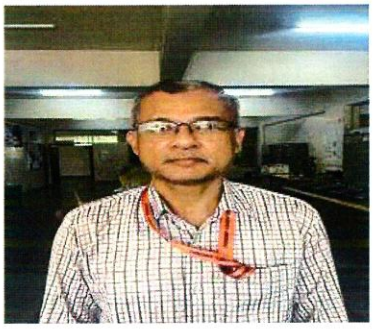
Rancharda, Via. Thaltej, Ahmedabad 382 115 Gujarat INDIA
T: +91 2764 260277 / 78 / 79 M: +91 9099944241 / 42

info@indusuni.ac.in
indusuni.ac.in

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Message from Office of Dean Research



Dr. Sujoy Chaudhury
Dean Research, Indus University

It is my pleasure to be a part of this 26th ISTE Gujarat State Annual Faculty Convention and conference on "Global Exigencies for Smart & Sustainable Technologies" (GESST). I would like to congratulate the organisers, sponsors, and supporters for their efforts in bringing together experts, researchers and industry professionals from all the emerging areas to discuss the challenges and opportunities associated with smart and sustainable technologies.

We are facing a critical moment in our history where our actions today will have a profound impact on the future. As we move towards a more sustainable future, it is essential to embrace innovative solutions and technologies that can help us mitigate the effects of climate change, reduce environmental degradation, and promote social equity.

This convention & conference provides an excellent platform for sharing knowledge, ideas and best practices related to smart and sustainable technologies. I am confident that your contributions will be invaluable in identifying the best practices and strategies for creating sustainable technologies that can positively impact our planet and society. I wish you all a fruitful and enjoyable experience at 26th ISTE Gujarat State Annual Faculty Convention and conference on "Global Exigencies for Smart & Sustainable Technologies" (GESST).

Sujoy Krishna Chaudhury

Dr. Sujoy Chaudhury
Dean Research, Indus University
25/4/23

Rancharda, Via. Thaltej, Ahmedabad 382 115 Gujarat INDIA
T : +91 2764 260277 / 78 / 79 M : +91 90999 44241 / 42

info@indusuni.ac.in
indusuni.ac.in

Preface

In an era marked by unprecedented global challenges such as climate change, resource depletion, population growth, and rapid urbanization, the need for innovative solutions that promote sustainability and enhance the well-being of our planet has never been greater. It is within this context that we have organized this conference, aiming to foster collaboration, exchange knowledge, and inspire transformative action.

The conference provides a platform for participants to delve into a wide array of topics spanning various disciplines and domains, all with the overarching objective of exploring smart and sustainable technologies as drivers of positive change. We believe that by harnessing the power of technology, we can address environmental, social, and economic issues and build a more resilient and inclusive future.

Throughout this proceeding, you will find a collection of research papers, case studies, and thought-provoking insights from leading experts in the field. These contributions cover a diverse range of themes, including Artificial Intelligence and Machine Learning, Internet of Things (IoT) Solutions, Sustainable Energy, Robotics and 3D Printing applications, Architecture and Urban Planning, Sustainable Habitat, Climate Change, Waste Treatment and Management Nanotechnology, Intelligent transport system and many others.

The collective knowledge presented in this proceeding offers valuable insights into the latest advancements, emerging trends, and best practices in the realm of smart and sustainable technologies. It serves as a comprehensive resource for academia, industry professionals, policymakers, and all those committed to transforming our world into a more sustainable and equitable place.

The aim of this conference proceedings is to inspire fruitful discussions, ignite innovative ideas and instigate meaningful collaborations that drive the global transition towards smart and sustainable technologies. Together, let us work towards a world where technology and sustainability intersect creating a harmonious balance between progress and the well-being of both people and the planet.

Acknowledgments

We wish to express our sincere gratitude to Dr. Pratapsinh K. Desai National President ISTE - New Delhi for addressing the conference through his insightful knowledge and unceasing ideas in the field of Smart & Sustainable Technologies. We extend our heartfelt thanks to Dr. Sachin Parikh, Chairman, ISTE Gujarat Section for sharing the profound experience and expertise on the theme of conference. We would like to thank Dr. Bhasker V. Bhatt, Secretary and Treasurer of the ISTE Gujarat Section, for his unwavering assistance in organising the conference from its beginning to its successful conclusion. We extend special thanks to ISTE - Gujarat State for showing faith & trust in hosting a one day conference on "Global Exigencies for Smart & Sustainable Technologies" (GESST).

We sincerely thank Dr. Nagesh Bhandari and Dr. Ritu Bhandari, Presidential Secretariat of Indus University for their continuous support and motivation throughout the journey to make the conference a grand success. We are thankful to Prof. (Dr.) Sandeep Chakravorty; Executive President of Indus University, Prof. (Dr.) Vedvyas J. Dwivedi; Executive Vice President of Indus University, Dr. R.K. Singh, Registrar, Indus University, Dr. Sujoy Chaudhury, Dean Research of Indus University for their valuable inputs and suggestions for organising the conference. We express our sincere gratitude to the Director, Indus Institute of Technology & Engineering, Indus University & Chairman-26th ISTE Gujarat State Annual Faculty Convention 2022 & Conference Chair, Prof. (Dr.) Ishbir Singh for his constant co-operation at every stage of the conference.

We extend our thanks to ISTE Institutional Member Colleges & ISTE life members for their active participation. We are grateful to all the research paper reviewers and session chairs of the conference for their insightful advice and recommendations on the presented research work. We express our gratitude toward the Head of Departments, faculty colleagues and staff members of Indus University for their constant support for organising the conference.

- Organizing Committee

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Indus University

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Indus University

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IITE, Indus University

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Assistant Professor
Department of Civil Engg.
IITE, Indus University

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Assistant Professor
Department of Civil Engg.
IITE, Indus University

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Estimation of Reliability Factor for Public Transportation Bus System

Rena N. Shukla
Ph.D. Scholar –Civil Engineering,
Gujarat Technological University,
Ahmedabad, India
renashukla@ldce.ac.in

Dr.L.B.Zala
Professor- Civil Engineering,
BVM Engineering College,
V.V.Nagar, India
lbzala@yahoo.co.in

***Abstract*— Reliability factor (RF) is denoted by 'K' in literature. It is assumed in study and taken as 2 minutes for buses as per Transport for London (TfL).**[1]**The methodology which was originally developed by the London Borough of Hammersmith and Fulham and later adopted by TfL has been adapted for many cities in India. Accessibility to the Public Transport (PT) system is the key to improving the level of service in bus lines with rising demand. To improve accessibility, it is important to be able to measure it as accurately as possible. The public transport system is used less in the urban areas for work and education like regular activities for trip making. Mass Transit System ridership in most Indian cities continues to lag behind projected numbers. Bus transit system without tracking system is poor in maintaining schedule and information for users. The traffic congestion is unexpected at an instance and the bus is delayed by the scheduled time. Waiting time for passengers is unexpected. There is less or no reliability of buses at Service Access Point (SAP). Total travel time for the trip is including walk time from the origin, journey time in PT Bus, waiting time for PT Bus and walk time from the bus stop to destination. Journey time in PT Bus also includes the duration of stops at the number of SAPs. Scheduled Waiting Time (SWT) is as per the frequency of the bus. To derive Average Waiting Time (AWT) by SWT based on frequency is true in ideal conditions. In mixed traffic conditions on urban streets, PT buses are delayed due to congestion, collision, accident and some unavoidable natural and manmade causes. There is a difference between AWT and SWT.AWT is computed from SWT in literature but it is required to derive by the survey. If there is less reliability, there is improper value substitution in AWT calculation. This ultimately leads to improper computation of Accessibility Index (AI). This paper focuses on the estimation of RF, denoted by K for the Bus transit system in the study area.**

Keywords*— *accessibility, public transport, reliability factor, service access point, waiting time

I. INTRODUCTION

Accessibility is the suitability of the Public Transport network to get individuals from their system entry point to their system exit location in a reasonable amount of time. There are five components as indicators of accessibility.

- Accessibility to stops/stations
- Accessibility to vehicles
- Accessibility to the service (operation time)
- Fare and ticketing system
- User information

The maximum walk times for bus are 8 minutes. Any SAPs beyond these distances are not taken into account to calculate K. walking speed of passenger is affected by number of factors such as age, gender, with/without luggage, with/without children, purpose of trip, time available etc. Preferable walk distance from residence or any location (office, school, college, university, industry) is 500 m.

The objective of the study is to estimate Reliability factor K for West Zone, Ahmedabad. Future scope of this method of estimation of Reliability factor K is to compute accessibility index for Ahmedabad

II. STUDY AREA

Ahmedabad has a key geographical location in Gujarat and is well connected with other major cities of the state as well as the country with road, rail and air. Ahmedabad is the fastest growing city in India. It is the Seventh largest metropolitan area of India. It has a strategic location on road and railway map of India.[2]

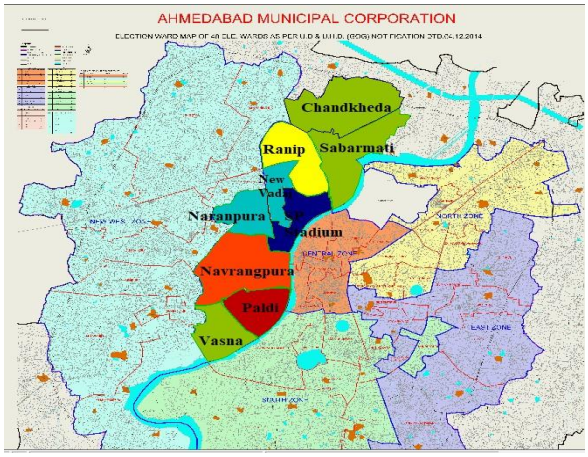


Fig. 1. Study area

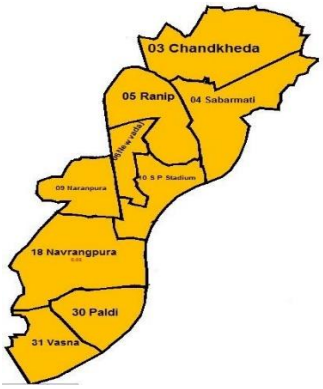


Fig. 2. Study area west zone, Ahmedabad

Ahmedabad has two major public transport systems: the Ahmedabad Municipal Transport Service (AMTS), a bus service running in mixed traffic, and the Bus Rapid Transit System (BRTS), operated by Ahmedabad Janmarg Ltd (AJL), which runs on dedicated corridors (except at junctions and at narrow links). The mass transit metro rail system, for the cities of Ahmedabad and Gandhinagar the Metro link Express Gandhinagar Ahmedabad (MEGA)is under construction since March 2015.AMTS has no tracking system such as BRTS. In this paper bus transit AMTS is taken, not BRTS. Reliability factor for AMTS PT bus transit is focused.

Point of Interest (POI) is defined as a point for which the accessibility level is to be measured concerning a SAP. SAP is a public transport stop such as a bus stop and a metro station. POI is workplaces, households or residents.

Election wards of West Zone of Ahmedabad city have been considered as a study area. Total area of 9 different wards namely Paldi, Vasna, Navrangpura, S.P. Stadium, Naranpura, Nava Vadaj, Sabarmati, Ranip and Chandkheda 65.68 km^2 and Total population is 7,87,753 as per census 2011.The survey for public transport system exists in Ahmedabad, Ahmedabad Municipal Transport Service (AMTS)is included to estimate Reliability K. The AMTS has maximum coverage in all the zones of the city. On an average 410 m distance,there is one AMTS bus stop in Ahmedabad. There are 131 AMTS Bus stops within all 9 Wards of West Zone of Ahmedabad city.

III. Data Collection

The survey for public transport system exists in Ahmedabad, Ahmedabad Municipal Transport Service (AMTS) is included to estimate Reliability factor K. The AMTS has maximum coverage in all the zones of the city. On average at a 410 m distance,there is one AMTS bus stop in Ahmedabad. For instance, where there is a stop on either side of the road for each service direction there would be one SAP service access point considered for K calculation. Stops having more important routes and more congested with passengers are considered for an interview for data collection. Each AMTS Bus stops have the number of different route services in each ward. The different routes have been identified from data given by AMTS office. Data was collected from AMTS office, App and from Google. Some Parameters identified from the literatures, AMTS Stops details, AMTS bus routes and schedule data are collected. Frequency of bus is calculated from data given by AMTS office.

Questions asked during interview survey are as below:

- Write name of Service Access Point (SAP)
- Note down Gender
- What is Age Group (years)?
- What is Origin of Trip?
- What is Destination of Trip?
- What is Purpose of the Trip?
- What is Walk Time from Origin to SAP (minutes)?
- What is Waiting Time for Bus (minutes)?
- What is Travel Time by Bus (minutes)?
- What is Walk time from SAP to Destination (minutes)?
- What is Walk Distance from SAP to Destination (meters)?

TABLE I . WARDWISE INFORMATION FOR SURVEY

Sr. No.	Ward Name	Total Stops (SAPs)	Surveyed Stops	No. of Persons Interviewed
1	Paldi	25	12	558
2	Vasna	11	7	326
3	Navrangpura	19	10	476
4	SP Stadium	2	2	96
5	Naranpura	8	8	390
6	New Vadaj	14	8	364
7	Sabarmati	13	8	400
8	Ranip	20	11	458
9	Chandkheda	19	11	531
Total		131	77 (58.78%)	3599

IV. Data Analysis

Through interview survey at various SAPs data collection for the study area is carried out. The data entrered by compilation in excel is shown in the table II below for a sample.

TABLE II. SURVEY FORM AND CALCULATION OF AWT FOR A SAP

Sr. No.	Name	Purpose of the Trip	Range of Walk Time to SAP (Minutes)	Average Walk Time (Minutes)	Average Walk Distance (Meter)	Average Waiting Time at SAP (Minutes)
1	Rishabh	Work	2-4	3	180	5
3	Maulik	Education	6-8	7	420	7
6	Piyush	Shopping	2-4	3	180	10
9	Manoj	Other	4-6	5	300	7
12	Sandip	Social	4-6	5	300	4

Estimation of reliability factor K is discussed by data analysis for Paldi,West zone, Ahmedabad by showing sample calculation for Jalaram Mandir SAP. Sample size is determined as total 12 AMTS stops from a total of 25 in Paldi for survey. It is more than 50%. Total of 558 Persons (Passengers) were interviewed at selected surveyed of 12 stops. It is also around 50% of total passengers waiting at SAP.

1. Calculation of frequency:

There are 25 bus stops provided by AMTS in Paldi Ward. At each stop various number/code bus is arriving to

pick up and drop the passengers from different origin & destination.

TABLE III. AMTS BUS ROUTE INFORMATION FOR PALDI

Ward	Paldi		Paldi
Sr. No.	Route No.	Sr. No.	Route No.
1	32	21	900
2	33	22	14-1
3	35	23	150S
4	40	24	151/4
5	42	25	151-3
6	43	26	31/4
7	45	27	31/4S
8	47	28	31-5
9	49	29	31S
10	58	30	33/1S
11	68	31	33/2
12	123	32	34-3
13	136	33	34-4
14	142	34	34-5
15	150	35	36/1
16	200	36	37-4
17	204	37	38/1
18	205	38	39-3
19	300	39	40-1
20	401		

Each number bus has a defined route and defined locations of connectivity in different parts of Ahmedabad. For example at Jalaram Mandir stop, there are different 11 route buses. The number of buses arriving per hour is called frequency. Bus frequency (f) per hour data is not directly available from AMTS head office, Therefore the data given by them is used to calculate the frequency of every bus route. For example, data are available in time format, from which frequency can be calculated as shown below:

Bus Route No. xxx timing of departure is given in interval for particular stop. Here it is given that xxx bus departs at every 15-minute interval, which means in 1-hour (60 minutes) total 4 buses will depart.

Therefore, Bus Route xxx has frequency (f) (per hour) = 60 minute / Interval (in minute)= 60/15=4

Total frequency is 13.05. Calculation for SAP Jalaram Mandir, Paldi is as shown in the table:IV below.

TABLE IV. FREQUENCY CALCULATION FOR SAP

Sr. No. (Route)	*Route No.*	*Frequency*
1	40	0.23
2	42	0.2
3	47	0.86
4	49	0.87
5	49/1	0.8
6	49/2	2.4
7	49/S	0.52
8	58	1.5
9	68	0.27
10	142	1.2
11	151/4	2.4
Total Frequency		13.05

2a. AWT Calculation using frequency

Frequency for Jalaram Mandir at Paldi Ward=60/total frequency: f =60/13.05=4.60

Likewise, AWT has been calculated for all bus stops (SAP) as shown in the table: V below.

There are total 25 SAP as listed in Table:II in Paldi Ward.

TABLE V. AWT CALCULATION FOR A SAP AS PER FREQUENCY

Sr. No.	*AMTS SAP (Stop Name)*	*Routes at SAP*	*Total 'f'*	*AWT (Using 'f')*
1	Vikas Gruh	4	4.34	13.82
2	Niranjan Society	1	1.5	40
3	Sharda Nagar	4	4.34	13.82
4	Dharnidhar Society	4	4.34	13.82
5	Jalaram Mandir	11	13.05	4.60
6	Mahalaxmi Society	8	14.8	4.05
7	Mahalaxmi Rasta	3	4.83	12.42
8	Jain Merchant	17	32.40	1.85
9	Paldi	16	19.03	3.15
10	Paldi Terminus	8	11.12	5.40
11	Pritam Nagar	9	14.28	4.20
12	Arvind Sales	9	14.28	4.20
13	Congress Bhawan	9	14.28	4.20
14	V.S. Hospital	4	7.26	8.26
15	Madalpur	7	11.41	5.26
16	Town Hall	7	11.41	5.26
17	Fateh Nagar	16	30.6	1.96
18	Viswakunj	5	5.38	11.15
19	Museum	20	25.58	2.35
20	Lavanya Society	6	8.34	7.19
21	Jivraj Mehta Hospital	6	8.34	7.19
22	Bakeri Medical	8	10.16	5.91
23	Bhatta	15	28.23	2.13
24	Anand Nagar	17	31.93	1.88
25	Malav Talav	7	8.69	6.90

2b. AWT by Survey

Minimum of 50 persons are interviewed at any selected stop. Min 50% of total SAP (bus stop) is taken as a sample size for the interview. Average walk time is taken as 5.14 min for Jalaram Mandir stop. Max walk time observed is 10 min. max distance 540-600 m calculated by average walking pace of users.

Average waiting time (AWT) is defined as the period from when a passenger arrives at the SAP upto the arrival of the desired service. For every particular route's bus, what is the average waiting time has to be taken by passengers at each stop that has been noted in the survey.

In the calculation, the hourly frequency (f) is halved because the scheduled waiting time (SWT) is estimated as half the headway. For example, a 10-minute service frequency (6 buses per hour) would give an SWT of 5 minutes. In addition, to make the calculations more realistic, a "reliability factor" (K) is added to the SWT depending on the transport mode. As per the literature K is taken as 1 for BRTS and 2.5 for AMTS.[3] AWT = SWT+K=0.5 * (60/*f*)+K

The walking time from a point of interest (it can be any location) to the public transport access points. At every selected stop, the survey has been carried out, in which every person (passenger) who came to the stop to travel in AMTS bus was interviewed. Some questions like walking time from home to stop (SAP) has been asked and noted. Walk access times are measured from the POI to the SAPs. From that Average walking time for every ward and every stop has been

calculated. Calculate walk access time from POI to SAP – The actual road network distance from POI to SAP is measured and, assuming a walking speed, walk time (WT) is calculated. The maximum walk time for the bus are calculated. Any SAPs beyond these distances are not taken into account to calculate PTAL for that particular POI. Maximum walk time which is used in accessibility index calculation are found from the Interview survey data analysis. Max walk time is taken 10 min and max walk distance is taken as 600 m.

TABLE VI AWT CALCULATION AS PER SURVEY AT SAP IN PALDI

Sr. No.	*AMTS SAP (Stop Name)*	*Routes at SAP*	*Persons Interviewed*	*AWT (Survey)*
1	Jalaram Mandir	11	49	7.61
2	Mahalakshmi Society	8	42	6.93
3	Jain Merrchant	17	49	4.84
4	Paldi	16	48	6.19
5	Pritamnagar	9	51	7.14
6	Congress Bhawan	9	42	6.74
7	Town Hall	7	46	8.11
8	Fateh Nagar	16	47	4.94
9	Museum	20	43	5.28
10	Bakeri Medical	8	44	8.70
11	Bhatta	15	48	5.08
12	Anand Nagar	17	49	4.69

TABLE VII. RELIABILITY FACTOR ESTIMATION FOR PALDI WARD

Sr. No.	*SAP (Stop Name)*	*Total Frequency (f)*	*AWT (Using "f")*	*AWT (Survey)*	*Reliability Factor (K)*
1	Jalaram Mandir	13.05	4.60	7.61	3.01
2	Mahalakshmi Society	14.8	4.05	6.93	2.87
3	Jain Merrchant	32.40	1.85	4.84	2.99
4	Paldi	19.03	3.15	6.19	3.03
5	Pritamnagar	14.28	4.20	7.14	2.94
6	Congress Bhawan	14.28	4.20	6.74	2.54
7	Town Hall	11.41	5.26	8.11	2.85
8	Fateh Nagar	30.6	1.96	4.94	2.98
9	Museum	25.51	2.35	5.28	2.93
10	Bakeri Medical	10.16	5.91	8.70	2.80
11	Bhatta	28.23	2.13	5.08	2.96
12	Anand Nagar	31.93	1.88	4.69	2.81

Average k value is 2.89 for Paldi is 2.89.Similarly, for all 9 wards K values have been calculated. Reliability factor for Naranpura is as shown below in table VIII.

TABLE VIII. RELIABILITY FACTOR ESTIMATION FOR NARANPURA

Sr. No.	SAP (Stop Name)	Total Frequency (f)	AWT (Using "f")	AWT (Survey)	Reliability (K)
1	Pragati nagar	2.41	24.90	27.84	2.95
2	Harish Chandra Park	5.49	10.93	13.80	2.88
3	Gujarat Housing Board	7.4	8.11	11.16	3.05
4	Pallav Society	8.9	6.74	9.48	2.74
5	Naranpura Char Rasta	17.7	3.39	6.40	3.01
6	Amikunj	9.97	6.02	8.73	2.71
7	Devendra Park	9.97	6.02	8.69	2.67
8	AEC Zonal office	11.16	5.38	8.33	2.96

The average k value is 2.89 for Naranpura.K values for all wards are obtained as mentioned in the table IX below:

TABLE IX. WARDWISE RELIABILITY FACTOR (K) VALUE FOR WEST ZONE , AHMEDABAD

SR . No.	Ward Name	"K" Value
1	Paldi	2.89
2	Vasna	3.06
3	Navrangpura	2.96
4	S.P. Stadium	3.05
5	Naranpura	2.87
6	New Vadaj	2.91
7	Sabarmati	2.84
8	Ranip	2.69
9	Chandkheda	2.79
Average RF		2.89

V. CONCLUSION

Using the arithmetic difference between the average waiting time obtained from the survey and the average waiting time obtained from frequency data, Reliability Factor (K) has been calculated for the study area. The reliability of the service modes available in urban area is more realistic when SWT is added by RF as per transport mode in calculation. RF affects Total Access Time (TAT) .Equivalent Doorstep Frequency (EDF) depends upon TAT. Accessibility Index (AI) is based upon EDF.Kvalue which is obtained from the literature is 2 as per TfL for bus transit. K value for Indian context is 2.5, whereas from the survey the value of K is obtained equal to 2.89, which is more than stated in literature. Increase in K value indicates the delays which occur due to increase in traffic conditions recently. This paper focuses on computation of reliability factor, and not the reasons for increase in delay for PT buses in Ahmedabad. K value affects Public Transport Accessibility Level (PTAL) mapping. Reliability factor is useful to find Accessibility Index.This increment in the calculated K value might be due to increasing traffic congestion and delays in transportation service.

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USE OF FLOWER WASTE AND FIBERS OF SURGICAL MASK FOR SOIL STABILIZATION

Jaini Umrigar

Research Scholar

Water Resource Engineering

Dr. S. & S. S. Gandhy College of Engineering and Technology, Surat.
Surat,India
jainiumrigar1@gmail.com

Mital Dholawala

Assistant Professor

Civil Engineering Department
C. K. Pithawala college of Engg. & Technology, Surat.
Surat, India
Mital.dholawala@ckpcet.ac.in

Abstract-**Any structure involving civil engineering must have soil as its fundamental base. It must carry the loads without failing. Some areas of the earth may be weak and unable to withstand incoming loads. Such situations require soil stabilization. There are many techniques for stabilizing soil which are found in the literature. In this study, clay soil, fly ash and polypropylene were combined to examine the relative strength gain in terms of bearing capacity, unconfined compression, and compaction. By performing typical proctor compaction tests, Atterberg's limit, unconfined compression tests, and CBR testing, it was determined how the fly ash and polypropylene affected the geotechnical properties of clay fly ash fibers from surgical mask mixtures. The prime aim of the present study is to give the comparison between properties of natural expansive soil with soil mixed with fibers and flowers waste ash. The tests have been performed according to the Indian standard specifications. For the experiments, the clayey soil was collected from a site near Vesu village in Surat. According to IS specifications, the soil's physical characteristics were identified. Fly ash used for the study is locally available at Surat. It gives much strength to the soil by the pozzolanic reaction of fly ash generated from flower waste.**

Keywords— **Soil Stabilization, Flower waste, Dry Density, UCS Test, Surgical mask, Polypropylene**

Introduction

The economy of the Republic of India depends heavily on transportation. The essential lifeline that enables trade and business is the road network. They are one of the most popular and economically efficient ways of transportation. For boosting trade and commerce in any nation, a reliable and well-established network of highways is necessary. It also satisfies the demand for a reliable transportation system for long-term economic growth. All-weather highways should link every nook and cranny of the nation to promote mobility and accessibility. The pavements should be planned and constructed with the utmost care to support the both static and dynamic loads. The quality of the materials used in highway construction determines how well the pavement performs.

The substance on which the pavement construction is positioned is known as the subgrade. Although there is a propensity to only consider pavement components and mix design when analyzing pavement performance, subgrade soils are frequently the most important element. If locally accessible, inexpensive materials are utilized to build the bottom layer of pavements, such as subgrade, sub-foundation, etc., the construction will be significantly reduced. (Palaniappan, K. A. et al.) If the stability of the local soils is insufficient to support the loads, appropriate means to improve the soil's qualities must be used. By increasing subgrade and reducing expansion tendencies by stabilizing the subgrade with a specific chemical stabilizer (such as Quick Fly ash, Portland cement, and Fly ash), it serves as a foundation. The effectiveness of fly ash and polypropylene, when combined with clay, is summarized in this study.

Finely separated garbage from wood waste produced in local businesses and enterprises is called polypropylene. Another locally accessible addition used to enhance subgrade properties is fly ash. Fly ash is heated at a high temperature to produce it. Natural clay purchased from the town of Vesu was the soil used in this research. Over there, the subgrade for the pavement is made up of clayey soil with a very low carrying ability. Several additives can be used to stabilize soil, but employing surgical mask fibers a waste product that is also difficult to dispose of will be considerably more effective. (M. Patel et al.)

Civil engineers are compelled to use inappropriate land for various applications due to rising urbanization and population, even after improving the land using various ground methods. (A. Kumar and others) Finding the finest alternate solution to stabilize the inappropriate ground and successfully utilize industrial waste is a crucial responsibility of geotechnical engineers. Over 750 million tonnes of flowers, particularly roses and marigolds, are reportedly donated at the nation's temples, mosques, and gurudwaras.

The majority of temples dump their garbage into nearby lakes, ponds, and rivers. Numerous temples in the nation, particularly those along the Ganges River, directly dispose of their daily trash in the river without even separating it into biodegradable and non-biodegradable parts. According to reports, 16% of all river pollution comes from floral waste. The pesticides sprayed on them leech into the water and endanger marine life while rotting flowers have an impact on the water's quality. Currently, the use of face surgical masks is rapidly expanding in response to the COVID-19 issue.

The difficulty for us is how to dispose of the mask because polypropylene fiber is the only type of plastic that is not biodegradable. Amid the pandemic, face masks are a regular part of our life. Many are made of plastic and intended to be used only once, resulting in hundreds of

additional tonnes of rubbish being sent to landfills. Moreover, evidence suggests that masks may be a cause of dangerous microplastic fibers in streams and on land. Plants and animals are also impacted. Plastic garbage can suffocate ecosystems and disrupt surroundings due to its sheer volume.

Materials

Discarded masks can originally put waste collectors, trash pickers, or community officials at threat of Coronavirus transmission. We are aware that in some situations, the virus can survive for seven days on a plastic face mask. Plants and animals are likewise impacted over the long term. Oceans can become choked with plastic garbage, which can also destroy habitats. Moreover, some animals do not distinguish between plastic products and their prey, choking on trash afterward. Plastic decomposes over time into smaller pieces, and the longer trash is left in a place, the more it will deteriorate. Second, plastics decompose into tiny plastics called microplastics and then even smaller ones called nano plastics. Most of these tiny particles and fibers are long-lasting polymers that can build up in food chains.



Fig. 1. Flower waste and surgical mask

One mask can produce millions of particles, each of which can move chemicals and microorganisms up the food chain but also possibly even into people. Our temple offerings are proof that we willingly give to our gods. It is believed that the country's temples, mosques, and gurudwaras sell some 750 million tonnes of flowers, including roses and marigolds. Many temples dump their trash into nearby bodies of water, including rivers, ponds, and lakes. Several temples in the area, especially those near the Ganga River, directly dump daily trash into the river without first separating it into biodegradable and non-biodegradable parts.

Study Area

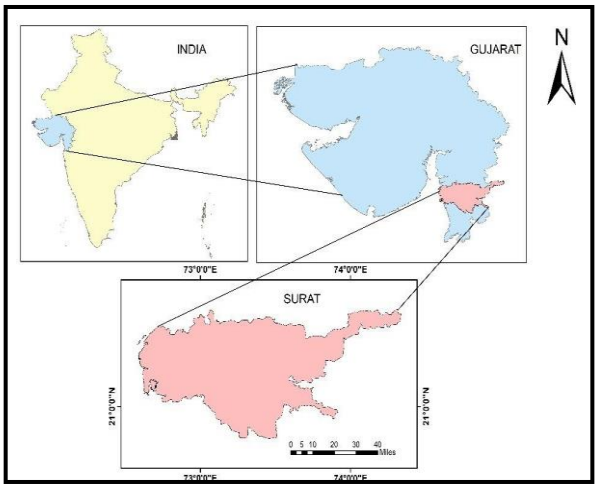


Fig. 2. Study Area

The study area which has been selected for the study is Vesu of Surat city in Gujarat state. The soil sample has been collected from Vesu, Surat. Surat city has a very large area, and the boundaries of the city are increasing day by day. Generally, Surat city has black cotton soil. As per the research, the Vesu area has perfect black cotton soil. Expansive soil, generally referred to in India as black cotton soil, is among the most troublesome soil from the perspective of civil engineering construction. Heavy clay soil which ranges from clay to loam, is black cotton soil; it is usually medium to dark grey.

The soil's tendency to shrink, become stone-like hard when dry, and have a very high load-bearing capacity is by far its most important characteristic. Yet, when the soil is wet, it expands, gets very soft, and loses its ability to support the weight. Because of its expanding nature, it expands in volume by 20% to 30% of the original volume and applies pressure. It is not feasible to construct foundations in such soil due to its particular characteristics. We shall thus carry out certain practical tasks and stabilize the soil sample by employing this soil.

Preparation of Sample

Flowers are used to decorating Deities' idols and pictures. Also at festivals in the temple, lots of flowers are used to decorate it. These flowers are removed after one day and they are thrown in rivers or dustbins. Flower waste can be mixed with soil to make it fertile. But here in this study, flower waste is utilized to make soil stabilize.

As it has been proved that polypropylene increases the strength of the soil and stabilizes the soil. We can use polypropylene material to enhance the strength of the soil. According To our research, we found that polypropylene is found in a surgical mask (use and throw masks). Non-woven fabric, which is less sticky than woven fabric and has greater bacteria filtering and air permeability, is used to make surgical face masks. They are most frequently made of polypropylene, which has a density of 20 or 25 grams per square meter (gm). During the pandemic situation of COVID-19 surgical masks are used a lot by Doctors, People,

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etc. to protect themselves from Coronavirus. As the surgical mask is a use and throw type mask so after one use it is thrown and not used again and also after washing, it cannot be used as the fibers of this mask become uneven to resist bacteria from it. So, an attempt has been made to use a used surgical mask by giving it the proper treatment. In this study, the fibers of surgical mask which are also known as polypropylene fibers are used for soil stabilization.



Fig. 4. Procedure to convert flower waste into flyash



Fig.5. Procedure of adding shredded fibers into soil

Methodology

According to the standard proctor test, each soil sample is compacted to its optimal moisture content and maximum dry density. The different percentages of flower waste and surgical mask fibers used in this research are 6%, 8%, and 10%. In the preparation of samples, if flower waste and fibers of the surgical mask are not used then, the air-dried soil was mixed with an amount of water that depends on the OMC of the soil. If surgical mask fibers and flower waste were being used, the appropriate amount of each was first manually blended into the air-dried soil in low amounts, assuring that the surgical mask fibers and flower waste were thoroughly combined. Only then was the necessary amount of water added. The study focused on three different types of soil: untreated soil, soil plus fly ash from flower waste, and soil plus surgical mask fibers. All three of the samples have undergone the following tests.

A. Liquid Limit(LL)

Casagrande tool cuts a groove of size 2mm wide at the bottom and 11 mm wide at the top and 8 mm high. The number of blows used for the two soil samples to come in contact is noted down. A graph is plotted to take several blows on a logarithmic scale on the abscissa and water content on the ordinate. The liquid limit corresponds to 25 blows from the graph.

B. Plastic Limit (PL)

This is determined by spreading out dirt until it has a diameter of about 3 mm, at which point a thread is used to measure the amount of water in the soil before it crumbles.

C. Standard Proctor compaction test

This template, modified in MS Word 2007 and saved as a "Word 97-2003 Document" for the PC, provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

$$Moisture\ content = \frac{Weight\ of\ Water\ (gm)}{Weight\ of\ dry\ soil\ (gm)} * 100 \quad (1)$$

$$Dry\ density = \frac{Wet\ Density * 100}{Moisture\ content\ of\ soil + 100} \quad (2)$$

Compaction of clay, clay-flower waste and fibers of the surgical mask have been carried out with a standard proctor test with three layers using the standard method. In this study, flower waste and fibers of the surgical mask are added

6%, 8% and 10% and strength is carried out for 3,7 and 14 days.

D. Unconfined Compression test

The unconfined compressive strength (UCS) of the soil sample is measured in this experiment, and the results are used to calculate the unconsolidated, undrained shear strength of unconfined soil. The compressive stress at which an unconfined cylindrical soil sample fails under a direct compression test is known as the unconfined compressive strength (qu). The compression apparatus and dial gauges for load and deformation are included in the experimental setup. Stress is determined using the following equation:

$$qu = \frac{Load}{Corrected\ Area} \quad (3)$$

Soil samples with & without admixtures were tested to determine the stress. In the present study, fibers of a surgical mask and flower waste are added 6%, 8%, and 10% respectively. The stress is applied and the deformation and load readings are noted until the specimen fails. The maximum axial strain is noted.

Results and Discussion

As per considered results from below Table 1, the liquid limit of untreated soil is observed at 53.89%, soil with flower waste ash shows 57.31% and sample 3 which contains fibers from surgical mask shows LL 50.23%. Sample 3 which is soil with fibers of the mask has shown lower LL than the untreated soil ultimately it will lead to giving more strength than the untreated soil. The plastic limit of sample 3 is shown better results than untreated soil, which also imparts good strength to the soil. The scenario of Optimum Moisture content (OMC) and Maximum Dry Density (MDD) sample 3 also shows good results in terms of shear strength and sample 2 shows a decrease in the shear strength of the soil.

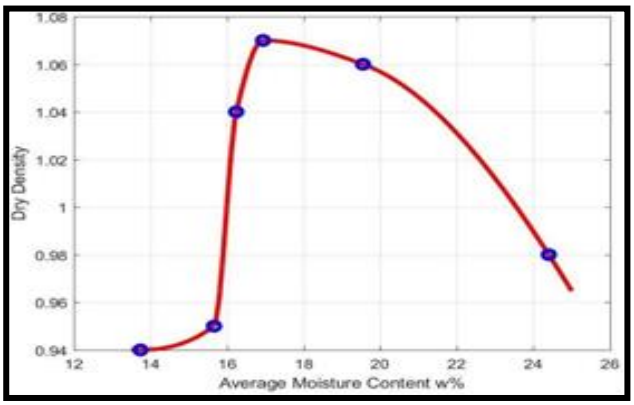
TABLE 1 RESULTS OF LIQUID LIMIT (LL), PLASTIC LIMIT (PL), OMC, MDD OF SAMPLES

NO.	SAMPLE	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	OMC(%)	MDD (gm/cc)
1	Untreated Soil	53.89	42.75	16.93	1.07
2	Soil & Fly ash from flower waste	57.31	31.14	17.85	1.07
3	Soil & Fibers of Surgical mask	50.23	41.03	14.85	1.01

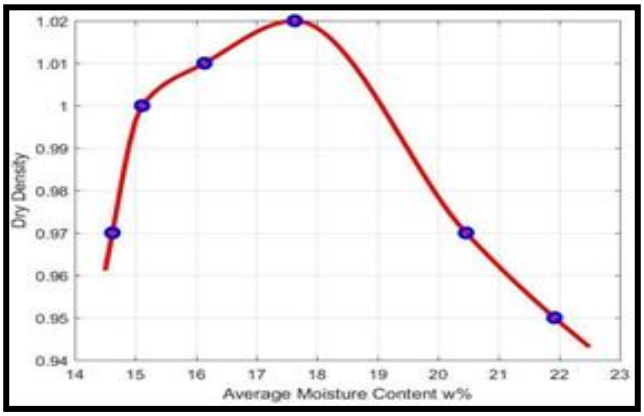
TABLE 2 RESULTS OF SHEAR STRENGTH FROM UNCONFINED COMPRESSION STRENGTH (UCS) OF SAMPLES

Day	Untreated Soil (N/mm^2)	Soil &Fly ash from flower waste (N/mm^2)	Soil & Fibers of Surgical mask (N/mm^2)
Day 1	0.16	0.07	0.15
Day 7	0.17	0.16	0.19
Day 14	0.39	0.27	0.42

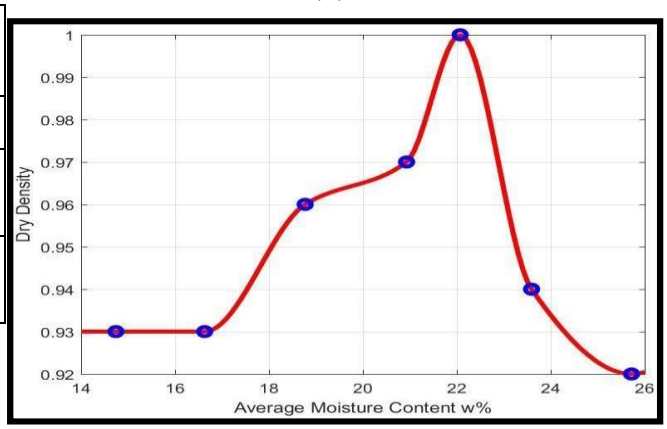
Table 2 shows the result of the UCS test of all the samples. The untreated soil sample shows a 14 days strength of 0.39 N/mm^2, whereas Sample 3 shows increasing in strength giving the value 0.42 N/mm^2. Sample 2, which is the soil sample with fly ash from flower waste, shows a lower strength than that of the untreated soil.



(I)



(II)



(III)

Fig. 6. Results of Standard Proctor Test gives OMC and MDD at (i) Untreated Soil, (ii) Soil & Fly ash from flower waste, (iii) Soil & Fibers from Surgical mask.

Conclusion

Soil sample with 10% of fibers from surgical mask shows good results in terms of strength. Sample 2 which contains the fly ash from flower waste shows a decrease in strength. I t shows an increase in the liquid limit (LL) and plastic limit (PL) than that of the untreated soil. If

organic matter is added, the soil's liquid and plastic limits rise without noticeably raising the liquid limit. As a result, the plasticity index of soils having high organic content is low. A soil's liquid limit serves as a gauge for its compressibility.

The results from the UCS test of soil samples for fibers of a surgical mask and flower waste of 6%,8% and 10%, the increase in the value of unconfined compressive strength by 23.07%, 58.06% and 65.78% respectively. From the laboratory experiments, it is concluded that the discarded materials like fibers from surgical masks and flower waste have the potential to transform the engineering properties of expansive clay such as black cotton soil. After performing all the experiments, it has been observed that the use of a combination of flower waste and fibers of a surgical mask gave better strength than only the use of flower waste. Because flower waste performs chemical reactions and fibers of surgical mass bind the soil particles. The above study added sustainability to the ecosystem as it used waste materials. Waste management of these materials is also a major problem, which can be solved by this kind of study.

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Sulphate attack on marine concrete: A concern and challenge

Rahul Shah
Asssitant Professor
School of Engineeting & Technology
Navrachana Unversity
Vadodara, India
rahulshahedu@gmail.com

J.D.Rathod
Associate Professor
Faculty of Technology & Engineeting
The M.S.University of Baroda
Vadodara, India

***Abstract*— Concrete structures in salty or offshore areas suffer significant damage from sulphate-induced concrete degradation. Uncertainty still exists regarding the way cast-in-situ concrete degrades. Construction engineers in coastal areas have long faced difficulties when it comes to building and maintaining concrete structures in a saltwater environment. Sea salts gradually seep into concrete, creating expansive and soluble compounds that cause structural concrete to crumble. issues with concrete durability in daily life. Since oceans cover 70% of the earth's surface, numerous structures are either directly or indirectly exposed to seawater because winds have the ability to carry ocean spray up to a few kilometers inland. The current paper discusses the types, mechanisms, and process of sulphate attack, as well as the feature of admixtures in attempting to prevent sulphate attack.**

Keywords—Concrete, Marine, Compressive strength, Durability

I. INTRODUCTION

A marine structure's resistance to the harsh maritime environment is crucial. The ability of a marine construction to withstand the severe maritime environment is essential. Leaching, sulphate attack, and chloride attack are a few examples of the chemical deterioration that leads to concrete disintegration in coastal conditions. Physical deterioration caused by the crystallisation of soluble hydrated salt in the pores of concrete, erosion, and abrasion promotes further disintegration. The underlying concrete is typically softened, cracked, and partially removed as a result of these attacks on it. Consequently, a new surface is now exposed to attack.

By observing the concurrent action of several physical and chemical deterioration processes on coastal and offshore sea structures, it is feasible to comprehend the complexity of concrete durability challenges in practice. Second, because oceans cover 80% of the earth's surface, many buildings are either directly or indirectly exposed to seawater because winds have the ability to carry ocean spray up to a few kilometres inland. The chemical composition of most sea waters is generally consistent, and it is distinguished by the presence of about 3.5% of soluble salts by weight. Na+ and Cltypically have the highest ionic concentrations (11,000 and 20,000 mg/litre, respectively). However, enough Mg^{+2} and SO_4 are present—typically 1400 and 2700 mg/litre, respectively—to take an aggressive approach to cement hydration products. The pH of seawater ranges from 7.5 to 8.4, with an average pH of 8.2 being in equilibrium with atmospheric CO_2. A pH value lower than 7.5 may be found in unusual circumstances. These are typically brought on by an increase in dissolved CO_2, which makes seawater more hostile to Portland cement concrete.

The optimum course of action must be developed so that buildings may be built that can best withstand the attack. Understanding the hostile elements of the environment and how they affect concrete structures is necessary for this. However, the majority of problems with concrete durability can be handled if suitable measures are taken in the material selection, mix design, reinforcing detailing, construction procedures, and quality control systems [12]. Water used in mixing and curing concrete has a considerable impact on its durability.

II. SULFATE ATTACK

A concrete structure can deteriorate quickly and lose strength if it is exposed to a sulphate-rich environment or contains sulphate salts in the water, aggregates, or cement that make up the mix. Sulphate Attack is a process that occurs when sulphate is combined with water and cementitious paste. Sulphate ions attack elements of the cement paste in a process known as "sulphate attack" on concrete [12]. Sulphate attacks from salts that are water soluble and contain sulphate can damage concrete. Alkali-earth salts (calcium, magnesium) and alkaline sulphates (sodium, potassium) are examples of these salts. Sulphate reacts with the calcium hydroxide and/or hydrated calcium aluminate in the hardened cement paste to begin disintegrating the cement paste that keeps the concrete together when it is added to concrete. Ettringite is a term for the newly formed expansive compounds that are created as sulphate dries. As these new crystals grow, they fill up the empty space and cause the paste to crack, further deteriorating the concrete. Internal stresses that result in cracking are

brought on by the volume increase and needle-like shape of ettringite crystals. This procedure is categorised as chemical. Sulphate attack can also happen physically, when water-soluble salts pass through the concrete and are deposited at the surface, causing it to scale and eventually spall.

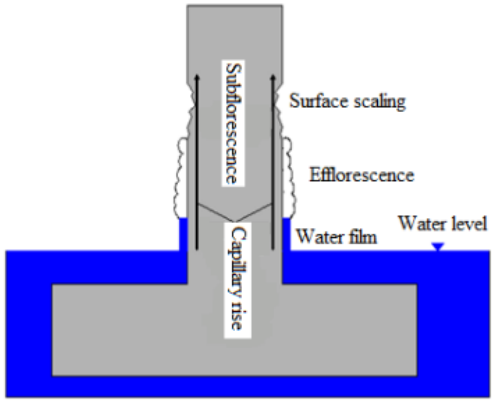


Fig. 1 Action of sulphate on sea front structure (Ahmed Ramadan Suleiman, 2014)

The concrete typically develops a pattern of tiny cracks as a result of sulphate attack. Surface scaling and disintegration

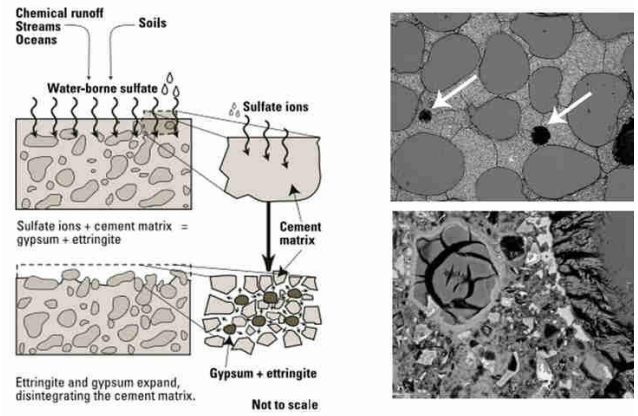


Fig 2 Suphate attack mechanism (Ref: Mehta P.K,)

consequently started, followed by mass deterioration. Sulphate attack can be identified by the following symptoms: salt buildup on concrete surfaces, surface scaling, spalling with salt traces, de-bonding between the aggregates and paste, and a change in the texture of the concrete to that of cavities paste[12]. This occurs during the Sulphate Attack's advanced stage.

When sulphate contamination is present in the nearby soil or water, this phenomenon is typically seen in buried or near-surface concrete members, such as piers, columns, slabs, foundations, and basements.

III. PARAMETERS RELATED TO SULPHATE ATTACK

Table I Parameters and their action

Parameter	Actions
Sulphate ingress	• Sulphate attack necessitates close contact between sulphate anions and the concrete's cement paste. • A concentration gradient (diffusion) drives sulphate ingress while the sample's permeability inhibits it. Therefore, it has been shown that using a lower water/cement ratio (w/c) results in improved resistance to external sulphate attack [23]. .
Precipitation of ettringite	• The most common image of sulphate attack is associated with the precipitation of ettringite, leading to expansion and cracking. Ettringite is a calcium sulfoaluminate hydrate with a composition of $C_6AS_3H_{32}$ • It is possible to increase resistance to sulphate attack by reducing the overall content of tricalcium aluminate, which forms ettringite when combined with water and sulphate. Numerous studies have demonstrated that reduced tricalcium aluminate content can increase resistance [23].
Leaching	• Calcium hydroxide leaks out of the cement paste as sulphates enter inwards. • The leaching of these kinds of substances causes the calcium-silicate-hydrate to decalcify, which is

	evidenced by a steady drop in the phase's calcium/silicon content. [21]. • Ettringite decomposes into gypsum at a pH of 10.7 due to the lower pH. [22]. • Leaching causes the cement paste to soften and lose its strength as the porosity rises. [29]
Crystallization pressure	• Factors that influence crystallisation pressure include humidity, pore size, pH, and the presence of solid solutions. • A higher scale of development is required to induce harm since the tension produced in a single pore is inadequate. [28]
Additional cementitious components and additives	• To prevent sulphate attack and decrease the development of ettringite and gypsum, additional cementitious materials, such as pulverised fly ash (PFA), ground granulated blast furnace slag (GGBS), and silica fume, are usually employed. • Fly ash content as low as 20% can effectively increase resistance to sulphate attack. [26][27] • It has been demonstrated that cement that contains up to 15% silica fume exhibits better resistance to exposure to sodium sulphate mix solutions. [25] • The increased aluminum content of slags makes using them at high concentrations for boosting resistance seem contradictory.
Cyclic Wetting drying cycle	• Damage from attack was larger in concretes containing pozzolans (fly ash, metakaolin, and silica fume) than in samples devoid of pozzolans because these pores were of smaller sizes. • Salt crystallisation is expected to cause failure in the exposed regions while chemical sulphate attack will be applied to the immersed portions. Therefore, both options may need to be taken into account.

Because there are so many variables that can affect sulphate attack in the field, laboratory experiments must be simplified versions of this situation. The specimen size, Water cement ratio, pH, Concentration of sulphate and renewal of solutions are also key parameters to be considered while conducting the laboratory investigation. ASTM C1012-13M (ASTM, 2013), and ACI can be an effective guideline.

IV. CONCLUSIONS AND COMMENTS

- The factors which influence the extent of damage occurred include type of solution, age of concrete and submersion type. The damage occur is generally a combined of physical and chemical attack.
- Wetting and drying cycles can effectively be applied in the laboratory while simulating the actual marine structure, taking into account the necessary inputs.
- Admixtures and additional cementitious materials have been quite often used to resist chemical and physical effects, but capillary effects can lead to serious harm to pores with smaller diameters.
- Compressive strength changes, mass loss, and expansion could all be signs of crystallisation, micro-changes, and eventually sulphate attack on the concrete.
- The effects of wetting drying cycles and long term durability study may be considered for better results.

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The effect of adaptive infill patterns on the flexural strength of FDM 3d printed PLA

Dr. Rachna Patel
Indus Institute of Management Studies
Indus University
Ahmedabad, India
rachnapatel1973@gmaial.com

Pavitra Patel
Mechanical Department
Vishwakarma Government Engineering College
Ahmedabad, India
pavitrapatel.astro@gmail.com

Neha Tiwari
Mechanical Engineering
Vishwakarma Government Engineering College
Ahmedabad, India
nt798261@gmail.com

***Abstract*—Additive manufacturing technologies offer several benefits, including the ability to produce hollow products that are lightweight, cost-effective, and can be manufactured quickly without compromising their mechanical properties. Additionally, 3D printed parts offer design flexibility, allowing for complex shapes that would be difficult to create using traditional manufacturing methods. By selecting the appropriate infill, the strength of the printed part can be optimized to meet specific requirements. In this paper, 2 infill patterns, related to each other, are investigated by using the commercial fused deposition modeling technology. For the investigation 3 point bending tests were done for 4 specimens at 20, 40, 60 and 80% infill densities for each infill pattern. From the results it is evident that the adaptive cubic infill pattern becomes more advantageous at higher infill densities and also that to obtain a more conclusive result, this research has to be repeated with improved methodology.**

Keywords—3d printing, additive manufacturing, adaptive infill patterns, flexural strength

I. Introduction

3-dimensional printing, or 3d printing has been a very fast-growing technology for the past decade. 3D printing works on the principle of additive manufacturing where material is added layer by layer to form a finished product. This is in contrast to traditional machining processes where material is subtracted from a block of raw material until desired shape is acquired. This process is often enormously wasteful as a significant portion of the workpiece is wasted in the form of chips. On the other hand, there is no waste of material in 3D printing.

There are several different types of 3d printing, namely Fused Deposition Modelling (FDM), StereoLithoGraphy (SLA), Selective Laser Sintering (SLS), Digital Light Process (DLP), Multi Jet Fusion (MJF), PolynJet, Direct Metal Laser Sintering (DMLS) and Electron Beam Melting (EBM).

The type of 3d printing we will be focusing on for this paper is Fused Deposition Modelling or FDM 3D printing in which thermoplastic filament is heated to its melting point and then extruded out layer by layer to create 3D objects [1] To save on material and time, 3d printers do not print a part with the entire of its volume filled with material, rather only a certain percentage of its volume is filled and the rest is left empty. This is called infill percentage. The infill percentage used in a part depends on the strength and weight requirement of the part.

Material is filled inside a part in a very specific pattern, called the infill pattern which plays a big role on the mechanical properties of the part. A non-homogeneous honeycomb structure [2] for example, is a good infill pattern for printing parts that are required to be flexible.

The cubic infill pattern is one such infill pattern which generates diagonally stacked cubes, resembling regular and inverted pyramids when printing. The cubic pattern provides three-dimensional strength due to the structural integrity of the crossing triangles involved. Another similar infill pattern is the adaptive Cubic pattern which works on the same principle as cubic. It consists of cubes-oriented corner-down where lines cross themselves in one layer. Unlike simple cubic infill, this infill gets automatically more or less dense, depending on the distance to the nearest wall, leaving large cavities in the middle. The result is shorter print time and lower filament consumption while maintaining great support for top layers and similar mechanical properties.

This paper aims at comparing the flexural strength of the adaptive cubic infill against the cubic infill to analyze whether the reduction in time and material usage is worth the reduction in strength of the 3d printed part.

II. Methodology

A. Making the test Specimens

In order to test the flexural strength of the 3D printed parts test specimens had to be prepared for the different infill patterns. For this, a CAD (Computer Aided Design) Model was created using Solid works 3D modeling software, of a rectangular strip 125 mm x 12.7mm x 3mm thickness according to the ASTM D790 flexural testing standard.

These CAD files were then exported into the Standard Triangle Language (STL) format then sliced using the PrusaSlicer-2.5.0 slicing software. The printing parameters used were as follows

Nozzle temperature: 200 celsius

Bed temperature: 70 celsius

Perimeters: 2

Solid layers on top: 2

Solid layers on bottom: 2

Layer height: 0.3mm

The specimens were printed horizontally as shown in figure 1.

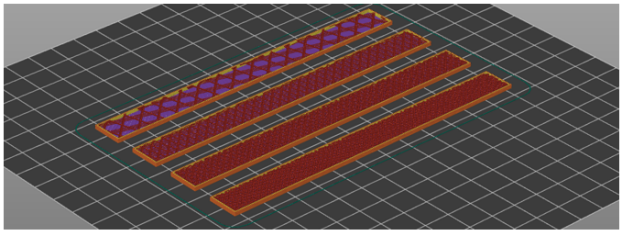


Figure 1

Specimen slicing in the Prusa Software

A total of 8 test specimens were printed, 4 with the cubic infill pattern and 4 with the adaptive cubic infill pattern. Both sets of specimens were printed with 20, 40, 60 and 80 % infill densities.

B. Flexure Testing

To determine the flexural strength of each of the different specimens, the 3-point bend test was used. The figure 2 depicts the setup for testing.

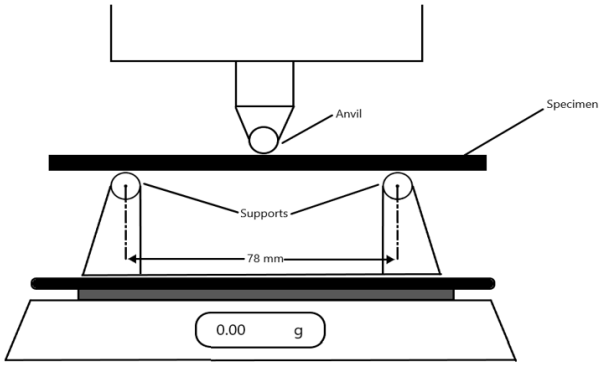


Figure 2

Diagram of the test setup and apparatus

Both the supports and the anvil had a radius of 5mm according to the ASTM D790 flexural testing standard. The span of the supports was fixed at 78mm.

To find the breaking stress, load was slowly applied to the specimen through the anvil. The load at which the specimen snapped was noted from the scale placed below.

The formula for the flexural strength in a 3-point bend test was then used to calculate the maximum flexural stress each specimen was able to withstand.

$$F = \frac{PL}{bd^2}$$

Figure 3

Formula for the 3 point bend test

III. RESULTS AND DISCUSSION

The mass of the specimens and the printing times were the estimations of the slicing software, which creates the toolpath, additional measurements were not made.

It should be noted that there was a significant deviation in thickness of the test specimens from the CAD model of the specimen. This is because the printer used to print the specimens did not have the auto leveling feature and leveling of the printer bed manually is a task that requires great skill to do perfectly. Imperfect bed leveling led to a different thickness of the first 2-3 layers of the print in each of the specimens leading to a deviation in total thickness of the specimens of +- 0.3 mm. This deviation however is accounted for when calculating the flexural stress of each specimen by the formula as shown in **figure 3**

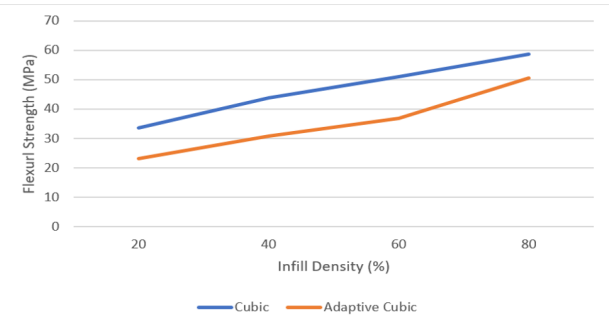


Figure 4

How flexural strength varies with infill density for the 2 infill patterns

Figure 4 shows how the flexural strength of both the infill patterns varies with infill density. It shows that both the infill patterns show a similar response to an increase in infill density. The Cubic infill pattern had, on average, 11.35 GPa more of flexural strength as compared to the Adaptive Cubic infill pattern. In terms of percentages this is a greater percentage at smaller infill densities and lower at higher infill percentages. Ranging from 44% more strength at 20% infill to 16% more strength at 80% infill.

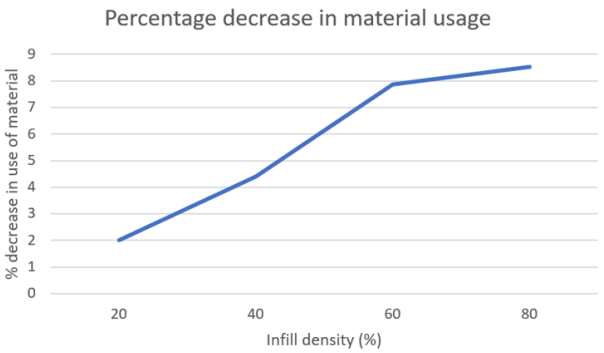


Figure 6

% decrease in use of material in Adaptive Cubic infill pattern for different infill densities

Figure 5 compares the print times and material usage of these infill patterns.

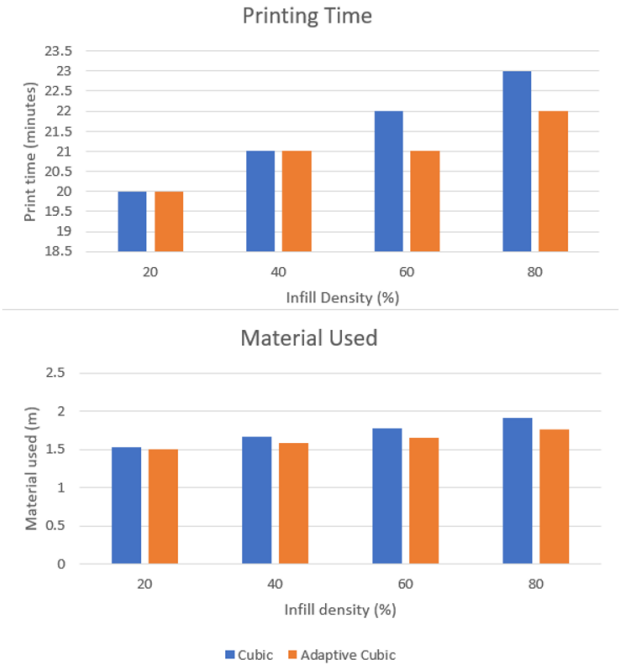


Figure 5

Reduction in print time and material used for adaptive patterns

The adaptive cubic infill pattern used only 2% less material for 20% infill density. However, this percentage is higher at 8.5% for 80% infill density. There is a clear upward trend in percentage decrease of material usage as the infill percentage increases. This trend is depicted in figure 6

Despite the initial assumption that the adaptive cubic infill pattern would prove advantageous in terms of decreased material usage for the same strength, these results seem to suggest otherwise. Even at 80% infill density where there is a significant gap between the 8.5% less material consumed by the Adaptive cubic infill and 16% more strength given by the cubic pattern at the same density.

However, this is possibly because the flexure testing standard for polymers, ASTM D790, might not be the best way to test infill patterns in 3d printed parts. This is because the inside of the specimen is not a continuous medium, rather filled with a pattern that will behave differently when printed inside of different shapes. In addition, the test specimens were very thin (3mm) and in 3d printing a certain number of layers of shells have to be printed enclosing the infill pattern. In this paper, the number of shells was set to 2, which means that out of a total of 9 layers printed, 4 were fully filled (2 on top 2 on bottom). This is a significant portion of the volume of the specimen hence could have greatly influenced the results.

A better way to test the strength of 3d printed parts would be one where the volume of shells is a negligible part of the total volume of the specimen. Further research could repeat this experiment with the necessary changes to eliminate the limitations of these.

IV. CONCLUSION

FDM specimens manufactured with 2 different infill patterns were subjected to the 3-point bend test to determine their flexural strengths. From the results, the following conclusions can be obtained:

- Due to imperfections in leveling the bed of the printer, the thickness of the 3d printed parts have great variation (up to +- 0.3mm)
- The adaptive cubic infill pattern follows a similar curve to the cubic infill pattern in a flexural stress against infill density graph. On average, the cubic infill pattern has 11.35 GPa

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greater strength than the adaptive cubic infill pattern

- The adaptive cubic infill pattern uses less material as compared to the cubic infill pattern and the % decrease in material used compared to the cubic pattern increases as the infill density increases. However, the conclusions that can be drawn from these results is that the reduction in material used is not worth the decrease in strength of the part.

- However, the methodology used to obtain the results of this test is imperfect. This experiment could be repeated with certain improvements such as using thicker specimens to get a more conclusive result.

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REVIEWING THE GROUND IMPROVEMENT TECHNIQUES FOR SOFT SOILS

GIRISH CHANDRA GANDHI
Department of civil engineering,
Indus institute of Technology
Indus University
Ahmedabad, India
girishgandhi.22.rs@indusuni.ac.in

PAYAL MEHTA
Asstt. Professor
Indus institute of Technology
Indus University
Ahmedabad, India
payalmehta.cvl@indusuni.ac.in

ANKIT SODHA
Asstt. Professor
Indus institute of Technology
Indus University
Ahmedabad, India
ankitsodha.cvl@indusuni.ac.in

Abstract—**Soft clays comprising of silt and clay always create problems during construction and thereafter. It is generally observed that soft soil leads to differential settlement and the structure standing on such soils develops settlement cracks. Therefore, the ground improvement techniques to be applied before the construction by inserting perforated vertical drains, vacuum consolidation, sand piles, vibro stone columns, geotextiles, chemical treatment etc. These techniques improve the soil properties and reduce the chances of settlement resulting in an increase in durability and serviceability life of the structure. A brief detailing of various methods for ground improvement of soft soils are discussed in detail with comparison between various methods.**

1 INTRODUCTION

The need to improve the soft soil should be carefully examined between the space availability, quality of the soil to be improved and extent of such soil in a project. Mainly the soft soil comprising of high silty clay found near the coastal areas. The foundation of the proposed structure or project can be successfully carried as per the category of the upcoming structure. Now comes the choice of the method of improvement of the soil that whether to go for the soil improvement or for deep foundation like deep piles. As per the requirement of the space availability, it can be decided, for example if he proposed structure footprint is a very small area then better to go for the pile foundations like buildings, Elevated Storage Reservoirs, Chimneys, Bunkers, and Silos but if there is no space crunch then it is better to go for the soil improvement techniques for example for Water Treatment Plants, Sewerage Treatment Plants, Common Effluent Treatment Plants, Master Balancing Reservoirs, Wind Mill Foundations, Settling Tanks, Chlorination Tanks, Hydropower house stations etc., where the base area is quite big and the applied load of structure is uniform in nature.

(Das'1983), classified the general soil improvement techniques whereas the (Kempfert and Gebresealssie'2006) detailed out these methods. The main classifications were further subdivided into three main techniques (Ahmed Raad et al'2019).

The present study focusses mainly on soil improvement techniques to improve the engineering properties of soil by increasing the shear strength, bearing capacity, and reducing settlement of soft soils.

Soil Removal & Replacement, Preloading technique, Vertical drains, Prefabricated techniques, Sand drains, Stone columns, application of geotextiles, application of cement-lime, application of cement, lime and fly ash are discussed in this paper study.

1 SOFT CLAYEY SOIL IMPROVEMENT TECHNIQUES

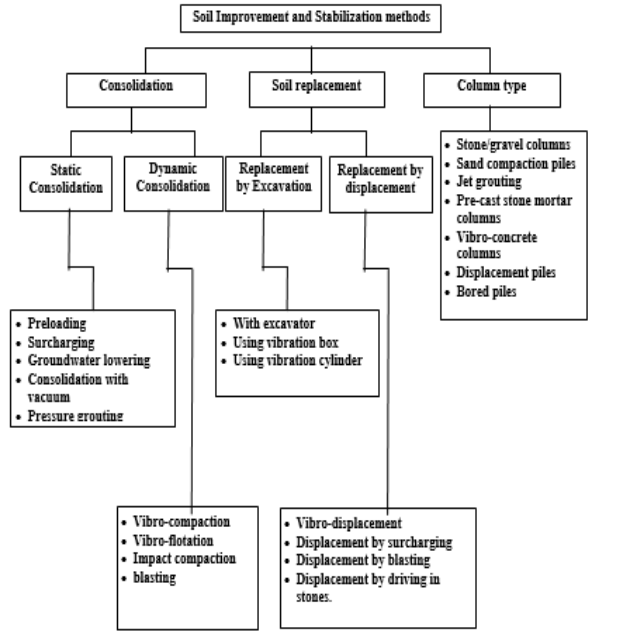


FIGURE 1: SOIL IMPROVEMENT TECHNIQUES CLASSIFICATION (AFTER KEMPFERT AND GEBRESEALSSIE 2006)

1.1 Removal & Replacement of Soil

Method adopted in here is to remove the deposit of soft clayey soil. This method is cheaper but there is no empirical formula about the thickness of the soil to be removed, only the history and experience are the deciding factors (A.K. Gabr,2012). Numerical study as per "Mohr's – Coulomb soil behaviour model", confirms reduction in settlement.

1.2 Preloading or Precompression Method

This method is suitable when the CH soil located at a limited depth and when the soil is supposed to support high density loads like earthen dam embankment, highway, buildings etc. The preloading can be done by using sand, gravel, water tankers or any other uniformly distributed loading materials. Another way by applying the techniques of lowering the water table to improve the shear strength and bearing capacity, increase in the rate of settlement and reduction in the overall settlements. The mechanism involved are the void ratio reductions, increase in dry density and improvement in the engineering properties of the soil. As per (Das,2015) the normal time to complete the process of settlement reduces to approximately to eight months instead of years, if the height of the filled material is about eight meter and the observed consolidation settlement is of the range of one meter depending upon the type of surcharge materials. (Varghese et al, 2005).

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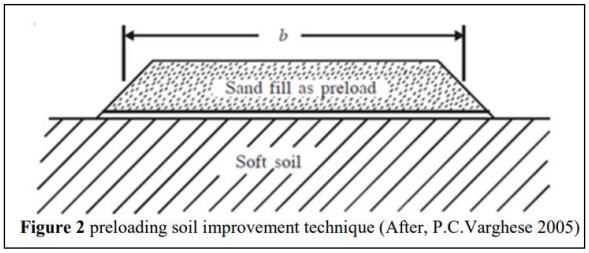


Figure 2 preloading soil improvement technique (After, P.C.Varghese 2005)

1.3 Vertical Drains

Vertical drains are mainly done for the soft soil having low permeability. These vertical drains allow and accelerate the flow of water from the soil and reduce the time of consolidation drastically. (Bowels L.E., 1996). The major categories of vertical drains are Sand drains and prefabricated drains.

1.3.1 Vertical Sand Drains

Vertical sand drains are installed by boring holes at a closely spaced pre decided grid pattern by any method of drilling. Coarse graded sand filled in these bore holes. The preloading is applied to top surface of soil after the preloading of sand drains, thus water starts flowing towards the sand drains and accelerate the rate of consolidation very fast. (Radhakrishnan G, 2010) Done an experiment to measure the rate of settlement with respect to time and found that consolidation settlement is 9% and 31% respectively for without and with vertical sand drains for initial ten months and 12% and 65% for twenty-four months of test time.

This method is also having some of the disadvantages like selection of pored sand with higher value of fineness modulus, free from any chemicals, dust, silt, clay particles, high cost for boring and installation of sand drains, and chances of formation of cavities during sand filling due to buckling of sand.

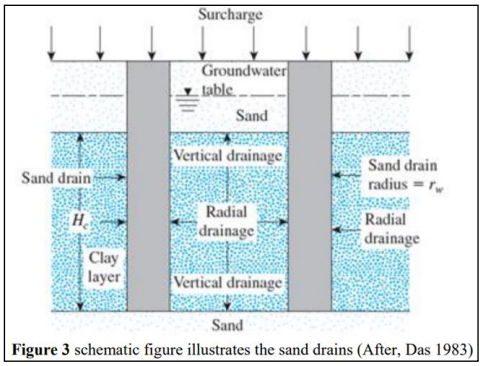


Figure 3 schematic figure illustrates the sand drains (After, Das 1983)

1.3.2 Prefabricated Drains(Wick Drains)

Very economical. It consists of number of vertical drains made up of perforated plastic or paper materials wrapped with geotextiles. Installation is normally done by vibratory hammer. This technique is applied before the commencement of the construction. Wrapped geotextiles helps to prevent the movement of soil particles along with water into prefabricated drains. This prefabricated can be made of any desired size as per the requirements. The technique is used widely all over the world to accelerate the rate of consolidation settlements. It is having some advantages comparing to sand drains :

1. Comparing to sand drains. (Bowles, 1997). It costs only a quarter of the sand drain system.
2. It can be installed for a depth of more than 30 meter.
3. Installation not required drilling process.
4. Installation is very fast.

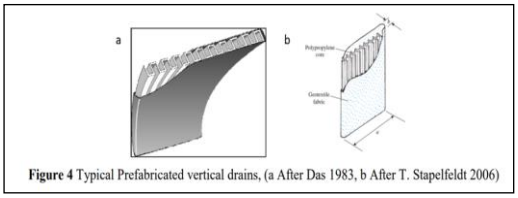
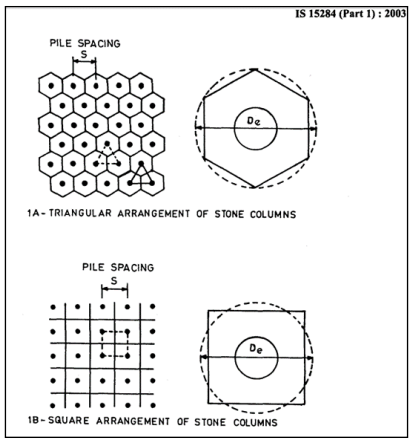


Figure 4 Typical Prefabricated vertical drains, (a After Das 1983, b After T. Stapelfeldt 2006)

2 SOIL IMPROVEMENT TECHNIQUE BY DENSIFICATION OF SOIL

2.1 Stone Columns

As per I S Code 15204(Part I):2003, the technique resembles with sand columns, except the filled material is gravel ranging from 6 mm to 40 mm. The hole is drilled by a water jetting (Wet vibro flotation method) with diameter ranging from 50 mm to 75 mm, through soft soil till it reaches to the harder soil. The crushed stone are then filled from the top by gravity, gradually and compacted radially and gradually with withdrawal of the Vibrofloat. The maximum depth can be achieved up to 15 meter and the terminal depth to be as per the designers' requirements. Spacing of the stone columns are normally 150 to 300 mm centre to centre placed in triangular or square pattern.

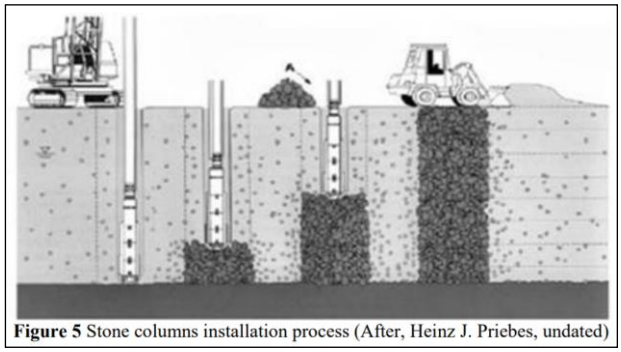


This method results in increasing the rate of settlement, reducing the consolidation settlement, and enhancing the capacity of bearing capacity and shear strength of soil.

Stone column acts as vertical drain and are not affected due to the presence of water table. It acts as reinforcement in the soft soils and densifying the soil around stone columns.

Expected effectiveness of stone columns regarding to Densification and Reinforcement

Soil Description	Densification	Reinforcement
Gravel and sand <10% silt, no clay	Excellent	Very good
Sand with between 10 and 20% silt and <2% clay	Very good	Very good
Sand with >20% silt and nonplastic silt	Marginal (with large displacements)	Excellent
Clays	Not applicable	Excellent


Figure 5 Stone columns installation process (After, Heinz J. Priebes, undated)

2.2 Soil Cement Pile (SCP)

Its installation is same as of stone columns. A drill having a drill pit and shearing blade. The drill pit penetrates in soil while blade is rotating and mixing soil with cement slurry. Normal dimensions of soil cement columns are 1 meter in diameter and having depth from 10 to 35 meter as per the requirements. (Gabr, A.K. (2012) "The uncertainties of using replacement soil in controlling settlement". Journal of American Science, 8 (12), 662-665).

In Soil Cement Columns the strength is achieved due to cohesion while in case of stone column it is due to internal frictions of the gravels / stones.

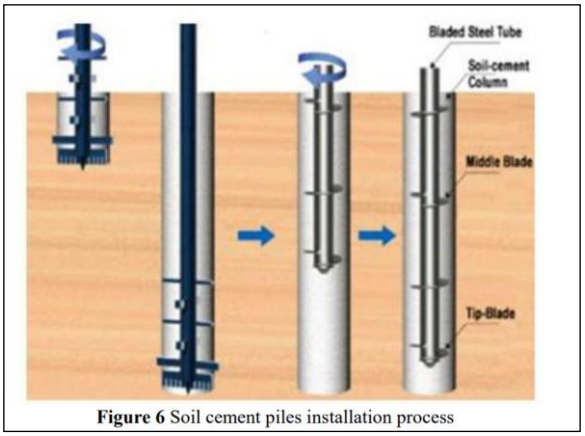


Figure 6 Soil cement piles installation process

2.3 Lime Piles

Lime pile technique is most widely used to improve the soft soils. Its installation process is same as of stone column installation. It consists of vertical hole in soil and fil them with lime or lime and sand. Lime piles increases the shear strength and bearing capacity of soil and decreasing the settlement of soil. This technique has significant effect to reduce the expansion potentials of expansive soil. The shear strength of soft clays can be increased up to 10 times when adding with 5% lime. Sometimes lime is added with a mixture of sand in a ratio of 1 lime: 4 sands. (Varghese, P.C. (2005). Foundation Engineering Handbook CRC Press).

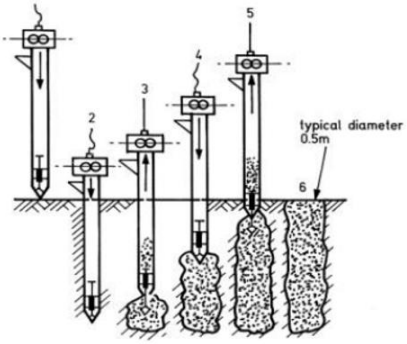


***Fig. 7** "Lime Piles installation process (After C.D.F. Rogress, 1997)"*

3 SOIL REINFORCEMENT BY GEOTEXTILES

Geotextile is also called as Synthetic fibre. It is made up from Nylon, Polyethylene, Polyester and Polypropylene. The geotextiles are available in the forms of sheets, strips, and geogrids. Prefabricated drains are inserted vertically to allow the water upwards to the ground to increase the rate of consolidation settlement. Normally topsoil up to 1-to-2.5-meter depths are being removed and then single or multi-layer geotextile are laid out with backfill of soils. Sometimes to improve the shear strength of soil geogrids are used in both the directions Horizontal and Vertical.

To improve the safe bearing capacity of soil for shallow foundations geogrids are laid below the foundation level. The dispersion area for the load distribution increases with laying of geogrids improves the bearing capacity of soil approximately by a range of 2 to 2.5 times, as comparing to without the application of the geogrids.

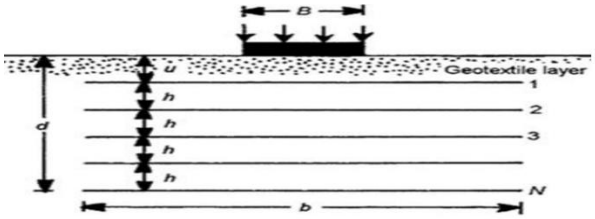


Fig 8 Arrangement of geotextiles for spread footing

4 IMPROVEMENT OF SOIL USING FLYASH WITH CEMENT, LIME

This method is used by addiding the adhesives with cement, lime, flyash or combined followed by compactions.

Adding the lime to the clay soil ay increase the unconfined shear strength of the soil from about 2100 KN/M2 without lime to 2800 KN/M2 when added with 3% to 5% of lime. [Das, B..M. (2015).:Principles of foundation engineering". Cengage learning].

The use of flyash improves the shear strenght of soil. Use of lime or cement is mandatory while using fly ash as the fly ash itself does not have any boding properties. The optimum percentage of flyash o be used as a second binder with cemnet is about 12% to produce highest unconfined shear strength of soft soil. [Sheo.l.et'al. (2008). Experimental study on the stabilization of orgnais clays with flyash and cement mixed method.].

5 STONE COLUMNS IN SOFT SOIL AS PER 15284 (PART-I):2003 (FAILURE MECHANISM)

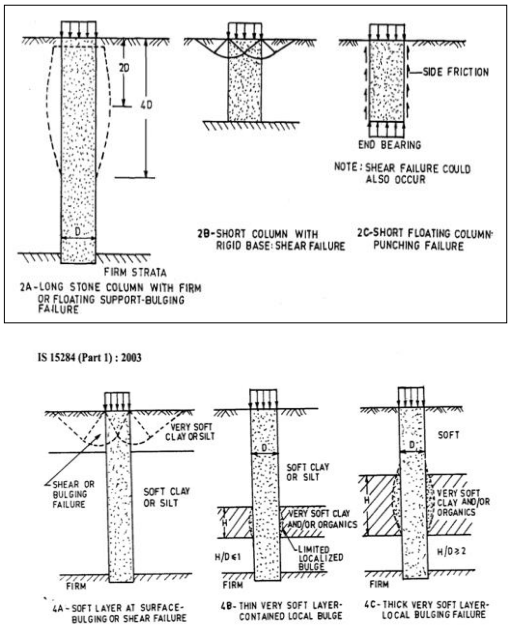


***Fig 9 :** FAILURE MECHANISM OF STONE COLUMNS IN NON HOMOGENEOUS COHESIVE SOIL AS PER IS CODE 15284 (PART - I) : 2003*

7. LOAD TEST ON SINGLE PILE

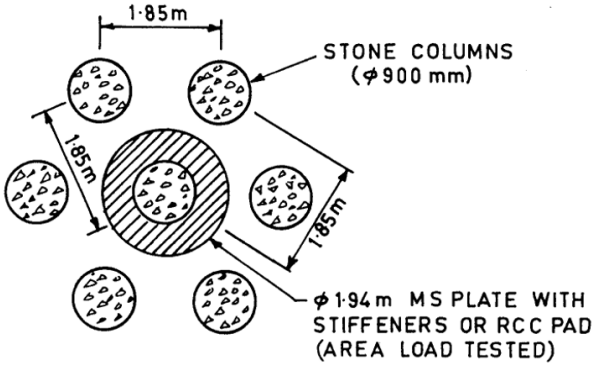


Fig 10 *SINGLE COLUMN LOAD TEST AS PER IS CODE 15284 (PART I) :2003*

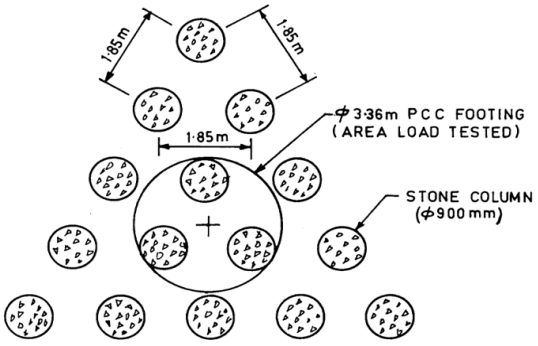


Fig 11 *THREE COLUMN GROUP LOAD TEST AS PER IS CODE 15284 (PART I) :2003*

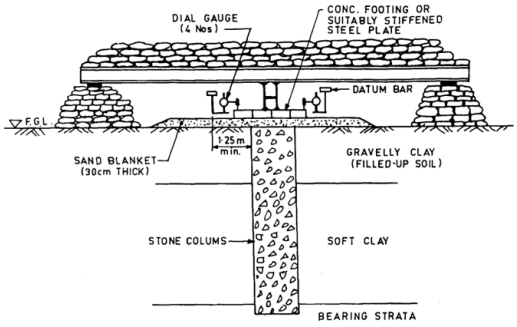


Fig 12 *SECTION SHOWING ARRANGMENT FOR SINGLE COLUMN TEST AS PER IS CODE 15284 (PART I) :2003*

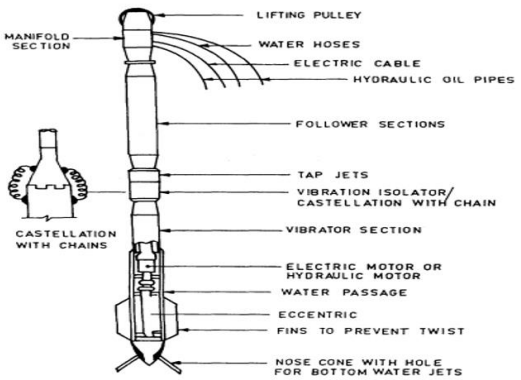


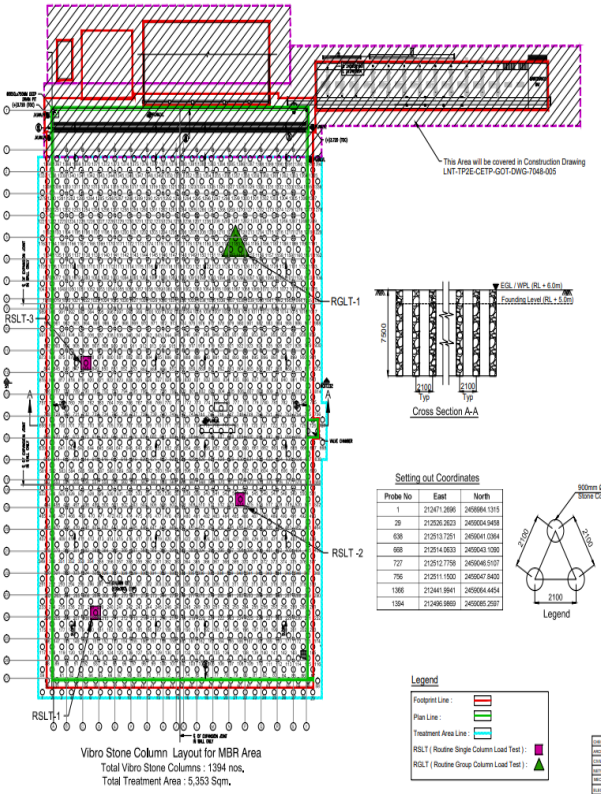
Fig 13 *ESSENTIAL FEATURES OF VIBROFLOAT*

TYPICAL DATA SHEET FOR RECORDING INSTALLATION OF STONE COLUMNS

NAME OF AGENCY:

STONE COLUMN INSTALLATION RECORD

Name of work: Drawing No.:	Name of client: Date/Shift:
Sl No. : Location : Diameter : Actual ground level : Length of tube : Type of hammer : Weight of hammer : Stroke/Drop of hammer : Total No. of blows : Set for last 5 blows : Repeat set for 5 blows :	Time of start of boring: Time of end of boring: Time of start and finish of compaction of each batch of stones: Total time taken for compaction of all batches of stones: Total time taken for installation of stone column: Length of stone column from GL: Total volume of stones consumed:



8. TYPICAL DRAWING SHOWING THE PLAN AND SECTIONAL DETAILS OF STONE COLUMNS FOR IMPROVEMENT OF SOIL CAPACITY FOR SEWERAGE WATER TANK (10 MLD) (COURTSEY TO L&T).



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9. REAL TIME PHOTOGRAPHS OF INSTALLATIONS OF STONE COLUMNS



10. STP COMPLETED AFTER GROUND IMPROVEMENT BY USING VIBRO FLOAT STONE COLUMNS AS PER I S CODE 15284 (PART I): 2003 (COURTSEY TO L&T)



11. COMPARISON BETWEEN SEVERAL SOIL IMPROVEMENT TECHNIQUES

Improvement techniques	Increase of bearing capacity	Accelerated Consolidation	Settlement reduction	Other advantage
Preloading	No	No	No	Partial consolidation
Preloading associated with VD	No	Yes	No	Rapid installation
Vacuum consolidation	No	Yes	No	Rapid installation
Reinforcement by columns	Yes	Yes	Yes	Prevent liquefaction

Table 1 *Comparison between soil improvement techniques*

12. CONCLUSIONS

The paper focused mainly on the problems faced by geotechnical engineers when encountered with soft soils. The concentrations sought upon the various proven methods with its pros and cons and limitations to improve the engineering properties of soil, its shear strength, bearing capacity, increase in the rate of primary consolidation, reduction in overall settlement and reduction in the chances of liquefaction. The study reviewed number of prevailing techniques to improve the strength of soft soils and reduce in the settlement.

Some of the techniques which can be conclude from this study are:

Techniques accelerate the settlements are as under:

1. Preloading and Pre-compression techniques.
2. Associating vertical drains with preloading like Sand drains and Wick drains (prefabricated drains).

Techniques for reductions of the rate of settlements are as under:

1. Soil Replacement
2. Stone Columns
3. Soil Cement Piles
4. Lime piles
5. Soil Reinforcement with Geotextile / Geogrid
6. Soil improvement by using cement, lime and fly ash.

Study also focused that some techniques are more effective than other particularly for soft soils. The commonly methods are for the reducing the rate of settlements of soft soils rather than the accelerate the rate of settlement.

Further study required to estimate the exact size of area to be treated with cut-off depths of different types of vertical drains, stone columns, reinforcement of geogrids / geotextiles, removal of topsoil. Present practice is the decisions as per the Engineer-in-charge of the project site based on their experiences.

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Effect of Aluminosilicate powder as a replacement of cement on properties of concrete

Dr. Abhijitsinh A. Parmar
Associate Prof., Dept of Civil Engg.,
Sankalchand Patel University
Visnagar, India
mail ID: abhijitsinhparmar777@gmail.com

Dr. Bibhabasu Mohanty
Assistant Prof., Dept of Env. Engg.,
Sankalchand Patel University
Visnagar, India
mail ID: bibhabasu.mohanty@gmail.com

Mr. Jash Kansara
Assistant Prof., Dept of Civil Engg.,
Sankalchand Patel University
Visnagar, India
mail ID: jnkansara.civil@spcevng.ac.in

***Abstract*—For evaluating concrete performance over a time period, the various thermal properties of concrete such as thermal conductivity, diffusiveness, durability, specific heat are all important. Specific heat is the heat capacity of concrete increased with the humidity of concrete. The thermal conductivity, the diffusiveness and longevity of the concrete and the specific heat depend on their moisture content, their aggregate form, their mixture proportions, their form of cement and concrete temperature, their hydration, their cement paste and their drying conditions. To increase the heat resistance capacity of concrete cube using Aluminosilicate powder (Al_2SiO_5). The material Aluminosilicate powder composed of aluminum, silicon, oxygen and major component of kaolin and other clay minerals. It is tolerated 400^0C, 500^0C and 600^0C temperature. The different thermal and mechanical properties of concrete, various test is carried out. Experiments were performed on concrete cube and beam with reinforcement using Aluminosilicate powder as a replacement of cement by different percentage 0%, 10%, 20%, 30% and 40% and 7,14,28,56 days and 400^0C, 500^0C and 600^0C temperature variation for different test. The different concrete tests were performed to determine the compressive strength of concrete and to check thermal and mechanical property test was done temperature test, Thermal conductivity test, durability test, water absorption test, and flexural test for reinforced concrete beam. Aluminosilicate powder (Al_2SiO_5) has lower thermal conductivity which is good thermal material and high temperature resistance capacity and fire resistance capacity and also similar property match with cement and good binder material so easily mix with good bonding. Maximum Compressive strength was achieved in 20% replacement and maximum thermal resistant capacity was observed in 40 % replacement.**

***Keywords—Concrete, Thermal Properties,* Aluminosilicate, testing, cement, replacement**

I. INTRODUCTION

Concrete is a very strong and flexible tool for molding building. It consists of cement, sand, and aggregate mixed with water (e.g., gravel or crushed rock). The cement and the water form a paste or gel that coats and aggregates the sand. When the cement has reacted chemically with the water (hydrated), it will harden and tie the whole mix together. The initial hardening reaction usually takes place in just a few hours. Concrete takes several weeks to achieve maximum hardness and strength. Concrete can continue to harden over many years, and gain strength. To produce workable concrete an appropriate water cement ratio is necessary. When water is mixed with materials, cement reacts with water, and reactions to hydration begin. One can cast concrete in any shape. Because it is a fresh state plastic material, various types and sizes of forms or types are used to provide specific shapes such as rectangular, circular, etc. [1]. Different structural elements are built with concrete, such as beams, slabs, footings, columns, lintels, etc. Aluminum minerals are gold, silicone and oxygen minerals, plus counteractants. They are an important component of kaolin and other clay minerals. These three minerals are usually found as index minerals in metamorphic rocks. Hydrated minerals of aluminosilicate are called zeolites and are naturally pore structures. Silica-alumina is a no Aluminosilicate compound amorphous substance. Aluminosilicate minerals with Al2SiO5 composition are natural Andesite, Cyanite and Sillimanite. At 500^0C and 0.4GPa pressure, the triple point of three polymorphs is average. Thermal conductivity of aluminosilicate powder is 2.0 W / m-K. Aluminosilicate can be designed to withstand temperatures up to 800 °C, borosilicate and ceramic-like temperatures considerably higher than the temperatures of the material being transformed [2]. Their formulations can be also matched to thermal expansion electrodes, such as molybdenum, allowing extremely tight gas resistant glass to be produced by metal screens through hot-shaping processes.

II. MATERIALS

Cement: -

Cement can be described as a bonding material with cohesive & adhesive properties that makes it capable of uniting the various building materials and forming a compact assembly. Ordinary / Regular Portland cement is one of Portland Cement's most widely used form. Joseph Aspdin gave the name Portland cement in 1824 because of its resemblance in color and its consistency when it hardens like Portland stone. Ordinary Portland cement is currently the most used construction material in the world.

Aggregates: -

The aggregates are rock-like, coarse particle material composed of < 0.1 to > 50 mm in thickness of a range of particles. It contains gravel, broken rock, sand, recycled concrete, slag and synthetic aggregate. Coarse aggregates and fine aggregates are part of the total types. Each type of aggregate is further subdivided into several types and its size classifications.

Coarse Aggregate: -

Coarse-grained aggregates with 4.75 mm openings do not move through a sieve. Particles mostly stored on the 4.75 mm sieve and moving through the 3-inch glass are considered coarse aggregates.

Fine Aggregate: -
The other type of aggregates are those particles that pass the 9.5 mm sieve, pass almost completely through the 4.75 mm seven, mainly kept in the 75 μm seven. For improved workability and quality, the fine aggregate should be rounded as demonstrated by less cement. A fine aggregate is designed as a working agent for filling vacuums in the coarse aggregate.

Water: -
Water is a major component of concrete development. The chemical reaction process, also known as hydration heat, is mainly dependent on water and cement. Water is therefore most important to making concrete. Because water is added to the cement, cement paste is generated, which is very helpful for bonding various coarse aggregates and fine aggregate particles together. Therefore, water plays an important role and therefore has a direct influence on the strength of concrete, so the quantity and quality of water should also be considered. The water used should be suitable for drinking. For practical use, tap water was used to make concrete.

Aluminosilicate Powder (Al_2SiO_5): -
Aluminum minerals are gold, silicone and oxygen minerals, plus counteractants. They are an important component of kaolin and other clay minerals. These three minerals are usually found as index minerals in metamorphic rocks. Hydrated minerals of aluminosilicate are called zeolites and are naturally pore structures. Silica-alumina is a no Aluminosilicate compound amorphous substance. Aluminosilicate minerals with Al2SiO5 composition are natural Andesite, Cyanite and Sillimanite. At 500^0C and 0.4GPa pressure, the triple point of three polymorphs is average. Thermal conductivity of aluminosilicate powder is 2.0 W / m-K [1]. Aluminosilicate can be designed to withstand temperatures up to 800 °C, borosilicate and ceramic-like temperatures considerably higher than the temperatures of the material being transformed [3, 4, 5, 6]. Their formulations can be also matched to thermal expansion electrodes, such as molybdenum, allowing extremely tight gas resistant glass to be produced by metal screens through hot-shaping processes.

III. RESULTS

A. Slump test: -
Place the mold on a smooth non-porosity horizontal basis, apply the oil and place the mold on the mold. In 4 roughly equal layers, fill the mold with a prepared concrete mixture. Spread the rod rounded end of each sheet in a regular manner over the cross part of the mould with 25 circles. For subsequent layers the tamping will penetrate the underlying layer. Scrape the unused cement, flatten with a trowel the surface. Clean out mortar or water from the base plate between the mold and the base plate. Lift the mold vertically from the cement instantly and gradually. Measure the slump as the height difference between the mold and the test specimen's height [3].

TABLE I. AVERAGE COMPRESSIVE STRENGTH TEST RESULT

Mix	Days		
	7 day (N/mm²)	*14 day (N/mm²)*	*28 day (N/mm²)*
Normal	26.90	32.20	43.40
Aluminosilicate 10%	26.98	32.42	44.78
Aluminosilicate 20%	28.09	33.78	45.86
Aluminosilicate 30%	27.18	32.96	44.12
Aluminosilicate 40%	26.68	33.12	43.57

TABLE II. AVERAGE TEST RESULT OF SLUMP TEST M-35 CUBE

Mix	Slump Test Result (mm)
Normal	82
Aluminosilicate 10%	80
Aluminosilicate 20%	77
Aluminosilicate 30%	74
Aluminosilicate 40%	71

TABLE III. AVERAGE COMPRESSIVE STRENGTH TEST RESULT AFTER TEMPERATURE EFFECT

Mix	28 Days		
	400^0 C (N/mm²)	*500^0 C (N/mm²)*	*600^0 C (N/mm²)*
Normal	26.90	32.20	43.40
Aluminosilicate 10%	26.98	32.42	44.78
Aluminosilicate 20%	28.09	33.78	45.86
Aluminosilicate 30%	27.18	32.96	44.12
Aluminosilicate 40%	26.68	33.12	43.57

B. Thermal Conductivity test: -

The hot wire method is a transient process based on calculation of the increased temperature, which is a linear heat source within the test material at a certain distance from the hot wire [1, 7, 8, 9]. The method of the hot wire sample uses the principle of the transient technical hot wire. Thermal conductivity, depending on the power input and time-dependent variance, is measured for transient and transient line sources. The flat source transient technique is used to calculate the thermal conductivity of materials in the air and in the air [10, 11]. A flat sensor, which raises the temperature as electricity passes through the sensor by means of a time-counter meter, may be used to calculate the thermal characteristics of the object [12].

TABLE IV. AVERAGE THERMAL CONDUCTIVITY TEST RESULT (W/MK)

Mix	28 Days		
	673.15K (W/mK)	*773.15K (W/mK)*	*873.15K (W/mK)*
Normal	2.2	2.31	2.40
Aluminosilicate 10%	1.97	2.04	2.10
Aluminosilicate 20%	1.73	1.83	1.89

Mix	28 Days		
	673.15K (W/mK)	*773.15K (W/mK)*	*873.15K (W/mK)*
Aluminosilicate 30%	1.57	1.66	1.72
Aluminosilicate 40%	1.28	1.39	1.50



Fig. 1. Thermal Conductivity test images

IV CONCLUSION

- Reduction in workability was observed with increase in replacement of cement with Aluminosilicate Powder (Al_2SiO_5). Least workability was observed in 40% Replacement and maximum in concrete with no replacement.

- Maximum compressive strength was observed at 20 % in replacement of cement with Aluminosilicate Powder (Al_2SiO_5). After more than 20% replacement, reduction in strength was observed from the test result.

- Compressive strength lost in concrete after application of external heat, minimum lost was observed in 40% in replacement of cement with Aluminosilicate Powder (Al_2SiO_5).

- Minimum Thermal conductivity was observed in concrete at 40% in replacement of cement with Aluminosilicate Powder (Al_2SiO_5).

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Parametric Study on Geogrid Application in Interlayer of Flexible Pavement

Vaidehi Jain
Asssitant Professor
School of Engineeting & Technology
Navrachana Unversity
Vadodara, India
vaidehiparikh19@gmail.com

Payal Desai
Associate Professor
School of Engineeting & Technology
Navrachana Unversity
Vadodara, India

***Abstract*— Flexible pavements are prone to deformation and damage due to repeated loading from heavy vehicles and environmental factors such as temperature and moisture. To enhance the structural capacity of flexible pavements, geogrids are often used as reinforcement in the pavement interlayer. Various research studies have been conducted to investigate the effects of geogrids in pavement interlayers on different parameters such as rutting, fatigue cracking, and reflective cracking. The literature review reveals that the use of geogrids in pavement interlayers can improve the pavement's performance under various loading conditions. The use of geogrids in the pavement interlayer can improve the pavement's resistance to deformation and damage, increase its service life, and reduce maintenance costs. The review analysed several studies conducted on the effect of geogrids in interlayers on different parameters such as rutting, fatigue cracking, and tensile strength using laboratory testing, field measurements, and numerical modelling.**

Keywords*— *Flexible pavement, Geogrid, Interlayer, Rutting, Fatigue cracking, service life, stress distribution.

I. INTRODUCTION

Flexible pavements are widely used for roadway, airport, and industrial pavements due to their excellent deformation characteristics. The structural performance of flexible pavements is primarily affected by environmental factors such as temperature and moisture, and the repeated loading from heavy vehicles. The repeated loading can cause the pavement to deform, leading to rutting and fatigue cracking. The use of reinforcement in the form of geogrids is a commonly used method to enhance the structural capacity of flexible pavements.

Geogrids are synthetic materials that are used to reinforce the pavement structure. They are placed between the base and asphalt layers to distribute the load more evenly and reduce deformation. The geogrids can be made of various materials such as polypropylene, polyester, or fiberglass, and they are available in different types and strengths.

A. Geogrid application in flexible pavement

Two of the main jobs of geosynthetics are carried out by geogrids when they are used in a pavement system: separation and reinforcement. The majority of commercial geogrid products have large aperture sizes, hence geogrids are often not utilised to separate materials with different properties [5]. The gradations of the two materials affect a geogrid's capacity to separate them, which is typically outside the parameters for common paving materials. Geogrids, even with their limitations, can theoretically offer some kind of separation. Because of this, the primary purpose of geogrids utilised in pavements is not separation. The main purpose of geogrids is to reinforce pavements by mechanically enhancing the engineering characteristics of the pavement system. the geogrid-related reinforcing techniques.

Geogrids can be constructed in single or multiple layers and are often created by stretching or extruding high-density polyethylene or polypropylene, or by weaving or knitting high-tenacity polyester yarns or glass fibre and coating them with the proper coating [9]. Large openings, known as apertures, are present in the resulting grid structure, which improves contact with the soil or aggregate. Geogrids are useful as reinforcement and stabilisation for soil and aggregate because of their high tensile strength and stiffness.



Fig 1: Geogrid application [15]

B. Pavement with and without geogrid

The use of geogrids in pavement construction has been shown to improve the performance of the pavement. Geogrids are materials that are made from polymer or fiberglass and are designed to provide reinforcement to soil, aggregate, or asphalt layers in a pavement system.

The main benefit of using geogrids in pavement construction is that they help to distribute the load from traffic more evenly across the pavement layers, thereby reducing the potential for rutting and cracking. Additionally, geogrids can improve the overall strength and stability of the pavement system [7].

Without geogrid's application, pavement performance can be compromised, especially in areas with heavy traffic or high loads. Pavements without geogrids may experience rutting, cracking, and other forms of pavement distress, which can lead to increased maintenance and repair costs.

In comparison, pavement with geogrid application has been shown to exhibit improved performance and durability. Research studies have demonstrated that the use of geogrids can extend the life of a pavement system by reducing the amount of rutting and cracking that occurs over time [11].

Overall, the use of geogrids in pavement construction can provide significant benefits in terms of improved performance, reduced maintenance costs, and increased pavement life.

II. GEOGRID EFFECTS ON VARIOUS PARAMETERS

A. Rutting:



Fig 2: Rutting Distress [1]

Rutting can be significantly decreased by incorporating geogrids into the pavement interlayers. The performance of the pavement is significantly influenced by how the geogrids are installed, particularly their direction and spacing. Rutting can be significantly decreased by using biaxial geogrids with increased strength and stiffness.

The performance of the pavement can also be enhanced by the introduction of geogrids in the interlayer. Flexible pavement rutting can be decreased by incorporating geogrids into the interlayers [8]. The load may be distributed more uniformly by the geogrids, which prevents the pavement from deforming. Several studies have demonstrated that the use of geogrids in interlayers significantly reduces rutting [11].

B. Cracking:

The use of geogrids in interlayers can also reduce the fatigue cracking of flexible pavements. The geogrids can distribute the load more evenly, reducing the tensile stresses on the asphalt layer. Several studies have shown a significant reduction in fatigue cracking with the use of geogrids in interlayers [6].

C. Stress distribution:

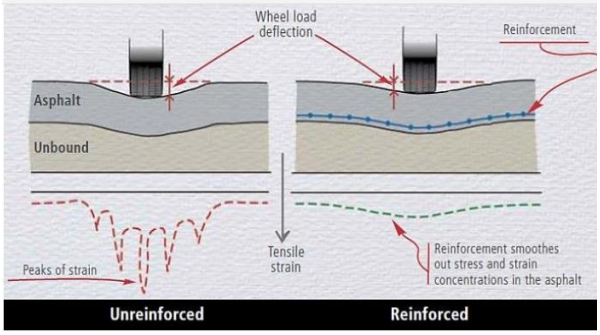


Fig 3: Load distribution through layers [14]

High traffic levels in recent years have harmed both new and old road infrastructure, accelerating deterioration and the loss of the structural and functional qualities of pavements. Geosynthetic reinforcements can therefore be used in between the pavement layers to restore and/or enhance mechanical performance [2]. The capacity of an interlayer to more effectively distribute the applied load over a broader area and to make up for the lack of tensile strength in the road pavement is referred to as "reinforcement." The reinforcing material should be stiffer than the material being reinforced, as with any reinforcement application [4]. Geogrids are a type of geosynthetic material that is frequently utilized in road construction because of their increased fatigue resistance, decreased rutting, and restricted reflective cracking.

Figure 3 shows the redistribution of stress under a wheel load. The horizontal tensile strain should be minimized at the base of the asphalt layer to prevent fatigue cracking and rutting, and the vertical stress should be minimized at the top of the subgrade to prevent permanent deformations. These two critical locations within the pavement structure are given special consideration in the design of flexible pavement.

D. Service life:

The efficiency of glass fiber grids as reinforcement, which, with proper design and installation, by improving interface shear resistance, can be used to expand the performance of flexible pavements in various ways: by extending the road service life by making a significant contribution against superficial rutting or by lowering construction costs due to the reduction in the thickness of the reinforced HMA layer and, consequently, of the mineral aggregate required [1].

III. Conclusion and discussion

The effectiveness of geogrid-reinforced pavements is further influenced by a number of additional factors, including asphalt thickness, subgrade soil type, and environmental factors. Where the deformation resistance of the pavement is relatively low, such as in thin asphalt pavements and poor subgrade soils, geogrids are more effective [8]. The performance of the pavement can be greatly enhanced by the inclusion of geogrids in the interlayers of the pavement under various loading circumstances. Based on the pavement design and anticipated loading conditions, the appropriate choice and positioning of geogrids should be taken into consideration. The long-term impacts of geogrids on the performance and sustainability of pavements need to be better understood.

It is also possible to minimize aggregate thickness economically and ecologically by utilizing the advantages of geogrid reinforced subgrade courses. Moreover, a longer lifespan can lower the overall cost of constructing a pavement while simultaneously extending the life of the pavement.
In order to reinforce subgrade materials for use in building roads, the study looked into the use of geogrids. The addition of the geo-grid significantly boosts the resilience of weak soils, which is shown in the increased CBR values [11].

The performance of the subgrade in the unsoaked condition significantly improves with soil reinforcement. Geogrids are used to strengthen weak soils, increasing their strength.
Because to its durability and lack of biodegradability, it also extends the pavement's useful life. Thus, the usage of Geogrids should be promoted as an efficient and cutting-edge method of enhancing road building on subpar subgrade materials. To determine the impact of geogrids on subgrade soils under the unsoaked condition, more study should be examined.

IV. Limitations

- As a result of its potential limited elongation, geogrid might not be appropriate for locations with significant soil settlement or ground movement.
- It may be necessary to replace Geogrid after a specific amount of time if it is damaged by UV rays or abrupt temperature fluctuations [13].
- If it is no longer required, geogrid can also be challenging to get rid of and might necessitate specialized tools [15].
- Ultimately, geogrid can be a useful and affordable alternative for soil reinforcement in many circumstances, but it's crucial to take the site's particular conditions into account as well as the method's long-term durability before choosing to utilize it.

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Water Desalination Technique Using Solar Still And Parabolic Trough Collector

1st Shaival R Parikh
Research Scholar, Indus University, Ahmedabad, India
Assistant Professor, Mechanical Engineering Department, Gandhinagar Institute of Technology Gandhinagar, India
shaivalparikh.rs@indusuni.ac.in, shaival01@gmail.com

2nd Dr. Umang J Patdiwala
Assistant Professor, Mechanical Engineering Department, Indus University,
Ahmedabad, India
umangpatdiwala.me@indus.ac.in

3rd Dr. Ruchir O Parikh
Assistant Professor, Mechanical Engineering Department, Gandhinagar Institute of Technology
Gandhinagar, India
ruchirop@gmail.com

***Abstract*— Solar energy is a well-known and major renewable energy source. However, because of the worldwide water crisis, many people have died as a result of drinking polluted water. Solar water desalination is a popular solution to this problem, although there is still significant space for efficiency improvement. The purpose of this research is to investigate numerous novel techniques to increase the efficiency of solar stills. A thorough investigation revealed that there has been a minimal study on the performance of single-slope solar stills paired with parabolic trough collectors. A solar still equipped with a parabolic trough collector can provide various innovative benefits, including increased energy efficiency, improved water quality, scalability, and lower production costs. The performance of a parabolic trough collector integrated solar still was experimentally examined in this study. An experimental study looked at three different brine depths (15 mm, 20 mm, and 25 mm). In May, conventional solar still produces 2.79 liters when still with trough produced 4.715 liters. Solar is still being tried with various water masses to determine the best output. The greatest results are obtained with a 15-liter mass. Finally, it is combined with a parabolic collector to improve efficiency. Collector efficiency is boosted by up to 74% after connecting to a parabolic trough. The prototype is being built and tested in Ahmedabad.**

Keywords*— Collector efficiency, trough collector, Solar still, desalination of water.

I. INTRODUCTION

It is our grand fortune to have a quarter past of our Earth filled with Water in adequate of quantity. It is incredibly rare that the usage of water in our routine life like drinking, bathing, irrigate our farm fields is pure and fresh. It is exanimated that some 1.1 billion people suffer from lack use of water. And a total of 2.9 billion people suffer from the infrequency of water for one month of a year. Unusual public health is also a drawback for 2.5 billion people. Many of the water systems keep ecosystems in such a Prospero various field which take some major portion Agriculture consumes more water than any other manner that provides facilities to growing and developing a human population that has become stressed. Rivers, lakes, and aquifers are drying up or becoming too polluted to use. India has four percent of the world drinkable water which has to serve around 19 % of the total population. According to a report issued in June 2019 by NITI Aayog, India is now witnessing the worst water crisis in its history. Around 6 billion individuals, or around 48% of the population, are under moderate to severe water stress. Furthermore, almost 4.5 billion Indians are afflicted by poor water quality as a result of pollution, increased fluoride, arsenic, iron, or saltwater intrusion.

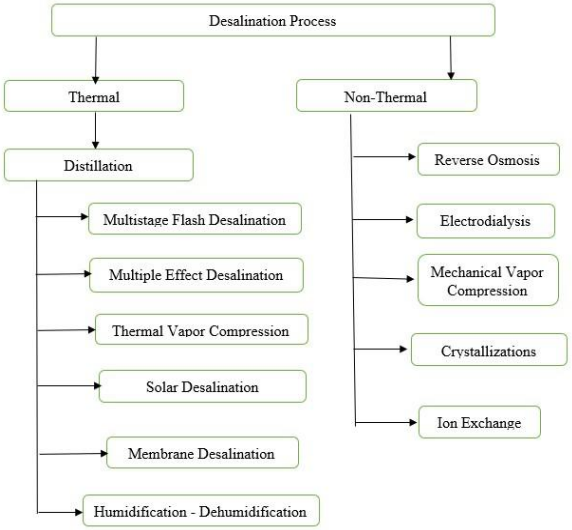


Figure – 1 Flow diagram of the typical desalination process based on the energy source employed

Desalination is a physical process that removes excess dissolved salts from various types of water, including brackish and seawater, as well as aqueous salt solutions, to produce low-salt water suitable for drinking, industrial, medicinal, municipal, or domestic use. It is basically a reproduction of the natural hydrological cycle, in which solar radiation causes the evaporation of water from natural water sources such as rivers, seas, and oceans, which is followed by condensation due to contact with colder air, resulting in dew or rainfall. By combining cooling and heating sources, this process may be intentionally duplicated and accelerated. The amount of energy required for the extraction process, on the other hand, is exactly proportional to the amount of salt concentration removed from seawater.

The basic idea behind a solar still with a PTC is to use the PTC to concentrate sunlight onto the still, which heats up the water and increases the rate of evaporation. The steam generated by the evaporation is then condensed on a cool surface, producing fresh water. The use of a PTC can significantly increase the efficiency of the still by concentrating sunlight onto a smaller area, thereby increasing the temperature of the water and reducing heat losses.

II. REVIEW OF THE LITERATURE

Water Desalination Technique Using Solar Still and Parabolic Trough Collector is a method of desalinating water that combines two technologies: a solar still and a parabolic trough collector. The solar still utilizes solar energy to evaporate water before condensing the vapor to make distilled water, whereas the parabolic trough collector uses solar energy to heat water to high temperatures.

The system can desalinate water more efficiently and cost-effectively by integrating the two processes. The parabolic trough collector raises the temperature of the water, increasing the rate of evaporation in the solar still. As a result, the yield of distilled water production improved.

This technology has the potential to give a long-term solution to the scarcity of shortage of water, particularly in places where solar radiation is abundant. It is also ecologically good because it uses renewable energy and emits no greenhouse gases.

Arunkumar et al. investigated several solar still designs for separating pure water from salty water. Despite the fact that several solar water desalination technologies were utilized, the essential idea remained the same. The researchers evaluated and analyzed the performance of numerous solar stills, including spherical, pyramid, hemisphere, double basin, tube, CPC-TSS-pyramid, and hemisphere concentrator solar stills. According to their findings, the tubular solar coupled pyramid solar still produced the most energy because of the concentrator effect. The researchers also mentioned that solar production is affected by environmental factors. These findings shed light on the design and optimization of solar stills for water desalination applications. [1]

Dnyaneshwarsonawane et al. investigated ways for enhancing solar still production by optimizing the angle of an absorber surface embedded with a phase change material (PCM). They concentrated on improving solar output using PCM and altering the tilt of the absorber surface. They investigated the usage of phase transition material at the bottom of a single-basin solar still, as well as its interaction with natural resources, to enhance energy utilization. The researchers discovered that the PCM material operated as a heat producer during the day and a heat sink at night, allowing the still to run constantly. They also discovered that altering the angle of the absorber surface at 34 °C enhanced distillate production by 62% when compared to another angle. These results indicate that optimizing the angle of the PCM-embedded absorber surface is a potential technique for increasing solar still output. [2]

Alpesh Mehta and colleagues investigated the design and functioning of a single-basin solar still. They built the solar still by hand and erected it on an open terrace that was only open from morning 9:30 AM to evening 5:30 PM. during winter. They discovered that the peak temperature and evaporation rates took place between 11:30 AM to 2:00 PM, with a maximum temperature of 53.5 ^{0}C achieved at 2:00 p.m. The temperature then progressively dropped.[3]

Hemin Thakkar et al. undertook a thorough examination of solar desalination approaches such as multi-effect desalination systems, desalination plants with pad humidifiers, and desalination with a separate evaporator. They also investigated the use of nanomaterials in the desalination process. The study discovered that traditional solar stills have a restricted output of around 3 liters, however, combining active solar technologies can increase output. In active solar stills, the evacuated tube collector outperformed the FPC.[4]

Thota Sivaji conducted a solar desalination experiment with a solar still and determined that this method is particularly successful in alleviating water scarcity situations. The study discovered that a 2 m^2 solar still basin may create enough portable water to support one person for a day. These findings provide light on the potential of solar desalination technology to reduce water shortage of water and increase the availability of pure drinking water.[5]

Deepak.S.A et al. investigated solar desalination of saltwater utilizing using parabolic concentrator in single-basin single sloped solar still. The aluminum solar still was installed above the parabolic concentrator. According to their findings, the amount of desalinated water generated was highly dependent on the intensity of sunshine and the chemical utilized for heat absorption. These findings provide light on the potential of solar desalination technology and the fundamental elements that impact its performance.[6]

Lanjewar P K et al. conducted a mathematical study of a storage solar still. They used a phase change material (PCM) as the storage medium for the solar still since they assumed solar stills only worked during the day. Based on heat balancing equations at different sections of the sun still, their results revealed that the maximum efficiency of the solar still was around 60%. To get these results, they constructed the experiment to detect the temperature at several locations.[7]

Mohammed Farid et al. analyzed the performance of single-basin solar still, which is an important technology for water purification in locations where clean water is scarce. The solar still was built using a 1mm thick galvanized sheet, a 1.5 square meter basin area, and a 6mm angled glass cover. Their findings indicate that a shallower water depth can greatly boost still production, emphasizing the necessity of monitoring and assessing the device's performance over time, which hourly readings can help. The study contributes to the improvement of sustainable water purification technologies by providing useful insights into the design and use of single-basin solar stills.[8]

Rameshaiah GN et al. investigated the performance of solar stills, commonly known as green distillation, in generating high-purity water. The researchers created solar still out of a variety of materials, including acrylic for the side walls and granite marble for the basin due to its high heat absorption,

oxidation resistance, and extended lifespan. They put a sand layer beneath the granite slab, followed by a thermocol slab for its great heat resistance, to improve the device's effectiveness even further. The study's findings revealed that the solar still generated high-purity water, highlighting its potential as a sustainable and effective option for water purification in locations with limited access to clean water.[9]

Amermamkagh et al. investigated the condensation rate enhancement of solar still connected to a solar water heater in their study. The solar still 500 * 500 * 150 mm was fabricated by the aluminum sheet. The basin's bottom was painted black to increase solar radiation absorption, while the edges were composed of clear acrylic sheets to allow for solar light transmission. According to their findings, putting cotton wick material within the basin greatly boosted freshwater output. These findings shed light on the design and optimization of solar stills, emphasizing the potential for cotton wick material to improve condensation rates and water purifying efficiency.[10]

Ravishankar et al. investigated the integration of several types of solar collectors to increase the production and efficiency of solar stills. In their experiment, the researchers used flat plate collector, focusing collector, pulsing heat pipe collector, U Pipe collector, thermoelectric effect, parabolic trough, and solar water heater. According to their findings, using Phase Change Material (PCM) material increased the efficiency of solar stills by up to 137 percent, highlighting the potential of PCM material in increasing the production of solar stills and boosting water purification efficiency. These findings offer important insights into the design and optimization of solar stills, demonstrating the possibility of employing PCM material to improve device efficiency.[11]

Mohammad Al-Harassed et al. investigated solar desalination with a solar still supplemented with an external solar collector and a phase change material (PCM). Their solar still was constructed of stainless steel and featured a one-square-meter basin. The glass of the solar still was covered at a 36-degree angle and was one centimeter thick. They used PCM material and connected the solar still to solar collectors. They discovered that the PCM functioned as an energy source over the evening period with no changes in thermal behavior. Furthermore, their trial yielded the maximum daily output of 4300 milliliters per day per square meter.[12]

S. Varun Raj and colleagues did research on the design and analysis of solar stills. They used galvanized iron sheets with a basin surface area of 50 cm * 100 cm, a height of 28.8 cm, and a thickness of 0.14 cm to build solar stills. The basin had a black coating applied to it. Based on their findings, they determined that when the water level was high, the greatest temperature of water, mist, and basin water was seen between 3:00 pm and 6:00 pm. [13]

After examining numerous initiatives to intensify the productivity of solar still, the following research gaps were found.

- Less effective solar stills.
- Variable yield due to the dependency on solar energy that is inherent.
- Lack of control over the rate of evaporation of the salty water

In light of the research gaps that were discovered, the following objectives were set to solve the shortcomings of the present system.

- To design a solar system that can produce more energy.
- To guarantee consistent output from the solar stills.
- To develop a revolutionary design known as SS in conjunction with PTC to address the enduring issue of solar stills' lower and inconsistent production.
-

III. Design Strategy and Technique

Methodology: The design and testing of a solar still with a PTC are as follows:

The initial stage is to design the solar still and PTC, which includes selecting proper materials and measurements for each component. Solar stills can be built of a range of materials, including glass or plastic, and should be designed to maximize the surface area exposed to sunlight while minimizing heat losses. The PTC should be constructed of a reflective material, such as aluminum, and should be designed to focus sunlight on the still.

Solar still fabrication

As indicated in Figure 1, the experimental setup reported in this paper consists of a single slope solar still coupled to a parabolic trough collector. The solar still has a 1 m^2 basin and is built of Mild Steel. The still cover's toughened glass is 4 mm thick and 1050 mm long and 1050 mm wide, with a slope angle of 23° from the horizontal. The solar retains its 75 mm front height, 500 mm rear height, and 75 mm maximum water depth capacity. An aperture of the trough collector is 1.1 m^2, while the reflector is composed of aluminum foil and has a parabolic length and width of 1110 mm and 800 mm, respectively. To improve heat transfer conductivity, the receiver is made of a copper tube with a length of 1200 mm and a diameter of 2.54 cm. The parabolic collector has a manual tracking system.



Fig 2 Experimental setup

IV. Experimentation

The fabricated experimental setup depicted in Fig 2 was tested on May 20, 2022, in Ahmedabad (23°02'N, 72°57'E), employing a single slope solar still connected with a parabolic trough collector for three distinct brine depths (15 mm, 20 mm, and 25 mm) as per the system's field configuration. The distillate produced by passive solar stills is often low, limiting its usage in industrial and home applications. The installation of a parabolic trough collector is one method for increasing distillate production. The PTC in this investigation was created using the design described by Upadhyay et al. [14]. In this experimental setup, the water was preheated in the parabolic trough collector before being fed into the solar still. Upon reaching the still, the hot water elevated the temperature of the water inside the still, causing an increase in the rate of water evaporation. This, in turn, caused a rise in the temperature of the internal glass cover, leading to a boost in distillate production. The experimental arrangement of the passive solar still with a parabolic trough collector is shown in Figure 2.

V. Result and Discussion

As a result of passive solar, the water depth varies:

The graph below depicts the distillate water production of passive solar still at three different water depths (15 mm, 20 mm, and 25 mm). The still with a water depth of 15 mm clearly generated the most distillate, making it the most efficient arrangement of the three tested depths.

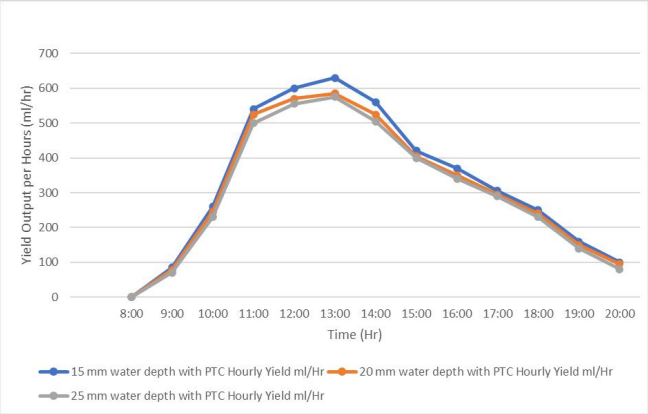


Fig 3 Single basin solar still without and with PTC at varying water depths

Comparison of single basin solar with and without PTC:

A study of a single basin solar still with and without a PTC (Parabolic Trough Collector) at different water depths reveals that, despite similar sun intensity in both cases, there is a substantial temperature difference between the glass and still water. The maximum temperature of the water without a PTC is 58.4°C, whereas the maximum temperature of the glass is 78.5°C. The maximum temperature of still water with a PTC is 55.1°C, whereas the maximum temperature of the glass is 95.8°C. In Ahmedabad, India, combining a parabolic trough collector with a single basin solar still boosts distillate production by 74%.

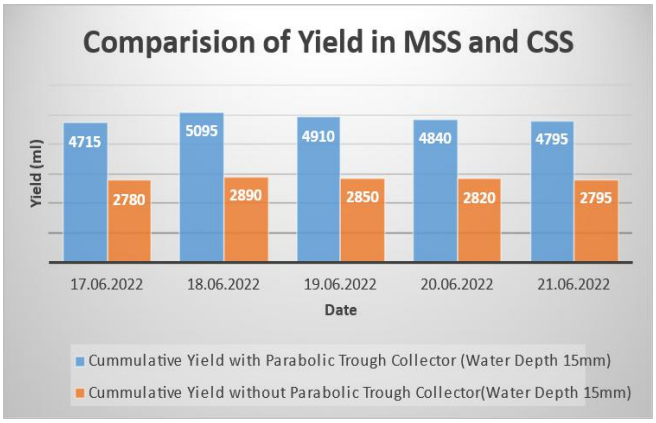


Fig 4 Distillate yield Comparison still without PTC and with PTC

VI. Conclusion

To summarize, a solar still with a parabolic trough collector is a viable technique for tackling water scarcity and sustainability concerns. The use of a solar still in conjunction with a parabolic trough collector can result in increased energy efficiency, lower production costs, and better water quality. This technology can also be scaled to suit varying water production requirements, making it a versatile and adaptable option.

The primary conclusions of the study are as follows:

1. The depth of the water in passive solar still strongly influences distillate output, with 15mm of water being the most effective.
2. Combination of parabolic trough collector and solar still may greatly enhance water temperature and distillate output.
3. The productivity yield of single basin solar still coupled with a parabolic trough collector can enhance by up to 74% when compared to conventional solar still.

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ReactJS: A Comprehensive Analysis of its features, Performance, and Suitability for Modern Web Development

KUNAL PAREKH
Computer Science & Engineering
Charotar University of Science and Technology
Nadiad, India
20DCS061@charusat.edu.in

DEVANSHI BHATT
Computer Science & Engineering
Charotar University of Science and Technology
Nadiad, India
20DCS009@charusat.edu.in

MEHUL MINAT
Computer Science & Engineering
Charotar University of Science and Technology
Nadiad, India
20DCS049@charusat.edu.in

Bansari Patel
Assistant Professor,
Computer Science and Engineering
Charotar University of Science and Technology
Nadiad, India
bansaripatel797@gmail.com

Shivangi Mehta
Assistant Professor,
Computer Science & Engineering
Charotar University of Science and Technology
Nadiad, India
shivangimehta.dcs@charusat.ac.in

Abstract — **ReactJS is an open-source technology used to create UIs specifically for single-page apps. Software developers may create large-scale web applications with ReactJS that can consume data and alter over time without refreshing the page. React utilizes a clever diffing computation in this manner to only recover in its DOM hub the data that needs to be retrieved while keeping the rest with no assurances. Our application may be built easily thanks to the use of reusable components. Reacts amazing design also makes UI arrangements predictable and relieves programmers of a significant burden, allowing them to concentrate on bigger goals and business thinking. Respond doesn't compel the use of a specific way to carry out a given task, either. Customers may pick from a wide range of libraries to play out a certain task thanks to this service. The ordering of events that are called during a segment's lifespan is handled by lifecycle strategies and react hooks, two additional important features. The ReactJS system's many strengths are discussed in this article, along with how these strengths are applied when creating applications. It also goes through a few of the terms that are used the most frequently, how to use them, and how to incorporate them into our program.**

Keywords — ReactJS, Components, Architecture, Lightweight DOM, Virtual DOM, JSX, Performance, One Way Data Flow, Pro's and Con's

I. INTRODUCTION

Angular was the lone and leading challenger in the JS framework market before React entered the scene. Although Angular was a comprehensive and proper framework, developers found it to be incredibly challenging because it required a lot of writing. Even seasoned JavaScript programmers struggled with the coding process and looked for alternatives to their problems. It was never the best practice to create JS applications with AngularJS. It has additional features that the majority of developers did not need.

React JS is a JavaScript library that is free to use and was created to help create user interfaces for websites. Jordan Walke, a software engineer at Facebook, created the open-source React JS JavaScript framework in 2011, although it wasn't made available to the general public until May 2013. Giving users the best rendering performance is React JS's main goal. The emphasis on distinct elements is what gives it its power. Developers find it simple to create sophisticated user interfaces when they use reusable components. Model-View-Controller (M-V-C) model's View component is integrated with React JS. In order to make data binding simpler than before, React JS introduces a one-way data flow. React employs a virtual DOM and provides simpler programming with quicker execution.

To assist in the development of website user interfaces, the React JS JavaScript library was developed. React JS JavaScript framework was developed by Facebook software developer Jordan Walke in 2011, but it wasn't made publicly available until May 2013. The fundamental purpose of React JS is to provide users with the highest rendering performance. What gives it its potency is the concentration on distinctive components. When using reusable components, developers find it easy to build complex user interfaces. React JS is connected with the Model-View-Controller (M-V-C) model's View component. React JS adds a one-way data flow to make data binding easier than it was previously. React makes use of a virtual DOM and offers easier programming with faster execution.

FEATURES

A. Lightweight DOM for Better Performance

One may rapidly become accustomed to the structure thanks to ReactJS's simple and uncomplicated nature. Numerous strong highlights include React. The finest aspect of React is certainly its readability. Even those who are unfamiliar with it may understand it efficiently React accomplishes definitely the opposite of other systems, which obviates the need to understand the fundamentals of the language while requiring extensive knowledge of the structure itself. Therefore, basic levels of skill inside the system may unquestionably be improved without any obstacles or complications.

B. JSX

HTML and JavaScript are combined to create JSX. HTML elements allow for the insertion of JavaScript objects. Because browsers do not support JSX, the code is trans-compiled by the Babel translator into JavaScript code. Codes become clear and simple thanks to JSX. Knowing HTML and JavaScript makes learning it simple.

C. Performance

As we previously explained, react updates just the updated portions of the DOM using virtual DOM. This thereby speeds up the DOM. Because DOM runs in memory, we can design distinct components, which speeds up DOM execution.

D. One-Way Data Flow

As the name suggests, one-way data binding is a one-direction flow. In the react programming language, the data is transferred from top to bottom, or from parent components to child components. The child component's properties (props) cannot return data to its parent component, but they can communicate with the parent components to change the states in accordance with the inputs given. This is how one-way data binding operates. This keeps things quick and modular.

E. Virtual DOM

The document object model is commonly referred to as DOM. Due to the fact that it separates into modules and runs the code, it is the most crucial component of the web. JavaScript Frameworks typically update the entire DOM all at once, which slows down the online application. However, react employs virtual DOM, a perfect replica of actual DOM. The entire virtual DOM is updated initially whenever there is a change to the web application in order to determine the difference between the real DOM and virtual DOM. When it does, DOM updates only the portion that has recently changed, leaving the rest unchanged.

APPLICATION OF REACTJS

A. Creation of dynamic application with ease

Developers may more easily construct dynamic web apps with React JS since it requires less coding and has greater capabilities.

B. Open-sourced library

React JS is the fastest-emerging JS library among the communities and organizations of front-end developers, and one of the reasons for this is that it is a JavaScript open-sourced library.

C. Use of reusable components

Components are the core of React JS. Any React JS application relies heavily on its components. Application development times might be sped up by the presence of several reusable components.

D. Easy Debugging tool

Facebook published a Chrome addon to help with react application debugging, which makes the process quicker overall. The open-source JavaScript library has a Chrome addon called React Developer Tool.

E. Backed by a large development community.

One of the top firms using React JS in their online apps is Facebook, which created and published the framework. Other notable users of the framework include Instagram, Reddit, and Netflix.

II. RESULTS / LITERATURE REVIEW

A. Direct 2 Whatsapp

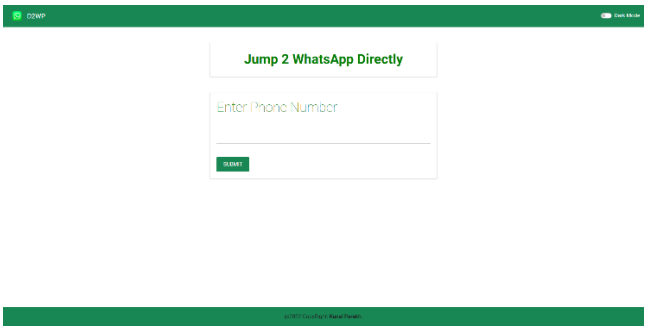


Fig 1: Direct 2 WhatsApp

About the Project: Using our own React and CSS components, we completely rebuilt this app from the ground up. This program was created in response to a real-world issue, which is that users must first store contacts before they can send messages over WhatsApp. Therefore, the user of this app may immediately input the number, and transmit app will jump to WhatsApp to that contact accordingly. It also has a dark mode that the user can toggle on or off and even store to local storage, all of which enable the user to use this program away from home.

Repository Link: https://parekhkunal.github.io/d2Wp

B. Notes



Fig 2: Notes

About the Project: This app is built from scratch writing our own CSS and react components. We have added cool features like adding a character count when the user types, we also added a search bar that lets the user search for a note we will add dark mode they can toggle on or off and even save to local storage so that user can use this app in real life.

Repository Link: https:/parekhkunal.github.io/Notes

C. Cheat Chat (Web Chat App)

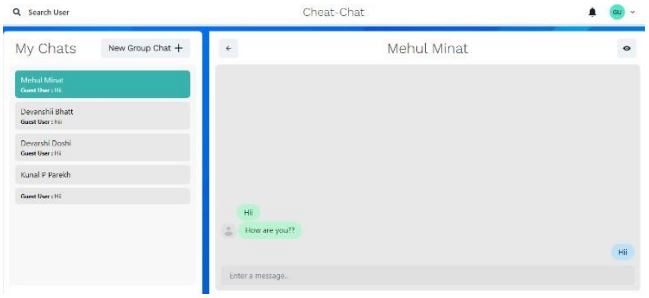


Fig 3: Cheat Chat App

About Project: The project is an example of a web chat app. The main purpose of this project is to provide multi-user chatting functionality through the network/cloud. It is made up of applications - the client application which runs on the user's mobile and the server application which runs on any pc on the network. To start chatting our clients should get connected to a server where they can do Group and private chatting. Client Server Architecture has been implemented in this project.

Tools Used: Postman, MongoDB Cloud DB, Heroku, VM on Azure, Nginx Server

Technology: MERN (MongoDB, Express, React, NodeJS), Bootstrap, ChakraUI

Live URL: https://mern-cheat-chat.herokuapp.com/

Year	Author	Title	Paper Overview
2022	Iida Kainu	Optimization in ReactJs	This study explores the strategies, approaches, and resources available in the React.js ecosystem for enhancing online application performance.
2021	Anal Roy	React Js for web developer	The objective of this paper was to create and study various technologies created by various open-source groups.
2021	Vijaykumar Pawara, Poonam Potrajeb, Sunny Paththarwalac, Himanshu Vermad, Akshay Yadave	Travel booking system using react.js	The aim behind our system is to provide a perfect travel framework in which clients may book their rooms according to their budget utilizing a system created using the React framework.
2021	Kowalczyk, Joanna	Analysis of React.js library and its popularity	The article provides a description of the React.js library, along with an analysis of its key ideas, syntax, and assets. The history of web development is considered, demonstrating the areas where React.js is most useful.
2020	Archana Bhalla, Shivangi Garg, Priyangi Singh	Present Day Web Application with ReactJs	The fundamental introduction, DOM, JSX, one-way date flow, etc. are provided in this work.
2020	Mohit Thakkar	Introducing React.js	But there is a much more effective method to begin a React project. To get started, we'll utilize the react node module "create-react-app."
2019	Stuart Boaler	ReactJS a Viable Career Option?	The conclusion is that ReactJS will continue to play a significant role in the market for the foreseeable future due to its cross-platform development capabilities and ease of use.
2019	Hung Thanh Lay	Developing a Web Application with ReactJS	Because React is open-source, there are no restrictions on its uses. As stated on Reacts home page, react makes it simple to

Table I: Literature Summary

III. METHODS

A. Installation

On a variety of operating systems, including Macintosh, Windows, Unix, etc., React JS may be installed. Any React JS application must be developed on a platform like Node JS & NPM.

Installing Node JS and the NPM package manager is possible using the following link: https://nodejs.org/en/download/.

The following are a few steps to install and develop a React application, taking into account the most recent version of React JS, 17.0.2, which was published on March 22, 2021:

1. Launch the command prompt to install React. npm install create-react-app is the command we use.

2. To build a ReactJS project, use the npx create-react-app command (application name here)

3. Lastly, we use the npm start command to start the project.

The program is executed at the default server, http://localhost:3000, by the package manager NPM.

IV. RELATED WORK

Analyzing all the Framework

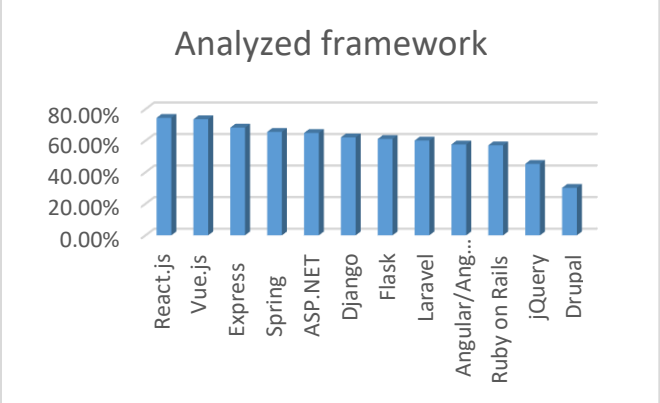


Fig 3: Analyzed framework

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Pro's & Con's

A. Easy to Learn

ReactJS is a JavaScript library backed by Facebook. It is released as an open source library, and being open source, any developer can create training, tutorials for it which are helpful to other new developer who ever making their learning curve easier. Developer who are well versed with JavaScript and

have used any of their frame work / library they usually get grip over React in few days as compared to a complete beginner

Since it is open source, more community is engaged with it, supply of developers is sufficient enough. Hence HR Managers, Business Hirer don't have tough time to find developer to get their work done. As mentioned, react is an open-source library, improvements are made consistently by the community it is backed by, so developers need to stay up-to-date on the latest improvements.

B. Virtual Dom

Real or standard DOM (Document Object Model) constructs have the downside of rewriting the entire DOM tree when they process modifications. DOM trees on trendy, interactive websites and applications are dense and complicated. Standard DOM must rewrite the entire page whenever inputs or queries are made, which in turn slow down performance, use up memory and also count to new work bandwidth cycle for resources.

The virtual DOM operates much more quickly, is substantially more productive, and eventually results in a superior User Interface. A virtual DOM just updates the element or component that is being changed, as opposed to rewriting the complete DOM tree each time a user makes a modification. Let's say, for reference, that your checklist contains ten items. Once one item on the list is checked, a real DOM will rewrite and re-render the entire ten-item list. Instead of rewriting the entire list, a virtual DOM simply changes the one item that was checked and update the state of that component only.

You can see how a virtual DOM construct would be far more effective at producing a high-performing User Interface than standard DOM given that interactive websites are significantly more sophisticated than basic lists. ReactJS's virtual DOM is primarily responsible for this JavaScript framework's ability to build fast and responsive user interfaces.

C. Reusable Component

Writing and maintain large scale projects is time - consuming as well as tedious task. Because modifications to one code component would affect all copies of that component, developers have historically been unable to reuse code components effectively.

The advantages of design reuse are not always relevant to programming and web development projects. A component's copy elsewhere may be impacted by minor modifications made to one instance. To overcome this ReactJS isolates all components. This in turn updates or modifies to one instance of a component and don't affect all other instances of that component. React enables developers to efficiently reuse design components, saving them time and improving the accuracy of their code and hence making them more productive.

D. One Way Data Flow

JavaScript frameworks have multi-directional data flows, which means that changes in one element can affect the data of another. This issue can lead to unstable code. One of the main reasons why this issue is considered a threat is that it can affect the larger parent element.

ReactJS makes this issue simpler by associating all data with downward motion. Changes to the child elements cannot impact the parent data in this structural architecture. As a

result, developers have better control over complicated and large-scale projects and the resulting code is more stable and durable.

E. SEO Friendly

For business owners, search ranking is a vital component of site creation. In order t attract users and drive business goals the websites need to perform well in organic search results on all major search engines and must have low latency while fetching and serving content. Projects that use JavaScript extensively, they face issue of not getting index as search engines face difficulty in crawling them. And this is major issue brought to front by ReactJS helps to solve the issue of heavy JavaScript website and make them enough readable by Google and other search engines. Still for those who have concern about reach and everything. They Use Google search console to check how google crawls their website. Light house audits can also give some rough idea about it.

While making your web app more discoverable for users around the world requires that you rank your React apps on search consoles like Google. JavaScript pages are not as easily indexed by Google and other crawlers as static HTML pages are. React supports server-side rendering, which helps crawlers because they can easily crawl content and don't have to wait for all other JavaScript file dependencies to load. This hence leads to faster crawling and indexing.

F. Scope of Testing Code

The key to utilizing the TDD (Test Driven Development) with React is choosing the appropriate toolset and framework for testing, whether you're performing unit testing, integration testing, or end-to-end testing. Testing React applications is quite simple. al scope It provides a environmental scope where programmers can test and debug their codes using native tools offered.

G. Tools that can be used are

a) *Jest*
b) Enzyme
c) Chai-enzyme
d) React-testing-library
e) React-hooks-testing-library
f) Majestic
g) React-unit
h) Ui-harness
i) Carte-blanche
j) Unexpected-react

Redux-test-recorder

The key to developing a seamless yet adaptable workflow that can change as you upgrade, extend, and modify your code is to combine the appropriate testing framework (like Jest, etc.) with the appropriate assertion/manipulation libraries (like Enzyme, etc.). Additionally, by essentially isolating components from their projects, you raise the bar for modularity and TDD.

H. Ability creating cross-platform products

This is an important consideration when talking to clients, especially small businesses, who wish to develop cross-platform solutions. We can easily build web apps with React, but we also have React-Native, which allows us to write code in React with the same syntax as for web. The changes are to made for mobile specific components only that too in syntax used in react web app. Because the client only requires React engineers, he saves a lot of money by not having to recruit several different types of developers, i.e. Android and iOS.

Complete SSR/SSG Framework

SSR - Server-Side Rendering

SSG - Server-Side Generator

Many technologies in the programming industry are based on React. Among all of these things, there are frameworks that enable us to create React applications that are either rendered by a server or just produce HTML files using React. Among all of these things, there are frameworks that enable us to create React applications that are either rendered by a server or just produce HTML files using React. Gatsby is an SSG example that makes creating quick and SEO-friendly websites with React. Next.js another JS framework using which in addition to SSG provides facility to generate pages rendered in React by the server, which helps to create dynamic and SEO-friendly web apps.

Con's

A. JSX

While some developers view the JSX syntax extension to be a benefit to React, yet there exist developers in who believe it to be a drawback. The JSX code is too complex and challenging for new developers and web designers to understand.

JSX is a challenge for many beginning developers in learning ReactJS. Although some developers may find this to be a drawback, it is vital to remember that JSX also has advantages and helps shield the code from other injections into it.

The main issue with JSX is how challenging it is. ReactJS's performance and user interface capabilities are unaffected by JSX. This drawback is resembling to more of a personal taste.

Actually, using Babel for trans-compiling improves code readability.

B. Learning curve

Although opinions among developers on this matter are mixed, it is reasonable to conclude that React.js is a challenging language to master for React.js beginners. Before employing React in their projects, aspirants who wish to learn how to code will need to develop other coding abilities. As React uses JSX, which requires a strong foundational knowledge in HTML and JavaScript. In addition to it having good about CSS is also required.

C. Verbose Code.

With React, developers have complete freedom in selecting their method and approach. Despite being primarily viewed as a benefit, it can sometimes be a serious restriction. There is no explicit development roadmap for web apps in React. Due to the lack of restrictions or rigid guidelines on how to carry out a specific task, the proficiency of developers will directly affect the outcome of your React project. It can be challenging to transfer a project from one firm to another or switch the development team if the teams have different perspectives on the same issue.

D. Based on 3rd party libraries

It has both a benefit and a drawback. o official libraries are available to handle typical aspects in frontend applications, such as routing, http requests, etc., and React is "simply a JS Library." Being free to choose the finest tools for your purposes and being a knowledgeable JS developer give you an advantage. Additionally, the fact that React doesn't come with many basic tools is a drawback. You could encounter React versions conflicts between the latest library version and your React app version even if you only utilize the most widely used and popular libraries (it is mostly about legacy apps).

The third-party libraries that are maintained by single contributing organization may also need to be updated if you want to keep your app up to date with the React version. While React has excellent backwards compatibility, some libraries—even those that are extremely well-liked—might undergo breaking changes.

E. Development Pace

ReactJS is always developing and evolving. Depending on who you are, you can consider Reacts development velocity as a benefit or a drawback. React is continually being enhanced, according to developers who regard this surge in development as a benefit. This makes their work easier. The developers who view the rapid rate of development as a drawback contend that it is challenging to keep up with because they continually have to learn how to deal with ReactJS.

One notable drawback of ReactJS is its rapid development, but it should be emphasized that Reacts core API has become much more reliable in recent years. Today, most upgrades concern the library and fresh features. Some developers are uncomfortable attempting to keep up with new innovations and are not pleased with the rate of change. Even if it's typical to say that React evolves too quickly, it's crucial to remember that new innovations enhance the framework and help it function at a higher level.

F. Documentation

The criticisms regarding Reacts development pace are related to this drawback. Due to the quick development, there may not be enough instructional resources and documentation to cover the most recent revisions.

Developers can generate their own support papers for ReactJS because it is an open-source framework, however since anybody can produce these resources, you might find subpar ones that provide little assistance.

Once again, your situation and your perspective on creativity and development will determine this drawback of React. Does appropriate documentation sometimes fall behind React's rapid development? Yes. But I tend to think that progress is good, particularly when it comes to developing dynamic online and UI experiences. For many of the queries or problems you could encounter while using React, you can find user-created support resources.

V. Architecture

A. React Virtual DOM

One of React JS's key components is the virtual DOM (Virtual document object model). It is quite comparable to the DOM created by the browser; the only distinction is that the latter is kept in memory. When changes to the page's content are required, they are first reflected to the virtual DOM that is stored in memory. A diff () algorithm then compares the two DOMs, the virtual DOM and the browser DOM, and any changes are then reflected to the program's own DOM rather than having to refresh the entire DOM. This simply offers the programmer a huge boost when significant data updates need to be done.

B. One Way Data flow

Data flow, or downstream, is permitted and facilitated by the design of React JS. In an application, unidirectional flow makes sure that data only travels in one way at a time, giving states and models more control over one another. A less complicated and more comprehensible application architecture is another benefit of unidirectional flow. There are no cascade modifications or updates made in the view section.

C. React components

Small UI (User Interface) pieces known as components give the view data that can vary over time. Together, these reusable parts form the application's whole user interface (UI). Developers may divide UI into different elements and create UI in the most efficient way by using components. Similar to JavaScript functions, they carry out the same purpose using several environments and methodologies. They receive input known as props and then output.

D. JSX Syntax

JavaScript XML is what it stands for. In JavaScript, it is an a-syntax extension. For the creation of user interfaces, React JS and JSX are suggested pairings. Since the source code for JSX is converted to JavaScript, it produces an extremely efficient output, making JSX quicker, safer, and simpler. The quality of an application produced with JSX is significantly greater than an equal piece of code written in JavaScript.

VI. Conclusion

All three frameworks—Angular, React, and Vue—are actively being developed. They maintain the current versions while releasing new ones frequently. You can utilize any of these frameworks with confidence because of the high level of support that each one currently enjoys. While Vue is a

newer development, it already looks to be spreading considerably, in contrast to Angular, which is not growing as swiftly as it formerly did. Since each project is supported by a fantastic community and is continually changing, it is impossible for us to anticipate which frameworks will be useful in the long run. It was my intention to clarify the architectural distinctions, analyses the advantages and disadvantages of each framework, and, where appropriate, compare them in this essay. There are a few things to take into account before beginning a new framework. The first thing to consider when selecting a new technology is the experience of your employees. The talent in your area must also be taken into account if you want to hire developers for your project. Finally, the project's complexity and scale can have an impact on the framework you choose.

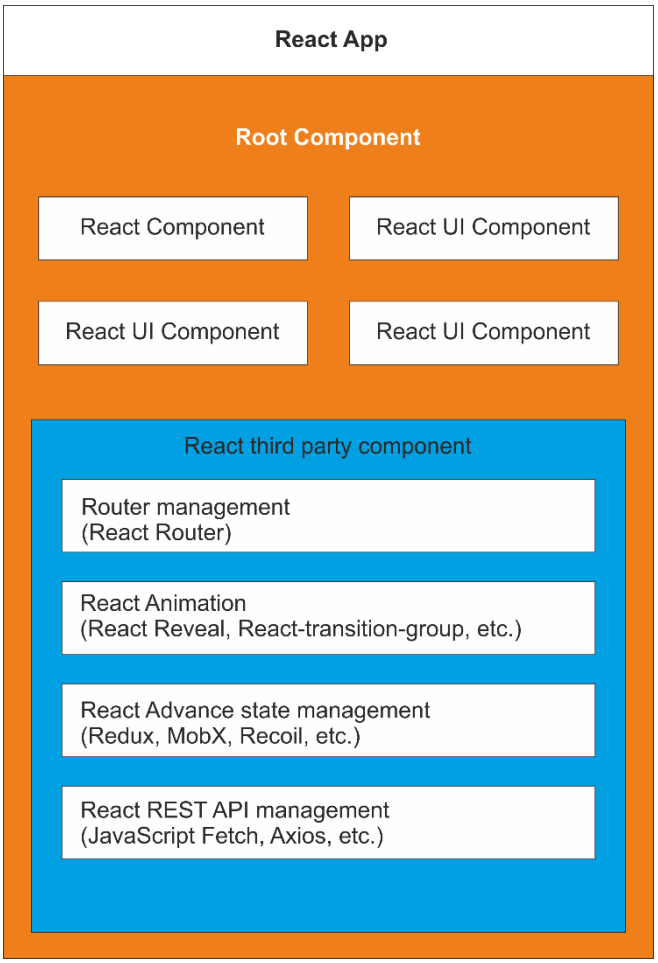


Fig 4: Architecture

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Mitigation of Circulating Current in Modular Multilevel Converter

Mr. Mehulsinh Ghanshyamsinh Jadeja
Research Scholar,
Electrical Department
Silver Oak University,
Ahmedabad,Gujarat, India
mehuljadeja.rs@silveroakuni.ac.in

Dr. Dharmesh P. Maheshwari
Professor,
Electrical Department
L. D. College of Engineering,
Ahmedabad, Gujarat, India
d_pmaheshwari@yahoo.co.in

Dr. Saurin Shah
Vice Chancellor,
Silver Oak University,
Ahmedabad,Gujarat, India
pricipal@socet.edu.in

***Abstract*—The Modular Multilevel Converter (MMC) is nowadays playing important role in the field of power electronics based electrical drives and high voltage dc transmission (HVDC) system. Due to its modularity in structure, scalability in output voltage level and high-power quality feature, MMC becomes more popular as compared to other multilevel converters. However, high value of circulating current which is produce due to voltage difference between upper and lower arm and large sub-module capacitor voltage ripple for the low and medium frequency operation is the major challenges in MMC. This paper proposed a mathematical model of MMC through which accurate value of arm inductor and capacitor is design such that the overall magnitude of circulating current and sub-module capacitor ripple is reduced. A details MATLAB based simulation is carried out and investigated the performance of MMC under proposed model. Details comparison between proposed model and conventional model is shown in term of waveform analysis. From the waveform analysis, it is observed that proposed model is more accurate and effective to recued and control the circulating current and reduced the sub-module capacitor voltage ripple.**

Keywords—Modular Multilevel Converter (MMC), Circulating current, Sub-Module Capacitor voltage ripple

I. INTRODUCTION

Latest advancement in industrial application, MMC has become increasingly important in last few years [1]. Modular design structure, scalability in output voltage, good fault tolerance ability, and best output power quality are the major key feature of MMC. MMC is favorable converter topology for HVDC system, electrical drives system, and renewable energy source conversion system [2, 3]. Moreover, good active and reactive power control, less switching loss and good harmonic reduction capacity will be the key feature to make MMC advantage compared to conventional converter topology [3, 4].

Moreover, Major challenges in MMC is the sub-module (SM) capacitor voltage ripple and circulating current during the low frequency operation of MMC. Voltage difference between the converter leg produces the circulating current in the phase leg. This circulating current flows through only phase leg and dc link voltage. This will lead to increase in power semiconductor current rating, switching loss and size of colling elements. To overcome the circulating current, many researchers cited control techniques to mitigate the effect of circulating current in MMC for entire range of frequency. The control and mitigate a circulating current in MMCs that gives the reference for circulating current from a closed loop based on PI control technique [5].

The low-frequency harmonics of the circulating currents concentrate the losses; therefore, efforts were focused on developing a controller that eliminates them [6]. Even though the primary goal of controlling circulating currents was originally to suppress them completely, it has recently been shown that the injection of a certain circulating current can be used to reduce the losses [7] and also the voltage ripple of capacitors [8]. Each submodule's capacitor voltage has many harmonic components as a result of the interaction between arm currents and modulation signals. The submodule capacitances should be designed properly to minimise this ripple in the capacitor voltage. However, the capacitor voltage ripple increases for a motor drive when the AC operating frequency may be lower than the line frequency and impacts the operation of the whole control system [9].

From a topological standpoint, there are numerous ways to deal with capacitor voltage ripple, such as modifying the circuit topology and redistributing power between submodules utilising half-bridge and full-bridge submodules [10]. Another strategy is to adjust the dc voltage when the drive is running at low speed while decreasing the voltage ripple of the capacitor [11] by using an intermediate cell with bidirectional performance [12] or a multipulse diode bridge. The voltage ripple of the capacitor can be reduced by using the current routes within the MMC, particularly the second and fourth order current harmonics [13][14]. When the circulating current control parameters, capacitor voltage ripple parameters, and converter operating limits are addressed as one integrated problem, optimisation techniques can be applied. The issue can be turned into a convex optimisation problem by taking into account the proper criteria; this produces global optimal solutions for combinations of voltages and currents that reduce the capacitors' voltage ripple [15]. Due to the interaction of the arm currents, when the MMC is operated with unbalanced voltages, a fundamental frequency manifests in the AC power and increases the magnitude of the capacitor voltage ripple [16]. In this situation, introducing a zero sequence voltage can lower the ripple's amplitude [17,18].

II. INTRODUCTION ABOUT MODULAT MULTI-LEVEL INVERTER

VSI is the most widely used converter topology in industry. Large number of VSCs is developed in the last decades. Apart from them, MMC is a most used topology in HVC and motor drive applications.

MMC is directly connected to medium-voltage and high-voltage without any external circuitry for synchronization with grid.. These features are potentially useful for a wide range of applications. This topology is commercially implemented in medium-voltage motor drives, HVDC transmission, multi-terminal HVDC systems, offshore wind farms, and static synchronous compensators (STATCOM).

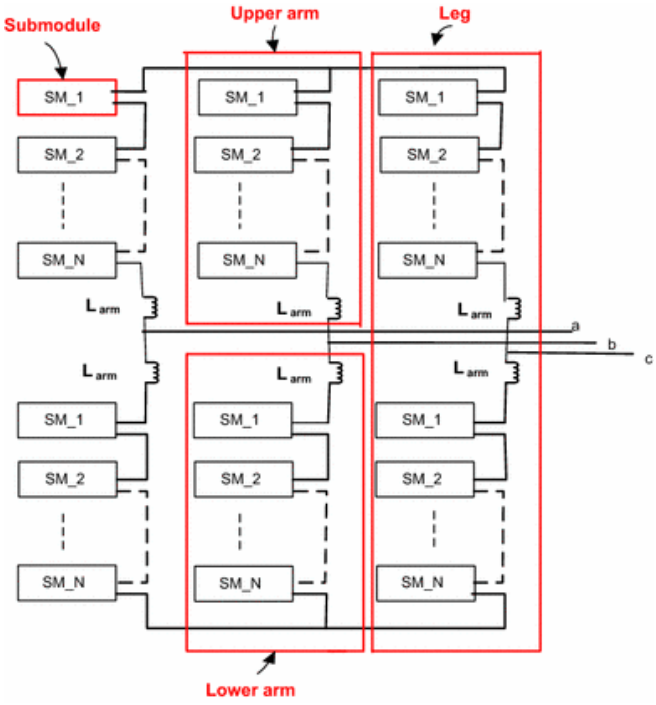


Fig. 1. 3-Phase Modular Multilevel Converter

Figure-1 shows 3-phase MMC diagram. 3-phase MMC consist of various sub-modules and each phase divided into two arms i.e., upper arm and lower arm. Each arm consists of half bridge sub-modules and arm inductor. Arm inductor is used to control the circulating current which is flowing through phase-leg.

The main features of MMC are as follows:

- High power carrying capacity without increasing the rating of switching devices.
- Provide high power quality output power with low harmonic content.
- Sub-module can be replaced without disconnecting whole load from supply.

III. Design and Selection of Passive Component

In the MMC, when it works for variable frequency operations, large amount of circulating current is produced which flows through converter phase-leg. This circulating current consist of ac and dc components. The ac component contains even-order harmonics. The selected parameters include: arm inductance and capacitance. Proper selection of such value of parameters may results in reduction of ac component, converter power losses and submodule capacitor voltage ripples. The parameter selection procedure is based on several iterative simulations using the averaged MMC model carried out in Matlab.

Average model of MMC: From the averaged MMC model, the following equation can be written by using the Kirchhoff voltage law.

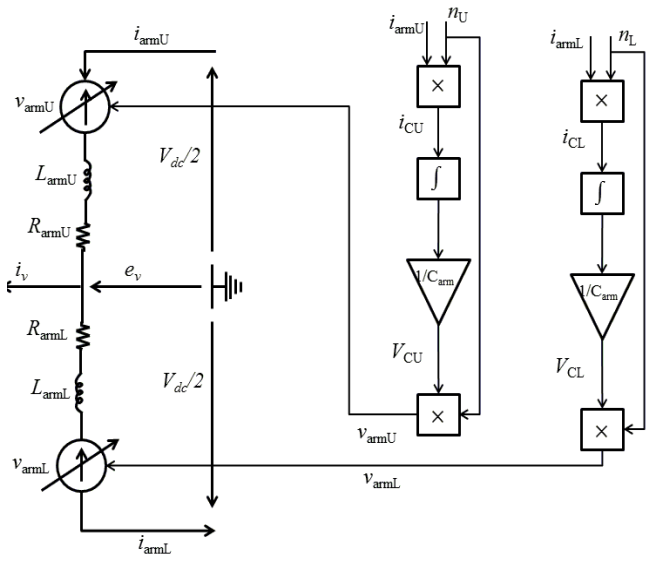


Fig. 2. Avreage Model of MMC

$v_{dc}/2=R_{armU}*i_{armU} + L_{armU}*d/dt(i_{armU}) + v_{armU} + e_v$

$v_{dc}/2=R_{armL}*i_{armL}+L_{armL}*d/dt(i_{armL})+v_{armL}- e_v$ (1)

upper arm v_{armU} and v_{armL} is calculated using

$v_{armU} = n_u*v_{CU}$, $v_{armL}=n_L*v_{CL}$ (2)

The upper and lower arm having purely sinusoidal modulating signal shown as below

$nu = (1-m_a\sin(wt))/2$

$n_L = (1+m_a\sin(wt))/2$ (3)

And, v_{CU} and v_{CL} are calculated as

$v_{CU}= \sum_{(k=1)^n} V_{CUk}$,

$v_{CL}= \sum_{(k=1)^n} V_{CLk}$,, (4)

Average model of MMC:

C_{SM} can be calculated as

$C_{SM}(dv_{CUk}/dt)=n_U\ i_{armU}$,

$C_{SM}(dv_{CUk}/dt)=n_U\ i_{armU}$, (5)

sums of capacitor voltages are equal to v_{CU} = n*v_{CUK} and v_{CL} = n*v_{CLK} so eq. (5) modified to

$C_{arm}*(dv_{CU}/dt)=n_U*i_{armU,}$

$C_{arm}*(dv_{CL}/dt)=n_L*i_{armL}$ (6)

Where $Carm=C_{SM}/n$ is referred to as the arm capacitance.

$i_{armU}= iv/2 + i_{Cr,}$

$i_{armL}= iv/2 + i_{Cr}$ (7)

Where output current $i_v=I_v*\sin(wt-\emptyset)$ and i_{cr} is circulating current

Average model of MMC: From eq. (1), (6) and (7) are represented as one-phase MMC converter is

$$\frac{d}{dt}\begin{bmatrix} i_{cc} \\ v_{cU} \\ v_{cL} \end{bmatrix} = \begin{bmatrix} -\frac{R_{arm}}{L_{arm}} & -\frac{n_U}{2L_{arm}} & \frac{n_L}{2L_{arm}} \\ \frac{n_U}{C_{arm}} & 0 & 0 \\ \frac{n_L}{C_{arm}} & 0 & 0 \end{bmatrix} \begin{bmatrix} i_{cc} \\ v_{cU} \\ v_{cL} \end{bmatrix} + \begin{bmatrix} \frac{V_{dc}}{2L_{arm}} \\ \frac{n_U i_V}{2C_{arm}} \\ -\frac{n_U i_V}{2C_{arm}} \end{bmatrix}$$

Circulating Current: The circulating current consists of a dc component together with even-order harmonics

$$icc = iccdc + \sum(h=1)^{\wedge}\infty * i_{cch} * \sin(hwt - \emptyset_h) \quad (8)$$

Where i_{ccdc} is the circulating current dc component, responsible for power delivery from or to the dc side of the converter, i_{cch} are harmonic amplitudes ($I_{cch} \neq 0$ for h= 2n and I_{cch}= 0 for h= 2n-1, where n= 1, 2, ∞) and $\emptyset_h$ is the phase shift angle of a given harmonic.

In even-order harmonics (h= 2n, where n= 1, 2, ...∞) the i_{2f} has the large magnitude in the circulating current [3].

The amplitudes of particular harmonics depend strongly on the resonance effect that can occur in both arms [2].

This resonance is caused by harmonics in the sum of the arm voltages $v_{armU}+v_{armL}$ which occur across both arm inductors with constant inductance $2L_{arm}$ [3].

Circulating Current: Resonance occurs at the resonance angular frequency

$$w_r = (1/(L_{arm}C_{arm}) * (2(h^2-1)+m_a^2h^2)/(8h^2(h^2-1)) \quad (9)$$

For h=2n, and n=1,2,3….∞.

eq. can also be rewrite to

$$L_{armr}C_{armr} = (1/w^2) * (2(h^2-1)+m_a^2h^2)/(8h^2*(h^2-1)) \quad (10)$$

For h=2n, and n=1,2,3….∞.

where ω is angular frequency (ω= 2π·50 Hz = 314.15 rad/s) and L_{armr}, C_{armr} are the arm inductance and capacitance at which the resonance occurs.

IV. COMPARISON BETWEEN SIMULATED VALUE AND CALCULATED VALUE

A detail comparison of simulated value and calculated value of I_{2f} component is carried out. Table 1 shows the different value of arm inductor and its I_{2f} value. Fig. 3 shows that calculated value is nearly match with the simulated value.

TABLE I. COMPARISON TABLE OF SIMULATED AND CALCULATED VALUE OF I2F

I_{2f}-Simulation value	I_{2f}_calculated Value	L_{arm}
0.3443	0.359526031	0.009
0.4156	0.409318016	0.008
0.5062	0.475118843	0.007
0.57384	0.56612801	0.006
0.6865	0.700263757	0.005
0.9625	0.917699138	0.004
1.3482	1.330972823	0.003
2.227	2.421433341	0.002

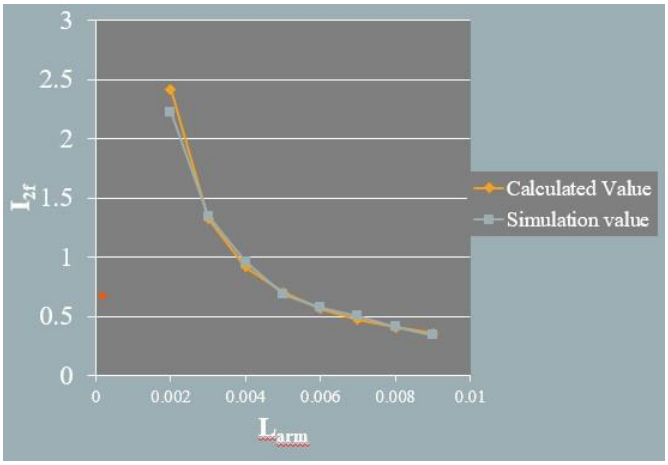
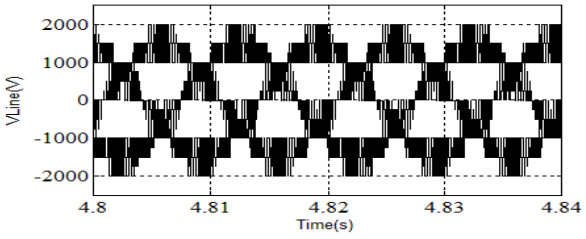


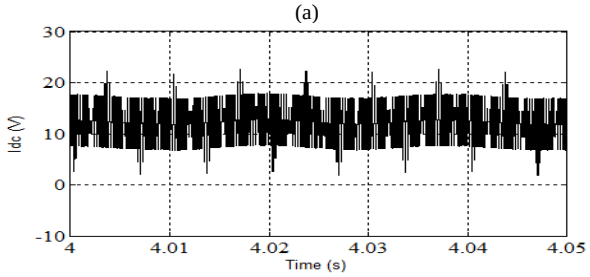
Fig. 3. Comparison chart of simulated and calculated value of I_{2f}

TABLE II. SIMULATION PARAMETERS

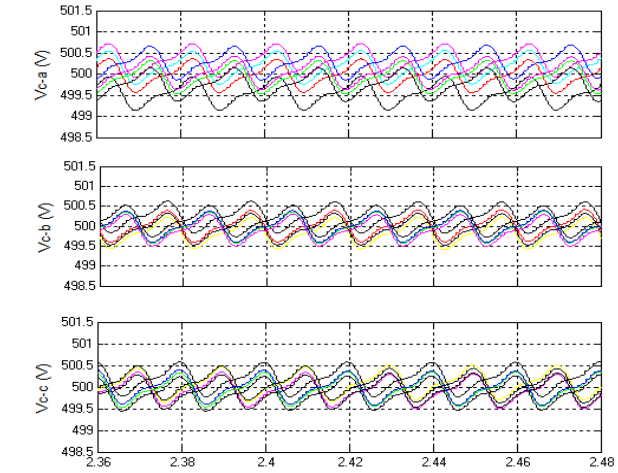
Parameters	*Value*
Active Power	22 kW
DC link voltage	2000 V
No. of Sub Module	4
Load Resistance	50 Ω
Arm Inductor	5e-3 H
SMs capacitance	3e-2 F
SM voltage	500 Volt
Carrier Frequency	1050 Hz
Fundamental Frequency	50 Hz & 5 Hz
PWM technique	PSC- PWM
Modulation index	0.9
Load current	11.88 A



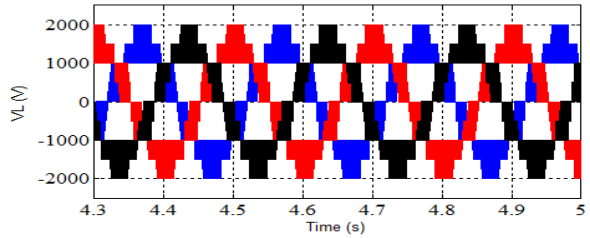
(a)



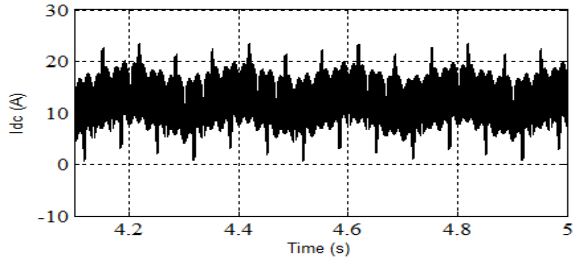
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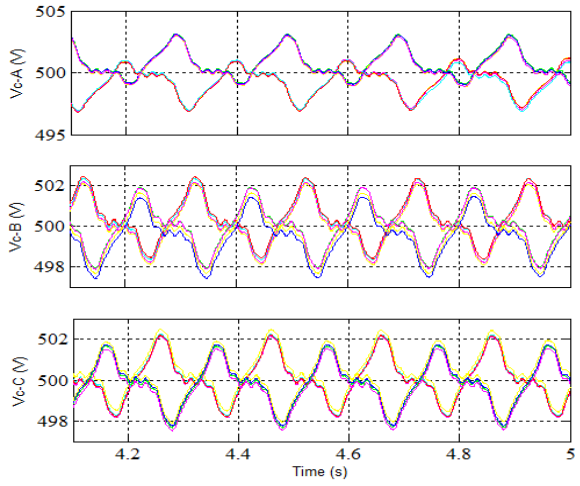
(c)



(d)



(e)

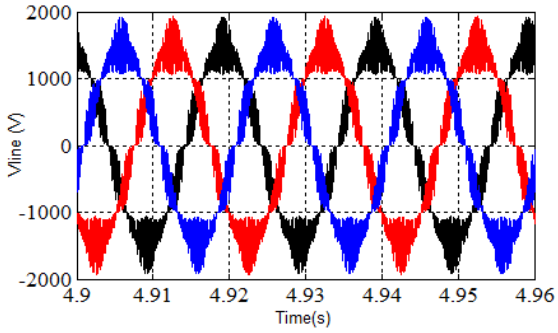


(f)

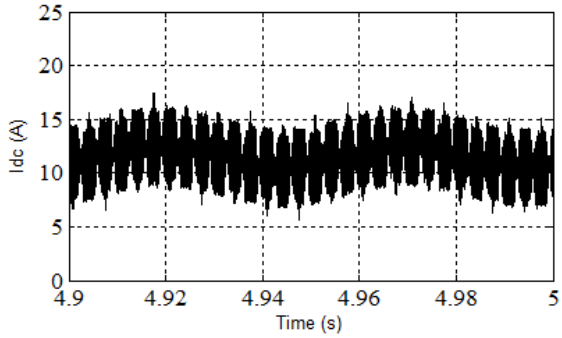
Fig. 4. (a) Line voltage (b) DC link current (c) Capacitor ripple voltage for 3 phases using fundamental frequency 50 Hz (d) Line voltage (e) DC link current (f) Capacitor ripple voltage for 3 phases using fundamental frequency 5 Hz.

TABLE III. SIMULATION PARAMETERS AFTER USING CALCULATED VALUE OF I_{2F} COMPONENT

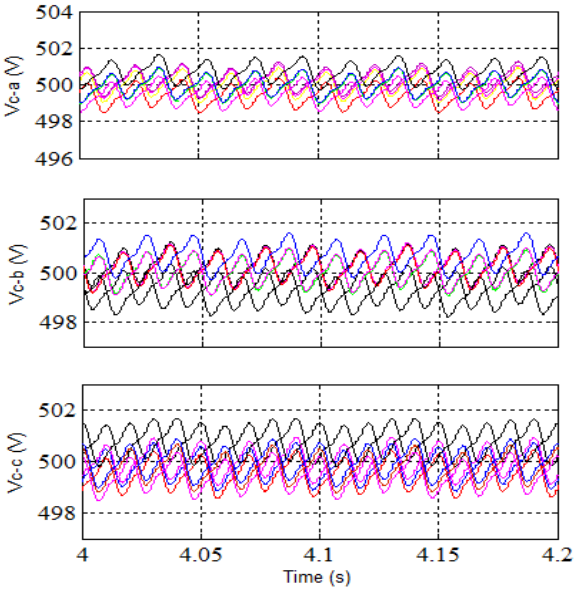
Parameters	Value
Active Power	22 kW
DC link voltage	2000 V
No. of Sub Module	4
Load Resistance	50 Ω
Arm Inductor	9e-3 H
SMs capacitance	1.3e-2 F
SM voltage	500 Volt
Carrier Frequency	1050 Hz
Fundamental Frequency	50 Hz & 5 Hz
PWM technique	PSC- PWM
Modulation index	0.9
Load current	11.88 A



(a)



(b)



(c)

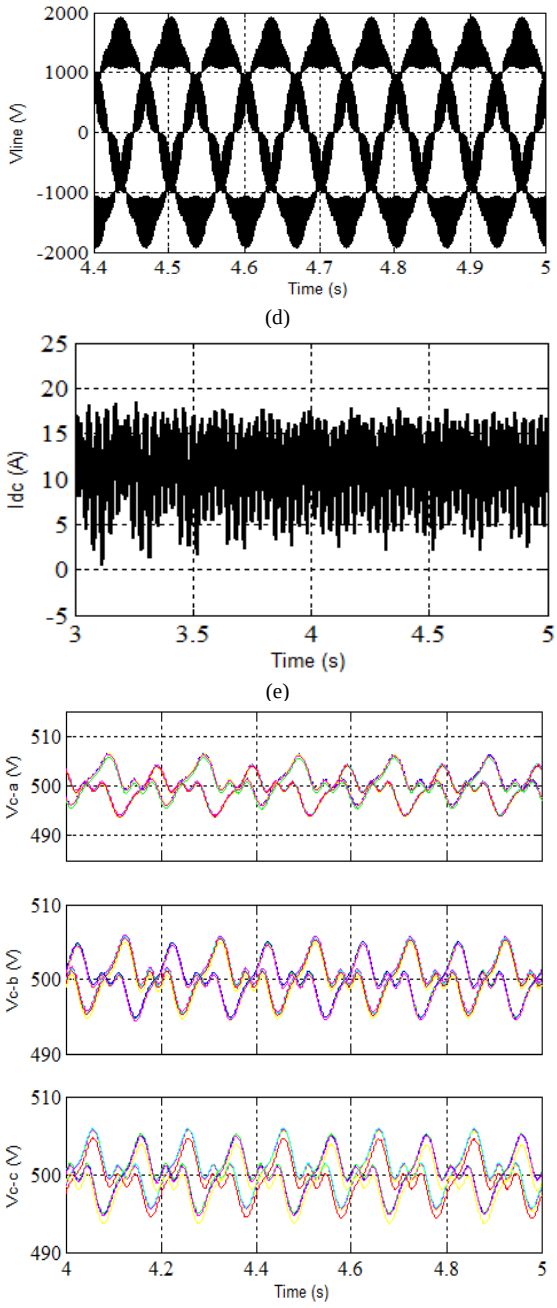
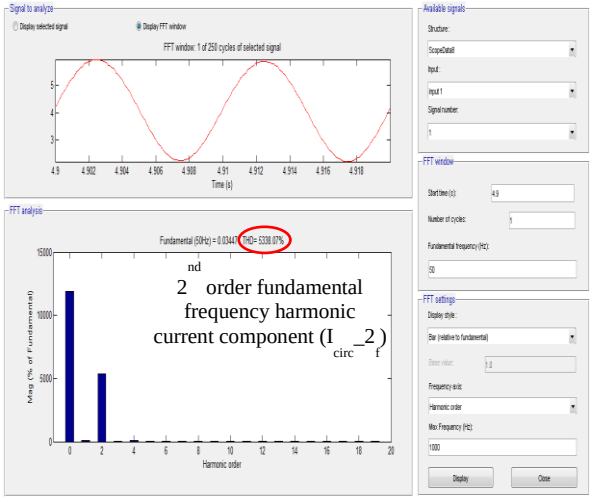


Fig. 5. (a) Line voltage (b) DC link current (c) Capacitor ripple voltage for 3 phases using fundamental frequency 50 Hz (d) Line voltage (e) DC link current (f) Capacitor ripple voltage for 3 phases using fundamental frequency 5 Hz after using calculated value of I_{2f} component.



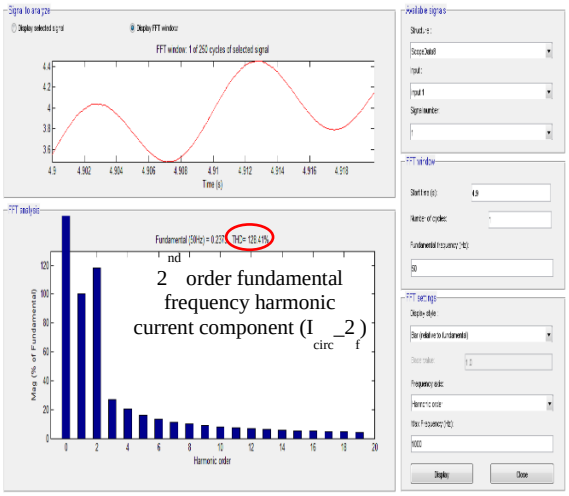
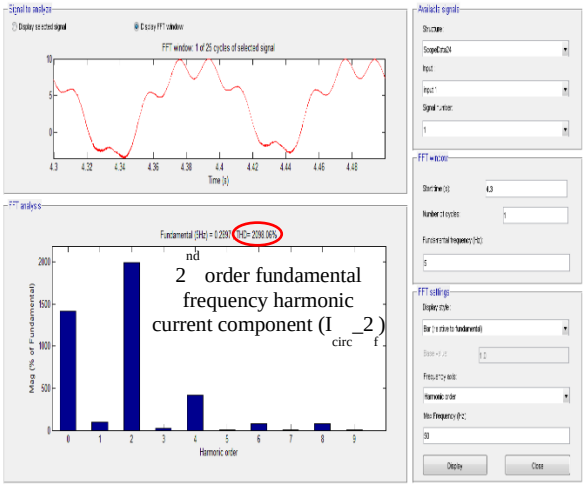
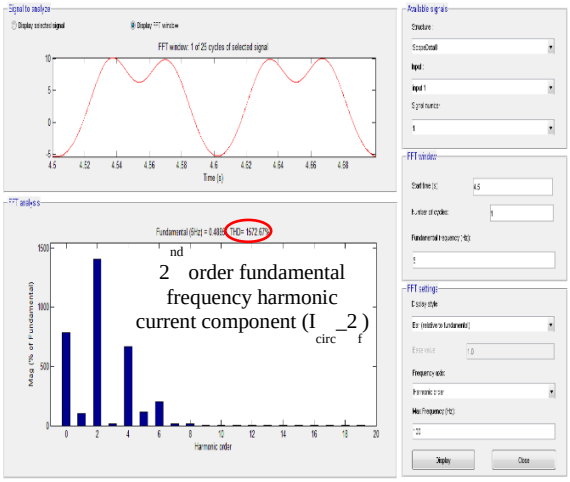


Fig. 6. (a) 2nd order fundamental frequency harmonic current component ($I_{circ}_2_f$) without using calculated value of I_{2f} component (b) 2nd order fundamental frequency harmonic current component ($I_{circ}_2_f$) with using calculated value of I_{2f} component for 50 Hz frequency.





(b)

Fig. 7. (a) 2nd order fundamental frequency harmonic current component (I_{circ_2f}) without using calculated value of I_{2f} component (b) 2nd order fundamental frequency harmonic current component (I_{circ_2f}) with using calculated value of I_{2f} component for 5 Hz frequency.

Table-I shows the comparison table of i_{2f} using MATLAB based simulation and calculated value. Table-II shows simulation parameters to check the effectiveness of proposed mathematical model of MMC. Figure-4 shows different parameters waveforms for different frequency i.e., 50 Hz and 5 Hz operation. It is observed from the figure-4 that in conventional method, large deviation in circulating current and sub-module capacitor voltage ripple is observed. Figure-5 shows simulation results of different waveforms using proposed method at different frequency. It is observed from figure-5 that proposed model is more accurate toward mitigation of circulating current and reduced sub-module capacitor ripple. Figure-6 and 7 shows %THD comparison of conventional method and proposed method and it is observed that proposed method reduced more harmonic from circulating current compared to conventional method at different frequency range of operation.

V. Conclusions

In MMC, circulating current and sub-module capacitor ripple is a major problem for entire frequency range of operation. This paper proposed a mathematical model through which one can design the value of arm inductor and capacitor such that it a limit the circulating current flowing through the phase-leg and reduced the sub-module capacitor ripple. It is observed from the investigation of proposed method and presented waveforms; proposed method is more accurate and effective towards the reduction in circulating current.

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Use of Industrial Waste - Calcium Carbide Residue in activating one part Sodium Hydroxide in geopolymer paste

Chanda Abhishek
Civil Engineering Department
Institute of Technology, Nirma University
Ahmedabad, India
https://orcid.org/0000-0001-9395-680X

Rawat Shivanjali
Civil Engineering Department
Institute of Technology, Nirma University
Ahmedabad, India
https://orcid.org/0000-0003-3680-8178

Thakkar Sonal
Civil Engineering Department
Institute of Technology, Nirma University
Ahmedabad, India
https://orcid.org/0000-0002-7584-3198

***Abstract*—Due to its accessibility, cement is one of the most commonly utilized construction materials. Since cement in its production process emits a huge amount of carbon dioxide into the atmosphere, a replacement must be found immediately in the age of sustainable growth. Another looming situation for the construction industry is the disposal of industrial wastes including fly ash, rise husk etc. which also needs an urgent solution. In the current study, fly ash (FA), Ground Granulated Blast Furnace Slag (GGBFS) and a combination of both were used with Calcium carbide Residue (CCR), a residual waste of the acetylene gas manufacturing plant was used as an activator along with 4% NaOH of the source material. CCR with varied percentages of 0%,2.5%,5%,7.5% and 10% was added to the aluminosilicate material by weight. The compressive strength test was done at both 7 days and 28 days showing CCR as an effective activator, producing strength of 6.6 MPa, 28 MPa and 27.9 MPa with fly ash, GGBFS and a combination of both respectively. More research and advancements are required, particularly in the ideal mix design in concrete, setting time, strength and durability aspects of CCR in Alkali Activated Concrete (AAC).**

Keywords—Industrial Waste, CCR, Activator, NaOH, alkaline activation.

I. INTRODUCTION

Cement, one of the widely used construction materials is not sustainable as one tonne of cement produced releases one tonne of carbon dioxide in the atmosphere. In just three years, from 205 to 2008, the global demand for cement increased m 2.2 billion per year to 2.8 billion per year. The corporations or cement manufacturing plants decided to scale back production of the cement manufacturing process in order to solve this worrying situation. Nevertheless, to further any nation's development, the need for cement is a must and must be met. Therefore, there is a possible choice to replace OPC with additional cementitious materials like fly ash (FA) [1]. Normal fly ash uses pozzolanic silicious and aluminous minerals as its source material, which react with calcium hydroxide when finely divided in the presence of moisture. Since CCR include calcium hydroxide, they can react with the silicious components found in the OPC to create C-S-H gel [2].

The manufacturing process for acetylene gas produces CCR which is a waste product. In previous investigations, it has also been found that CCR has improved the strength and compressibility of clay soil. Land contamination is caused by CCR, primarily in the form of slurry with high alkalinity and water content [3]. Other industrial wastes along with CCR will build up in landfills if they are not disposed of properly and will damage the local ecosystem as shown in Fig. 1. CCR as waste is not often generally used which presents a significant challenge for landfill disposals [4]. The production process of CCR follows a chemical process listed below:

$$CaC_2 + 2H_2O \longrightarrow C_2H_2 + Ca(OH)_2 \quad (1)$$



Fig. 1 Landfill disposal of CCR

Various studies have concluded that in order to make a quality cementitious product, various wastes with high Calcium Hydroxide concentration such as CCR, can be combined with pozzolanic material like fly ash and rice husk ash (RHA) [5]-[6]. To encourage the use of geopolymer material to reduce cement consumption, and henceforth pollution, CCR can be used as an alternative alkaline activator [7].

II. CHEMICAL COMPOSITION OF CCR

TABLE I. CHEMICAL COMPOSITION OF CCR

CaO	*SiO_2*	*Al_2O_3*	*Fe_2O_3*	*MgO*	*SO_3*	*K_2O*	*LOI*
70.80	6.51	2.53	3.25	0.67	0.66	7.93	1.35

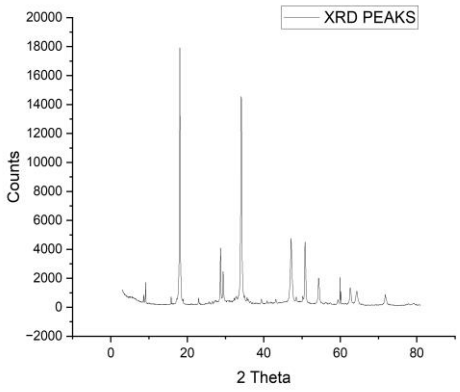


Fig. 2 XRD image of CCR

CCR mainly consists of calcium hydroxide, portlandite, calcium magnesium vanadium oxide, calcium carbonate and

quartz. The XRD studies showed that CCR was crystalline in nature where its highest peaks were obtained for 2Ɵ was observed between 19 and 40 respectively which can be clearly observed in fig 2. Similarly, the EDAX was done to find the elemental composition, where it was found that the element of Calcium (Ca) had the highest atomic weight percentage of 29.43 among all other elements.

III. MATERIALS

A. Geopolymerization

There are two basic elements for the geopolymer formation. The precursor material including FA, GGBFS and Metakaolin (MK) and the alkaline activators which includes sodium hydroxide and sodium silicate solution or potassium hydroxide and potassium silicate solution.

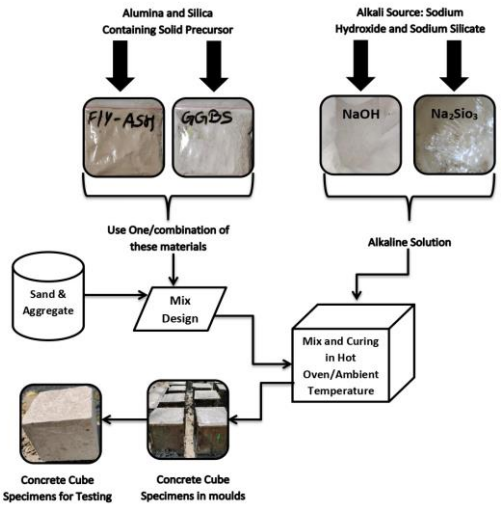


Fig. 3 Process of Geopolymerization

The interaction between these two fundamental elements results in a cross-linked thick polymer structure which is also known as the geopolymerization process [8]. The term "Geopolymer" was first coined by prof J Davidovits in the year 1970 describing a class of source material that were formed by the combination of alkaline solution with the aluminosilicate powder [9]. The GPC can be used as an environmentally friendly material as it hardens at room temperature. The curing temperature has an impact on how the geopolymers develop their strength. In one of the activation processes with CCR it was observed that a temperature cured environment with NaOH for activating FA produced a strength of 40 MPa and excelled up to 90 MPa when activation was done using sodium silicate [10].

B. Source Materials

While creating GPC, source materials are those that are utilised in place of cement or as an additional cement or as an additional cementitious material. To reduce the need for OPC many researchers have suggested using innovative cementitious materials as a concrete binder. One of these compounds combines CCR waste with pozzolanic components as FA, RHA etc [11]. The silica components found in bottom ash, fly ash, RHA and kaolin can be used as a precursor to react with the liquid alkaline activator. The FA offers the highest possibility for the commercialization of this approach due to the plentiful worldwide raw material supply produced from the coal-fired for generating energy [12].

Fly ash (FA) is the pozzolanic substance that replaces cement the most frequent manner. FA is made up of silicon dioxide, aluminium dioxide, ferrous oxide, calcium hydroxide and CSH gel which improves a number of properties including compressive strength, resistance to sulphate attack and water permeability [13]-[14]. Additionally, fly ash is often used in clayey soils when combined with waste products that are high in calcium hydroxide content to create a high-quality cementitious product [15]. FA in the inert zone is most advantageous for development of strength because soil strength significantly increases as FA content rises. Due to its lower early strength compared to OPC, FA's applicability was formerly limited to geotechnical applications and pavement [16]. The geotechnical characteristics of soil are another area where FA is used. With FA concentration at 16% and CCR content at 8%, the optimal FA-CCR percentage for stabilizing expansive soil for use as a liner material in built in landfills was discovered to be 24% [17]. Alkali activated FA cured at room temperature has the potential to be used in modern construction, but its strength, shrinkage and chemical resistance are often subpar. To enhance these properties, several additives that facilitate the geopolymerization of alkali-activated FA should be used [18]. In another study of alkali activated FA mortar with CCR, it was discovered that the compressive strength of alkali-activated, high calcium FA mortar mixed with CCR increases with an increase in the CCR replacement. The compressive strength of alkali-activated high calcium FA integrated with CCR decreases at a dosage of CCR above 20% [19].

Ground Granulated Blast Furnace Slag (GGBFS) is produced as a by-product of the iron-making process. Known for its application in the construction industry, GGBFS is a key component in the creation of blended mortar, cement and concrete. When finely ground, GGBFS can almost completely replace 35-70% of OPC. Additionally, it demonstrates exceptional properties that can be combined with other substances to create GPC [20]. The chemical composition of GGBFS is similar to that of typical OPC, which is mostly composed of silica, calcium oxide and alumina. Strong alkalis such as NaOH can be used in GGBFS activation, although doing so has several disadvantages, such as a quicker setting time, inefficient manufacturing and a potential for handling materials with higher pH value. Alkaline earth activators like calcium oxide, calcium hydroxide and magnesium oxide have drawn a lot of interest for GGBFS activation because of their lower cost and better yield [21]. In soil stabilization process though, the sample stabilized with the best CS-GGBFS has an unconfined compressive strength that us double that of the soil stabilized with OPC, according to a study that examined the engineering features of soft clay stabilized with carbide slag and GGBFS [22]. GGBFS is also activated with sodium carbonate. It was observed that after 28 days ambient curing, the strength was measured to be ranging from 30 MPa to 40 MPa [23].

C. Alakaline Solution

A KOH or NaOH and binder substance such as K_2SiO_3 or Na_2SiO_3 make up an alkaline solution.

IV. Experimental Program

To test the compressive strength of paste with CCR as an activator, various combinations were created. The CCR was oven dried at 100°C in order to remove moisture and dry it out. The dry CCR was then taken to the pulverize machine for the grinding process. The determined paste mixture's water content was fixed at 30% of source material. The 50mm x 50mm x 50mm plastic cube moulds were cast using raw materials of FA, GGBFS and a combination of both FA-GGBFS.

TABLE II. Mixture proportions using CCR as an activator

Name of Mix	Mix Constituents					
	FA	*GGBFS*	*FA-GGBFS*	*CCR*	*NaOH*	*Water*
Mix 1	200gm	0gm	0gm	0gm	8gm	60gm
Mix 2	200gm	0gm	0gm	5gm	8gm	60gm
Mix 3	200gm	0gm	0gm	10gm	8gm	60gm
Mix 4	200gm	0gm	0gm	15gm	8gm	60gm
Mix 5	200gm	0gm	0gm	20gm	8gm	60gm
Mix 6	0gm	200gm	0gm	0gm	8gm	60gm
Mix 7	0gm	200gm	0gm	5gm	8gm	60gm
Mix 8	0gm	200gm	0gm	10gm	8gm	60gm
Mix 9	0gm	200gm	0gm	15gm	8gm	60gm
Mix 10	0gm	200gm	0gm	20gm	8gm	60gm
Mix 11	0gm	0gm	200gm	0gm	8gm	60gm
Mix 12	0gm	0gm	200gm	5gm	8gm	60gm
Mix 13	0gm	0gm	200gm	10gm	8gm	60gm
Mix 14	0gm	0gm	200gm	15gm	8gm	60gm
Mix 15	0gm	0gm	200gm	20gm	8gm	60gm



Fig. 4 Paste Samples

The water and NaOH flakes were combined to form a solution which was then added to CCR to form the activator part. Three different precursor technique was used. In the first technique, FA was taken and the activating solution of NaOH-CCR was added by weight of source material by a varied percentage of 0%,2.5%,5%,7.5% and 10%. The second activation was done on GGBFS keeping all the other constituents same as was done with FA. In the third technique the precursor material was a combination of both FA-GGBFS in the ratio of 50%-50% each. All the other activation constituents were kept same as per the other two trials. Both methods of curing viz the ambient curing and the oven dry curing at 60°C for 24 hours was done. A set of 6 cubes for each curing method was adopted and test for compression was done at both 7days and 28 days respectively.

V. Results and Discussion

The 3000 kN capacity Amil's compression testing machine was used for the test. Both the ambient cured and elevated cured specimens were tested and peak stress was recorded for each. The average value was then collected and graphs were plotted. The FESEM analysis for microstructural study on CCR with FA, GGBFS and combination of FA-GGBFS was also done to understand the reaction mechanism.

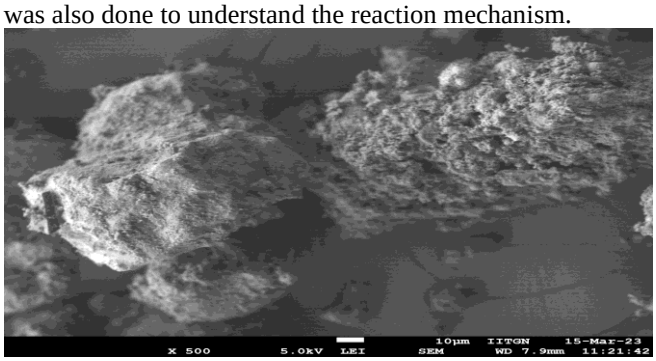


Fig. 5 Scanning Electron Microscopic image of FA-CCR

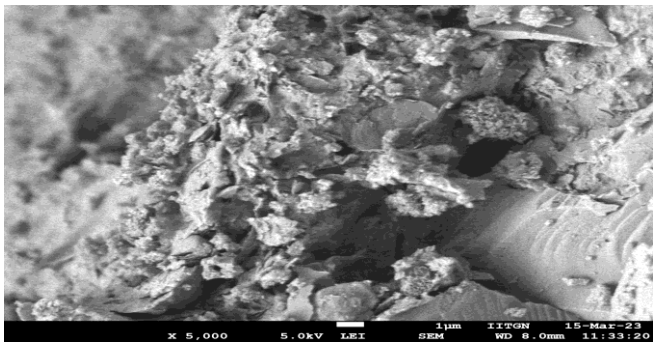


Fig. 6 Scanning Electron Microscopic image of GGBFS-CCR

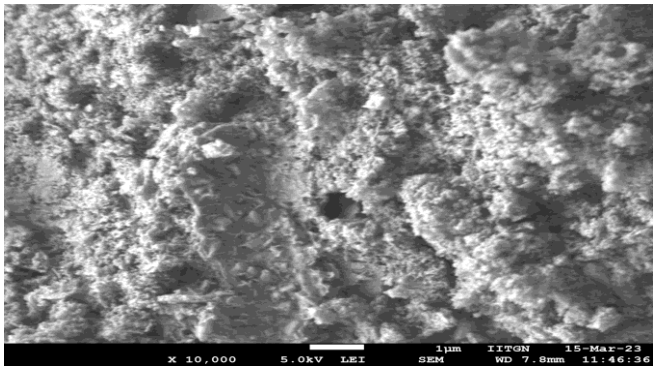


Fig. 7 Scanning Electron Microscopic image of FA-GGBFS-CCR

From the fig. 5,6 and 7 it can be seen that FA has not fully reacted with CCR while GGBFS has completely participated in the reaction mechanism and has completed the geopolymerization process. While in the fig. 7 it can be observed that few particles of unreactive fly ash are present

which leads to a conclusion that FA takes time in the reaction mechanism due to low reactive silica present in it. The tests on compression are graphically shown below. The graphs represent the compressive strength at both the curing conditions viz the ambient curing represented by (A) and the oven dry curing method represented by (O).

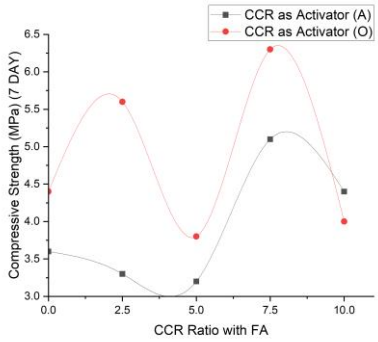


Fig. 8 Compressive strengths of FA-CCR at 7 days for all curing methods

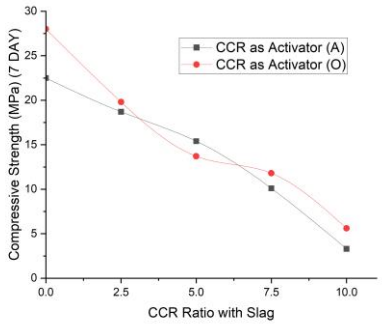


Fig. 9 Compressive strengths of GGBFS-CCR at 7 days for all curing methods

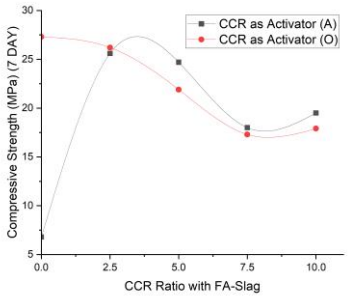


Fig. 10 Compressive strengths of FA-GGBFS-CCR at 7 days for all curing methods

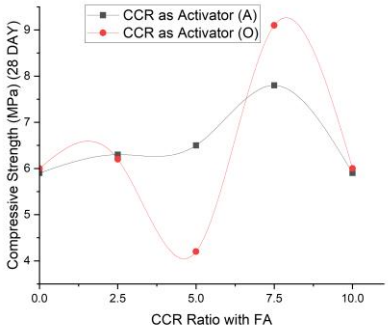


Fig. 11 Compressive strengths of FA-CCR at 28 days for all curing methods

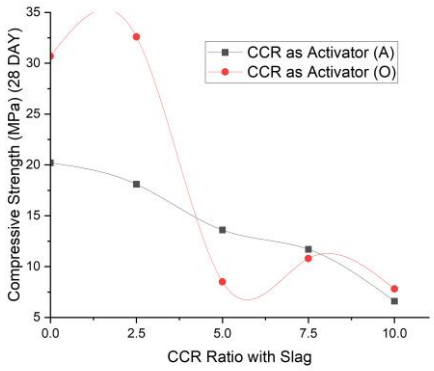


Fig. 12 Compressive strengths of GGBFS-CCR at 28 days for all curing methods

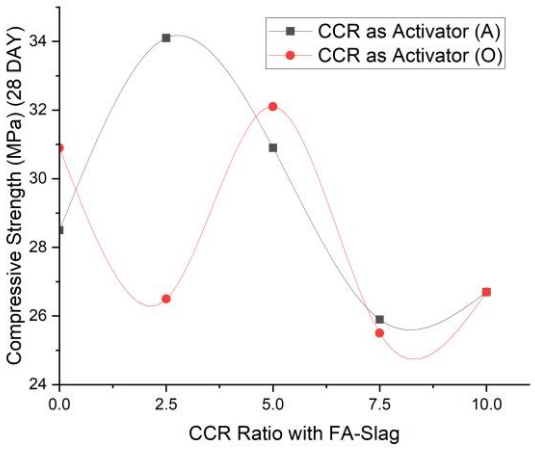


Fig. 13 Compressive strengths of FA-GGBFS-CCR at 28 days for all curing methods

According to the aforementioned graphs, the oven dry approach produced a mix design with higher compressive strength than ambient curing. Additionally, the strength ranged between 25 and 30 MPa when the FA-GGBFS based paste was activated with CCR as it did in the case of the GGBFS activated paste mixture. The FA based mix activated with CCR maintained its modest compressive strength which varied between 5 and 10 MPa at all curing ages.

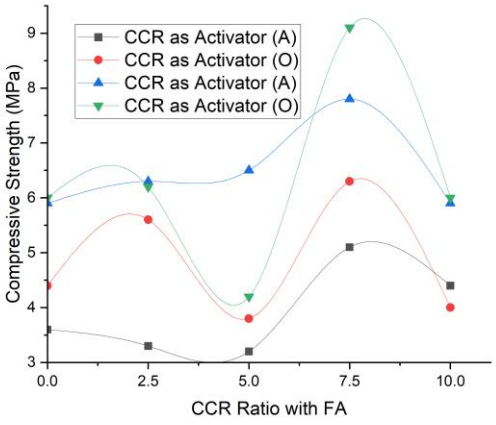


Fig. 14 Compressive strengths of FA-CCR at all curing ages.

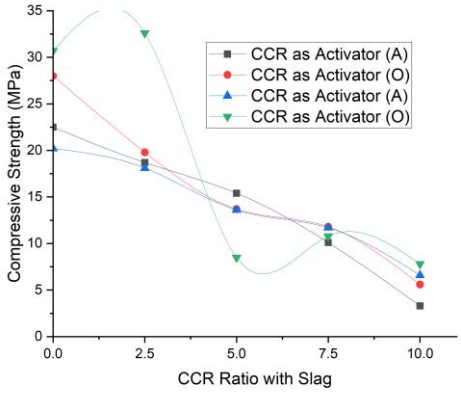


Fig. 15 Compressive strengths of GGBFS-CCR at all curing ages.

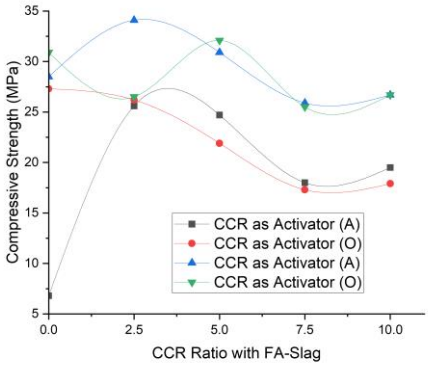


Fig. 16 Compressive strengths of FA-GGBFS-CCR at all curing ages.

The maximum strength achieved when CCR was used as an activator in GGBFS which ranged between 30-35 MPa at the dosage of 2.5% and 5%. But when FA-GGBFS mix was used with similar dosage of CCR of 2.5% and 5%, the produced strength was between 25 and 30 MPa. Therefore, it may be claimed that depending on the source material employed, CCR can be used as an activator. Also, it was observed that when FA was activated with CCR, the strength increased at 28 days which also sets up the idea that CCR activated FA can gain more strength if the curing period is prolonged from 28 days.

VI. Conclusion

According to the investigation done above, we can conclude that when CCR dosage was increased by adding only supplementary cementitious material, they effectively served as a good activator and boosted strength. The fact that CCR didn't increase strength when FA was replaced with it implies that FA cannot be utilized alone to increase strength in GPC. But on the other hand, when GGBFS was activated with CCR, the strength got increased both at ambient temperature and elevated temperature. Following notable conclusions can be drawn:

- The highest compressive strength of CCR with FA was observed at 7.5% dosage while that with GGBFS and a combination of both FA-GGBFS was at 2.5% stating that FA alone requires higher amount of CaO to become reactive and impart strength.
- The oven dry curing becomes effective when FA and GGBFS are alone activated with CCR, but when they are combined together for the activation process, then ambient curing becomes more effective. This signifies that for field application, combination of FA-GGBFS activated with CCR will be a viable solution.
- The strength of FA-GGBFS at 2.5% dosage of CCR was 16% higher as compared to GGBFS activated with CCR and nearly 80% higher when compared with FA activated with GGBFS stating that the combination of both FA-GGBFS gives higher strength than the activation of individual precursors.
- For GGBFS activated with CCR, the strength suddenly decreases as the dosage of CCR goes above 2.5% whereas when the combination of both FA-GGBFS is taken the strength drops but to a minimal amount signifying the prolonged process of fly ash taking part in the mechanism supported by the calcium oxide present both in GGBFS and in CCR.
- It has also been seen that FA takes time to show reaction mechanism to gain strength. So in order to understand the participation of fly ash in the reaction process, the curing period for 28 days might not suffice and has to be prolonged until there is no further strength development.

However, using GGBFS alone shortens the setting time and is ultimately uneconomical due to high cost of the material. The CCR gave strength equivalent to FA-GGBFS combination to that of GGBFS alone. Also, when CCR was used to activate the combination of FA-GGBFS, the most important point being the utilization of both the precursor raw materials, waste treatment, ecological balance and most importantly economic stand point.

VII. Future Scope of Work

As very extensive studies have not been done on CCR hence its properties are not investigated thoroughly.

- To examine the mechanical properties, mix design of concrete and durability of the GPC with CCR as a catalyst material, more research must be done. If CCR is not used more widely, landfills will deteriorate and the soil's properties will be lost.
- More focus and investigations are needed to understand how to use CCR in order to benefit the economy and the environment.
- To reduce the carbon footprints and improve the ecology, CCR must be used in conjunction with other industrial and agricultural wastes. Using only cutting-edge materials won't be enough because cement manufacturing is becoming more and more popular every day. To create a more sustainable future, more research work is needed to be done for pulling off a better tomorrow.

Acknowledgment

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Analysis on Machine Learning Techniques to Spot Cyberbullying

1st Ms. Krishna Patel
Computer Eng. Department, SAL Education
Ahmedabad,Gujarat,India
krishupatel114@gmail.com

2nd Prof.Sudha Patel
Computer Eng.Department, SAL Education
Ahmedabad,Gujarat,India
sudha.patel@sal.edu.in

3rd Prof. (Dr.) Khyati Rami
Computer Eng.Department, SAL Education
Ahmedabad,Gujarat,India
drkhyatirami@gmail.com

***Abstract*— Cyberbullying is a growing problem that affects individuals of all ages and backgrounds. With the increasing use of social media platforms, it has become easier for cyberbullies to hide their identity and target their victims anonymously. NCRB data reported that cybercrimes in India increased by 63.48% (27248 cases to 44548 cases) from 2018 to 2019, which upsurged by 12.32% in 2020 (44548 cases to 50035cases) and14.55% in 2021(52974 cases). As a result, machine learning techniques have emerged as a promising solution to identify and prevent cyberbullying behaviors before they cause harm. This review provides an overview of the different machine learning algorithms and techniques applied to identify cyberbullying behaviors in social media platforms. We also discuss the challenges when implementing these techniques, such as the need for large datasets, the difficulty of detecting sarcasm and irony, and the risk of falsely labeling innocent behaviors as cyberbullying. Finally, we present future research directions and recommendations for improving the accuracy and effectiveness of machine-learning techniques in detecting and preventing cyberbullying.**

Keywords*— *Cyberbullying, Machine Learning, Twitter, Sentiment Analysis, CNN, RNN

INTRODUCTION

Cyberbullying has become a significant concern in recent years due to the increasing usage of social media platforms. However, detecting and preventing cyberbullying is challenging for individuals and organizations. Machine learning methods have shown promising results in identifying and preventing cyberbullying on social media platforms. According to a study by [1], machine learning algorithms can accurately detect cyberbullying in social media posts, making it a useful tool for reducing the negative impact of cyberbullying. This paper will explore the various machine-learning methods used for detecting cyberbullying on social media and discuss their effectiveness in identifying and preventing this harmful behavior.

Cyberbullying refers to using technology, such as social media, messaging apps, and online forums, to harass, intimidate, or threaten someone. It can take many forms, including sending hurtful messages or comments, sharing embarrassing photos or videos, spreading rumors, or impersonating someone online. Cyberbullying can occur 24/7, and its impact can be long- lasting, as the content shared online can be difficult to remove completely [2]. It can cause significant emotional distress, harm mental health, and even lead to physical harm. Therefore, detecting and preventing cyberbullying is crucial, and machine learning methods are effective in identifying and addressing this issue.

Machine learning algorithms are effective in detecting cyberbullying on social media platforms. These algorithms can analyze large amounts of data and identify patterns and characteristics of cyberbullying behaviors. For instance, a study by Kouloumpis et al [3] used machine learning techniques such as Support Vector Machine (SVM) and Decision Tree (DT) to detect cyberbullying on Twitter. The study found that these algorithms achieved high accuracy rates in identifying cyberbullying- related tweets. Similarly, a study by [4] used machine learning methods such as Naïve Bayes and Support Vector Machine to classify tweets as cyberbullying or not. The study found that these algorithms achieved high precision and recall rates in detecting cyberbullying. In addition, machine learning algorithms can also analyze linguistic features, such as the use of profanity or aggressive language, which can be indicators of cyberbullying behavior. For example, a study by [5] used Natural Language Processing (NLP) techniques and machine learning algorithms to detect cyberbullying on Twitter. The study found that linguistic features such as swear words and derogatory terms highly predict cyberbullying behavior.

Machine learning algorithms have shown great potential in detecting cyberbullying on social media platforms. As the amount of data on social media continues to grow, machine-learning methods are becoming increasingly important in identifying and addressing this harmful behavior. The main novelty of the paper is that it provides review of various methods used for each steps involved in spotting cyberbullying using machine learning.

LITERATURE REVIEW

The advent of social media has brought forth a new dimension to communication and interaction among people. However, this platform has also become a breeding ground for cyberbullying, which has become a major concern for the online community. Machine learning techniques can be utilized to identify cyberbullying and thereby reduce the adverse effects associated with it. This literature review examines various machine-learning techniques to detect cyberbullying on social media. In addition, this section includes basic steps for detecting cyberbullying using the machine learning approach, as shown in Figure 2.1. Finally, this section reviews various methods for each cyberbullying detection step.

Data Collection

Data collection is a critical step in machine learning for detecting cyberbullying on social media. The following are some common data collection techniques used in cyberbullying detection:

1) Manual Collection: This technique involves manually collecting data from social media platforms by searching for instances of cyberbullying using keywords or hashtags [6]. The manual collection is time-consuming and challenging to scale, but it allows for a more targeted approach to data collection.

2) Web Scraping: Web scraping involves using software to extract data from websites or social media platforms automatically. This technique is useful for quickly collecting large amounts of data, but website terms of service and technical difficulties may limit it.

3) API Access: Application Programming Interface (API) access allows automated access to social media platforms to retrieve data. This technique can be used to collect large amounts of data quickly and efficiently, but it requires technical expertise and may be limited by API usage limits [7].

4) User Reports: Social media platforms often have reporting systems that allow users to report instances of cyberbullying. This data can be collected through the platform's reporting system or by directly contacting users who have reported cyberbullying incidents [8]. This technique is useful for collecting labeled data but may be limited by privacy concerns and bias in the reporting system.

5) Crowdsourcing: Crowdsourcing involves outsourcing data collection to a large group of individuals, typically through online platforms such as Amazon Mechanical Turk [9]. This technique can be used to collect large amounts of data quickly, but quality control issues and the need for careful task design may limit it.

6) Synthetic Data Generation: Synthetic data generation involves creating artificial data that simulates instances of cyberbullying [10]. This technique can be used to supplement limited or biased labeled data but may be limited by the accuracy of the generated data.

Thus, data collection techniques for detecting cyberbullying on social media include manual collection, web scraping, API access, user reports, crowdsourcing, and synthetic data generation. The choice of data collection technique should be based on the research objectives, available resources, and ethical considerations.

Data Pre-processing

Data pre-processing is a crucial step in the machine learning process for detecting cyberbullying on social media [12]. The following are some common data pre-processing techniques used in cyberbullying detection

1) Tokenization: Tokenization involves breaking down text into individual tokens, such as words or phrases. This technique is used to standardize the input data, allowing for easier processing and analysis.

2) Stopword Removal: Stopwords are common words in a language that do not carry significant meaning, such as "the" and "and". Removing these words from the input data can reduce noise and improve the accuracy of the machine learning model.

3) Stemming and Lemmatization: Stemming and lemmatization are techniques used to reduce words to their root form [11]. Stemming involves removing suffixes from words, while lemmatization involves mapping words to their base form. These techniques can improve the consistency and accuracy of the input data.

4) Spell Correction: Spell correction involves identifying and correcting spelling errors in the input data. This technique can improve the accuracy of the machine learning model by reducing noise caused by spelling errors.

5) Part-of-Speech Tagging: Part-of-speech tagging involves identifying the part of speech for each word in the input data, such as noun, verb, or adjective. This technique can be used to extract features related to the linguistic structure of the text.

6) Sentiment Analysis: Sentiment analysis involves identifying the emotional tone of the input data, such as positive, negative, or neutral. This technique can be used to extract features related to the sentiment of the text.

Data pre-processing techniques for detecting cyberbullying on social media include tokenization, stopword removal, stemming and lemmatization, spell correction, part-of-speech tagging, and sentiment analysis. The choice of pre-processing technique should be based on the research objectives and the characteristics of the input

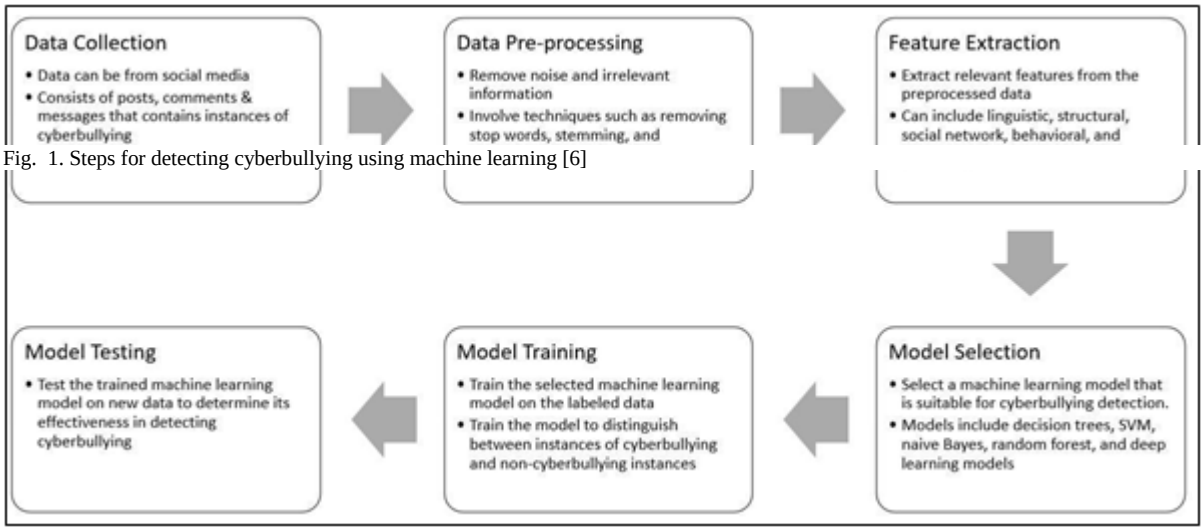


Fig. 1. Steps for detecting cyberbullying using machine learning [6]

data.

Feature Extraction techniques

Feature extraction techniques are crucial in identifying and detecting cyberbullying on social media. These techniques help to analyze the content of social media posts and extract relevant features that are indicative of cyberbullying behavior.

1) N-grams: N-grams are a feature extraction technique that involves breaking down text into sequences of n words or characters. For example, in a sentence, "I hate you" can be broken down into a bigram of "I hate" and "hate you." A study by Li [6] used bigrams and trigrams to extract features for identifying cyberbullying on Instagram. The study found that using n-grams as features resulted in high accuracy rates in identifying cyberbullying posts .

2) Linguistic features: Linguistic features are indicators of language use, such as the use of aggressive or insulting language. A study by Yang [8] used linguistic features such as the use of negative words and profanity to detect cyberbullying on Instagram. The study found that linguistic features achieved high accuracy rates in identifying cyberbullying posts.

3) Sentiment analysis: Sentiment analysis is a technique that involves analyzing the emotional tone of a text. A study by [3] used sentiment analysis to extract features for detecting cyberbullying on Twitter. The study found that negative sentiment was highly predictive of cyberbullying behavior.

4) Word embeddings: Word embeddings are a feature extraction technique that involves representing words as vectors in a high-dimensional space. A study by Mishra and Pathak [1] word embeddings to extract features for detecting cyberbullying on Twitter. The study found that word embeddings achieved high accuracy rates in identifying cyberbullying posts.

5) Behavioral features: Behavioral features are indicators of online behavior, such as the frequency of posting or the number of followers. A study by Guo [5] used behavioral features such as the frequency of posting and the number of followers to detect cyberbullying on Twitter. The study found that behavioral features were highly predictive of cyberbullying behavior.

In conclusion, these feature extraction techniques are useful in detecting cyberbullying on social media, and their effectiveness may vary depending on the social media platform and the context of the post. The combination of multiple feature extraction techniques may further enhance the accuracy of cyberbullying detection.

Model Selection

Machine learning techniques are powerful tools for detecting cyberbullying on social media [16]. These techniques use algorithms to analyze social media data and learn patterns that are indicative of cyberbullying behavior.

1) Support Vector Machines (SVM): SVM is a popular machine learning technique for binary classification tasks such as identifying cyberbullying posts. A study by Li [6] used SVM to classify Instagram posts as cyberbullying or non-cyberbullying. The study found that SVM achieved high accuracy rates in identifying cyberbullying posts.

2) Decision Trees: Decision trees are another machine learning technique that can be used for cyberbullying detection. A study by [9] used decision trees to detect cyberbullying on Twitter. The study found that decision trees achieved high precision and recall rates in identifying cyberbullying posts.

3) Naive Bayes: Naive Bayes is a probabilistic machine learning technique that can be used for text classification tasks such as identifying cyberbullying posts. A study by Kouloumpis [3] used Naive Bayes to classify Twitter posts as cyberbullying or non-cyberbullying. The study found that Naive Bayes achieved high accuracy rates in identifying cyberbullying posts [15].

4) Random Forests: Random forests are an ensemble machine learning technique that combines multiple decision trees to improve classification accuracy. A study by Founta [10] used random forests to detect cyberbullying on Twitter. The study found that random forests achieved high accuracy rates in identifying cyberbullying posts.

5) Deep Learning: Deep learning is a type of machine learning that involves training neural networks with multiple layers to learn complex patterns in data. A study by Mishra and Pathak (2021) used deep learning techniques such as Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks to detect cyberbullying on Twitter. The study found that deep learning achieved high accuracy rates in identifying cyberbullying posts [14].

Thus, these machine learning techniques are useful in detecting cyberbullying on social media, and their effectiveness may vary depending on the social media platform and the context of the post. The choice of machine learning technique may depend on the size and complexity of the dataset, as well as the computational resources available for training and testing the model.

Model Training

The process of training a model to detect cyberbullying on social media involves feeding it data and allowing it to learn the patterns that are indicative of cyberbullying behavior. The following are some of the popular model training techniques used in cyberbullying detection:

1) Supervised Learning: Supervised learning involves providing labeled data to the model during training. The model learns to classify the data into the appropriate categories based on the labels. A study by [9] used supervised learning to train a model to detect cyberbullying on Twitter. The study found that the model achieved high accuracy rates in identifying cyberbullying posts.

2) Semi-Supervised Learning: Semi-supervised learning involves using a combination of labeled and unlabeled data to train the model. The model learns from the labeled data and then uses the patterns it learned to classify the unlabeled data. A study by Agarwal [8] used semi-supervised learning to train a model to detect cyberbullying

on Twitter. The study found that the model achieved high precision and recall rates in identifying cyberbullying posts.

3) Transfer Learning: Transfer learning involves using a pre-trained model as a starting point for training a new model. The pre-trained model has already learned patterns from a large dataset and can be fine-tuned for the specific task of cyberbullying detection. A study by Mishra and Pathak [1] used transfer learning to train a model to detect cyberbullying on Twitter. The study found that the model achieved high accuracy rates in identifying cyberbullying posts.

4) Ensemble Learning: Ensemble learning involves combining multiple models to improve classification accuracy. A study by Founta [10] used ensemble learning to train a model to detect cyberbullying on Twitter. The study found that the model achieved high accuracy rates in identifying cyberbullying posts.

5) Online Learning: Online learning involves continuously updating the model as new data becomes available. This technique is useful for detecting evolving cyberbullying behavior. A study by Mitra [13] used online learning to train a model to detect cyberbullying on Twitter. The study found that the model achieved high accuracy rates in identifying cyberbullying posts.

In conclusion, the choice of model training technique may depend on the size and complexity of the dataset, as well as the computational resources available for training and testing the model. These techniques can be used to train models that are effective in detecting cyberbullying on social media.

Model Testing

After training the model, it is essential to test its performance to evaluate its accuracy in detecting cyberbullying on social media. The following are some of the popular model testing techniques used in cyberbullying detection:

1) Cross-Validation: Cross-validation involves partitioning the data into training and testing sets. The model is trained on the training set and tested on the testing set. This process is repeated multiple times to ensure that the model is generalizable and not overfitting the training data. A study by Mishra and Pathak [1] used 10-fold cross-validation to test their model's performance in detecting cyberbullying on Twitter.

2) Holdout Testing: Holdout testing involves splitting the data into a training set and a testing set. The model is trained on the training set and tested on the testing set. This approach is simple and fast but may not be as reliable as cross-validation. A study by Agarwal [8] used holdout testing to evaluate their model's performance in detecting cyberbullying on Twitter.

3) Leave-One-Out Cross-Validation: Leave-one-out cross-validation (LOOCV) is a special case of cross-validation. It involves leaving one data point out of the training set and using it as the testing set. This process is repeated for each data point in the dataset. A study by [9] used LOOCV to test their model's performance in detecting cyberbullying on Twitter.

4) Receiver Operating Characteristic (ROC) Analysis: ROC analysis is a method for evaluating the performance of binary classifiers. It plots the true positive rate (sensitivity) against the false positive rate (1-specificity) for different classification thresholds. A study by Founta [10] used ROC analysis to evaluate their model's performance in detecting cyberbullying on Twitter.

5) Precision-Recall (PR) Analysis: PR analysis is another method for evaluating the performance of binary classifiers. It plots precision (positive predictive value) against recall (sensitivity) for different classification thresholds. A study by Agarwal [8] used PR analysis to evaluate their model's performance in detecting cyberbullying on Twitter.

In conclusion, it is crucial to test the model's performance to ensure that it is generalizable and not

overfitting the training data. These model testing techniques can be used to evaluate the model's accuracy in detecting cyberbullying on social media.

COMPARATIVE ANALYSIS

Here's a comparative table of various machine learning algorithms used for detecting cyberbullying on social media, along with their year of implementation, accuracy, dataset they used, merits, and demerits:

The choice of algorithm depends on various factors, such as the type of data, the size of the dataset, and the desired level of accuracy. While some algorithms may be more computationally expensive, they may offer higher accuracy on complex datasets. On the other hand, simpler algorithms may be easier to implement but may not perform as well on complex data.

FUTURE RESEARCH TRENDS

Future research in machine learning for detecting cyberbullying on social media is expected to focus on improving the accuracy of existing algorithms, incorporating more advanced natural language processing techniques, and exploring the use of deep learning models. One promising direction for future research is the use of

TABLE 1 COMPARATIVE TABLE

Paper Name	Machine Learning Algorithms	Year	Accuracy	Dataset	Merits	Demerits
"Detecting Cyberbullying on Social Media: A Machine Learning Approach" [31]	SVM, Random Forest, Naive Bayes, KNN, Decision Tree	2016	82.5%	Twitterdataset	High accuracy, able to detect multiple types of cyberbullying	Dataset is limited to Twitter
"An Ensemble Learning Approach to Detect Cyberbullying Activity on Social Media" [32]	AdaBoost, Random Forest, Decision Tree, Logistic Regression, SVM	2018	90.27%	Twitterdataset	High accuracy, able to detect both cyberbullying and non-cyberbullying content	Limited to Twitter dataset
"A deep learning approach to detecting cyberbullying using recurrent neural networks" [33]	RNN, LSTM	2019	95.15%	Twitterdataset	High accuracy, able to detect cyberbullying in different languages	Limited to Twitter dataset
"A Comparative Studyof Machine Learning Algorithms for Cyberbullying Detection on Social Media" [34]	SVM, Random Forest, KNN, Naive Bayes, Decision Tree	2020	89.7%	Instagram and Twitter datasets	High accuracy on Instagram dataset, able to detect different types of cyberbullying	Limited to Instagram and Twitter datasets
"A survey on cyberbullying detection techniques using machine learning" [35]	SVM, Naive Bayes, Random Forest, KNN, Decision Tree, CNN, LSTM	2021	Varies	Various datasets	Comprehensive overview of different machine learning algorithms used for cyberbullying detection, discusses advantages and limitations of each algorithm	No new algorithmic approach was used.

ensemble models, which combine multiple machine learning algorithms to improve performance. For example, a recent study by [20] showed that an ensemble model combining

decision trees, support vector machines, and deep learning models achieved better performance than individual models on a dataset of cyberbullying tweets.

Another area of research is the use of advanced natural language processing techniques, such as sentiment analysis and emotion recognition, to improve the accuracy of cyberbullying detection models. For example, a study by [21-30] found that incorporating sentiment analysis improved the accuracy of a Naive Bayes classifier for cyberbullying detection on Twitter [27]. Finally, there is

growing interest in the use of deep learning models, such as recurrent neural networks and convolutional neural networks, for cyberbullying detection. These models have the potential to capture complex relationships between features and can learn from large amounts of data. A recent study by [22] showed that a deep learning model using a hybrid attention mechanism achieved high accuracy on a dataset of cyberbullying tweets.

Overall, future research in machine learning for cyberbullying detection is expected to focus on improving the accuracy of models, incorporating advanced natural language processing techniques, and exploring the use of deep learning models.

CONCLUSION

In conclusion, the use of machine learning techniques to detect cyberbullying on social media has shown significant progress in recent years. Various feature extraction techniques, machine learning algorithms, and model training and testing methodologies have been used to develop accurate cyberbullying detection models. However, each technique has its merits and demerits, and researchers must carefully consider them when choosing the appropriate approach. Future research in machine learning for cyberbullying detection is expected to focus on improving the accuracy of existing algorithms, incorporating more advanced natural language processing techniques, and exploring the use of deep learning models. The use of ensemble models and sentiment analysis has shown promise in improving the accuracy of cyberbullying detection, while the potential of deep learning models in capturing complex relationships between features is also being explored. Overall, the development of accurate cyberbullying detection models is crucial in addressing the increasing prevalence of online harassment and ensuring a safer and more inclusive online community. The continued advancement of machine learning techniques in this area will undoubtedly play a significant role in achieving this goal.

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Low Cost Small Scale 3-axis CNC machine using Arduino-based Control System

Asst. Prof. Zalak Patel
Department of Electronics & Communication Engineering
Indus University
Ahmedabad, Gujarat, India
zalakpatel.ec@indusuni.ac.in

Chetan Panchal
Department of Electronics & Communication Engineering
Indus University
Ahmedabad, Gujarat, India
chetanpanchal.18.ec@ iite.indusuni.ac.in

Bharvi Vadodariya
Department of Electronics & Communication Engineering
Indus University
Ahmedabad, Gujarat, India
bharvivadodariya.19.ec@iite.indusuni.ac.in

***Abstract*— Computer numerical control (CNC) machining is a useful tool for improving production processes in a wide variety of sectors. The need for automation has already reached a significant level in the modern era, and it will continue to rise in the years to come as a result of the rapidly expanding and growing technological capabilities. Therefore, from this point of view, our research work focuses on the design, testing, and implementation of a cost-effective CNC-based 3-D engraving Machine. This machine is intended to be used in small-scale industries and other areas that are particularly targeted, such as academic institutions (engineering), in order to encourage students to engage in the process of self-designing electronic circuits. An AT Mega 328P Arduino microcontroller and auxiliary drivers operate stepper motors. When each stepper motor is deployed using this mechanism, its rotating movement appears as regulated linear motion of the x, y, and z-axis. Certain software converts a design or picture into G-codes. The Arduino Programming IDE uses these G-codes to generate piecewise actuating signals. Overall, the procedure is quicker, more precise, and less expensive. The process can be deployed to monitor a broad range of machinery—including but not limited to cutters, grinders, mills, and routers—through a specific set of prompts.**

Keywords—CNC, Engraving, Stepper Motor Control, Arduino interfacing

I. INTRODUCTION

The growth of small-scale industry (SME) has raised the need for small-scale CNC machines, since the use of machines in the manufacture of small-scale products has demonstrated a profitable economic value. The use of machines in tiny component fabrication has been shown to boost product manufacturing efficiency while decreasing product costs. This has the potential to enhance small business earnings and propel business development to new heights. The primary goal of this work is to explore the creation of 3-axis CNC machines by integrating a microcontroller as the main controller and a spindle drill. The main purpose of this equipment is to cut and carve soft materials like wood. A serial communication mechanism is used to send the design product to the microcontroller. The microcontroller will regulate the spindle drill movement based on the point coordinates to produce the required engraving or cutting based on the design. Three tests are performed to assess the quality of product manufacture. This machine can carve 2D and 3D items up to a maximum size of 381 mm* 431 mm. The goal behind the creation of a low-cost CNC Milling Machine is to meet the need for CNC machines in small and medium-sized enterprises at a cheap cost. The project's main goal is to create a prototype of a 3-axis CNC milling machine utilizing an Arduino-based control system. It provides the following features.

• Minimal cost • Simple operation • Simple interface • Flexibility • Low power consumption

II. DESIGN AND IMPLEMENTATION

The CNC machine is built in three stages: first, the mechanical frame is produced, then the electric system is put together, and last, the control and computer systems are installed. The appropriate control signals are sent from the electronic system to the mechanical system, which finally leads to the activation of the motors in the desired manner. Controls for the mechanical system are generated by the electronics system based on a command or group of commands received from the software system. The following figure presents a block diagram of the system that comprises the CNC machine. This computer numerical control (CNC) machine has three subsystems, which are shown in Figure 1. They include the mechanical system design, the electrical system, and the computer for software tools.

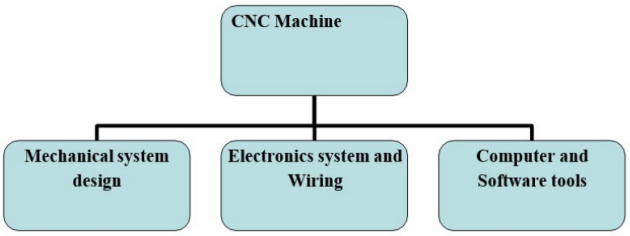


Fig.1. Stages of CNC machine production

In the CNC system development architecture, there are three phases: design and fabrication, control box design and wiring, and software development and testing. The phases of design and fabrication include mechanical design, 3D design of X, Y, and Z axes using Solid Works, 2D conversion of the overall assembly, and manufacture of the parts. The majority of the CNC system's structure is composed of wooden profiles. Working space dimensions for the 3-axis CNC machine design are 600 x 800 x 500 mm^3. Production accuracy is targeted at 50 m, with environmental reproducibility at 10 m. The range of the CNC machine's operational width is between (0-10Hz). This can guarantee the CNC machine operates at peak performance. The CNC machine features a 550 mm (without spindle motor) height and 600 mm width structure. Aluminum 6061 is used in the fabrication of this CNC machine's primary

frame. To fasten the machine's internal framework, an M6 crew is employed. This machine has a Z-axis travel range of 150 mm at its tallest point. A CNC machine's structure is a key part of the machine's overall design. Static and dynamic stiffness of the machine structure must be high, and the machine tool damping response must be solid. One reason for this is that the components of a CNC system, including the motor and spindle motor, will be built right into the machine itself.

The ability to perform precise motions and produce high-quality goods relies on the machine's solid construction. This 3-axis CNC machine was built with a sturdy framework with the intention of providing precise results. This is done so that the CNC machine has a greater margin of error and can more effectively build larger lanes. Because of its high rigidity, the CNC machine can operate at fast speeds, improving the precision of the cutting and engraving. There is less vibration in the cutting and engraving processes because the CNC machine is built with the right joints and symmetry.

TABLE I: MACHINE SPECIFICATIONS

Machine dimension	600 x 800 x 500 mm^3
Working Area	431.8×381 (mm^2)
Z-axis travel	152.4 mm
Driver Motor	Stepper motor, 1.8°/step
Spindle Motor	24 volt DC motor, 12000 rpm
Feed Rate	5 to 100 mm/min
Controller	PC based GRBL Controller and Arduino IDE

The framework of the machine is put together in the steps shown in Fig.2. of machine assembly. After that, the movements of the X, Y, and Z axes are carefully aligned. This is done to make sure that the product can be cut and engraved with high precision so that a good product can be made. Both the X and Y axes are put in from the top down. When mounting the frame from the top down, it is hard to get the frame back in the right place if the screws are not in the right place. Because of this, it is very important to make sure that the design is well thought out at the beginning of the machine development process, which is when the CNC machine is being designed.

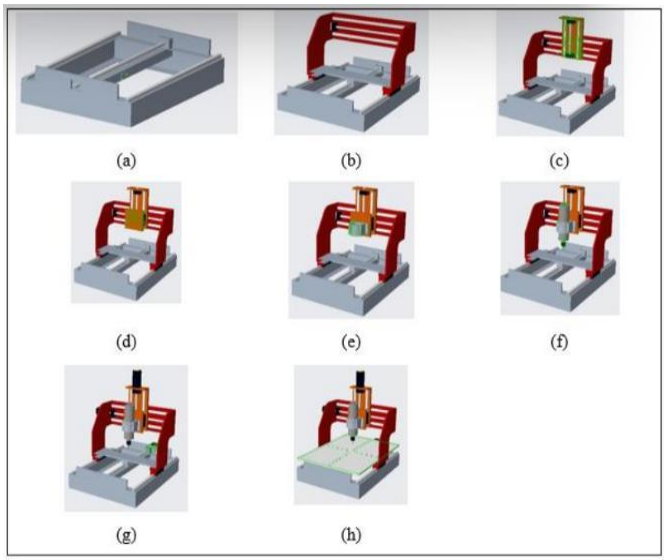


Fig.2. Machine Assembling

III. HARDWARE AND SOFTWARE DESCRIPTION

The schematic block diagram of proposed low cost small scale 3-D CNC machine is shown in Fig.3. The computer interface is achieved by use of a suite of programs and components have been utilized for use with CNC machines with three axes of motion. Easle CNC software transfers the image file to UGS (Universal G-Code Sender) software, which then generates the G-codes based from the design. The Arduino UNO requires the grbl firmware in order to understand the G-codes, as it is incapable of doing so on its own. The Arduino IDE decodes the G-codes that are sent to the Arduino UNO. The stepper motors used along the X, Y, and Z axes cannot be activated by the output signals sent by the microcontroller. As a result, the actuation signals required to operate the stepper motors are generated by a device called an A4988 stepper motor driver of CNC shield. The stepper motor driver receives its own dedicated DC supply. PWM pins of the Arduino UNO are used to connect to the stepper motor drivers. The Arduino UNO can be powered via the USB cable used to serially load its programme codes. Directly proportionate to the design file given into the Arduino UNO, real-time G-codes are created, which direct the stepper motor along the predetermined path. The stepper motors will now begin to rotate the outer rim along their designated axis. The necessary shape will be engraved on wood sample block by the spindle motor with 12000 rpm mounted on the Z axis.

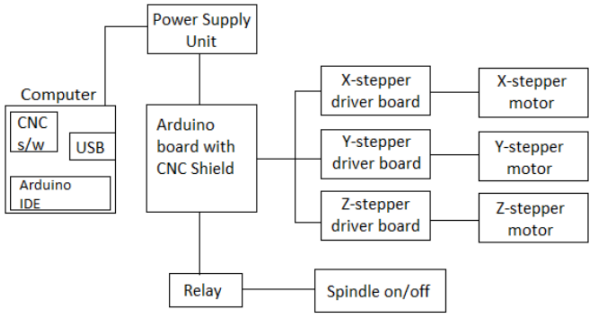


Fig.3. Block diagram of proposed CNC machine using Arduino-based control

A. ARDUINO UNO

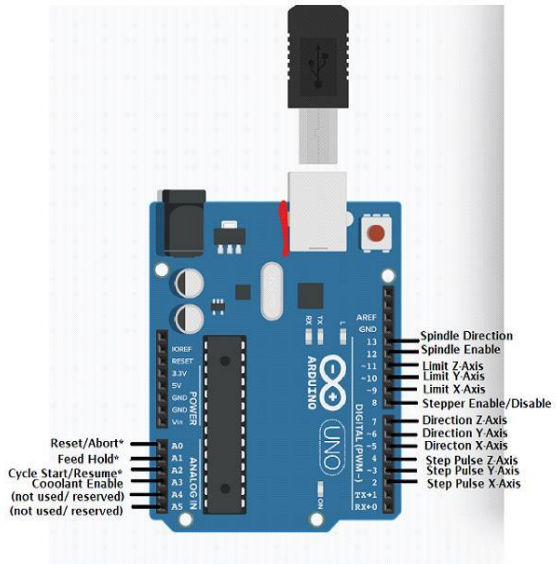


Fig.4. Schematic diagram of Arduino Uno ATMega328P

Arduino Uno uses Atmega328P Atmel AVR microprocessor is shown in Fig.4. Open-source software and hardware creates and produce a single microcontroller. On-chip ADC samples 6 analogue inputs and 14 digital input/output pins. Open source can control Arduino Uno. The digital IO pins have 6 PWM outputs multiplexed. The size of Arduino Uno is 68.6 x 53.4 mm.

B. CNC SHIELD

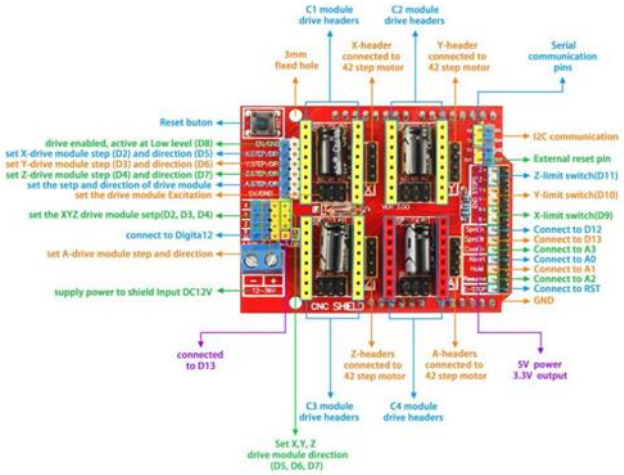


Fig.5. Schematic diagram of CNC shield

The Arduino CNC Shield is a shield for the Arduino microcontroller that allows for the operation of three stepper motors via three individual A4988 Stepper Motor driver expansion boards using open-source software. This CNC shield's primary function is to regulate the stepper motors that control the CNC machine's three axis (X, Y, and Z).

C. NEMA 17 STEPEPR MOTOR



Fig.6. Schematic of Stepper Motor

The digital pulse stepper may move the spindle in X, Y, and Z directions. Brushless stepper motors rotate in equal steps [2]. The stepper motor in Fig. converts many drives to a particular column 12 increment. Every pulse rotates the column. This machine is powered by a combination of three stepper motors, a lead screw, and two belts. The lead screw will be moved along the X, Y, and Z axes as a result of the motor's rotation.

D. DC 24 V POWER SUPPLY



Fig.7. Schematic of Power Supply used

For the purpose of powering the stepper motor driver, a 12 V SMPS (Switch mode Power Supply) is employed. Microcontroller (Arduino Uno) boards require a 12 V SMPS for operation.

E. DC 24 V MOTOR for SPINDLE



Fig.8. Schematic of DC motor used

A machine spindle is a crucial component that is required in several industries, such as the automotive and aerospace industries. Spindles are electrically or pneumatically driven devices available in a variety of sizes. A 24 V DC motor powers the spindle. The spindle then revolves about an axis. The axis is controlled by either human or computer-issued directives. When the machine revolves the tool's spindle, it cuts, slices, and refines, among other operations.

F. ADJUSTABLE POWER SUPPLY MODULE



Fig.9. Schematic of Adjustable Power Supply Module used

The DC-DC Step-down Buck Converter Adjustable Constant Voltage Module has a capacity of 300 Watts and 10A, and it can output voltages ranging from 1.5V to 35V. The module has the capacity to deliver up to 10 A. A heat sink and a cooling fan allow it to continue run high-power applications without overheating.

G. SOFTWARE

1. **Easle Software**
   The Easel CNC programme is being utilized for the planning and design of the job.

2. **UGS (Universal G-Code Sender) Platform**
   The design is translated into G-codes using a Universal G-code sender [5].

3. **Arduino IDE platform**
   The G-codes are used by the Arduino IDE to control the stepper motor and accomplish the engraving [3].

IV. WORKING

Slots, holes, and other mechanical features can be carved into raw material with the use of a proposed CNC machine. More precision and depth may be achieved since most machines have three to five axes of motion. These days, CNC milling machines may be built in either a horizontal or vertical orientation. Metals aren't the only option for making components; polymers, ceramics, and composites can all be used. There are a variety of technological components, such as automatic tool changers, tool carousels and magazines, cooling systems, and enclosures, that contribute to the machinery's ability to run smoothly and without the need for human involvement. The Arduino IDE source code is built before being uploaded to the board, and the GRBL library is loaded in before the cut position is specified on the Universal Gcode Sender platform. The benefits of computer numerical control (CNC) machines in manufacturing are immense. Several sectors, including aerospace, medicine, and electronics, can profit from CNC [6].



Fig. 10. Final Hardware Demonstration Model

The purpose of the machining test was to determine the extent to which the small-scale CNC machine could perform its functions. The performance of this machine is evaluated by cutting wood at a variety of feed rates. Nonetheless, the spindle speed and cutting tool diameter will remain unchanged while the materials are being machined. This CNC machine was used to carve a sample shape out of a piece of wood, as seen in Fig. 11.

The proposed CNC machine can operate nonstop around the clock, 365 days a year, with only few shutdowns for maintenance. A CNC machine may be instructed to replicate



Fig. 11 A machining test of proposed CNC machine

the same design hundreds of times. The identicality of each manufactured item is guaranteed. Unlike manual lathes, mills, etc., CNC machines can be operated by persons with less training and ability. Training for the usage of CNC machines allows for updates to the machines' control software. Universal Gcode Sender platform may be used to access the machines. The typical CNC machine may or may not be able to machine the large work-piece, depending on the requirements of the job. The challenge of micromachining is addressed in this paper. Although the standard CNC machine is capable of machining the little part, more time will be required to properly configure the part for the machine. The setup space required for small-scale CNC machines is minimal, making it simple to precisely position and finish the workpiece.

CONCLUSION

A low-cost small scale 3-D CNC machine has been designed and developed. The described machine can be implemented quickly and at little cost, and it performs similarly to existing commercial options. The CNC machine's parts have been chosen because of their ability to deliver precision and ease of use on a low budget. When it comes to precision and repeatability, the CNC machine body parts assembly has nailed it. In the future, a 4-axis or 5-axis CNC engraving machine may well be implemented to maximize engraving accuracy, quality, efficiency, and flexibility.

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Outlook and Challenges of Sustainable Energy

Dr. Mudit M. Saxena
Dept. of Mechanical Energy
IITE, Indus University
Ahmedabad, India
muditsaxena.me@indusuni.ac.in
mms.saxena@gmail.com

***Abstract*-**In the whole world presently the energy policy drivers are energy safety, sustainable growth and welfare. Noteworthy progress has been made by India, by enhancing the installed sustainable energy capacity and it is predictable to increase potentially. The research in novel and superior expertise, strong energy strategies, act, and setting up actions has make our country enabled for sorting out the obstructions of sustainable energy business production. In house production as well as utilization of unconventional energy, like wind power, solar energy, hydel-energy, bio-energy, and bio-fuels from new biomass will substantially lessen use of the conventional fuel .Sustainable expansion in economic and industrial sector need secure and sustainable resources of energy too. The renewable energy utilization in India will assist in escalation of reduced -carbon energy as well as giving a unsoiled atmosphere by contaminants and greenhouse gas emissions reduction.

Keywords-Sustainable Energy, Renewable Energy, Energy Scenario, Climate change, Energy Policy, Unconventional Energy

I. INTRODUCTION

By sustainable energy utilization of the standard of living of society will also be made better. By adopting and applying renewable energy expertise to provide off-grid energy is strongly needed. Fossil fuels use produces a lot of environmental problems like pollution of air and global change in climate (Zidanšek et al. 2009)[1]. Existence of life is threatened by global change in climate. It is required to have a excellent equilibrium of sustainability of environment with needed development of economy as well. The transform to sustainable energy know-how offers a chance to take care the problems of environmental pollution and overall developmental and economic requirements to make people's standard of living and fiscal sustainability (IAC 2007)[2]. Most important factor be the urgency and priority of finding techniques to produce and employ energy that protect the reliability of primary natural sources, lessen degradation of environment and carry on development to a further sustainable, better as well as cultured planet (IAC 2007). Wind energy, Solar energy, hydel energy as well as bio-fuels are some forms of renewable energy (IAC 2007; Steven and Majumdar 2012)[3]. The harnessing advance and novel energy expertise has made our country enable to remove the hurdles of commercial making of sustainable energy.

II. AIR POLLUTION BY CONVENTIONAL FUELS

Current power systems of transportation, chiefly dependent on conventional fossil fuels, and are predominant supplier to pollution of air in the entire universe. Carbon monoxide, Volatile carbon Compounds, NO_x and particulate matter are released by combustion of fossil fuels. By sunlight, the mixture of the volatile carbon compounds and nitrogen oxides forms ozone in troposphere, which forms smog (Levine 1991)[4]. Thermal power plants produces more emissions of CO_2 and other contaminants per Kilo Watt Hour generation of electricity (IEA 2004)[5].Emission of SO_2 by coal burning also affects rigorously the air quality. (Institute for Energy Research 2014)[6]. Gross Production of nearly 40% CO_2 and 38% O_3 , by biomass combustion is a major gaseous emissions basis (Levine 1991)[4]. 14 lac tonnes of CH_4 is produced in conventional systems & bio-mass.

III. CONVENTIONAL FUELS AND CLIMATE CHANGE

As per 5th assessment report of IPCC , greater than 75% emissions raise of greenhouse gas amidst last 40 years subsequent to 1970 has been chiefly by burning of fossil fuels and pollution by industry. Change in global climate is anticipated to cause adverse effects on health sector, cultivation and whole ecosystem.(IPCC 2014)[7]. As per observations global emissions of CO_2 from industry pollutants and carbon fuels were nearly constant amidst 2014 to 2016, rising 0.2% merely, in comparison to the 2.2% rise in preceding decade. It was because of lessening in coal utilization globally and upgrading in energy use efficiency and greater than before consumption of renewable different sources of energy (REN21 2017)[8]. Various renewable energy sources are developed in India, like solar power generation, wind energy, biomass energy, and additional practical alternative sources (Zidansek et al.2009)[1].

IV. SUSTAINABLE AND RENEWABLE ENERGY

Bio-fuels, Wind energy and Solar power, and are renewable energy illustrations which are non- depletable energy harnessed from natural resources. (Farrel and Gopal 2008)[9]. The advanced expertise to harness non-conventional renewable energies may be termed as green energy or renewable energy technologies (RET).

Sustainable energy goes further ahead in energy efficiency terms in comparison to renewable energy. Energy consumption optimization goes further to elevated energy efficiency (Beckett 2012)[10].Sustainable energy resources support economic and society growth needs and conserving the atmosphere, decreasing risks of climate change subsiding green house gases emissions.

V. PRESENT WORLDWIDE SCENERIO OF RENEWABLE ENERGY

The renewable energy span lies further than giving the feasible energy sources of future (IAC 2007). It deals with fossil fuel generated problems on human health and atmosphere. It promotes energy safety, fiscal and welfare of society (REN21 2014)[11]. Addition of renewable energy in world's energy generation is rising slowly. 19.3% of total world's energy generation is provided by renewable energy with contemporary renewable sources adding nealy 10%, and remaining from biomass in 2015. From gross utilization of energy, heat energy produced by modern renewable sources is 4.2% by hydel-power and concerning 3.6% and 2.4% by additional sources of renewable energy. (REN21 2017)[8].By International Renewable Energy Agency's (IRENA) estimate, the global renewable energy part might go beyond 30% by 2030.We have already available technologies for that. Worldwide contribution might be increased by additional 6% due to enhancing energy efficiency and advancement energy access (MNRE 2009)[12]. Renewable sources supplied worldwide 24.5% of electric energy by the end of the year 2016. The biggest development in the sector of renewable energy was perceived in solar energy which contributes nearly 1/2 of the lately set up power, and also by wind and hydel-power (REN21 2017)[8]. In the same way, bio-fuel production growth rate, predominantly for transport sector, also accelerated in 2013.

VI. SUSTAINABLE ENERGY PLANS & ORGANIZATIONS IN OUR COUNTRY

Global strategy verdicts are currently is highly affected by issues of pollution of environment, energy safety and change of climate (Planning Commission 2003)[33]. The Public Utilities Regulatory Policy Act, 1978 strained buying of electric power from self-governing power producers at rational prices in United States. Hence, from 1990s, identical policies were followed in different countries as production of biomass electricity raised significantly (Larson and Kartha 2000). India has a isolated MNRE to speak to matters of growth of sources of renewable energy beside bio-fuels. From the whole capacity installed, renewable power (14.8%) has attained the 2nd place following thermal (69.4%) and is scattering speedily in India (MNRE 2017)[13]. Indian Government took many steps in the precedent years together with the initiative of Green Energy Corridor concept, solar park and, roof top solar system instigation, augment in clean atmosphere cases, solar pump scheme, making buying of energy from desecrate to power stations, etc. Under the Surya Mitra scheme 50,000 person were skilled in solar photo-voltaic arrangements.

Moving ahead towards improved cook-stoves initiatives; the other note-worthy schemes are beginning synchronized R & D work in solar photovoltaic an thermal systems; 2nd generation bio-fuels, fuel cells and hydrogen based energy etc. India has since 1993, had a constant buying cost for electricity produced by biomass to support growth of ability of biomass-generation. MNRE made a task force for growth of a co-generation national Program based on Bio-mass. (Shukla 2000)[14], it explained a waste named bagasse as a source of possible energy and recommended preliminary drive on of co-generation of bagasse in the sugar producing industry. GOI is keen in growing aid of sustainable energy undertaking essential setting up plans to make sure employing renewable energy everywhere. This goal achievement is made sure by national-level institutes such as National Institute of Solar Energy, National Institute of Wind Energy, and Alternate Hydro Energy Center (MNRE 2014)[15], in the direction of GOI. Monetary help is provided by IREDA, for expansion of renewable energy and makes better energy efficiency projects also administering the renewable energy incentive plan. GOI and many lending firms also provides funding. Planning Commission, Prime Minister's Council on climate change and Ministry of Power, too accountable for growth of renewable energy.(REN21 2014). In 1981, GOI put forward a biogas development countrywide project. MNRE implemented The National Biogas and Manure Management Program in India. The schemes are supporting in the progress of home-grown innovation and industry, skill, skilled people and systems in the country (MNRE 2014)[15]. GOI made a proposal to reduce dependence on fuels purchase from other countries. GOI made a notification in Sept 2003 for doing amalgamation of gasoline with 5% ethanol obligatory at first in 3 union territories and 9 states, which had been expanded to the other parts of our country further. Some steps has been taken for biodiesel like the recognition of Jatropha as the right substance for production of biodiesel by the 'National Mission on Biodiesel, 2003'. It stressed on the desert plantations of Jatropha (MNRE 2009, 2014)[12][15]. A purchase policy of Bio diesel was started in 2005 to permit oil firms to buy bio-diesel with 5% amalgamation with diesel by the Ministry of Petroleum and Natural Gas. Further, the National Bio fuels Policy, 2009 was commenced to make certain avoidance of discussions amid fuel and food and the employ of just non-agriculture for farming of bio-fuel crop (MNRE 2009)[12]. It also provide concentration to matters like MSP's, financial support for crops cultivators of bio-fuel, selling, financial support for bio-fuel firms, necessary amalgamation of ethanol in bio-diesel, testing and certification of bio-fuels (Planning Commission 2003; MNRE 2014)[33].

VII. INDIAN RENEWABLE ENERGY POTENTIAL

With a striking expansion in clean energy over the earlier period, India is rising up fast for being a worldwide pioneer in renewable energy production (MNRE 2014; IRENA 2014)[15][16]. Our country has wonderful expansion capacity in the production of energy from diverse sources of renewable energy, with a potential of nearly 900 GW. According to MNRE reports, wind, solar, small

hydel-power and bio-mass jointly give to 1/6th of whole installed electrical capacity by the last part of 2016(MNRE 2017)[13], with wind energy providing greater than ½ of the capacity installed amid renewable (GWEC 2017)[17]. Further the nationwide aim of the establishment of renewable energy producers advantages environment long run ecology to protect energy needs, job foundation, attain economic growth and lessen dependence on the conventional exhaustible resources of energy. (IRENA 2014; Kumar et al. 2015)[16][18].

VIII. ADVANCES IN RENEWABLE ENERGY

The dare of sustainable growth can be attained by expansion of renewable energy expertise.(Make in India 2015)[44]. A lot of technical obstructions require to be conquering in further half to one decade to gather the go-getting renewable energy technologies potential addition objective and bio-fuel consents for sustainable energy delivery. Yet, the existing researches in renewable energy technologies are competent of resolution of hurdles of business production.

A. Wind Energy

In the midst sources of renewable energy, wind energy is coming up as the vital power generation sources. For off-grid power generation in our country, generally wind turbines are employed. Wind energy generating plants have a wind turbine and a generator of electricity associated with a gearbox. Wind kinetic energy is converted into mechanical power by wind turbine. For definite tasks like as pumping water, grinding grain or an electrical generator wind turbine can be used. It can convert the mechanical energy to electrical energy (Ahmad et al. 2014)[19]. The technology of wind mill is improved hence harnessing of wind energy improving day by day, also tower height is increased. Associations of industry in India stress the elevated wind energy potential from 65 to 242 GW, if height of tower are increase to greater than 50 m, efficiencies of energy conversion are enhanced and essential strategy plans are taken up (Ramasamy et al.2015)[20]. According to NIWE At a 100 m height, wind power potential in India is estimated to be 302 GW. At present, with 31 installed capacity of 31 GW in the first four months of 2017 and adding to 57% of whole renewable energy. Worldwide India is at the 4th rank, in wind power (MNRE 2014; GWEC 2017)[15][17]. Tamil Nadu, Gujarat, Rajasthan, Maharashtra, and Karnataka, supplying 94% together, of whole generated wind energy. The estimation of wind resource is led by the coastal state of Gujarat with 84.4 GW potential, next the other states talked about earlier (GWEC 2017)[17].To accomplish growing require for energy, new states are too subsequent in the foot-steps to augment wind power generation (Ahmad et al. 2014).

B. Solar Energy

Two techniques of using solar energy are thermal and photovoltaic. The thermal technique uses the heat through energy of sun for food preparation, heating water, distillation and drying. The photovoltaic cell converts the energy of solar light to electric energy by the application of solar panel, it is utilized for pumping, communications, lighting, and power supply in areas where electricity is not available (Indian Renewable Energy Status Report 2010). India is having abundant quantity of strong sunny days, it obtains four to seven kilowatt-hour per m^2 radiation per day usually hence, there is fine possibility for of solar power generation. (Ramasamy et al.2015)[20]. Rajasthan Deserts attains the utmost yearly solar radiation. MNRE executes plans of solar energy, taken as one of the vast programs worldwide. 748,990 MW solar power potential is evaluated around India, from which the cumulative capacity of solar grid 15.60 GW as of October 2017 (Energy statistics 2017; MNRE 2017). Solar electricity cost is reduced by enhancement of Solar capacity, which has lesser than that of fossil fuel generated electricity. From installed capacity of solar power in India in March 2017, maximum part is of Andhra Pradesh, then chased by Rajasthan, Telangana, Tamil Nadu, and Gujarat (Bridge to India 2017).In India state and central administrations joint beginning of the Jawaharlal Nehru National Solar Mission (JNNSM) in 2010, is a significant pace in direction of the sustaining of sustainable energy. The task goals can be (i) to set up grid solar power of 20,000 MW (ii) to build up 200 lac of solar lights which will gather the aim of off-grid 2000 MW of power (iii) by the year 2022, to cover a region of 200 lac m^2 by the solar heat collector;.

C. Small Capacity Hydropower

Considering economic viability, small hydel projects are superior than other sources (Balachandar 2014). Yet, at present merely 5% of total capacity of source is harnessed on a worldwide basis, from 150–200 GW capacity according to International Energy Agency. One more benefit is lesser and equivalent rates of small hydropower to conventional thermal power of nearly Rs 2–3/kWh, with no extra connected irregular energy cost like thermal power (World Bank 2010).

High potential to produce this power irrigation channels are in rivers and plains in mountainous areas. Government has given concessions for upcoming units and to sustain on hand hydropower plants, to harness this power productively (Indian Renewable Energy Status Report 2010).

D. Geothermal Energy

Enormous resources of energy are geothermal reservoirs. It is harnessed from the heat form core of the earth, mantle, and crust, and has been fulfilling needs of industrial and domestic requirement of energy with great accomplishment. It is a perfect source of substitute energy meeting all prerequisites as an unsoiled, renewable energy (Razdan et al. 2008). United States is the global leader In the field of geo-thermal energy with installed capacity of 3.6 GW after it Indonesia and Philippines in 2016, by means of worldwide generation is a expected 78 TWh (REN21 2017)[8]. Our country is nearly potential phases of geothermal energy expansion, primarily because of the lesser coal rates. GSI information disclose the nearly 340

hot springs existence, scattered in 7 geothermal regions of India(Aggarwal 2016)[21], i.e. Sahara Valley, Himalayan (Puga, Chhumathang), Son-Narmada-Tapi (SONATA) lineament belt , Cambay Basin, , Mahanadi and Godavari basin , West Coast. Common amidst them in the little range of surface temperature from 37 to 90 °C. It is suitable for power and direct heat applications (Kakkar et al. 2012)[22]. Currently the resource of geothermal is tiny, but the striving plan of GOI is to generate 10,000 MW uptp 2030 (Aggarwal2016)[21]. As per International Sustainable Energy Agency, sources of geothermal might supply sustainable, cheap and secure energy by 2050.

E. Biomass - Generated Bio-energy and Bio-fuels

From the atmosphere CO_2 is trapped by plants, and this fundamental method forwards to the biomass addition as a source of renewable energy (Larson and Kartha 2000)[23]. India type tropical climate countries are having vast capacity for generation of energy via biomass and its remains. Biomass is accessible in large quantity in the type of agricultural waste, industrial waste and municipal waste etc. Our country has biomass accessibility nearly 5000 lac metric tons in an year, that can be transformed to bio-energy(using biochemical process and thermo -chemical process) or straightforwardly used like a power source or heat source (IRENA 2014)[16].Setting up Bio energy with capture of carbon and appropriation outcomes in a gross yield in environmental carbon. Huge potential of bio-fuels turns out to be more prominent like a substitute for draining fossil fuels. Also, it can be produced locally, needing very small alteration before ending application. Also Biomass energy bear country wealth, needs smaller investment of money than further renewable energy, forwarding to smaller item cost (Sharma and Trikha 2013)[24].

F. Conversion of Biomass to Bio energy by Thermo-chemical Process

By thermo-chemical transform of biomass the biomass change to a substitute type of contemporary bio-energy may be attained initially. The process of thermo-chemical end-products like pyrolysis, burning, as well as gasification, comprise electricity, heat, or liquid or gaseous forerunners that might be customized to bio-fuels. By biomass used like a source of energy more than $3/4^{th}$ of country and generating 32% of gross whole major use of energy, bio-mass have a key place in energy safety (Biomass Knowledge Portal 2017)[25], from 30,000 MW predictable production of power merely a inadequate 8% is harnessed as now (Schroder et al. 2008). At present, our country has more than capacity of 5940 MW power by biomass supported agriculture from them merely 4946 MW is associated to grid and 994 MW off-grid generating stations (Biomass Knowledge Portal 2017)[25]. Energy from Biomass and other sources of renewable energy, can have a vital role in considered electrification to nearly 24,500 distant recognized Indian rural community where expansion of grid based power is not probable or may be too costly (EAI report 2012; Thomas et al. 2015)[27][26]. Consistent biomass accessibility all over our country, mainly among country areas, boosts significance as a source of energy. This plentiful supply value yearly crores of money investments of with >700 billion units of electricity generation and employing a lot of people, contains the capacity to produce a noteworthy part of energy mix of our country in upcoming years. (Thomas et al. 2015)[26].

G. Direct Biomass Combustion

Globally the biomass direct combustion has been done since early age. From prehistoric time's agriculturel residues, firewood and cow dung is a critical section of supply of energy and this customary biomass yet has its users chiefly in country areas as well as at distant site. Biomass in total burning is oxidized generating CO_2, H_2O and thermal energy (Farrell and Gopal 2008). In spite of its enormous fame, this method's energy efficiency is very less (15%), also producing air pollutants such as CH_4, CO_2, CO, nitrogen oxides, tars and particulates (Farrell and Gopal 2008).

H. Pyrolysis of Bio mass

Pyrolysis is organic components combustion in inert environmental conditions or else in partial air supply, at temp. range 350–550 °C up to 700–800 °C (EAI report 2012)[27]. For the duration, the carbon long chains, hydrogen chains and compounds of oxygen split to minor molecules of shape of extremely heterogeneous solid, liquid as well as gaseous by-products (Jahirul et al. 2012)[29]. Liquid product the pyrolysis oil, is a heterogeneous mixture formed as more content of oxygen and alike a extremely viscous tar, that may be made (Fisher et al. 2002)[30]. Middle solid residue is Char that is generated in reactors in the pyrolysis process. This remaining char is used as a modification of soil or fuel. (Jahirul et al. 2012)[29].

I. Gasification of Biomass

Gasification is one of the effective methods of generating green power is. Biomass' partial oxidation under controlled conditions is done for receiving max of gaseous compounds yields, affluent in hydrogen and carbon compounds such as H_2, CH_4, CO, CO_2, and liberates heat. (Fisher et al. 2002)[30]. These are called producer gas or syngas and may can be applied with small alterations in inlet air, to function a diesel run engine in double fuel manner. A disadvantage is production of Tar', which pollutes the environmental It is formed by more molecular mass substances (EAI report2012; Fisher et al. 2002)[27][30]. Gas is directly used for generation of electricity through a petrol engine comprised of alternator (Tanger et al. 2013)[31]. These features make sure the feasibility and sustainability of gasification of biomass in India.

J. Conversion of Biomass to Liquid Bio-fuels

Ethanol and biodiesel like liquid bio-fuels are common green substitutes to vehicle fuels which are based on fossil fuels. In India a sugar industry by- product of molasses, is

the key element for production of bio ethanol, biodiesel is generated by the of not edible oil seeds' trans-esterification. Indian government has put forward several plans in help of bio-fuels, with loans of lesser rates of interest for putting up ethanol generation units, motivating growing of non edible as well as agriculture based oil-seeds and exempt tax for making bio-diesel.

K. Ethanol Used as Bio-fuel

Production of ethanol is done by sugar containing raw materials used as fermentation feed stocks for (Meshram and Mohan 2007)[32]. Fermentable untreated substances are divided into 3 categories (a) Starch containing straight fermentable sugar (b) lingo cellulosic bio-mass (c) organic industrial residues. Sugarcane fermentation , sugar beet fermentation and sweet sorghum fermentation might too produce ethanol (Prasad et al. 2009)[36], it need the low-cost pretreatment, but having starch, lingo cellulosic and additional wastes require costly pre-treatment, to convert to fermentable substances (Rao et al. 2013)[35]. Currently, lingo cellulosic biomass, like the adequate renewable energy source is considered broadly for generation of ethanol. We can look forward when all requirements of fuel be able to be attained from the remains of agricultural, as employ of at present accessible agricultural remains in the whole earth could manufacture 16 times greater production of ethanol over existing level (Prasad et al. 2007)[37]. The ethanol generation potential by biomass is sufficient to substitute 32% of worldwide consumption of gasoline (Meshram and Mohan2007)[32]. By utilizing just $1/3^{rd}$ of accessible excess biomass , the whole yearly petrol consumption in India can be attained(Ramasamy et al. 2015)[20].Ethanol produced from organic systems is well thought-out of specific significance as it might be directly applied as fuel for SI engines with no alterations. Ethanol's oxygen percentage of 34.7% by weight, aid full fuel combustion as well as emissions decline too. To increase octane number it is normally used as an additive in petrol, and get better, the emission types. Ethanol, is the low-carbon fuel, has enormous possible advantages to curtail the risk of emissions of greenhouse gas. Carbon monoxide emissions and smog is also substantially reduced; typically produced because of the sulfur deposits in petrol (Kim and Dale 2004)[38].

L. Use of Biodiesel as Bio-fuel

Biodiesel is explained as 'long chain fatty acids of mono alkyl esters gained from renewable lipid feedstock, like animal fat or vegetable oil ' by ASTM (Prasad et al. 2012)[37]. It can directly employ or employed after amalgamation. The 'B20' combine, comprise of biodiesel and diesel in the volume ratio 1:4 is very widespread. Blends of Biodiesel reduce particulate matter emissions, CO_2 emissions, hydrocarbon emissions and emissions of sulfur oxides, therefore not as much of damaging to environment and humans. Biodiesel does not affect change of climate, to put side by side to fossil fuels (Karmakar et al. 2010). A biodiesel production plant of 1000 liters/day capacity was installed at Por-Vadodara, Gujarat, by the Aatmiya Bio-fuels Pvt. Ltd. Where feedstock is jatropa seeds (Marina et al. 2002).

M. Energy Production by Hydrogen

Hydrogen is a good fuel is a good resource of sustainable energy, which be able to be produced easily from existing environment by processing. It can replace the fossil fuels in most of the applications. H_2 is non polluting and has high conversion efficiency and recyclability, It yields water only on combustion (Francis et al. 2005)[39]. Hydrogen can be produced with ease by water electrolysis, gasification of bio-mass, and several biological processes. Presently, mostly to produce H_2 steam transformation of CH_4 or electrolysis of water is employed. Currently, H_2 is produced, mainly, by steam methane combustion or by electrolysis of water. For H_2 production fractional oxidation of supercritical water, steam decomposition, and gasification has been prevalent thermo-catalytic methods (Gupta et al. 2013)[40]. The significant troubles linked with H_2 economics have altered radically in the previous decade. Yet, refineries consume H_2 to lessen pollution and give good reason for ecological rules and regulations. In our country, lots of investigative projects concentrating on the progress of diverse features of hydrogen manufacturing technology is used, Govt. of India do the funding for it. IISC, Bangalore, is in the research on putting a downdraft open top gasification system to improve the working of the oxy-steam gasification element for generation of hydrogen at a speed of nearly 0.1 kg/kg biomass at a variety of ratios of steam-to-biomass. The NIT, Rourkela is developing a capacity of 5 kW fluidized bed gasifier for making of hydrogen at the rate of approximately feedstock of 0.09 kg/kg. (Sherif et al. 2003)[41]. It is foreseen collective power generation capacity of hydrogen-based 1000 MW and 10 Lac H_2-base automobiles in our nation.

N. Bio-Gas

Production of Bio-gas production proficiently administers and transforms organic wastes into uncontaminated bio-energy and offers the best chances to slash climatic greenhouse gases emissions (Kumar et al. 2010)[42]. Anaerobic digestion of bio-degradable and organic matter like food throw away, agricultural ravage, sewage, municipal ravage, and so on generates Bio-Gas. The slurry residue following digestion is affluent in macro and micronutrients and directly can be utilized as important organic manure. Constituents of Biogas are CO_2 and CH_4 also has little of moisture and (H_2S). Only flammable ingredient of biogas is CH_4. (Pathak et al. 2009)[43]. Due to less specific gravity CH_4, methane will go up on evading, hence dispersing at place of escape therefore it safer than another fuels like LPG and gasoline. 1 m^3 biogas produces 1.5 kWh which equivalent 0.54 L petrol, 0.52 L of diesel, 1 pound LPG, and 4 kWh of electric energy in calorific value terms. Biogas can be used as a heat energy source for the purpose of cooking by straight combustion and also for electrical and mechanical power purposes by IC engines(Pathak et al. 2009; Rao et al. 2010)[43][34]. Plants of Biogas provides adequacy for household food

preparation gas and good organic households fertilizer. (Horst 2000).

IX. SUSTAINABLE ENERGY CONTRIBUTION TO CLEAN DEVELOPMENT MECHANISM

In past decade the clean development mechanism (CDM) provided quick growth in, rapidly turning out to be the noteworthy carbon balancing instrument in the globe. Presently, our country produces nearly 4% of worldwide emissions of green-house gases. Though, on per person base, its secretions are only 1/4th that of worldwide standard and smaller than ten percent of forward countries.

NAPCC in 2008 began to encourage expansion goals while considering Green House Gases alleviation and alteration of climate change. According to it, renewable sources have the likelihood to fulfill 15% of demand of nation's energy by 2020 (Ramasamy et al. 2015)[20].On of the eight missions the NAPCC is dedicated to solar energy (Sood et al.2014).

X. CONCLUSION

The necessity of current era is sustainable energy and it is attaining attention because of its potential of low–carbon production, frequently go together with additional advantages. The changeover of conventional energy of fossil fuel to sustainable energy would assist in efficient air pollution reduction, alleviation of climate change, and support sustainable growth of economy with fairness and ecological excellence. The 5th assessment report of IPCC authenticates the capable position of bio-energy in heartening financial development by escalating and expanding farm revenues and imparting employment in country area as well as in presenting inexpensive options for lessening environment worsening. The necessity is to take on and employ renewable as well as sustainable energy techniques for extenuating of ecological challenges everywhere.

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Electrical Design Analysis and Implementation for commercial buildings

MENDAPARA JAY RAMNIK BHAI

DR.SWETA SHAH

Electrical Engineering Department Indus University
Ahmedabad India
jaymendapara.20.el@iite.indusuni.ac.in

swetashah.el@indusuni.ac.in

***Abstract*—Electricity plays an important role in day to day life but we have to use it electricity in a economical and proper way. This paper analyses and shows different types of electrical design in autocad, system load calculations, cable size calculations, short circuit calculations and voltage regulation sheet.**

Keywords—Design, Autocad, Cable size, VR sheet, single line diagram

I. INTRODUCTION

Every electrical installation required proper planning which is either commercial buildings or residential buildings. Different types of buildings involves different types of calculations based on which type of building it is and purpose of building.In a Electrical design it covers all the parameters which involves all the types of plannings, HVEC planning and testing of installed equipment according to the standard nominal. The design includes lighting layout, CCTV layout, AC layout, raw power layout, TV points. It also shown that which equipment is connected to the generator when there is a power off due to some problem. The important area covered in this paper are: Lighting design, Power design, Cables sizing according to the load, Protection system design, Single line diagram and Voltage Regulation sheet.

II. LOAD ANALYSIS FOR DISTRIBUTION SYSTEM

A. Single phase calculation

$P = VICOS\varnothing$. Where P is the total load in KW, I current demand is Amps, V is the voltage, cos⌀ is the power factor. $I = P/VCOS\varnothing$.

for example P = 1000watt V = 240volt power factor is 0.8. I=1000/240*0.8 $I = 5.8AMP$

B. Three phase calculation

$P = \sqrt{3}VICOS\varnothing$. Where P is the total load in KW, I current demand is Amps, V is the voltage, cos⌀ is the power factor. $I = P/\sqrt{3}VCOS\varnothing$.

for example P = 1000watt V = 415 volt power factor is 0.8. $I = 1000/1.73 * 415 * 0.8$. $I = 1.73AMP$

III. RESULTS AND DISCUSSION

After carried out the appropriate calculation in accordance with required regulations and standard, the aim and objectives of the paper was achieved. The following sections explains the analysis of the results.

A. Electric legend

It is a standard symbolic presentation in a autocad sheet. Main purpose of electric legend is easy to understand for the contractors who are work according to the diagram. Electrical components and legend used in a design such as light, fan, geyser , switches, air conditioner etc.

B. Lighting Design Layout

This is the design of electrical system that shows lighting layout positions and how they are interconnected to one another and how they are operating through the different switch boards. Lighting layout includes: lighting fittings, ceiling fans, switch boards, etc.

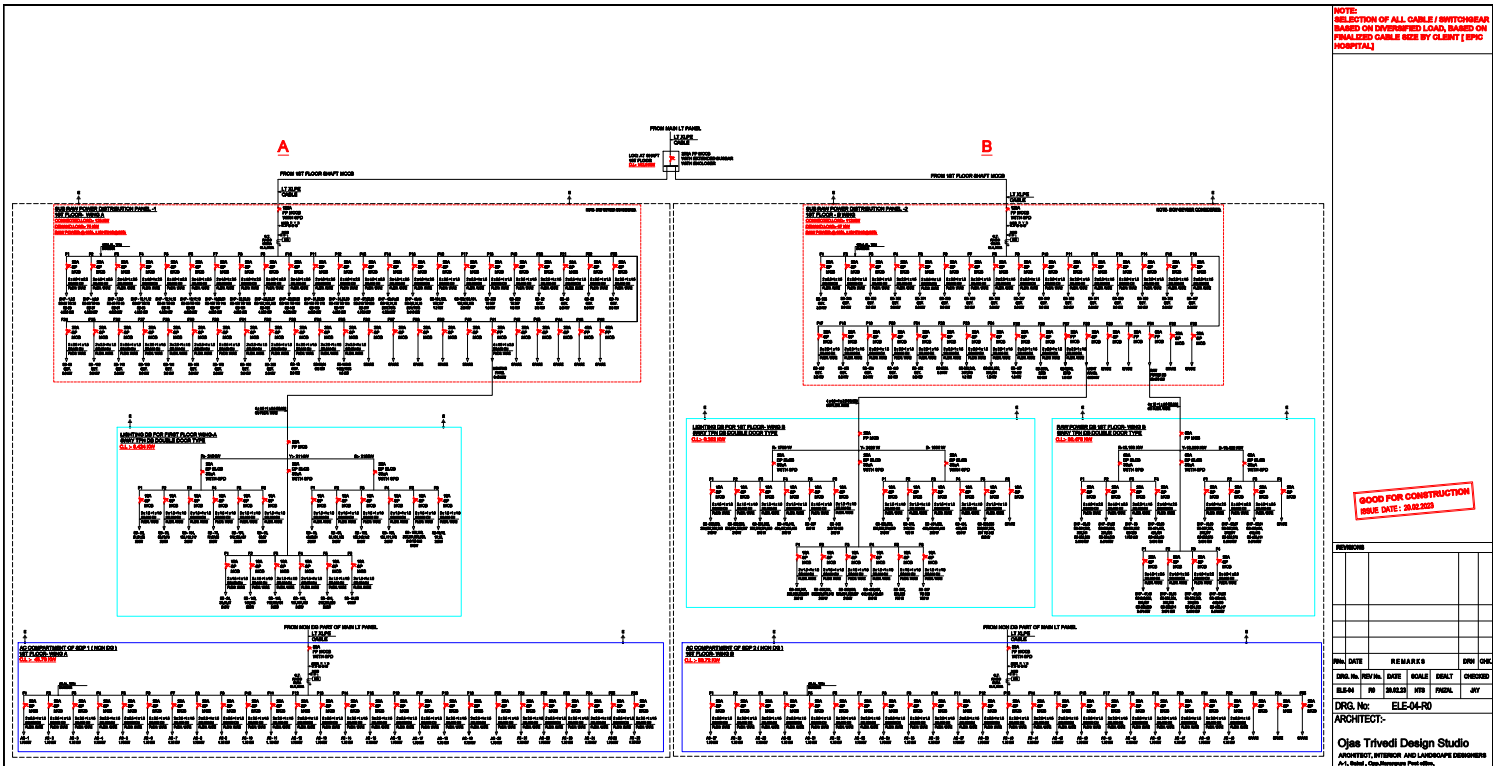
C. Single line diagram

single-line diagram also sometimes called one-line diagram. It is a main part for the load calculation. Single line diagram shows different types of load on different different feeders of an electric power system. Once the single line diagram is done you can easily know that total how much load is required for the building.

D. Balanced systems

In a three phase system the power factor and the phase current or line current of three phase are equally distributed which is known as balanced load system. For example if there is total 150KW of load then the distribution of the 150KW load is 50KW in each R phase, Y phase and B phase.

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NOTE:
SELECTION OF ALL CABLE / SWITCHGEAR BASED ON DIVERSIFIED LOAD, BASED ON FINALIZED CABLE SIZE BY CLIENT (EPIC HOSPITAL)

GOOD FOR CONSTRUCTION
ISSUE DATE : 20.02.2023

REVISIONS

No.	DATE	REMARKS	DRN	CHK

DRG. No.	REV No.	DATE	SCALE	DEALT	CHECKED
ELE-04	R0	20.02.23	NTS	PARDAL	JAY

DRG. No: ELE-04-R0

ARCHITECT:-
Ojas Trivedi Design Studio
ARCHITECT, INTERIOR AND LANDSCAPE DESIGNERS
A-1, Saket , Opp.Narayanpura Post office, Ahmedabad-380013. India. CELL:9879149929

PROJECT
NEW EPIC HOSPITAL
AT; AHMEDABAD

TITLE
SLD FOR
SUB LIGHTING PANEL
1ST FLOOR

This drawing and the design are the property of APOORVA PARIKH electrical consultant they will not be reproduced, copied loaned exhibited nor used except in limited way and private use permited by any written consent given by the CONSULTANTS

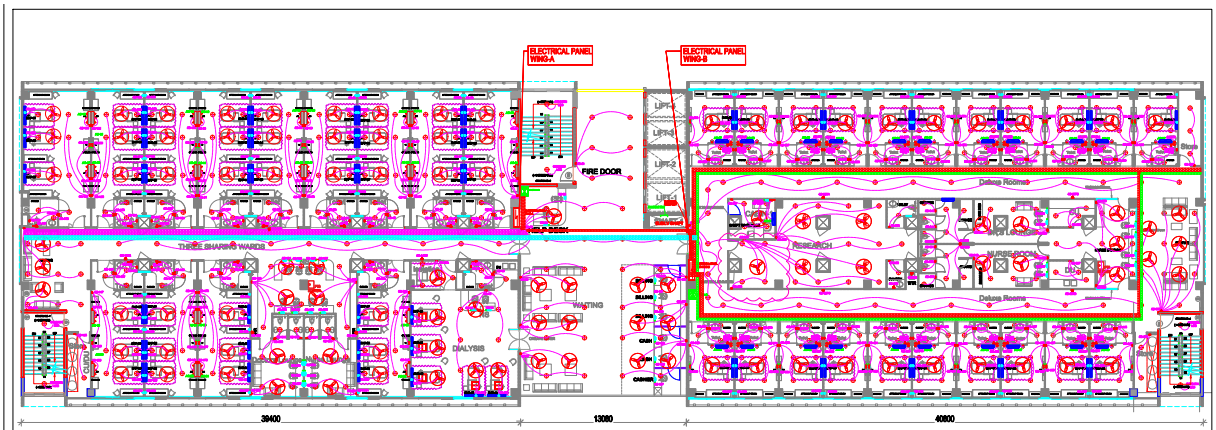
ELECTRICAL NOTES

PANEL CONSTRUCTION:-

- FRAME — 2MM CRCA SHEET
- GLAND PLATE — 3MM CRCA SHEET
- BASE CHANNEL — 75 MM
- PROTECTION CLASS — IP54
- PAINT — SEVEN TANK PROCESS FOLLOWAD BY POWDER COATING OF 75 MICRON THICK SIMENS GRAY (RAL 7032)
- BUS BAR — ELECTROLYTIC GRADE ALUMINIUM BUS (E91) WITH HEAT SHRINKABLE COLOUR COATED SLEEVE WITH BMC/DMC SUPPORT & 0.6mm./SQ. MM CURRENT DENSITY.

- PORTION SHOWN INSIDE DOTTED LINES IS PANEL PORTION.
- ALL METERS SHALL BE DIGITAL WITH COMMUNICATION TO BE WIRED FOR FUTURE EMS SYSTEM
- ALL LAMP SHALL BE LED TYPE ONLY.
- ALL CONTROL WIRING MCB 2Amp.
- M1- MULTI FUNCTION METER (HPL EMF98 VIFPE OR EQUIVALENT WITH R9485 PORT IF MENTION)
- M2 - KWH ENERGY METER, VOLTMETER, AMMETER
- M3 - VOLTMETER, AMMETER
- D.G SETS SHALL HAVE AUTO SYNCHRONISING & AUTO LOAD SHARING FACILITY.
- EACH D.G INCOMER COMPARTMENT SHALL BE COMPLETE WITH ALL DG PANEL.
- ALL O/G FEEDERS / BREAKERS SHALL BE MDO WITH THERMAL MAGNETIC RELE.
- ALL ACB SHOULD HAVE ELECTMECH ANTIPUMPING, RACKING LOCK, UNDERVOLTAGE, SHORT CIRCUIT RELEASE
- ALL ACB SHOULD BE EDO 4 EDO 1CB=1CB+1CW 1SEC EXCEPT APFC I/C WITH MP RELEASE(HING PROTECTION WITH S/C, O/L, AND E/F WITH TIME DELAY. RELEASE SHOULD HAVE CURRENT DISPLAY WITH R ,Y, B INDICATION
- ALL MCCB SHOULD HAVE PHASE BARRIERS.
- SPD - SURGE PROTECTION DEVICE
- CONTACTOR SHOULD BE CAPACITOR DUTY (NOT AC 3 AS MENTION IN SLD)
- ALL MCCB SHALL BE WITH O/C, S/C, & E/F RELEASES & LOAD SETTING FACILITY.
- ALL MCCB SHOULD BE 4 POLE ICS =100% ICU WITH ROM AND TRIP ALARM CONTACT WITH 9HUNT TRIP : 36 KA I.P TO 200 A WITH VARIABLE S/C AND O/L AND ABOVE 200 AMP RELEASE WITH VARIABLE S/C ,O/L AND E/F WITH TIME DELAY SETTING .
- MCCB ABOVE 250A & ABOVE SHOULD BE 4 POLE WITH MICROPROCESSOR RELEASE WITH E/F INSULT WITH ROM & TRIP/ ALARM AUX CONTACT. Icw= Icu 50KA
- ADDITIONAL CT TO BE PROVIDED FOR APFCR BEHIND IN CAPACITOR PANEL.
- CAPACITOR FEEDER ACB TO BE INTERLOCKED SUCH THAT IT CAN OPERATE ONLY ON EB SUPPLY.
- SEPERATE TERMINAL BLOCK DRAWING TO BE PROVIDED ALONG WITH CONTROL CIRCUIT WIRING DRAWING MARKED WITH TERMINAL NO. AND IDENTIFYING THE TERMINALS FOR EACH INDIVISUAL BLOCK.
- ALL TERMINALS TO BE MARKED WITH PROPERLY NUMBERED FERRULES.
- PROVISION FOR CONTROL CABLES FOR INTERLOCKING / INTERCONNECTIONS
- THE HINGES USED ARE HEAVY DUTY AND BEST QUALITY.
- THE PANEL LOOKS ARE NON-METALLIC ECO POLY
- THE GASKET OF THE PANEL IS NEOPRENE LONG LIFE.
- THE WIRES USED IN THE CONTROL PANEL ARE OF REPUTED MAKE I.E LAPP, RR KABLE.
- THE JOINTS OF COPPER BUS BARS ARE TINNED.
- ALL PANEL DOORS ARE EARTHED BY COPPER BRAIDED WIRE.
- A COPPER / ALUMINUM EARTH BUS BAR IS RUN THROUGHOUT THE PANEL
- ALL PANELS ARE PROVIDED WITH PROPER GLAND PLATES ENSURING FAST & EARY INSTALLATION OF PANEL AT SITE.
- FOR ALL ACB & MCCB, BUS BAR IS PROVIDED WITH INSULATOR FOR CABLE TERMINATION.
- THE PANELS ARE MANUFACTURED WITH SEPARATE BUS BAR CHAMBER ISOLATED FROM UNIT FEEDER CHAMBERS AND CABLE ALLEYS.
- ALL POWER AND CONTROL WIRING TERMINALS ARE BROUGHT OUT IN THE CABLE ALLEY FOR USE OF EASY CABLE TERMINATION.
- ALL CABLE ENTRY FROM TOP ONLY.

Apoorva Parikh
Consultant-Electrical
Industrial Design
Infrastructure Planning
109, ANJANI FLATS OPP. KARNAVATI CLUB,
NR. ANKA KADAM BUNGLOWS,
RANDESHWAR - ODHPUR ROAD, SATELITE,
AHMEDABAD - 380 015.
PHONE :- (079) 32924418 , 26926294
E-mail apoorvaparikh@gmail.com



LEGEND:-

CEILING FAN POINT		2NOS 6A UPS POWER SOCKET WITH SWITCH	
CEILING LIGHT POINT		3NOS 6A UPS POWER SOCKET WITH SWITCH	
BRACKET LIGHT POINT		TPP - 3PHASE POWER SOCKE WITH MCB/MCCB	
BRACKET LIGHT POINT (2 WAY)	D	DATA POINT	
SWITCH BOARD WITH 6A SOCKET	T	TELEPHONE POINT	
SWITCH BOARD ONLY	TB	TELEPHONE POINT	
SWITCH BOARD WITH 6A/16A SOCKET		A/C POINT	
SWITCH BOARD WITH BELL PUSH SWITCH		BUZZER POINT	
SWITCH BOARD FOR A/C			
1NO 6A RAW POWER SOCKET WITH SWITCH			
2NOS 6A RAW POWER SOCKET WITH SWITCH			
3NOS 6A RAW POWER SOCKET WITH SWITCH			
2 NOS 5/15A RAW POWER SOCKETS & SWITCHES 2 NOS 6A RAW POWER SOCKETS & SWITCHES 1 SWITCH FOR TV, LIGHT, FAN SWITCH & REGULATOR 1 TELEPHONE, NURSE CALL POINT WITH CAT 6	1300W+ 1300W		

NOTE:-

1. ALL SWITCH BOARD SHOULD BE MINIMUM 0'-6" AWAY FROM DOOR / WINDOW OPENING.
2. BOTTOM HEIGHT OF THE SWITCH BOARD SHOULD BE AT 4'-0" FROM FFL. UNLESS OTHERWISE SPECIFIED IN THE DRG.
3. BOTTOM HT OF THE SERVICE PLUG SHOULD BE 1'-6" FROM FFL. UNLESS OTHERWISE SPECIFIED IN THE DRG.
4. BOTTOM HEIGHT OF ALL TELEPHONE AND COMPUTER POINT SHOULD BE 2'-6" OR AS PER FURNITURE.
5. ALL TELEPHONE & DATA MODULE COUNT SEPARATELY.
6. BOTTOM HEIGHT OF ALL A.C. MODULAR SWITCH SHOULD BE AT 4'-0" FROM FFL.
7. BOTTOM HEIGHT OF ALL SERVICE PLUG POINT IN PASSAGE SHOULD BE AT 1'-6".
8. BOTTOM HEIGHT ALL HAND DRYER POINT AT 5'-0" FROM FFL.
9. BOTTOM HEIGHT ALL TOILET BELL PUSS SWITCH AT 2'-6" FROM FFL.
10. BOTTOM HEIGHT ALL FOOT LIGHT POINT AT 6'-9" FROM FFL.
11. BOTTOM HEIGHT ALL BUZZER POINT AT 5'-0" FROM FFL.
12. BOTTOM HEIGHT ALL TV POINT AT 5'-0" FROM FFL.
13. CENTER OF BRACKET LIGHT POINT AT 6'-6" ABOVE LINTEL LVL.

FOR APPROVAL
ISSUE DATE : 20.02.2023

REVISION PARTICULARS:

REV.	DATE	REMARKS	DRN	CHK
R1	20.02.23	REVISED AS PER NEW ARCH. LAYOUT	PD	JAY

PROJECT :
NEW EPIC HOSPITAL
AT AHMEDABAD

TITLE : ELECTRICAL CONTROL
LAYOUT FOR FIRST FLOOR

DATE: 20.02.2023 DWG NO: ELE-09-FF

DRAWN BY: PARDAL CHECKED BY: JAY

REV: R1

ARCHITECT
Ojas Trivedi Design Studio
ARCHITECT, INTERIOR AND LANDSCAPE DESIGNERS
A-1, Saket , Opp.Narayanpura Post office, Ahmedabad-380013. India. CELL:9879149929

ELECTRICAL CONSULTANT
Apoorva Parikh
Consultant-Electrical
Industrial Design
Infrastructure Planning
109, ANJANI FLATS OPP. KARNAVATI CLUB,
NR. ANKA KADAM BUNGLOWS,
RANDESHWAR - ODHPUR ROAD, SATELITE,
AHMEDABAD, GUJARAT - 380 015.
PHONE : 079 -26927926, 26926294
E-mail : apoorvaparikh@gmail.com

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E. Unbalanced systems

Unbalanced load system means a load distribution in R phase Y phase and B phase is not equal. For example the total load is 150KW and the distribution of the load is 80KW 50KW and 20KW respectively then it is known as unbalanced system. The main disadvantage of an unbalanced system is this can lead to overheating of electrical components and possibly overloading the main panel. A large numbers of small load connected to only one phase it cause more current flow from that particular one phase and it causing high voltage drop.

IV. Load considerations

- Light Load : 18-28 Watt
- Fan Point : 80 Watt
- 16 Amp plug socket : 500 Watt
- 5 Amp plug socket : 100 Watt
- Buzzer or Door bell point : 50 Watt
- Geyser : 3000 Watt
- Split Ac maximum Load : 1800 Watt

F. Balance load calculation

- Total load for R phase including all sections is 58.224 KW
- Total load for Y phase including all sections is 55.84 KW
- Total load for Z phase including all sections is 56.40 KW

Phase	Section 1	Section-2	Section-3
R	40.664KW	2.3KW	15.26KW
Y	38.68KW	1.9KW	15.26KW
B	39KW	2.1KW	15.26KW

G. Voltage regulation sheet sample calculation

Calculate the voltage regulation for 50KW and length of cable is 125meters

$Vd = Vs - (Vs - Vr)/Vs * 100$

Vd = 415 - (415-{I*R})/415 * 100

1KW = 1.72AMP so 50KW = 86AMP

Vd = 415 - (415- {86*1.54/1000*actual cable length in meter})/415 * 100

Vd = 415 - (415-{86*0.1925})/415 * 100

Vd = 415 - (415-16.555)/415 * 100]

Vd = 415 -(398.445)/415 * 100

Vd = [415 - 398.445]/415 * 100

Vd = [16.555/415]*100

Vd = [0.0398]*100

Vd = 3.98%

Table-1 is representing VR sheet

Table 1

FROM	TO	CABLE SIZE	CABLE LENGTH	RES/KM	RES/M	KW	AMP	VS-VR	VD
T/C-1	FSP-1	2CX4 SQ.MM AL AR CABLE	15	5.68	0.0852	4.808	8.31784	0.7087	0.1708
FSP-1	SFU-1	2CX4 SQ.MM AL AR CABLE	17	5.68	0.0966	4.808	8.31784	0.8032	0.3643
FSP-2 TO 12	SFU-2	2CX4 SQ.MM AL AR CABLE	20	5.68	0.1136	4.808	8.31784	0.9449	0.3985
FSP-13	SFU-13	2CX4 SQ.MM AL AR CABLE	10	5.68	0.0568	4.708	8.14484	0.4626	0.2822
FSP-14	SFU-14	2CX4 SQ.MM AL AR CABLE	15	5.68	0.0852	4.224	7.30752	0.6226	0.3208
FSP-15	SFU-15	2CX4 SQ.MM AL AR CABLE	18	5.68	0.1022	3.416	5.90968	0.6042	0.3164
FSP-16	SFU-16	2CX4 SQ.MM AL AR CABLE	20	5.68	0.1136	1.2	2.076	0.2358	0.2276
FSP-17	SFU-17	2CX2.5 SQ.MM AL AR CABLE	20	9.08	0.1816	2.2	3.806	0.6912	0.3373
FSP-18	SFU-18	2CX2.5 SQ.MM AL AR CABLE	12	9.08	0.1090	1.8	3.114	0.3393	0.2506
FSP-19	SFU-19	2CX2.5 SQ.MM AL AR CABLE	13	9.08	0.1180	1.8	3.114	0.3676	0.2593
FSP-20 TO 33	SFU-20 TO 33	2CX2.5 SQ.MM AL AR CABLE	10	9.08	0.0908	3.0	5.19	0.4713	0.2843
FSP-34	SFU-34	2CX2.5 SQ.MM AL AR CABLE	19	9.08	0.1725	0.6	1.038	0.1791	0.2139
FSP-35	SFU-35	2CX2.5 SQ.MM AL AR CABLE	20	9.08	0.1816	1.5	2.595	0.4713	0.2843

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H. Conclusion

Main purpose of this project is to making easy way to calculate load by drawing single line diagram in autocad. We can take care of the voltage regulation drop and our voltage regulation drop is less than 5% which is standard nominations and load distribution is balanced in R,Y and B phase. This help better to understand the total load and distribution for builder.

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FOOD CALORIE MEASUREMENT AND DIETARYASSESMENT USING DEEP LEARNING

Bhautik B Trivedi
Computer Engineering
Indus University
Ahmedabad, Gujarat, India
bhautik.trivedi@gmail.com

Dr. Seema Mahajan
Computer Engineering
Indus University
Ahmedabad, Gujarat, India
ce.hod@indusuni.ac.in

***Abstract*— Nutritional Assessment and Food Calorie Appraisal are crucial components for effective calorie measurement. For the producers, advisors, and organisations dealing with the hotel industry, it has consistently remained hot cake. This field of study tries to guide persons with dietary constraints brought on by unavoidable obesity or unexpected medical conditions. A literature review is conducted in the field of the aforementioned themes with the intention of helping the society by developing a method of calorie measuring that is used for both patients and individuals who are illiterate. The survey focuses on deep learning algorithms for categorizing different types of foods using their photographs, as well as methods for calculating the calorie and diet content of wheat food using images and specific criteria.**

Keywords— Machine learning, calorie estimation, dietary assessment, and calorie measurement.

Introduction of Research Area

It is a well-known fact that the majority of Indians experience dietary restrictions when dealing with medical emergencies or when some classes of fat individuals require them on a constant basis to maintain their health and fitness. It is crucial that computer vision and machine learning can look for an area of opportunity to deal with challenges and solutions of Calorie Estimation of Food due to an increase in computer technology and targeting the interests of people dealing with the hotel business. different foods. In order to assess diet using food calorie measurement, a literature study is conducted here, and deep learning algorithms as Grab-cut, R-CNN, SS-SVM, SVN, CNN, etc. are reviewed.

Group of Machine Learning Techniques

Two categories of machine learning algorithms can be made:

Supervised learning and Unsupervised learning

Supervised learning

The labelled data set's known value is employed in this manner as a tool to train the model. The technique can be used to estimate a target variable that is not derived from sample data. Classification and regression techniques are the typical applications of supervised learning.

Unsupervised learning

The key to this method's success is finding underlying patterns or fundamental data structures, which aid in drawing the conclusions you want from unlabeled data. The target area for this strategy might be found in exploratory applications with unclear goals or in other cases where the specifics from the given data are unclear. It functions as a framework for an excellent process to reduce the dimension of data with various attributes. The Clustering model is a popular choice for this form of learning adaption, and its application also covers exploratory data analysis techniques like object identification and DNA sequence analysis.

Objective of Calorie Food Research

Here the goal of research under focus is to address the need of people who have diet restrictions arising from medical emergency or having natural obesity. This research will enable

the illiterate human beings to estimate the amount of daily calories of diet so that unwanted conditions arising from heavy diet can be regulated.

Food Calorie Computation Method

This research paper's main study question focuses on calorie evaluation of food using the more rapid R-CNN technology. The GrabCut algorithm is used to acquire the contour of each item of food. Following that, volume estimation formulas are used to estimate the volume. Finally, we calculate the calories in each food. [1].

Since photographs are shot with smartphones and then processed using sophisticated image processing techniques, the suggested method can quickly become a tool that can be comfortably incorporated into health apps as a component of engineering solutions.. [2]

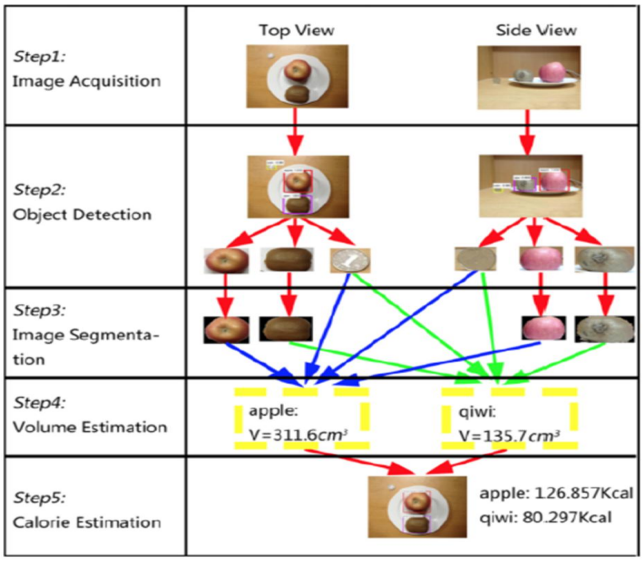
While it attempts to solve the issues listed below, Im2Calories has attracted the attention of computer scientists. 1. Identifying fine grains, which is essential for classifying various food forms. 2. Marking of hierarchical spaces to control an object's relevant marking. This makes it easier to accept and handle the open world [3].

In this instance, the method of calorie measurement for food is intended to calculate the volume of food from the captured image and display the result using the foundation of tables providing nutritional facts for the calorie measurement of the object under consideration. The benefits of this proposed approach extend beyond the obese population to include regular people who are aware of their daily diets and want to eliminate concerns about gaining weight through overeating. The tools necessary for the proposed methods focus on identifying the food items seen in the image. The ability to process images, create segments, and classify data using SVM are all included. The outcome here has claimed the intended fidelity of the suggested method with a parameter-related measurement aspect [4].

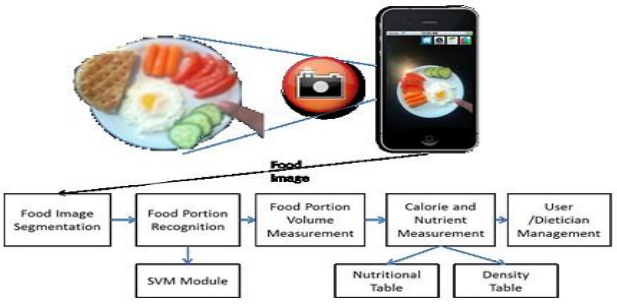
In this work, a technique for extracting graphs and texture from food photos via graph cut segmentation is highlighted. Many experiments have been conducted, and the outcomes are aimed at the classification module from the segmentation module. In comparison to the author's prior work, an overall accuracy improvement of 3% in 30 different single food portions, 5% in non-mixed food, and 15% in mixed food is achieved. Future plans call for expanding the database and putting more emphasis on the classification of blended foods [5].

This study proposes fuzzy c-mean segmentation and classification for nutritional assessment using SS-SVM. For this type of method, the food photograph is used as a source of input. The classification was carried out using the SS-SVM classifier. Following the classification, the calories in each recognised food were determined. The segmentation and classification rate of the corresponding images was used to validate the outcome. As a result, the proposed technique had a 95% accuracy rate, which improved classification performance[6].

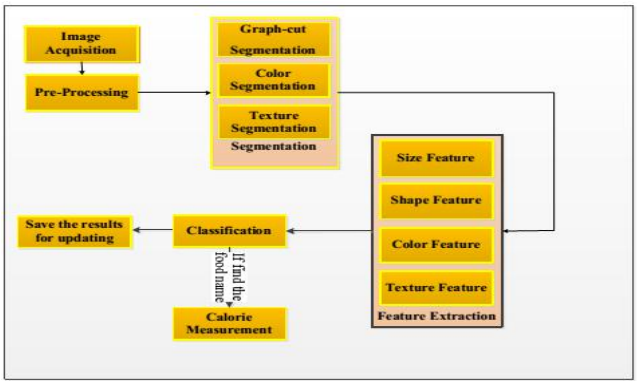
A. Figures and Tables



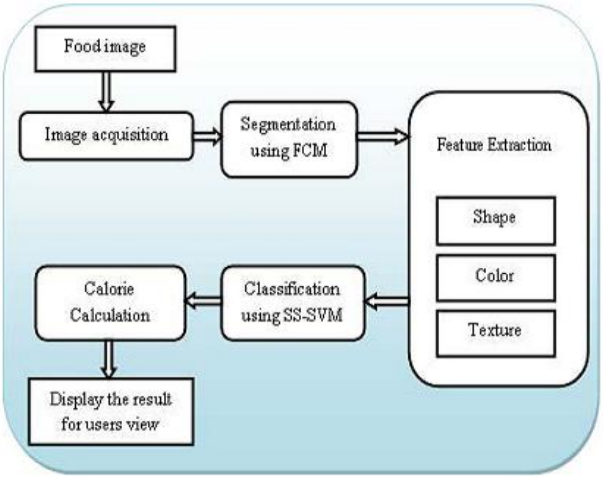
Calorie Estimation Flowchart [1].



Overall System Design [3].



Overall System Design [5].



Overall System Design [6].

Challenges

How to detect Object ?
How to recognize Object ?
Need to recognize Which type of object is in the plate and count of it.
Ingredient used in it.
Amount of Ingredient.
Volume of object.
Must have precise health record of the consumer.

Outcome

ON THE BASIS OF THESE CALCULATIONS AND KEEPING NEED OF CALORIES OF AN INDIVIDUAL IN CONSIDERATION SUGGESTIONS WILL BE GIVEN ON CONSUMPTION OF THE FOOD.

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"Building the Metaverse: A Comprehensive Overview and Analysis of Current Research and Development"

Dr. Vrushank Shah
Electronics and Communication Engineering Department,
Indus University, Gujarat, India
drvrushankshah13@gmail.com
(M) 9898331721

***Abstract*—The metaverse, a virtual shared space that allows users to interact with a computer-generated environment and each other, has long been a topic of fascination and speculation. Recent advancements in technology, including virtual and augmented reality, blockchain, and artificial intelligence, have brought the metaverse closer to reality than ever before. This paper provides a comprehensive overview and analysis of the current state of research and development of the metaverse. We define the concept of the metaverse and its potential impact on society, explore the enabling technologies, examine the current metaverse platforms and applications, and discuss the ethical and social implications of this emerging technology. We find that while significant progress has been made in the development of the metaverse, there are still many challenges that need to be addressed, including technical limitations, business models, and governance issues. However, the potential benefits of the metaverse are enormous, including new opportunities for entertainment, education, and commerce, as well as the potential for greater social connection and collaboration. Overall, we believe that the metaverse represents a significant opportunity for innovation and progress, and we recommend that further research and development be conducted to ensure that it is developed in a responsible and inclusive manner that benefits all of society.**

***Keywords*—Metaverse, Virtual reality, Augmented reality, Blockchain, Artificial intelligence**

I. Introduction

The concept of the metaverse, a virtual shared space that allows users to interact with a computer-generated environment and each other, has been around for several decades. However, recent advancements in technology, including virtual and augmented reality, blockchain, and artificial intelligence, have brought the metaverse closer to reality than ever before [1].

In this paper, we provide a comprehensive overview and analysis of the current state of research and development of the metaverse. We begin by defining what the metaverse is and its potential impact on society, including in areas such as entertainment, education, and commerce.

We then explore the various technologies that are enabling the development of the metaverse, including virtual and augmented reality, blockchain, and artificial intelligence. We discuss the advantages and limitations of each technology and how they can be integrated to create a seamless and immersive metaverse experience.

Next, we examine the current metaverse platforms and applications that are already available or in development, such as Second Life, Decentraland, and Fortnite. We analyze their features, user base, and business models and identify the challenges they face in achieving widespread adoption.

Finally, we discuss the ethical and social implications of the metaverse, including issues related to privacy, security, identity, and governance. We conclude with some recommendations for future research and development in this exciting and rapidly evolving field.

II. Background

In recent years, advancements in technology, such as virtual and augmented reality, blockchain, and artificial intelligence, have made the metaverse more feasible and appealing to developers, investors, and users alike.

The concept of the metaverse has been around for several decades, and it has been explored in science fiction, gaming, and other forms of media. However, the recent convergence of these enabling technologies has brought the metaverse closer to reality than ever before, and many companies and individuals are actively working on developing and implementing metaverse platforms and applications. As the metaverse becomes more mainstream and widely adopted, it raises important ethical and social questions related to privacy, security, identity, and governance. Therefore, it is important to conduct research and analysis to better understand the potential impact of the metaverse on society and to identify the best practices and strategies for its development and implementation [2].

III. Metaverse & Its Societal Impact

The metaverse refers to a hypothetical future version of the internet that is immersive, interactive, and three-dimensional, where users can create and interact with digital environments as if they were in the real world. In essence, it is a virtual universe where people can engage with each other and with digital objects in real time [3].

The potential impact of the metaverse on society could be significant, particularly in the areas of entertainment, education, and commerce. Here are some potential examples:

Entertainment: The metaverse could transform entertainment by offering a more immersive and interactive experience for users. Imagine attending a virtual concert where you can interact with other fans, dance, and even meet the performers. Or, imagine playing a video game

where you can actually enter the game world and interact with other players in a more realistic way.

Education: The metaverse could also revolutionize education by providing a more engaging and interactive way to learn. For example, students could attend virtual classrooms and interact with teachers and classmates in a more immersive way. They could also explore historical sites or scientific concepts in a more interactive way, bringing the subject matter to life.

Commerce: The metaverse could also change the way we shop and do business. Imagine being able to browse a virtual mall, try on clothes or products, and interact with sales associates in a more immersive way. Companies could also use the metaverse to create more engaging and interactive advertisements and marketing campaigns [4].

However, there are also concerns about the metaverse, including issues around privacy, security, and addiction. Additionally, the metaverse is still a concept that is evolving, and there are many technical and logistical challenges that need to be overcome before it becomes a reality. Nevertheless, the potential impact of the metaverse on society is worth considering and exploring further.

IV. Challenges

The Metaverse, as a concept, presents several challenges that need to be addressed for it to become a mainstream phenomenon. One of the most significant challenges is the limited adoption and accessibility of VR and AR technology. While these technologies have been around for some time, they are still relatively expensive and inaccessible to most people. This limited adoption and accessibility could limit the reach of the Metaverse and reduce its potential impact on society [5].

Another challenge is the lack of a shared standard and interoperability between different platforms and applications. Without a common standard for the Metaverse, it may become fragmented and difficult to navigate. This could lead to an ecosystem of siloed applications and platforms that do not interact with each other, reducing the overall potential of the Metaverse.

Privacy and security concerns are also significant challenges for the Metaverse. As people become more immersed in the Metaverse, there are growing concerns about the collection, use, and sharing of personal data. The Metaverse is likely to generate massive amounts of user data, and there is a need to ensure that this data is protected and used responsibly [6].

Another significant challenge is the ethical and social implications of the Metaverse. As the Metaverse becomes more integrated into our lives, it could lead to a blurring of the line between the physical and virtual worlds. This could raise questions about ownership, identity, and the nature of reality itself.

In conclusion, the Metaverse presents several significant challenges that need to be addressed to unlock its full potential. These challenges include limited adoption and accessibility of VR and AR technology, lack of a shared standard and interoperability, privacy and security concerns, and ethical and social implications. Addressing these challenges will require collaboration between various stakeholders, including technology companies, policymakers, and users, to ensure that the Metaverse is developed in a way that benefits everyone.

V. Current State of Research and Development

Overview of companies and organizations involved in Metaverse development

The development of the Metaverse is being driven by a diverse range of companies and organizations, including technology giants, gaming companies, and startups. Some of the major players in the Metaverse landscape include:

Facebook: Facebook is one of the largest companies investing in the development of the Metaverse. In 2021, the company announced its intention to transition from a social media platform to a "metaverse company."

Epic Games: Epic Games, the company behind the popular video game Fortnite, is also heavily invested in the Metaverse. The company has created a virtual platform called the Epic Games Store, which allows users to purchase and play games.

Roblox: Roblox is a gaming platform that allows users to create and share their own games. The company has been expanding its offerings to include more social and educational experiences, with a focus on building the Metaverse.

Decentraland: Decentraland is a blockchain-based virtual world that allows users to buy and sell virtual real estate and create their own experiences.

Niantic: Niantic is the company behind the popular augmented reality game, Pokemon Go. The company has been exploring the potential of the Metaverse, with plans to release an AR-based game called "Transformers: Heavy Metal."

Microsoft: Microsoft has been investing in VR and AR technology for several years and has recently announced its intention to build a "metaverse for enterprise."

Nvidia: Nvidia is a leading provider of graphics processing units (GPUs) for gaming and other applications. The company has been working on developing technology to power the Metaverse, including a platform called Omniverse.

These companies are just a few examples of the many organizations involved in Metaverse development. As the Metaverse continues to evolve, we can expect to see more players enter the market and new partnerships and collaborations emerge [7].

Major initiatives and projects

The Metaverse is a rapidly developing field, and there are already many major initiatives and projects underway. Here are some of the most significant ones:

Open Metaverse Interoperability Group (OMG): The OMG is a nonprofit organization that aims to create an open standard for the Metaverse. Its goal is to enable interoperability between different virtual worlds and platforms, allowing users to move seamlessly between them.

Decentraland: Decentraland is a blockchain-based virtual world where users can create and share their own experiences. The platform allows users to buy and sell virtual real estate using cryptocurrency, and it has its own native token, MANA.

Facebook Horizon Workrooms: Facebook Horizon Workrooms is a virtual reality platform designed for remote work and collaboration. It allows users to hold virtual meetings, share files, and collaborate on projects in a 3D environment.

Roblox: Roblox is a gaming platform that allows users to create and share their own games. The platform has over 200 million active users and is rapidly expanding into other areas, such as social experiences and education.

Microsoft Mesh: Microsoft Mesh is a mixed reality platform that allows users to collaborate and interact in a shared virtual environment. It can be used for a variety of applications, including remote work, education, and entertainment.

Sandbox: Sandbox is a virtual gaming platform where users can create and share their own games and experiences. It uses blockchain technology to enable ownership of virtual assets and the monetization of user-generated content.

Epic Games MetaHuman Creator: The MetaHuman Creator is a tool developed by Epic Games that allows users to create realistic digital humans. It uses advanced graphics and animation technology to create lifelike avatars that can be used in a variety of applications, including gaming and virtual production.

These are just a few examples of the many initiatives and projects underway in the Metaverse. As the field continues to develop, we can expect to see more exciting and innovative projects emerge [8].

Key technologies and applications being developed

The Metaverse is a complex ecosystem of technologies and applications, and there are many different technologies and applications being developed. Here are some of the key ones:

Virtual Reality (VR): VR technology is a key component of the Metaverse, allowing users to immerse themselves in virtual environments. VR technology is used in many Metaverse applications, including gaming, education, and virtual tourism.

Augmented Reality (AR): AR technology allows users to overlay digital information onto the real world. AR is being used in Metaverse applications such as location-based games and virtual try-on experiences.

VI. Analysis of the Metaverse Landscape

Blockchain: Blockchain technology is being used in the Metaverse to enable ownership of virtual assets and the monetization of user-generated content. Blockchain-based virtual worlds like Decentraland and The Sandbox use cryptocurrency to facilitate transactions within their ecosystems [9].

Artificial Intelligence (AI): AI is being used in the Metaverse to create more realistic and responsive virtual environments. AI can be used to create lifelike characters, generate realistic physics simulations, and improve natural language processing in virtual environments.

Social Networking: Social networking is a key component of the Metaverse, enabling users to connect with each other and share experiences. Social networking platforms like Facebook Horizon and Second Life allow users to create avatars and interact with each other in virtual environments.

Virtual Production: Virtual production technology is being used in the Metaverse to create immersive experiences in film, television, and gaming. This technology uses real-time rendering and motion capture to create realistic digital environments and characters.

Education: The Metaverse has the potential to revolutionize education, allowing students to learn in immersive virtual environments. Applications such as Engage and AltspaceVR allow educators to create virtual classrooms and offer interactive learning experiences.

These are just a few examples of the many technologies and applications being developed in the Metaverse. As the field continues to evolve, we can expect to see even more exciting and innovative technologies and applications emerge.

VII. Analysis of the Metaverse Landscape

Strengths, weaknesses, opportunities, and threats (SWOT) analysis

The Metaverse has many strengths and opportunities, but also faces significant challenges and threats. As the field continues to develop, it will be important to address these challenges and leverage the strengths and opportunities to ensure the long-term success of the Metaverse. The SWOT analysis of Metaverse [10] is as follows:

Strengths:

Immersive experiences: The Metaverse offers highly immersive and engaging experiences, which can be used for gaming, education, entertainment, and more.

Creative freedom: The Metaverse provides a platform for users to create and share their own experiences, giving them a high degree of creative freedom.

Potential for monetization: The Metaverse has the potential to enable new forms of monetization, such as the ownership of virtual assets and the sale of user-generated content.

Collaboration: The Metaverse can facilitate collaboration between people from all over the world, enabling new forms of social and professional interaction.

Weaknesses:

High cost: The development and deployment of Metaverse technologies can be expensive, limiting access to users who can afford the necessary hardware and software.

Technical complexity: The Metaverse requires advanced technologies such as virtual reality, artificial intelligence, and blockchain, which can be difficult to develop and integrate.

Security risks: The Metaverse can be vulnerable to security risks such as data breaches, identity theft, and cyberattacks, which could undermine user trust and adoption.

Opportunities:

New markets: The Metaverse represents a new market for a wide range of industries, including gaming, entertainment, education, and more.

Disruptive potential: The Metaverse has the potential to disrupt traditional industries and business models, enabling new forms of creativity, collaboration, and monetization.

Social impact: The Metaverse can be used for social impact initiatives such as virtual events, fundraisers, and educational programs.

Threats:

Competition: The Metaverse faces competition from other emerging technologies such as augmented reality, mixed reality, and the Internet of Things.

Regulatory challenges: The Metaverse may face regulatory challenges related to issues such as data privacy, intellectual property, and cybersecurity.

Ethical concerns: The Metaverse raises ethical concerns related to issues such as identity, representation, and the potential for addiction or exploitation.

Market size and growth potential

The Metaverse is an emerging technology field, and its market size is difficult to estimate accurately. However, some industry analysts have predicted significant growth in the coming years.

According to a report by Grand View Research, the global virtual reality (VR) and augmented reality (AR) market size was valued at USD 16.8 billion in 2020 and is expected to grow at a compound annual growth rate (CAGR) of 42.2% from 2021 to 2028. The report cites the increasing adoption of VR and AR technologies in various industries, including gaming, entertainment, education, and healthcare, as a key driver of market growth [12].

In addition to VR and AR, the Metaverse also encompasses blockchain, artificial intelligence, and other advanced technologies. A report by MarketsandMarkets estimates that the global blockchain market size will grow from USD 3.0 billion in 2020 to USD 39.7 billion by 2025, at a CAGR of 67.3% during the forecast period. The report cites the increasing adoption of blockchain technology in various industries, including finance, healthcare, and supply chain management, as a key driver of market growth.

The growth potential of the Metaverse is significant, as it has the potential to disrupt traditional industries and enable new forms of creativity, collaboration, and monetization. However, the field is still in its early stages, and it remains to be seen how quickly it will develop and how widely it will be adopted. Factors such as cost, technical complexity, and regulatory challenges may also impact market growth. Nonetheless, many companies and organizations are investing in Metaverse technologies and applications, suggesting that the field has strong growth potential in the years ahead.

Competitive landscape and market share

The Metaverse is an emerging field that is still in the early stages of development, and there is no clear market leader or dominant player. However, there are several companies and organizations that are actively involved in Metaverse development and are competing for market share.

One of the most prominent players in the Metaverse is Facebook, which is developing its own Metaverse platform called Horizon Workrooms. Facebook also owns Oculus VR, a leading provider of virtual reality hardware, and has invested heavily in virtual and augmented reality technologies in recent years.

Other major companies involved in Metaverse development include Microsoft, which is developing its own Metaverse platform called Mesh, and Roblox, a popular online gaming platform that has recently been expanding into the Metaverse space.

In addition to these major players, there are many smaller companies and startups working on Metaverse technologies and applications. Some of these companies are focused on developing specific technologies, such as virtual reality hardware or blockchain-based platforms, while others are developing applications and experiences for use in the Metaverse.

Overall, the competitive landscape of the Metaverse is still evolving, and it remains to be seen which companies and platforms will emerge as market leaders. However, the field is attracting significant investment and attention from a wide range of players, suggesting that there is strong interest in the potential of the Metaverse [13, 14].

VIII. Conclusion & Future Directions

In conclusion, the Metaverse represents a new frontier in technology, offering the potential for immersive and interactive experiences that transcend physical space and time. While the field is still in its early stages, there are already many exciting developments underway, from the creation of virtual worlds and social platforms to the integration of blockchain and other advanced technologies.

While there are challenges and risks associated with the development of the Metaverse, there are also significant opportunities for innovation, creativity, and economic growth. As the field continues to evolve, it will be important to address these challenges and work towards creating a Metaverse that is accessible, secure, and beneficial for all.

Future work in the Metaverse field will involve continued research and development in areas such as virtual world creation, blockchain integration, and artificial intelligence. As more companies and organizations invest in the Metaverse, there will also be a need for standards and regulations to ensure interoperability and protect user privacy and security.

Overall, the Metaverse is a rapidly evolving field that is poised to transform many aspects of our lives. With continued investment and innovation, it has the potential to create new opportunities for connection, collaboration, and

creativity, and to shape the future of technology in exciting and unexpected ways.

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Role of Artificial Intelligence in Micro-Financing for Women Empowerment in India- A Review

Drishti Nahata
Computer Science and Engineering
Indus University
Ahmedabad, India
drishtinahata.20.cs@iite.indusuni.ac.in

Sapna Kataria
Computer Science and Engineering
Indus University
Ahmedabad, India
sapnakataria.cse@indusuni.ac.in

Abstract- Despite having the second largest population and one of the fastest developing economies, India has a large poverty hassle. India has a chronic hassle of underemployment as 60% of the populace depends on agriculture. The biggest proportion of individuals dwelling beneath the global poverty line, 30% of the population, is found in India. Fundamental necessities along with food, housing and garb are not sufficient for bad humans to stay on. In addition they require fundamental financial offerings like coverage, financial savings with interest and so forth. In addition they have processes for settling extra bank finances and retreating big sums of money at some stage in emergencies. Financial institutions must take note of the risks associated with the usage of artificial intelligence, as it opens up a flood of new possibilities. The banks' handiest source of credit had extremely high hobby prices, draining their sources and trapping them in an limitless cycle of debt. Microfinance is the answer to this hassle. It's far from a commercial enterprise method that offers financial services to humans with low earnings. It is a way of providing economic security to those without sufficient resources or income. Microfinance seeks to empower people, especially women, and boost the income of the poor. The precise promise of artificial intelligence, which mixes cost financial savings and improved discernment, is average appealing. Those benefits, with the feasible exception of fraud detection, are scale dependent. Assets of threat are non-consultant records, distortion of consultant information, set of rules choice and human judgments based on their AI evaluation. For the foreseeable destiny, minimizing risk calls for a vigilant division of exertions between human beings and AI. It tries to bolster the independence of women. Many rural and low-earnings ladies have stepped up and commenced their own. Microfinance in a single form or some other has been practiced in India since the Seventies. It spread over the years and many humans, especially ladies, benefited from it. The primary objective of this paper is to recognize the present day challenges related to microcredit and the position of artificial intelligence in microfinance within the social upliftment of ladies in India. The studies offer current methods from SHGs and authorities assume tanks to first-class make use of public and personal assets for rural women's development and empowerment.

Key-words: Artificial Intelligence, knowledge-based systems, machine- learning, Microfinance, SHGs, Women Empowerment

I.INTRODUCTION:

The banking industry, specifically, is abuzz with talk of synthetic intelligence (AI). Despite the fact that we might also have hit a boom plateau as a result of growing inequities in training, demography, and debt (as well as pressures on our planet), it is meant to spur financial improvement through better productivity and performance (Mokyr, 2018).

In response to the financial sector's volatility, uncertainty, complexity, and ambiguity (VUCA), which has been known as a VUCA international within the literature, a combination of technical improvements, especially synthetic intelligence (AI), are revolutionising business (Millar et al., 2018). Financial institutions and marketplaces, consisting of banks, insurance companies, fee processors, mutual budget, and microfinance organizations, are referred to as the "economic area.".

Loss of the matters one wishes to live a fairly decent life is known as poverty. These requirements could encompass things like food, garments, housing, healthcare, education, and other sorts of infrastructure. The impoverished continually combat to get by in lifestyles. They undergo an expansion of demanding situations, are liable to horrific matters occurring, and lack the small pleasures that make existence worthwhile. Schooling, economics, network development, psychology, research of social offerings and public health, amongst other subjects and disciplines, all share the idea of empowerment. As empowerment can be defined from many different angles, it has long been a contentious challenge. For a conventional thought, it could be characterised as a multifaceted social process that aids individuals in taking rate in their very own lives. [12]

It's a procedure that encourages people to act on issues which can be widespread to them in their personal lives, groups, and society.

These figures make it clear that it all depends on the boundary one attracts; one may additionally tighten it to encompass individuals or slack it to exclude them. India currently makes up a larger share of the sector's impoverished.

In India, ladies endure a disproportionately big part of the load of poverty. Simply 13% of farmland in India, a rustic with a

pervasive patriarchal society, is held by women. Girls in India are disproportionately impoverished because of gender disparities. This is a major issue in rural regions. In preferred, girls in rural . [12]

Areas are abused. The largest impediment those girls come upon is a lack of information, ambition, and access to financial assets and education to release their corporations. Girls who experience poverty do so due to these injustices.

Further to providing loans, microfinance contains a wide variety of different services inclusive of saving, investing, sending money, counselling, and so on. The supply of economic services to people with modest incomes is referred to as micro-credit score. Giving underprivileged individuals a hazard to interrupt out from the cycle of poverty by means of enabling them to engage in entrepreneurial endeavours is the agency's primary objective. To promote economic equality, the government ought to work to improve the lives of the poor and the deprived.[12][9]

Empowerment, in keeping with the world bank, is "the manner of improving individuals' or corporations' capacity to make choices and translate the ones choices into favored actions and outcomes."

Now, ahead we will see literature review, conclusion and comparison for the same.

II. Literature Review

A. Concept of Artificial Intelligence

Gear of ever-extra sophistication had been created in the course of many a long time to gain the human species. In lots of approaches, digital computers are simply every other device. They're capable of doing the same kind of numerical and symbolic operations as a regular human, but extra speedy and as it should be. Many humans' lives were altered through microfinance, microcredit, in particular the ones from the sector's weakest communities. Hundreds of thousands of individuals worldwide had been given the danger to set up their own agencies, and microfinance has appreciably contributed to making that goal a reality.[1]

A family of relatively realistic pc equipment have been created as a result of synthetic intelligence studies, that's perhaps even greater than these small triumphs. These technologies have made it possible to resolve many troubles that were previously notion to be insurmountable and to remedy many other issues extra efficiently. From a practical standpoint, this by itself makes them exciting and precious.[1]

Businesses that offer microloans are constantly looking for methods to increase their consumer base and attain new audiences. They've made extensive investments in artificial intelligence (AI) equipment that allow them to offer loans to oldsters who've very little entry to the conventional banking gadget. [8]

These all but been supplanted in complex applications in this century by using sizable advancements inside the disciplines of gadget mastering, neural networks, and data mining (pushed by improvements in storage generation), unless there's insufficient facts for system gaining knowledge of.

However, without the use of any policies- or gadget-learning-based AI, even a modest amount of records, while accurately modelled using predictive analytics, can also bring about a widespread stage of predicting accuracy (Herrmann, 2019). But, buyers will need to go farther and base their selections on the massive amounts of records which can be already available, which brings us to gadget learning.

The gear of AI can be roughly divided into those vast kinds:

• understanding primarily based systems (KBSs), i.e., specific models using words and emblems;

• Computational intelligence (CI), i.e., implicit modelling with numerical techniques; hybrids.

Strategies consisting of rule-based, model-based totally, frame-based, and case-based totally reasoning fall within the first institution. The data can be read and comprehended by way of human beings seeing that it is explicitly modelled in phrases and symbols.

Despite the simple success of their personal fields, symbolic approaches are essentially restrained by way of their capability to handle best instances which have been explicitly represented. Symbolic fashions are commonly terrible at managing the unfamiliar, no matter certain structures allowing the model to grow with experience.[1]

By permitting the PC to create its personal version from observations and experience, computational intelligence enables it to overcome those demanding situations. Here, the facts are implied rather than expressed brazenly and is as an alternative represented by numbers which can be changed because the accuracy of the gadget will increase. This organization covers strategies for addressing uncertainty, such fuzzy good judgment, in addition to neural networks, genetic algorithms, and different optimisation algorithms.[10]

B. Concept of Artificial Intelligence & Women Empowerment

Generation advances can cause extra environmentally pleasant offices, safe occupations (with some dangerous labour being accomplished through computerized robots), new and greater specialized goods and offerings, and quicker manufacturing. Even as efficient technology will assist the financial system as a whole and new technology will boom employment through a diffusion of channels, the allied changes will enhance issues in a number of regions, consisting of employment and well-being.

Synthetic intelligence is a modern-day era that is permeating many industries so as to improve a company's monetary boom.The invasion of artificial intelligence can be witnessed in lots of sectors, from the workplace to the household. It ought to be highlighted that the most famous AI gadgets that are dominating our lives. [3]

The dearth of female machine learning analysts isn't always in particular unexpected. It is often believed that men dominate thea greater famous situation of pc technology. Ladies make up the handiest 22% of AI experts worldwide, consistent with an international financial forum research. Moreover, it claims that by 2022, the use of synthetic intelligence would possibly create as much as 58 million new employment (with a few positions being added and others being removed). There aren't many women in high roles in AI, notwithstanding the fact that ladies have made large contributions to pc technological know-how in the course of its history. Possibilities for empowering ladies may be located drastically as ladies begin to recognize AI generation and practice AI equipment & methods in many conditions.[3]

C. *Concept of Micro-financing and women empowerment*

Seventy percent of the world's poor are women. [http://www.ilo.org/wcmsp5/groups/public/@dgreports/@gender/documents/meetingdocument/wcms_091581.pdf]. Women can become excellent leaders and entrepreneurs if they are given the right chances and financial inclusion. From this point on, several nations are making efforts to empower women. The main goal of microfinance is to lessen gender disparity. For instance, studies by the World Bank show that communities and countries with high rates of discrimination and gender inequality frequently often have high rates of poverty, slow economic growth, and poor governance. Giving women access to financial resources also contributes to the stability of the family (Cheston & Kuhn, 2002). Susy Cheston and Lisa Kuhn, "Empowering Women Through Microfinance," 2002. Cheston, Susy and Lisa Kuhn. 2002. "Empowering Women Through Microfinance". [4] <http://www.microcreditsummit.org/papers/+5cheston_kuhn.pdf> (March 30, 2006).

Women need to retrain, upgrade their capabilities, and arm themselves with AI understanding. This may provide higher possibilities for activity development and progress. AI has the potential to uplift ladies, add value, and cause them to the centre of interest. Women must capture this possibility in view that AI has a tendency to beautify rather than update human attempts.[5]

Destiny recruiting gear will help with the method and concentrate on selecting the exceptional applicant with the applicable talent set for open vacancies. Subconscious prejudice within the employment procedure may be prohibited via this. A number of organizations, like Unilever, have embraced AI-primarily based digital hiring. Ladies can be capable of landing higher jobs if they're talented with the most in-demand capabilities.

With the introduction of AI in the place of job, an adjustment segment is already going on, as with each technology of automation. How do you make certain AI complements your paintings in preference to replacing it? You could do that by elevating your academic level and developing your better-order cognitive capabilities. Enhance your AI competencies; with the intention to stay in the future, we can all need to be adaptable, practical, and innovative.

The onset of globalisation and liberalisation in India within the early 1990s exacerbated the issue of ladies operating in unorganised sectors considering most of the people of ladies who were involved in various self-employment activities have lost their means of subsistence. However the tremendous contribution that girls make to the rural sector, their labour remains no longer paid for and is visible as merely an extension of the home sphere. In the new economic system, microfinance is proving to be a mighty tool for reducing poverty. SHGs rule the microfinance enterprise in India. Similarly to correctly addressing the particular needs of deprived girls, the SHG programme additionally assists them in enhancing their capacities, which leads to their empowerment. A whole lot of interest has been paid to microfinance for ladies since it promotes ladies's financial empowerment and reduces poverty. The focus on girls has numerous advantages. Firstly, it promotes gender equality. Second, on account that women make choices that have an effect on the health of the entire family, focusing on them has a multiplier effect.[1][5]

D. *Case –Studies*

Can ladies be empowered by using the usage of microcredit and the usage of synthetic intelligence? "Indian Self-assist groups' ' consistent with Ranjula Bali Swain 2007 have a look at, the SHG programme has benefited many ladies, and people are presently taking steps to come to be extra independent. In common, NGOs and SHGs are better able to have a beneficial effect on girls' empowerment.[12]

Kabeer Naila (2005) Is Microfinance the "Magic Bulle" to Empower women? Economic offerings do decorate the social welfare of disadvantaged women, according to analyze from South Asia, but they do not supply women more energy "automatically. " There are not any miracle treatments, brief fixes, or pre-made concoctions.[6]

Microfinance is the largest quarter for effect investments, wherein socially accountable investment ought to be balanced with threat (Ashta, 2020). In fact, Pierre Rinaldi cites the use of synthetic intelligence in the ESG organisation as a key possibility.AI techniques are honestly extra crucial than ever whilst you take into account that ESG: responsible investing can also infer those particular traits from new kinds of records units (which incorporates public records or social media).The fantastic fashion surrounding ESG investing has made room for AI in finance. Mr. Pierre Rinaldi is the 5th respondent.[13]

A research of Alper Ozpinar (2016) says that during this look at, the author shows a unique cloud-primarily based service-oriented architecture for credit chance evaluation. All varieties of economic institutions, such as microfinance corporations, are centered via the recommended treatment. To protect client privateness and trade secrets, the counseled service would keep customer facts on a non-public cloud.

The gadget additionally offers a safe database garage for current patron facts, and it has been endorsed that the historic information be combined with sparkling customer facts to continuously develop the underlying AN engine. Preliminary findings from pattern records confirmed that the "Low threat be given" class performed with an accuracy of eighty%, the "Medium danger analyze" magnificence with a overall performance of 95%, and the "excessive danger Reject" magnificence with an accuracy of 89%.[13]

Consistent with John Agyekum Addae 2015 observation, "effect of Microfinance on Women's Empowerment: An overview of the research," microfinance undoubtedly affects ladies' empowerment. Several studies checked out exceptional aspects of women's empowerment, with the financial aspect predominating the literature. The economic element had to be worked in which technology helped to skilled. The psychological issue of women's empowerment has not been considerably studied. The examination was additionally executed on someone-by-means-of-person foundation. For this reason, use of artificial intelligence in microfinance contributes to the empowerment of ladies.[13]

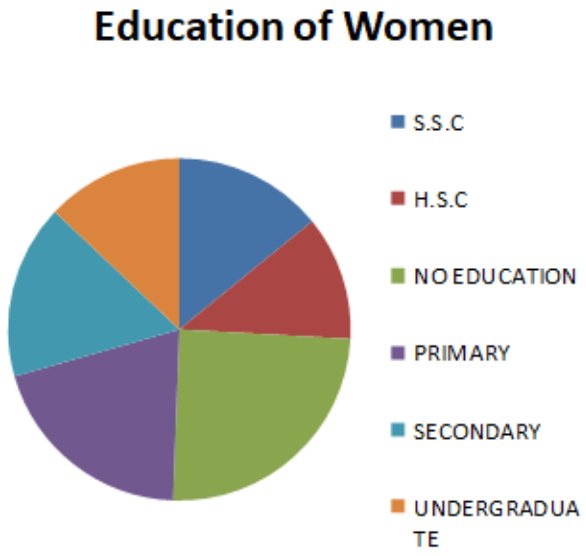
By leveraging real information from Africa, Apostolos Ampountolas and co-workers (2021) evolved a completely unique machine mastering-based totally approach for evaluating credit hazard in a micro-credit score chance scenario. With a purpose to select specific parameters (client age, gender, and marital fame) for prediction inside the context of microcredit, they preprocessed the statistics. In addition they decreased variance by using the use of log values of mortgage amounts and prevented overfitting by means of deleting strongly correlated variables. SMOTENC set of rules turned into used to address information imbalance. For the validation set, every ensemble classifier mentioned an average accuracy of as a minimum 80%, with Adaboost providing the nice end result with a prediction accuracy of 81.2071%. Other subjects of study pointed up by way of the authors consist of temporal factors of credit score hazard for microcredit hazard and default detection.[12]

In step with Dr. ANANDA RAO.N's position OF MICRO-FINANCE inside the EMPOWERMENT OF TRIBAL ladies, the SHGs in rural areas are doing well. More than monetary empowerment, microfinance promoted psychological and social advancement. Microfinance has a first-rate impact on fostering bravery, boom, self assurance, talent, and empowerment. It's been cited that numerous SHG programme individuals need the business enterprise to offer extra schooling sessions on approaches to generate sales.

"THE scope OF MICROFINANCE for INDIA'S women's EMPOWERMENT" according to Dr. Shuchi Loomba, microfinance notably contributes to Indian women's economic, social, and mental empowerment. The observed findings imply that microfinance has a substantial impact on the capability of girls participants within the SHG linkage programme in Ghaziabad to make decisions, as well as their know-how, economic standing, and feel of self-worth.

Whilst Citibank and Barclays first began their aggressive advertising power to encourage the usage of credit playing cards, they distributed free playing cards on university campuses. Students have been therefore not able to repay the credit. They were not silly; they definitely lacked the budget to make amends. Barclays suffered so significantly that they left the Indian market, and Citibank became burned through this tactic, consistent with Abhishek Garg, co-founding father of Finomena, a microfinance enterprise with its Bangalore headquarters that simplest serves young millennials, and not college-going humans.[13]

All case studies says about the importance of education sector to make it work.



III. Review objectives and methodology

This section introduces review objectives and methods used in the papers, starting with review objectives:

1. Researching how microfinance helps women become more independent.

2. To assess role of artificial intelligence in micro financing for women empowerment.

3. To examine the history of the female users of microcredit.

4. To make recommendations for the advancement of women via the microfinance sector.

5. To see the use of machine learning in micro financing.

6. To help the women to uplift their life using technology.

7. To establish a relation between artificial intelligence, micro-financing and women empowerment.

Now, let's see the methodology for the objectives to come to the conclusion.
Several scholars claim that various AI approaches are crucial. This presents a synthesis of the complex system of techniques and their use in the many financial sectors that are covered in the literature reviewed in this paper. One article emphasises the significance of neural networks, deep learning, and machine learning for various financial applications.

(a) Expert Systems :
Professional systems, which are regarded as symbolic AI, have been broadly speaking the difficulty of papers written in the twentieth century. Discern illustrates how a knowledge base includes the know-how of an expert. Then, an inference foundation that permits answering user questions is attached to this base. Depending on the device, the user queries the machine the use of a more or less sophisticated interface to receive recommendations based on the professional's expertise base-recorded revel in. Know-how acquisition, or the inaccessibility of specialists and challenges with rule extraction, is a large difficulty in the improvement of professional structures. Evaluation problems (class, diagnosis, solutions, and interpretations), synthesis troubles (configuration, layout, making plans, and scheduling), and combined troubles (manipulate, preparation, monitoring, and prediction) are most of the hassle domain names of accounting and finance programs where knowledge needs to be extracted. Relying on whether or not the venture is acquainted (commentary, simulation), interview-based (unstructured, established), or a confined personal task (reasoning, event take into account, scaling, sorting, innovative hassle fixing, and selection analysis), distinctive methods can be used to gather understanding for every form of area (Wagner et al., 2002).[8]

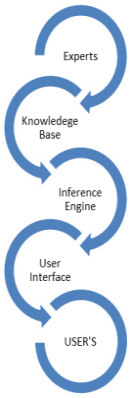


Fig.1 Expert System

(b)Machine Learning:
Facts, possibility theory, and arithmetic are the foundation of machine studying. It consists of reinforcement studying, unsupervised studying, and supervised gaining knowledge of, as illustrated in determine four.
Categorized data is used in supervised gaining knowledge of, and if the output is a success, comments are given. Unsupervised getting to know, in evaluation, permits the system to research on its own and should find its shape or styles in unlabeled statistics. Credit score is assigned depending on fine and bad indicators, and reinforcement studying enables the structure to learn for an internet surroundings (Boden, 2018; Li et al., 2018). Reinforcement studying may prove useful while buying and selling belongings that want habitual portfolio rebalancing (Luo et al., 2019). Gadget gaining knowledge is being used greater without delay within the monetary markets by developing an internet portfolio selection manner (Bin and Hoi, 2014). The choice of a web portfolio includes making successive decisions. Benchmarks, observe-the-Winner techniques, observe-the-Loser techniques, sample-Matching-primarily based strategies, and Meta-getting to know Algorithms are just a few of the encouraged methods. The method permits the creation of the applicable set of rules. The assessment article examines each records analysis and machine studying.[13]
Case-based total reasoning, frequently blended with genetic algorithms, was the system studying approach that seemed maximum frequently in our overview.

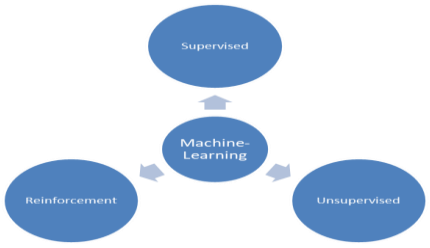


Fig.2 Machine- Learning

(c)Alogoritms:

Algorithms are a collection of guidelines and procedures used in computer science and mathematics to categorise or resolve an issue. As a result, they start with an input and end with an output, as seen in Figure . An issue is often specified, a set of rules is developed to solve it, and the solution is then 11 tested using a variety of instances. There are many algorithms and several classification schemes. There are many different types of algorithms being employed, even in financial and financial market research. When the set approach eventually stops functioning, algorithmic trading employs agent-based models that use genetic algorithms to process information and develop the suggested solution (Yang et al., 2016).[9]

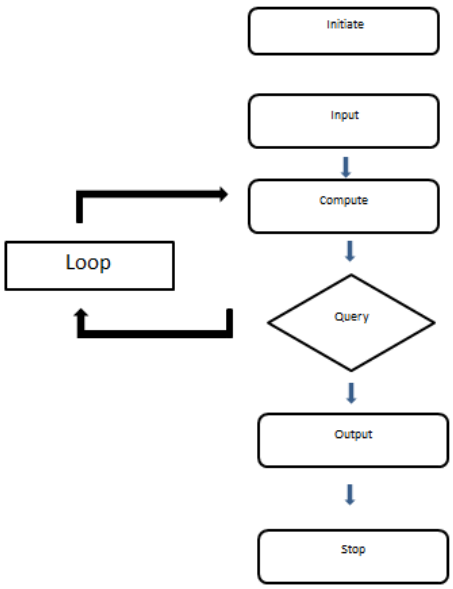


Fig.3 Algorithms

(d) Neural Network:

Inputs and outputs are related via neural networks (NNs), however there are hidden middleman layers of neurons in among (Li et al., 2018). Each unit in each layer, as shown in discern , is connected to the alternative gadgets and performs just one computation. Weights are assigned to each of those connections, which may be steady or exchange over the years. A few networks even permit connections to be discarded and new ones to be created (Boden, 2018). Inside the artificial NN technique, there are two primary gadget mastering algorithms hired. The first one is mistakes correction, that's discovered using unsupervised getting to know strategies like "backpropagation" with gradient descent, with the goal of regularly bringing the error to a minimum on the subject of a loss (or fee) characteristic. The second one uses competitive mastering with a self-organizing map (SOM) or self-organizing characteristic map (SOFM). These two methods are applied to diverse jobs. Although the latter is utilised for clustering and marketplace segmentation, the previous is mainly employed for forecasting and marketplace prediction. [1]

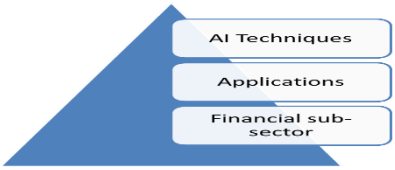


Fig. 4 Techniques representation

(e)Fuzzy-Logic:

Fuzzy logic is founded on the concept that people regularly base their decisions on incomplete and non-numerical information. As incomplete and inaccurate facts (accordingly the phrase fuzzy) causes humans to make judgements below uncertainty, fuzzy fashions are used to explain such facts. Those models are capable of figuring out, representing, manipulating, interpreting, and the use of ambiguous and unsure statistics and records (properly & de Hajek, 1993; Lopez de Marantas, 1993; Mironov, 2005).
Parent below demonstrates how a fuzzy common sense device works similarly to an professional gadget however also consists of a fuzzifier and a defuzzifier. The model is then operationalized by way of the usage of fuzzy units to greater absolutely.[10]

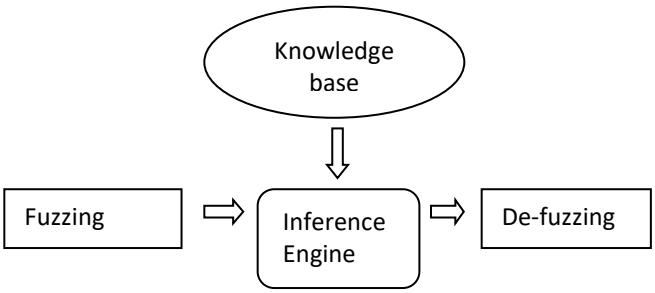


Fig.5 fuzzy-logic

With these steps to methodologies it says about how to gather data and what frequency did we gather the data and after that all steps were performed to review the objective of scope of technology, especially artificial intelligence in women empowerment in micro-financing for India. The model is then operationalized by using fuzzy sets to more clearly specify the variables. Fuzzy sets are described by their membership functions, represented by the symbol, which map the universe's items under consideration to the interval [0, 1].

IV. ANALYSIS

Paper Topic	Algorithm Recommended	Data Description	Accuracy
Micro-financing Risk Evaluation on Machine Learning	Logistic Regression & Artificial Networks.	Custom the Dataset	70%.
Fuzzy logic used for micro-credit scoring for microfinance	Mimics of human gathering for fuzzy mimics	Says about description of client profile and judge their behaviour	No data gathered
Rural Micro Credit Assessment using Artificial Intelligence	Artificial Neural Networks	Artificial intelligence techniques	93.27%
An Artificial Intelligence Approach for Micro-Financing Scoring.	Adaboost – tree based algorithms	Original data	81.2071

[13]

V. CONCLUSION

With textbooks and technical guides outlining the tools, economic rules, and the effects of the economy, "artificial intelligence in finance" has emerged as an important phrase in the economic literature. A synthesis of the many studies that trace the course of a phenomenon as it cycles between hype and disillusionment is tough to describe. In order to determine what works and what is not worth the effort, researchers are analysing the various AI approaches both individually and in combination, and comparing them to alternatives.

Therefore, seeing all the research papers and summarizing it here conclusion goes like, use of artificial in micro-financing can be done in many ways like it helps to prevent frauds, detect it. It helps to update the technology in the microcredit sector, banking sector, and micro-financing sector. Artificial plays a role that says to be updating the facilities giving more assurance to the economy of the particular country. Academic and popular literature is developing in tandem with the fluctuating advancement of AI and computer power in their use in banking and financial markets. The financial crisis-era restrictions on economic development, followed by the recent epidemic spurts, have presented further difficulties for AI-related technology.

28 articles were analysed, and the results offer optimism for enhanced productivity, new data, information, advisory and management services, risk reduction, and some unresolved problems about detrimental effects on sustainable growth and boosting economic wellbeing.
All around the world, microfinance is recognised as a key strategy for achieving and upholding sustainable

and long-term economic growth. Re-evaluating the underlying presumptions and implementing the necessary modifications are necessary to continuously reach the needy on a large scale with alluring goods and services. Microfinance is now working to enhance flexibility and continuity while matching the ease and flexibility of the informal sector.

In addition to providing solutions to complex global concerns, new digital technologies have the potential to be a new source of broad-based global economic growth. It is crucial that no one, especially no woman, is discouraged from attempting to accomplish their goals in order to seize this chance. What policy does now will determine what the future holds for women: It's time to start working and seize the digital transformation to prove that it provides a leapfrog opportunity for women and a chance to create a more inclusive digital environment. As a result of the digital transition, women must shatter stereotypes and shine brightly if they are to succeed.

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Artificial Intelligence Techniques in Disease Diagnosis: A Review

Kashish Shah
Computer Science and Engineering
Indus University
Ahmedabad
kashishshah.20.cs@iite.indusuni.ac.in

Sapna Kataria
Computer Science and Engineering
Indus University
Ahmedabad
Sapnakataria.cse@indusuni.ac.in

Abstract – These days, in this age of technology, there is a massive surge in the number of diseases. Hence it has become vital to have a discourse about the effects and significance of artificial intelligence (AI) and machine learning (ML) on the society and healthcare system and services. Machine learning is a branch of science which combines computer science and mathematics in order to build models that study to analyse data and predict future outcomes. Artificial intelligence is basically a simulation of intelligence equated with humans. It has been established that it is a very prevailing model for solving problems. The anticipation in the world of medical science is that AI along with Machine learning and Deep learning will be established as a boon for the healthcare system. Professionals have a sheer optimism that it will be able to diagnose diseases precisely, give better suggestions for treatment procedures, and find various other ways to advance health infrastructure in the future. This article reviews various AI techniques used to diagnose and treat patients with terminal diseases and discusses what the future really holds for AI.

Index Terms **– Disease, Machine Learning, Artificial Intelligence, SVM**

I. INTRODUCTION

A. Disease

A disease can be described as an atypical condition that results in an undesirable change in the anatomy or functioning of a living being typically not immediately after external injuries. They are often identified or found with particular signs and symptoms. They may be caused by external influences like bacteria and viruses or by internal ailments. Human beings broadly link diseases with pain, distress, social problems, dysfunction, and death. Unusual variations of body structure and functioning, injuries, abnormal behaviours, infections, disabilities, disorders and syndromes are a few signs of diseases.

There are mainly 4 classifications of diseases, they are: infectious diseases, physiological diseases, deficiency diseases, and hereditary diseases. Diseases can also be classified into Communicable & Non-Communicable diseases. Communicable Diseases are those which can spread between human beings via physical contact. Non-Communicable Diseases are those diseases which cannot spread between human beings via physical contact. The diseases can also be acute, chronic, congenital, acquired, terminal, incurable, etc. Some of the most common diseases worldwide include Asthma, Cancer, Alzheimer, Obesity, Diabetes, Influenza, Heart Diseases and Mental Illness.

As per the World Health Organization, there are more than about 30,000 known diseases worldwide, out of which approximately 7,000 are rare diseases. Heart diseases account for about 16% of total deaths caused worldwide while Alzheimer's disease is also among the top 10 causes of death globally. Non-communicable diseases make up about 7 of the globe's top 10 causes of death.

B. Artificial Intelligence Techniques

Artificial intelligence is known as the intellect exhibited by machines, like a simulation of human intelligence. Basically, it is a branch of science that integrates computer science, mathematics, and big data, to facilitate problem-solving opportunities. It incorporates ML and DL with it. AI algorithms create adept systems that are used to calculate and create future predictions based on the provided input. Popular examples of Artificial Intelligence include voice recognition, mapping of inputs, and translation tools.

Artificial Intelligence is now also widely used in the field of medicine. It has served as a boon to the industry, especially with regard to the diagnostic or predictive analysis of medical images. It uses machine learning models to find medical data and analyses it to observe patterns and collect insights for improving health treatment and analogies along with the experience of the patients. Artificial intelligence is quickly becoming an integral part of modern healthcare due to the advancement of technology. AI and its applications are being applied to help professionals in clinical settings and for research purposes. The uses of Artificial Intelligence include diagnostic and screening tools, especially the ones used in recognising images, as they have the ability and prospective to yield enhanced and efficient health care system and services.

Artificial Intelligence is a very powerful and helpful tool, mainly due to its breakthrough in deep learning alongside

artificial Deep Neural Networks. Adoption of artificial intelligence tools in clinical practice requires intricate attention and a punctilious verification of their functioning and usefulness. Authentication of their functioning requires more than just an illustration of their technical reliability.

Machine learning can be defined as the subdivision of AI and Computer Science that emphasizes on big data and mathematical algorithms to learn things and analyse them just like human beings do, in order to improve its correctness and make future predictions. Machine Learning models acquire sample data in order to build training data to achieve accuracy and make future predictions. Machine Learning along with Artificial Intelligence and Deep Learning is extensively used in the field of medicine for disease diagnosis and treatments. Some applications of machine learning along with artificial intelligence in medicine use data and neural networks in a way such that it replicates the working of a brain. Some other applications of machine learning include, filtering email, voice recognition, agriculture, etc.

The next part of the paper is categorised as: Section II reviews the literature. Section III provides frameworks and research methods. Comparative analysis is conversed in section IV. Conclusion is discussed in the section V.

II. Literature Review

A. Diseases

A disease is defined as anything that impairs or dysfunctions normal human functioning. Diseases can be classified into many types, like acute, chronic, genetic, infectious, acquired, congenital, Iatrogenic, Idiopathic, Incurable, Primary, Secondary and Terminal diseases. Some of the most common diseases globally include Heart Diseases, Cancer, Diabetes, Alzheimer's, Asthma and Obesity. Not all diseases are life threatening, some diseases like cough and cold exist which can be cured in a short span of time. While some diseases stay with a person for their whole life span. Few diseases are contagious whereas some are not. Infectious diseases are mainly caused by microorganisms called pathogens and include varieties of bacteria, viruses and fungi. The causes of diseases can airborne, foodborne, waterborne, lifestyle, infections and non-communicable causes[8].

Diseases can be prevented by including proper sanitation, nutrition, exercising and vaccination in your lifestyle. Treatments for diseases range from medication to surgery depending on its fatality. All diseases cannot be prevented but improving your lifestyle can definitely help in avoiding many of them[9].

Diseases which are not fatal can be cured with proper diagnosis and treatment; however, chronic and life threatening diseases require a lot more efforts, strength and treatment. With the advancing world, the diseases have also become more prevalent and threatening than ever. Medical fraternity is continuously gathering data, researching, and finding cures to these diseases. Hence, medical science is working hand-in-hand with the technology to get the best results. It incorporates Artificial Intelligence, Machine learning, Deep learning along with medicine to find better and faster solutions and analyse the behaviour and traits of certain diseases to make future predictions[9].

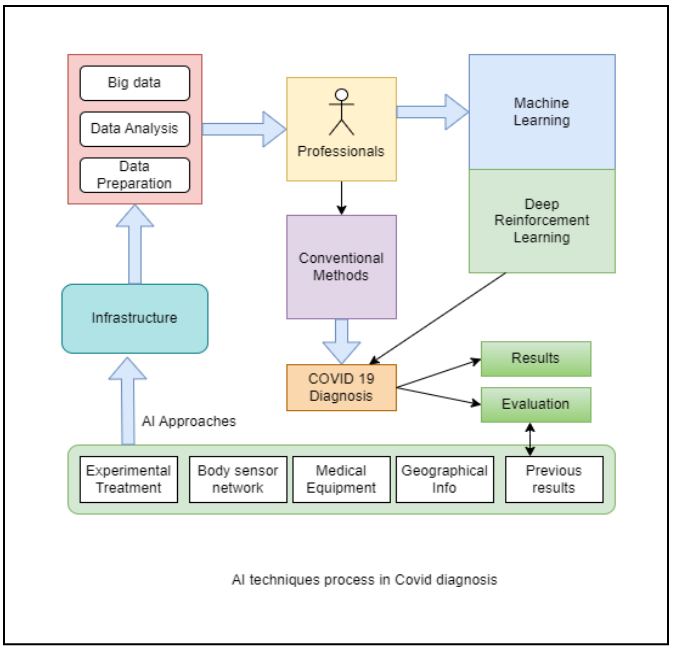
B. COVID-19

With its inception in 2019, the novel coronavirus (COVID-19) induced a pandemic and changed the lives of people throughout the world. The outbreak of this lethal disease was sparked by the excruciating acute respiratory syndrome Coronavirus 2 (SARS-CoV-2). This virus is a member of the human coronavirus (HCoV) family and it has a severe effect on the lower respiratory tract of human beings. It can spread via direct, indirect, and close contact with an infested patient. Sneezing, coughing and speaking can cause the creation of aerosols that work like a channel for the airborne transfer of this infection. Due to a large amount of population and covid-19 spreading at a rapid pace, various countries had to impose nationwide lockdowns. This had a drastic impact on the economies worldwide and the quality of life. The current count of confirmed cases worldwide since the COVID-19 outbreak in December 2019 is about 51 million. Approximately more than about 30 million people have recovered from Coronavirus. The global health system is currently facing extremely difficult challenges brought on by the COVID-19 epidemic[6].

The main test for confirming infected patients is the Reverse Transcription-Polymerase Chain Reaction (RT-PCR) test. However, the RT-PCR result was often inadequate in many severely affected areas, especially during initial outbreak of the disease. Due to a variety of reasons, including sample groundwork and quality check, the lab test has a huge false-negative degree. In the medical environment, readily available imaging tools, such as chest X-ray and thoracic CT, are extremely useful to professionals[9].

The study and advancement of AI-assisted solutions in academics and medical science have been spurred by the COVID-19 pandemic. The AI-assisted medical and health infrastructure has caught the attention of the public because it can effectively address the damage caused by COVID-19 and former epidemics. Artificial intelligence (AI) technology is being extensively used in the treatment of health problems and diseases. It has drastically enhanced epidemic avoidance and analysis, and has also played an imperative role in medication advancement and increasing effectiveness. Furthermore, AI technology can be used to test viruses globally and hasten the study of virus action modelling on a nationwide level in order to efficiently predict and counter other future analogous

humongous epidemics. For the medical image diagnosis, for example Artificial Neural Network technology in AI can precisely categorize the image and successfully diagnose the COVID-19 virus. At some degree, it even reduces the creation of unessential medicinal data and dismisses system load[8].



AI techniques process in Covid diagnosis

C. Alzheimer's Diseases

Alzheimer's disease can be defined as a neuro-degenerative disease that progressively depreciates memory and critical thinking skills, and even the capability to perform even the most rudimentary everyday tasks of a human being. The majority of patients diagnosed with it — especially the ones with late-onset— come across its symptoms above the age of 60. Initial symptoms arise between the ages of thirty and sixty and are extremely rare. It is the leading cause of dementia found in the elderly. As observed in an Alzheimer's patient, their Brain cell connections and the cells themselves degenerate and die, which results in damaging their memory and other crucial mental functions. Avid Memory loss, confusion, mood swings and disorientation are the main symptoms of this disease. There remains no cure for this disease, however medications and management strategies might help temporarily. About 60-70% of cases of dementia are caused by Alzheimer's[2].

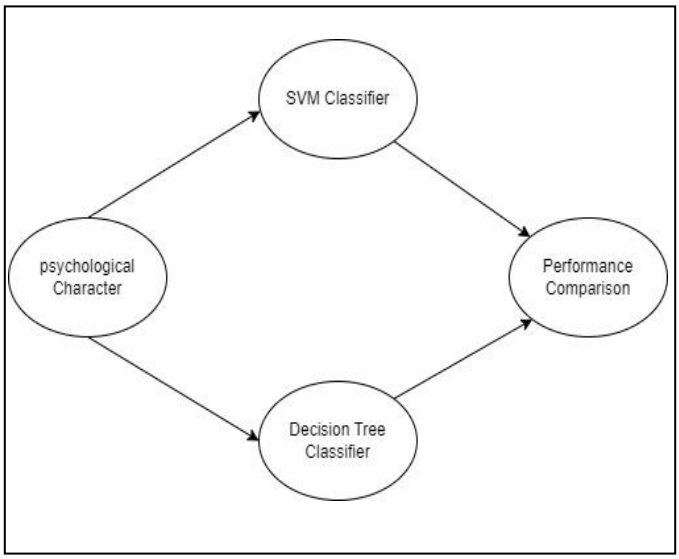
The reason behind Alzheimer's disease is not very well recognised. Its development is influenced by numerous environmental and genetic factors. An APOE allele is the most powerful genetic risk factor. Clinical depression, Injuries in brain, and high blood pressure can also be the causes. It can be mostly linked through neurofibrillary tangles, amyloid plaques and neuronal connection loss in the brain. Initial symptoms are frequently confused with normal brain ageing. An inspection of the brain tissue is required for a definitive diagnosis, however it can be done only after the demise of the patient[1].

No treatments can possibly cure or reverse its development, but they lead to an improvement of the patient. Alzheimer's patient gradually rely more on other people for support, putting a strain on the carer. The burdens can be social, psychological, physical, or economic in nature. Workout courses can be advantageous in terms of performing everyday tasks and can potentially improve outcomes. Antipsychotics are commonly prescribed for treating psychosis caused by dementia, but they are not typically advised because there is a minimal advantage and an enlarged threat of decease[1].

However, with the emergence of Artificial intelligence and Machine Learning, there is a glimmer of hope in the field of medical science. Researchers have been proposing different methods to diagnose and predict this disease. SVM can be defined as a governed study model that organizes by segregating the entities with the help of a hyperplane. Its applications include regression and classification. Hyperplanes can be produced with the support of margins. The primary objective of SVM is to expand the hyperplane and the margin distance[2].

The margins are produced by using support vectors that belong to the entities or objects. The key benefit of SVM is that it can differentiate between linear and non-linear objects. Figure shown below demonstrates the stages required for prediction of the Alzheimer disease with the help of machine learning algorithms[2].

Classifier = SVM (formula=age, visit, MMSE, EDUC, data = train, type = 'C-classification', kernel = 'linear')



Steps to predict Alzheimer's using ML

D. Cancer

Cancer can be defined as a collection of diseases with an uncharacteristic cell growth with the prospective to conquer the human body. Signs and symptoms of cancer consist of lumps, uncommon bleeding, coughing, drastic weight loss. There are over 100 types of cancer that can be found in humans. Cancerous tumours spread in nearby tissues in a body and can travel to far places to create new tumours. These tumours may also be called malignant. It is a genetic disease[4].

Reasons that cause cancer can occur due to:

- Inaccuracies that appear due to the division of cells.
- DNA damages due to lethal elements in the ecosystem
- Inheritance from biological parents.

A patient's body usually destroys damaged DNA cells prior to turning cancerous. But the body's ability to do so deteriorates with age. This is the reason why older people are more prone to cancer. Every human's cancer has a distinctive blend of genetic deviations. Even more deviations follow as it continues to develop. Even inside the same tumour, cells can have variable genetic deviations[4].

The reason behind approximately 22% of cancer demises is Tobacco. 10% die because of obesity, an imbalanced diet and insufficient exercise or unwarranted alcohol consumption. Additional causes are particular infections, contact with harmful chemicals, and pollutants. Almost 15 percent of cancers are spawned because of contagions like Helicobacter pylori, hepatitis B, Human papillomavirus infection, hepatitis B and Human Immunodeficiency Virus (HIV). About 5 to 10 percent of cancers are caused due to hereditary diseases. They can be identified with the help of screening tests. They are further diagnosed with the help of medical imaging and confirmed by biopsy[3].

The peak prevalent types of cancer found in men are lung, prostate, and stomach cancer. In women, the most prevalent types are breast, lung, cervical, and colorectal cancer[3].

It is very challenging to diagnose cancer especially at a very young age and early stage. Hence, creating improved predictive models using multi-variate data and high-purpose diagnostic equipment in scientific cancer research is vital. Machine learning, along with Artificial Intelligence, is exercised to build predictive models that can study logical patterns from big ancient data in order to forecast the persistence rate of the sufferer. Machine Learning is being broadly used for refining prognosis. Machine Learning has proved that it can enhance the precision of cancer proneness, reappearance, and survival predictions.

Classification refers to the issue of transferring a sample to a predefined class on the basis of conditional arrangements. Various classification methods, such as support vector machine (SVM), Decision Tree, Neural Networks, k-nearest neighbour (kNN), and Bayesian classifier, are being considered in a number of applications. SVM, as suggested by the author and their contemporaries is an innovative methodology for solving classification complications.[3] Artificial Intelligence along with Machine Learning and Deep learning is a benediction for medical science and has a lot of scope for the diagnosis and prognosis of lethal diseases like cancer in the future.

III. Framework and Research Methodology

A. Alzheimer's Disease

Upon the arrival of a new subject, the rudimentary data is proximately stored. This data is the information and volatile information accessible at this level. In this methodology, the first priority and approach is to categorize the new subject prior to determining about arranging a Biomarker. Classifier, the newly accessible data are set side by side with the ones readily available of previously diagnosed patients. This analysis determines which category of data is more analogous to the new subject. To reflect this, the calculation of weights is required: more analogous data is allotted with greater weights, which has a greater impact on training the Classifier.[1].

After that, an attempt is made to make a diagnosis. In case this can be made with sufficient confidence, this procedure is finished hereby. Or else, the system decides which supplementary biomarker can help the most with the diagnosis of the new patient by capitalizing on the data or the data per unit cost it delivers. In this procedure, it observes merely the available data of the new patient and also the previously stored data[1].

As soon as the system opts for the subsequent biomarker, it is documented for the new subject and appended to the assortment of previously recorded data. Also, some new weights are assigned to the data based on their similarity index with the new collection of data, and the classification is once again processed. When the confidence in this procedure surpasses a fixed threshold or if no biomarkers are readily obtainable, this monotonous procedure takes a turn towards its end[1].

Ruoxuan Cuia et.al. have suggested a framework where continuous Magnetic Resonance Imaging is executed and a lengthwise examination is observed. It is absolutely necessary to design the components and find the estimation of the progression of the disease over a fixed period of time in order

to achieve more precise results [2]. The real approach employs MRI functionalities like longitudinal difference and brain morphological abnormality in order to build a classifier to differentiate among various entities. The Alzheimer's Disease Neuroimaging Initiative data is fed with MRI brain images every consecutive six months.[2]. After this process, with the help of 3-Dimensional Convolutional Neural Network, feature learning is executed. It is then accompanied by a pooling layer, which consists of various choices like estimating the average, the highest value or even a particular sequence of neurons in the selected segment [2].

Fan Zhang et.al. have suggested an intermodal framework that requires medicinal pictures to train the model. It can be executed with the help of two different and independent convolutional neural networks .In this framework, a secondary analysis is performed with the help of a deep learning model[2]. These Convolutional Neural Networks are required to obtain the functionalities of MRI and PET scans. A combination of the downer sampling method and forward convolution are used to produce it. Correlation analysis is used to estimate the cohesiveness and exclusivity of the outputs. This arrangement comprises of a down sampling layer, a convolutional sequence, a pooling layer, and the output sequence [2].After that, the Pearson correlation coefficient technique is acquired to estimate the relationship amongst the expected results of MRI scans and PET images. The chief notion behind it is to examine the results of the accuracy of both the scans. Identification and classification can be attained by the use of the output layer with the help of the Logistic Regression technique [2]. This technique is very beneficial as it combines medical neuropsychological outcomes with neuroimaging outcomes [2].

B. Cancer

Machine Learning models work on the basis of the big data they are provided with to train themselves. Hence, it is very important to select precise data to get accurate results, and for this, we need to constantly inspect and measure the outcomes[3].

In the given analysis, two techniques, namely the different filtered wrapper and fuzzy rough sets based on selection techniques were compared. The obtained result was that the k-nearest neighbor (kNN) classifier provided greater precision and feature selection with fuzzy sets. It was much quicker and formed lesser features[4].

This framework conveyed the issue of detecting tumors with very feeble disparity to their background and extracting functionalities. Enhancing Mammograms and Segmentation of the tumor can solve this issue. Clustering methods like Partitioning, Balanced iterative reduction and Hierarchial and Clustering LARge applications were used by them. Mini-Mammographic Institute Society Analysis (MIAS) dataset will be acquired for this framework[4].

Radial Basis Function for organization of mammograms based on GLCM was used by them. The authors also observed and analyzed the MIAS dataset and calculated the correctness of their framework which was found
to be 93.98%[4].

They also improved Mammograms with the help of Genetic Programming filter and detached noise with fusing Discrete Wavelet Transform and Discrete Cosine Transform [4].

They conferred about using Histopathological pictures to decrease inconsistency and surge impartialness. CNN was required to execute DL for the breast cancer forecast. They also trained the model using pictures of various magnification levels and predicted outcomes of the diagnosis regardless of the magnification used in the dataset[4].

A model for automatic detection alongside localization of tumors up to 100 x 100 in giga size was presented, and the results were acquired on microscopic CAMELYON16 pixel images. The CNN database was used[4].

C. Covid-19

For image processing and analysis in the experiment, segmentation was required in the artificial intelligence based system. It outlined the ROIs like lungs, lobes, and infested areas, in CT for future calculations[7].

High-quality Three Dimensional images were required for detecting this virus and they were provided with the help of CT. Deep-learning methods are often used in the segmentation of ROIs. Some common networks used comprises of networks like U-Net [8],

Jin et al [8] have suggested a two level pipelining structure for screening, in which the entire lung area is diagnosed beforehand with the help of an effective technique. These techniques had the purpose of differentiating lesions[8].

Çiçek et al [8] have suggested a Three Dimensional U-network, which used information with the help of substituting the levels of the original U-network by using a three dimensional model.

Milletari et al [8] have suggested the V-network that uses remaining objects like the base of the CNN object, which optimizes the network with cube deprivation[8].

Ghoshal et al [8] have suggested a Bayesian CNN in order to evaluate ambiguity in the diagnostic prediction. Seventy X-ray images of patients were acquired with the help of a dataset available on the internet [8].

Ying et al [8] have proposed a DL centred CT diagnostic infrastructure for distinguishing between covid-affected, bacterial-pneumonia affected patients, and fit humans. Training and testing data found CT chest images from about eighty-eight patients suffering from coronavirus, one hundred and one patients with pneumonia, and approximately eighty-six fit persons [8].

Cohen et al [8] have created Data Gathering of pictures by compiling pictures from the internet. It presently contains about one hundred-twenty-three radiographs. This data comprises 288 slices for formerly established samples[8].

IV. Comparative analysis

Authors	Environment/Platform	Techniques used	Results
J.Neelaveni et al.	Psychological parameters	Machine learning algorithms	Brain Magnetic Resonance Imaging scans and other constraints should be used for diagnosis and enhanced accurateness.
Javier et al.	ADNI data	ML approach	Promising results are obtained, by bringing down the amount or the expenditure of biomarkers required.
Jung et al.	Risk groups of radiation pneumonitis (RP)	SVM	This will provide an improved apprehension of the structure and the development of the segregation of radiotherapy in sufferers
Feng et al.	X-ray and CT images	Image acquisition ,segmentation	Fusion of data from multiple sources in order to execute a precise and effective diagnostics, examination, and follow-up.
Feng et al.	AI-based medical network architecture	Next-generation network (NGN) technologies based on machine learning (ML)	Artificial Intelligence is the base of treatment of Novel coronavirus. However there are various restrictions and drawbacks to its adoption & implementation.

V. Conclusion

In this piece, we discussed intelligent AI techniques that can be used for the rapid and efficient diagnosis and prediction of diseases. The frameworks attained in the process might contain unessential types of interactions that specify the relationship amongst variables, yet, only on the basis of this, any synergism shall not be proclaimed. Hence, a supplementary procedure that can differentiate the relations, individuality or association, and extract data and share date-based systems of statistical procedures to define these relations was observed. With the help of the big data used here, it can be determined that the speed of diagnosis has enormously increased, and accuracy is increasing with every data set. With these gigantic developments, we might be able to diagnose diseases very easily and accurately soon and provide the best treatments possible as well. However, Artificial Intelligence along with Machine learning and Deep learning still has a long way to go and can provide even better solutions than what we have right now. They can really be hailed as the future of medical science.

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Machine Learning Techniques in Edge Computing: A Review

Avi Chauhan
Computer Science and Engineering
Indus University
Ahmedabad
avichauhan.20.cs@iite.indusuni.ac.in

Sapna Kataria
Computer Science and Engineering
Indus University
Ahmedabad
sapnakataria.cse@indusuni.ac.in

Abstract **-** Edge computing is the computing model that has gain extensive attention in the computing world by both academic and industry. Edge computing addresses the limitations posed by traditional cloud computing model. Cloud computing faces challenges such as handling of independently massive data generated by different mediums such as sensors and servers. Edge computing offers low latency, mobility, and location-based sustenance for time sensitive applications. Resource management in one of most pursued issues in edge computing. Resource management deals with the resource allocation, offloading, scheduling of resources, etc. in order to fill the demands of users. Resource management is a dynamic system to manage resources. In order to deal the issues related to resource management, machine learning techniques are used. Machine learning provides best solutions to optimization problems. In this paper, we have reviewed resource management techniques in edge computing paradigm where machine learning techniques are used.

Index Terms – Resource Allocation, Machine Learning, Edge Computing

I. INTRODUCTION

Edge computing provides computing at network edge. It fetches services and functions of cloud computing nearer to the end user. This enables applications to be processed in minimum time [1][2]. Mobile Edge Computing a new paradigm for mobile applications has been introduced by the European Telecommunications Standards Institute (ETSI). This computing enables users to use base station computing services. The current cloud computing world is facing issues like real-time data processing, security and privacy, and energy consumption. Several devices are added day by day in the network that creates issues of intermediate data processing during transmission of data to the cloud data centre. The network does not provide any type of security therefore security becomes one of the issues during transmission of data. Privacy is also one of the concerns because it becomes difficult to separate handling of user data. As the number of devices connected to the network increases, the consumption of energy is also increases [1]. Traditional cloud computing cannot significantly handle the problem of increasing demand of energy.

Edge computing can address above listed problem in better way than any other technology. Edge computing utilizes different advantages of artificial intelligence in order to offer computing services to end network devices [2]. Edge computing helps to stable the services offer by edge devices. Artificial intelligence offer advantage of automatically training of edge network devices in order to make them intelligent. Machine learning helps to achieve in built intelligence in the edge network devices. Moreover, deep learning, a sub-branch of machine learning helps to understand and learning like to human being [2]. Edge computing performs computing at the edge or source of data like terminal sensors. The data are stored and processed at the edge of network. User gets proximity, location awareness and end-point computing services. Edge computing process data faster, in bound to time and secure compared to the cloud computing. It also helps to reduce the energy consumption compared to cloud computing because of computing at the end of network edge. Edge computing in overall reduces cost of execution, minimizes execution time and decreases use of bandwidth. Edge computing is used in various fields such as production, applications such as home automation, transportation and energy production fields [3]. Rapid development of Internet of Things (IoT) has revolutionized the use of Edge Computing paradigm in the field of computing.

Devices connected to the edge of the edge computing generated tremendous data. It is very important to process those data in less time and efficiently. Machine learning is the technique which helps to effectively process the data. Machine learning helps edge computing to work and respond the end user in minimum time [3]. It helps to process the data locally at the network edge. Edge devices send the processed data to the cloud data centre in order to process them in real time [4]. Based on the applications, machine learning or its sub-branch such as deep learning algorithm and methods are used to solve them.

Resource management is one of the issues that has been researched more in the academia as well as industry. The objectives of resource management techniques are to provide

efficient allocation of computing, storage and bandwidth resources. They have to optimize the cost of provisioning and allocation of resources in order to satisfy user demands in minimum cost. They have to address the time constraints in order to execute the tasks also. Optimization of consumption of energy is also the important goal in order to complete the task. In this paper, we are going to introduce edge computing in detail with its architecture, technologies used and applications in the area of resource management.

The rest of the paper is organised as: section II reviews the literature review. Section III provides frameworks and research methods. Comparative analysis is discussed in section IV. Finally, conclusion is discussed in section V.

II. Literature Review

A. *Cloud Computing*

The data are transferred to the cloud data centre through network and processed in the traditional cloud computing model. The processed data are stored in the data centre [8]. Nowadays, cloud computing is evolved a lot and it became a fully distributed computing environment with strong network services. It provides resource management, load balancing, network storage, and other services through the utilization of parallel computing and virtualization. Due to the proliferation and development of Internet of Things in day-to-day life, the devices connected to the internet is increased tremendously [9]. Due to it, large amount of data is generated in seconds. The bandwidth to transmit this large amount of data becomes a bottleneck. More over computing of large amount of data in centralized environment possess many problems such as storage, real-time processing, energy consumption, security, failure of centralized site, etc [1][2].

B. *Edge Computing*

Edge computing is different than cloud computing as it performs computing at the end of the network edge. "Edge computing is a new computing mode of network edge execution. The downlink data of edge computing represents cloud service, the uplink data represents the Internet of Everything, and the edge of edge computing refers to the arbitrary computing and network resources between the data source and the path of cloud computing centre [13]". "Edge computing is a new computing model that deploys computing and storage resources (such as cloudlets, micro data centres, or fog nodes, etc.) at the edge of the network closer to mobile devices or sensors" [6]. The data, application and services are moved to the data servers from the edge of the network in the edge computing. Edge computing offers services at the end of the network edge therefore it becomes useful to the end users. Edge computing possesses high bandwidth, less time execution of task and low latency access of data to the various user applications. An architecture of edge computing has been shown in the figure 2. It consists of three layers: cloud, edge, and end. End layer is close to the user or user applications. Therefore, it perceives, observes, receives and digitize the user information form the physical world. Different sensor devices connected to the network performs these operations. The received data are processed at this layer. Processed data are sent to the cloud data centre for storage. The devices connected at this layer is having very limited storage capacity.

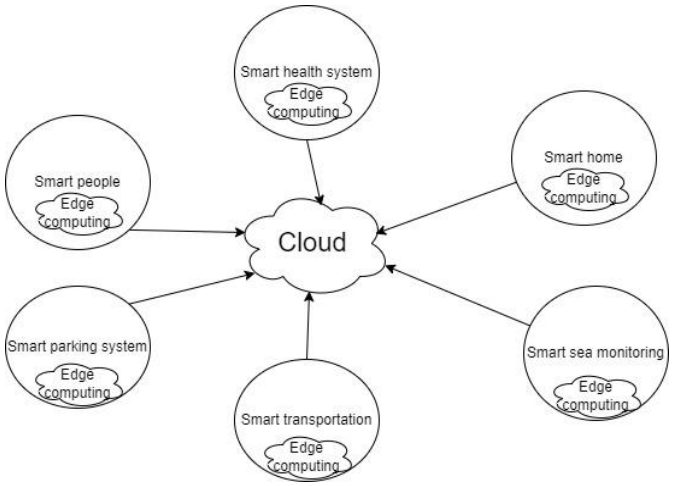


Fig 1. Edge Computing Applications

Edge is the in-between layer of end and cloud layers. The functions of this layers are storage, computing and network transmissions. This layer performs many tasks which were earlier performed by cloud layer. Edge layer provides low latency as it is close to the end users. This layer consists of gateways, different units such as control, storage, and compute. Last layer is the cloud. It is having all the facility provided by the cloud computing such as storage and compute servers. It is having overall control of the architecture.

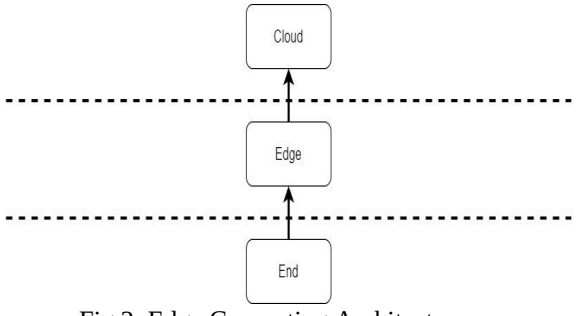


Fig 2. Edge Computing Architecture

Edge computing and cloud computing share several similar characteristics. Though edge computing differs in several forms, such as given below:

- Dense Geographical Distribution
  Users get different services at their finger tip because of their deployment near to them [3]. These devices are in large numbers, a large dense architecture is created. It offers the following merits: location-based services can be offered to the end users by network administrators without traversing whole network. Large amount of data can be processed in less time with desired accuracy. Real time data processing is possible in large scale which includes sensor networks for various application such as home automation, environmental monitoring, etc.
- Mobility Support
  Edge computing offers mobility of devices and applications in less time because of LISP protocol. LISP protocol decouples location identity from host with directory system based on distributed computing model.
- Location Awareness
  Edge computing offers location aware services to the mobile users at the gate of network. Global positioning system, wireless access points, etc are the technologies used for providing location aware services to the end users.
- Proximity
  Users get best experience as computing services and resources associated with them are near to the end users in the edge computing. The users are enabled with local proximity therefore they leverage network context information in order to make decisions fast and in real time.
- Low latency
  Edge computing offers low latency access of services to the users as services are available near to the users. Edge computing paradigms bring computing resources and services closer to users, reducing the latency of accessing services. The low latency of edge computing allows users to run their resource-intensive and delay-sensitive applications on the resource-rich edge devices [1].

C. Machine Learning in Edge Computing

Before invent of edge computing, the data were sent to cloud servers in order to process and obtain desired information. But as the different sensor-based application started in use by different applications, need of computing at the edge was required. An IoT based edge computing model is shown in fig 3. Critical application-based data such as medical, industrial were required to be processed very fast. Devices connected at the edge were enabled to process those data. Machine learning helped a lot in collected and processing of this huge data collected by the sensors. Edge devices were enabled with machine learning technologies in order to process the data to take actions efficiently and fast. They send only those data to the cloud servers which will be required further processing [8].

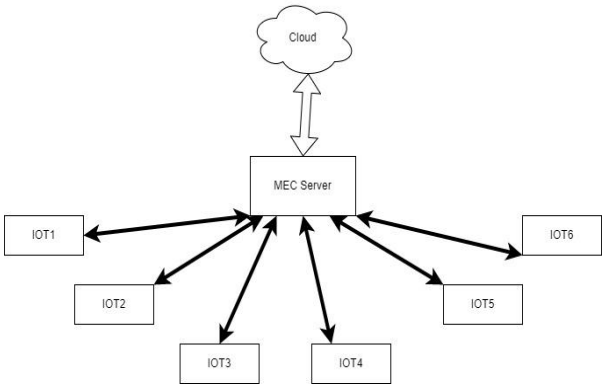


Fig. 3. IoT Edge Computing

IoT based edge computing has more concern on security and privacy as the sensors are located outside the control of the computing environment. It provides solutions to the security related issues where personal data of users are involved. The user data is in large volume and it requires tremendous amount of processing power. Machine learning can help to design applications related to medical hospitals which can make easy living of users. Machine learning based solutions can also provide solutions to the applications which require different data of patients like heart rate, level of blood sugar, etc. Edge devices do not have security power as cloud data centre have therefore processing and transmitting of data from edge devices to the cloud data centre require more secure solutions. The edge devices are increasing day by day which at the end increases the edge computing size. Therefore, machine learning based solutions must be more bossy than existing solutions based on security and privacy issues [10].

D. RESOURCE MANAGEMENT USING MACHINE LEARNING

Network created by edge devices is very dynamic as compared to traditional cloud computing. Users connected to these dynamic devices utilizes several applications, require constant power. Users connected to the edge devices constantly move from one place to other or from one device to another that creates complications in transmission data rates, delay associated to this transmission, complications associated with different channels, etc. User applications use different range of time scales for execution of applications. The resources can be

allocated in two ways: static and dynamic. In static resource allocation, users get dedicated resources for execution of their applications while in dynamic resource allocation, users get resources at run time. Both resource allocation methods are not good for edge computing because the resources and users both are not fixed at a given time. Therefore, a technique required which can be used to solve both allocation methods. Machine learning is the technique which can provide best solutions to both static and dynamic resource allocation. In static allocation of resources number of variables are more compare to dynamic and the complexity also increases in optimizing them. Machine learning can provide best solution to the optimizing resource allocation problems. Machine learning is in infancy state in the use of resource allocation problems in edge computing [6][7][13].

III. Framework and research methodology

In this section, frameworks and techniques used in edge computing for resource allocation problems are surveyed and discussed. Edge computing is very dynamic environment. The number of users and devices connected to the edge computing devices varies very randomly and constantly changing. The user applications and their different demands complicates the resource allocation. The allocation of resources has to deal with varying time-scales, and characteristics. Machine learning based methods provide best solutions to resource allocation issues [6].

Khan et al. [7] have proposed a generic framework for performing computing tasks. In this framework a computing device can offload its load to peer computing devices. They offer trustworthy and rapid computation in computing the given load. The proposed framework consists of two phases:

i. An algorithm named Louvain is implemented to detect the community of given network. It separates the network in several groups. These group consists of several IoT devices in such a way that these devices possess strong relationship among themselves.
ii. In second phase a machine leaning methods is used to train the grouped resources in sharing and computing. It uses both computational and non-computational characteristics of grouped devices. The method predicts task completion time.

The proposed framework provides best time in completing the task assigned by edge device. The method is tested on real-time dataset and obtained results demonstrates that it outperforms.

A. Alnoman[8] has proposed a method for allocation of virtual machine in edge computing. It offers solution to the varying compute requirement at different edge devices. K-means method has been used to categorize the tasks in to different groups according to their processing needs. Each group of tasks is assigned a dedicated virtual machine that can execute them efficiently. Proposed method has been simulated and obtained results shows that it effectively and efficiently clusters the tasks in order to get best utilization of edge devices.

T. Alfakih et al. [10] have proposed a reinforcement learning-based algorithm named as state-action-reward-state-action (RL-SARSA) to solve the resource management problem in the edge server. The proposed algorithm provides optimal solutions in offloading the load. It minimizes time, cost, minimize energy consumption and reduces the delay to minimum. The method is named as OD-SARSA (Offloading Decision-based SARSA). The proposed method has been simulated and obtained results are compared with the Q-learning reinforcement method. The proposed method outperforms in all the aspects.

Wang et al [11] proposed a method for allocation of resource in order to maximize the revenue. The method maintains incentive compatibility and rationality. Deep neural network has been used in resource allocation with mobile blockchain network. Prospectors' birds are the input to the neural network. The output is the cost of prospectors. There are two steps: in first step neural network accomplish the monotonic transformations. The allocation is performed in second step in order to compute the winning probability. At the last the neural network is trained to maximize the profit of the provider. Multiple mobile edge nodes are used to design the network.

S. Hou and X. Huang [12] have proposed an optimization algorithm to the mobile edge computing environment. The algorithm addresses allocation of channel and offloading of compute load. Algorithm uses Hopfield neural network to solve the optimization problem. Obtained results are outstanding compared to the state of the solutions.

Yang et al. [14] have proposed a resource allocation method to minimize the end-to-end delay. It considers system under channel quality and finite block length coding constraints. The model consists of multiple users and a single mobile edge computing server. The proposed method is simulated and obtained results are compared with equal and random allocation method. The results outperform in completion of tasks in given time period.

IV. Comparative analysis

This section provides comparative analysis of surveyed methods.

Authors	Environment/Platform	Techniques used	Results
Khan et al.	Edge Devices	Louvain	Best results in completing the

[7]	and Servers.		tasks in given time period.
A. Alnoman[8]	Edge Computing	k-means unsupervised algorithm	effectively and efficiently clusters the tasks in order to get best utilization of edge devices.
T. Alfakih et al. [10]	Edge Server	a reinforcement learning-based algorithm named as state-action-reward-state-action (RL-SARSA)	Minimize time and cost of execution of tasks.
Wang et al [11]	Mobile edge computing	Deep neural network	Maximizes the provider's revenue.
Yang et al. [14]	mobile edge computing server	Machine learning based algorithm	Task completion in given time.

V. CONCLUSION

Edge computing is the new computing paradigm which deals with the computing at the edge of networks. Resource management is one of the issues which is most south in the edge computing paradigm. Machine learning is one the techniques paradigm which provides best optimization solutions to the resource management problems. In this paper, we have reviewed resource management techniques where machine learning techniques are applied. The paper has addressed all the issues related to resource management.

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NLP's Impact on Virtual Assistants: A Review

Isha Katkar
Computer Science and Engineering
Indus University
Ahmedabad, India
ishakatkar.20.cs@iite.indusuni.ac.in

Sapna Kataria
Assistant Professor - CSE
Indus University
Ahmedabad, India
sapnakataria.cse@indusuni.ac.in

Abstract: Technological improvements in IT sectors have made the inculcation of Virtual assistants a part of our day-to-day lives. It has been used everywhere from schools to healthcare. This technology's primary aim is to quickly provide customers with the information they want. This is why almost all major sectors use voice assistants to increase productivity and accuracy while decreasing the error frequency in data retrieval. For the betterment of virtual assistants in the years to come, a deep understanding of NLP is the need of the hour. This will help us come up with a more efficient mechanism to improve the quality of functioning. In this work, all the applications and features of virtual assistants have been analysed and help understand the impact of NLP on them. The primary focus of this review paper is to highlight the current shortcomings, applications, what is needed to tap into this technology's unlimited potential, and how it can be improved in the future.

Keywords: Virtual Assistants, Machine Learning, NLP, Learning Systems, Literature review, IoT, Artificial Intelligence

I. INTRODUCTION

Neuro-Linguistic Programming also known as NLP is the approach of using algorithms to help approach complex problems. It is a subfield of linguistics and computer science that requires data training to respond to a particular problem that might arise in the future. Not just in spoken but also in written languages NLP helps to get an understanding of the imputed data. Being a branch of artificial intelligence, NLP finds its application in many of the top projects that we use today. Some of these include the virtual assistant. Virtual assistants have been implemented in all websites and applications to provide the user with the best result. This technology has contributed to industrial revolutions and brought forth a change that will take us further. It has been used in all major fields from healthcare to education. Along with this, major IoT platforms are using this technology for localization and connecting with customers to cut the competition. With the use of virtual assistants, the industry has been able to see significant profit changes which would have only been an idea in the past few years.

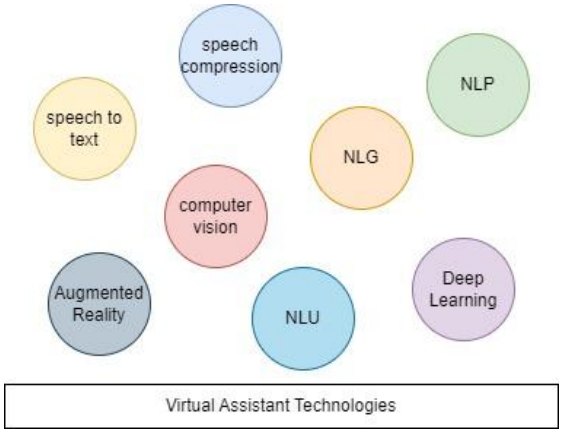
The world today is dependent on virtual assistants, it has been found out by studies that nearly 56% of young people in the US use voice search programs and the acceptance rate for the adult generation has been drawn to 85%. But this technology has proven to stay in the market for the long term, instead of just being called a trend. The main reasons for this are that improved quality speech recognition in the future will promote the quick and less complex processing of data in the future which will be more accurate as the day progresses. The processing centres will also be able to adapt to this by an increased broadband internet service with the introduction of 5G in almost all regions. The betterment of the algorithm can drastically provide more customised solutions to the data that has been processed. This is helping to give customization in the product service increasing the satisfaction received from the output. The second reason is the increase in interaction rate from the customers. They are now actively taking part in connecting with the user interface.

It is no hidden fact that the voice input method has a high presence over the traditional text input since it is quick and convenient. It has helped to eliminate these bulky items and instead give a better structural approach to the devices. Apart from that, the most common voice assistants like

Siri and Alexa are being used as personal virtual assistants to help with the most basic human needs like switching on and off the lights in homes to asking for reminders about a specific task. The improvements in artificial intelligence have helped to power back virtual assistants. The learning and processing ability of the IPAs has been increasing significantly due to the advanced machine learning algorithms. Along with this, technologies like cloud computing and advanced sensors help with the accurate collection and storage of data for further use.

Focusing on some of the major fields like education, NLP has helped to get the hold of the language that is being taught to come up with better techniques to improve the retention rate of the students. Enough knowledge and the right training are the keys to knowledge retention. In this paper, we are trying to understand how virtual assistants can help impact higher education. It was found that most of the students were facing issues with time management and productivity. To help with this, the personal assistants can help to define personal goals which are trackable. The workload faced by these students was immense and for this reason, optimal study environments and focus training was something that was looked into. But, a single faculty couldn't judge each student at the same time. This is the reason why virtual assistants help with retaining knowledge and transform the traditional teaching methods of chalk and blackboard.

They are now able to connect with the sources and get in-depth knowledge regarding a particular topic at any given instance, extracting only the relevant knowledge. This filter has made them productive and grasps the concept better. This system was also helpful to draw out summaries and lecture notes with ease. Most of the reports showed that the students took an active interest in writing summaries which seemed like a burden previously. The end conclusion was drawn that all the students that were studied need constant persistence and workflow management that will help them to acquire the desired knowledge. This is the prime niche where virtual assistants can be used along with NLP. The system ensured that they knew the amount of time required to meet the deadlines, what needs to be submitted, and the amount of time that needs to be scheduled to meet the required deadlines.NLP helps to also understand the cognitive working of the student and realise the areas which might be the weakest for them. Along with this, it also reduces the input time which makes sure that they are not distracted.



II. Integrated Applications of NLP and Virtual Assistants

NLP in Business Analytics

Essentially NLP is being used to gain more insight into customer behaviour. It is helpful in conveying what was the approach of the company while developing the product that has reached the manufacturing process. It also ensures that the scope of the product is analysed before it has been released into the market. This makes sure that the major risks are managed. The list below gives the major applications of NLP and virtual assistant in business analytics:

Summarization of Data

NLP along with NLG is applied to compress the extreme forms of data in terms of databases and draw out summaries that fit the best to the context. It is always not possible to do this manually. Hence, NLP can help draw out the summaries based on the model that has the correctly trained algorithms. These are usually added to documentaries and also for adding transcripts in certain cases.

Analysis of client sentiments

When a customer logs on to a site and leaves his or her review, ratings, and recommendations this data becomes extremely crucial for the betterment of

customer service. This data can be interpreted correctly to help gain better profits through adding virtual devices that help capture the needs correctly and process them with exactitude.

Chatting Bots as virtual assistants

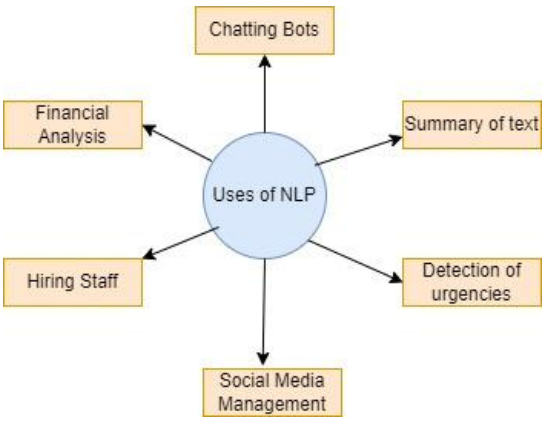
Even the smallest of businesses are looking forward to adding chatbots to their websites and applications. This has proven to be extremely helpful for those clients who find it difficult to navigate through the user interface. They are also engaging the customers in a way that eases the marketing funnel which in turn increases the chances of making a purchase. A significant example of this is the addition of Alexa to the Amazon website which creates fascination among the masses.

Spam Detection:

Spam bots can create redundant data in the databases of the company. It can also cause the system to malfunction due to the input of redundant data. This is where NLP can help to detect the true nature of the client and then instruct the virtual assistant to take the task further to handle the spam bots.

Answering the common questions

Having the same doubts is common when you are addressing a huge number of clients. This is where virtual assistants can help answer these questions patiently through machine learning and artificial intelligence. Programming the algorithms in the right way has proven to make the customer base get more insights into the product.



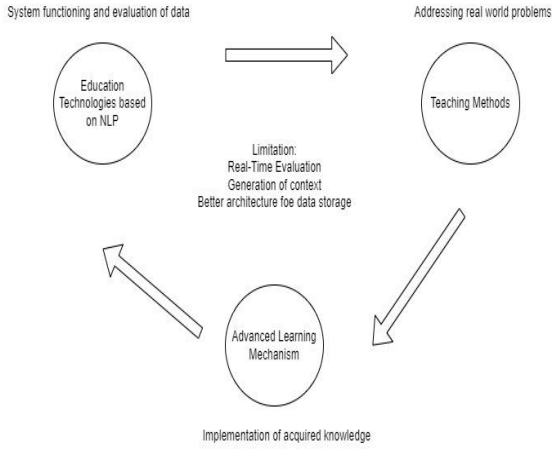
1. **Integration within academics**

The prime focus of integrating virtual assistants in academics is to help students with the motivation to continue and help them understand the current topics with ease. The papers written by Albalowi and Alhamed prove that four main factors help determine the retention capacity of students. These include integration within academics, social integration of the concept, commitment to the institution, and other factors.

The virtual assistant was able to contribute to the first three. Addressing the first one, with the help of machine learning the system was able to detect the weak point of each student, and help them focus more on these grey areas. The second one was making them understand the concepts through chatbots and supervising assistants was a way to provide information to the student in their time of need. Thirdly, artificial intelligence helped to gain insights about the student's mistakes and also improved the teaching mechanism which helped the students to grant the knowledge faster.

Zakharova, 2018, created a model which helped to analyse the papers that were submitted by the students and provide relevant feedback. This helped to keep the students actively engaged in the learning process.

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2. **Virtual Assistants for Dysarthric Speech**

This type of speech is a condition that occurs when a patient suffers from dysarthria. This causes problems in the synaptic neuro system which is a resulting consequence of cerebral palsy. In that condition, the speech of the patent usually sounds unintelligent.

In the results conducted it was found that both Siri and Alexa were able to predict the command with accuracy despite the lack of the correct syllable and a general monotone in the entire input. Though there are certain areas that need improvement it is in fact proven to be the closest to accuracy in decoding these inputs. While Alexa virtual assistant was not able to provide the entire transcript of the input a general binary output was obtained in the test cases. With the improved algorithms and correct applications of machine learning the accuracy of the predictions can be improved for the years to come.

III. Review Literature

NLP is a subcategory of AI that helps the computer to understand the inputs that are based on voice commands entered by the user.

Virtual Assistants are applications of AI that understand the voice commands that are imputed and perform a specific task that is required.

Artificial Intelligence is stimulating a given process of human intelligence under machine systems.

Machine learning is a sub-system of artificial intelligence that primarily focuses on the usage of algorithms and the researched data to come to a logical conclusion

The diverse field of NLP uses machine learning techniques to a vast extent. Some of these include morphological analysis, semantic analysis, syntactic analysis, and pragmatic analysis. All of these are used to predict the nature of the data that has been collected over the course of the study and aim to improve its implementation of it.

Sr. No.	Authors	Field of Application	Platform	Result
1.	Pascal Muam Mah, Iwona Skalna 1 and John Muzam	Industry 4.0	Artificial Intelligen-ce, NLP, Machine Learning	Success
2.	Fabio BALLAT-I, Fulvio CORNO and Luigi DE RUSSIS	Dysarthric Speech	Virtual Assistants, NLP	Success
3.	Regina Gubarev-a and Rui Pedro Lopes	Higher Education and Academic Integration	Machine Learning And virtual assistant	Success

The prime objective of this review literature is to find the impact of NLP on virtual assistance and its implementation in the various fields to find out the rate of accuracy that it provides for the input in each field that it has been tested in. In this case, the data collected is from three main fields including business analytics, academic integrations, and dysarthric speech.

It was tested and found that each of the fields has its own successful application of NLP that has impacted the virtual assistants that have been deployed. Though there are certain shortcomings in the field of dysarthric speech it was still proven to be a success in determining the input given by the patient.

This has been the closest to getting valid input. In the case of academics, it too has shown that concentration and the focus of the students were significantly increased. Along with this, a study was made to understand how well the students are able to retain information through advanced virtual assistants which were proven to be highly impactful too.

IV. Limitations and Future Work

There still arise numerous factors where virtual assistance and NLP still need improvement. These are the major factors that can cause a significant change in technology in the years to come. The factors are listed below.

1. **Integration within systems(4)**
   The most crucial factor in increasing the scope of this technology is to reach out to other devices and contribute towards managing them. Not just devices but it applies to the scope of data and inputs that are being received from the user. Some of the most functional integrations of intelligent virtual assistance are within smart appliances that can withdraw information from the environment they are situated in and help provide feedback based on it. This mechanism has been inculcated within smart parking systems by Zhao and Zhang, Ji, Ganchev, and O'Droma in 2014.

2. **The adaptability of the system(4)**
   There are five main categories of smart virtual assistants as we know them today. They are classified as utility-based, simple reflex, goal-based and model-based. Depending upon the necessity and the algorithm being used each of these models can be implemented individually to get the best conclusions. One of the highly concerning factors of any machine is its rate of learning. This helps the assistance to draw conclusions for the future data that it is going to receive. The more the learning curve of the machine the more adaptable it is.

3. **Awareness of the current context(4)**
   It has been stated by Marc Weiser that a machine learning system should adapt the functionality to the activity and inputs given by the user. When a system has awareness of the context, the functions can change with the changing conditions. This helps to increase the relevance of the data that is being outputted. Interactions with the virtual assistant can help to train it better and gain an insight into the nature of the user, after all the contextuality is subjective for each system.

4. **Security(4)**
   Security has become a major concern of all NLP-based virtual assistants along with other forms of artificial intelligence and its implementation. Since the cloud is connected to it, the sensitive information of users can be at stake. This can be authorised by unwanted parties without getting detected for a long period of time. Better encryption mechanisms need to be developed to ensure that cloud transmission is safe.

V. Conclusion

It is no doubt that virtual assistants are the future of all technological advancements. In order for this technology to make the betterment the functionality and adaptability need to be looked into. The data provided to train the software also play an important role in determining the accuracy rate of the model.

IoT systems are also benefiting from it to help understand the side of the customer better. The main domains like customer satisfaction, user analytics, and correct prediction of the functioning of data are being implemented through NLP and virtual assistants. Hence it can be concluded that privacy is one of the most important factors that determine the acceptance of virtual assistants in many fields. Other major determining factors of virtual assistants are reactivity and input processing

rates which help understand how functional the entire system is. In conclusion, NLP is the basis of virtual assistants, all the major processing of the input is brought forth by it, and to make sure that there is improvement the factor mentioned above should be studied and worked upon.

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Online Attendance System using Facial Recognition and QR code

Asst. Prof .Bhoomika Modi,
Computer Science and Engineering
Indus University
Ahmedabad, India
Email:-
bhoomikamodi.cse@indusuni.ac.in

Sakib Ali Choudhary
Student At Computer Science and Engineering
Indus University
Ahmedabad, India
Email:- sakib786110@gmail.com

***Abstract*— The implementation of an online attendance system based on facial recognition and QR code technology is a biometric solution that can improve the accuracy, efficiency, and security of attendance tracking.**

To overcome the drawbacks of conventional attendance monitoring techniques, this project attempts to create and implement an attendance system that makes use of facial recognition and QR code technologies.

The system will be able to identify people with great accuracy by studying their facial features thanks to the usage of facial recognition technology. The QR code will be used to store information such as the person's identification, date, time, and location as well as to confirm the person's identity.

Previous research has indicated that the use of facial recognition and QR code-based attendance systems can yield positive outcomes. Until now, issues with these technologies' accuracy and privacy have also been brought up. The project will put in place the necessary security measures and ensure adherence to the pertinent data privacy laws to guarantee the functionality of the system.

The initiative intends to transform the way organization manage attendance, streamlining the process and delivering a more secure and trustworthy solution. The project will be judged on its precision, effectiveness, security, and usability. By offering a more effective and dependable solution, the deployment of this attendance system has the potential to enhance the process of tracking attendance in businesses.

Keywords—QR Code, Security, Usability

I. INTRODUCTION

Taking attendance in educational institutions has long been a laborious and time-consuming process. This process, however, has become more efficient and accurate with the introduction of online attendance systems that incorporate facial recognition and QR code technology. These systems not only save teachers time but also make it simple for students to keep track of their attendance and reduce the possibility of human error.

Facial recognition technology has grown in popularity in recent years and is now being used in a variety of fields, including education. These systems can quickly and accurately recognize a student's face and match it with their personal information, such as their class schedule and attendance history, by utilising cameras and advanced algorithms. For students who do not want to rely solely on facial recognition technology, QR codes provide a simple and easy-to-use alternative. To confirm their attendance, students simply scan the QR code displayed on a screen or their phones.

Online attendance systems with facial recognition and QR code technology have additional advantages in addition to expediting the attendance procedure. They can, for example, aid in the reduction of truancy and absenteeism since pupils who are regularly absent can be quickly detected and necessary measures made to address the issue. These systems can also give educators significant data insights, such as recognizing patterns in attendance or identifying children in danger of falling behind.

Online attendance systems utilising facial recognition and QR code technology, like any technological innovation, have downsides. Concerns have been expressed about data privacy and security, for example, because these systems may collect personal information from students. Furthermore, some students may be wary of facial recognition technology or may not have access to a smartphone to scan a QR code.

Notwithstanding these concerns, the development and implementation of online attendance systems that use facial recognition and QR code technology constitute a big step forward in enhancing attendance tracking in educational institutions. Educators may ensure that they are employing the most up-to-date and innovative approaches to assist their pupils achieve by carefully evaluating and analysing the effectiveness and viability of these systems.

II. MOTIVATION

To solve the constraints of traditional attendance systems, the suggested online attendance system with facial recognition and QR code scanning is required. Traditional attendance systems that rely on manual marking or biometric identification methods such as fingerprint recognition can be time-consuming, prone to errors, and jeopardise students' or employees' privacy and security.

The suggested method enables accurate and secure attendance marking by integrating facial recognition and QR code scanning technology. In the aftermath of the COVID-19 outbreak as there is a raise of risk of microbial pathogen contamination or cross-infection of food and water by subsequent user’s Physical contact also enhances the likelihood of dangerous microbial infections entering the respiratory tract and causing infectious illnesses [1], facial recognition technology reduces the need for direct touch, making it a more sanitary alternative. Furthermore, QR code scanning offers an additional option for students or employees who may struggle with facial recognition. And there is a significant impact of Covid-19 on biometric

identification systems [2] so we need to keep up to date with modern problems.

Overall, the suggested approach provides a more efficient, accurate, and secure method of recording attendance, which is critical for educational institutions and businesses that must track attendance for accountability purposes.

III. THE PROPOSED WORK

The suggested system is an online attendance system that verifies the identity of students or employees using both facial recognition and QR code technology before marking their attendance. The system will be a terminal-based system that can be combined with any device that has a camera and base configuration to compute the code.

The front-end component will have basic features that students or employees will utilise to indicate their attendance. For registering attendance, the front end will have two options: facial recognition and QR code scanning.

The facial recognition system will use a camera (open cv) to capture the student's or employee's face. The taken image will then be compared to the images of the registered and encoded pupils or employees in the database. If a match is found, the system will note the attendance and notify the back-end component.

Students and employees will be able to scan a unique QR code produced for each session using the QR code scanning option. To accomplish an anti-cheat mechanism, the system will then verify the QR code and mark the attendance if the code is valid. A notification will also be sent to the back-end component by the system.

A local database will serve as the back-end component. When a student or employee registers their attendance, the back-end component sends a notification to the front-end component. The backend will then use a simplified Excel sheet to update the attendance information in the database.

When a person is accurately identified and attendance is recorded, the back-end component will also take a screenshot as proof to achieve an anti-cheat mechanism.

In addition, the back-end component will compile attendance reports and distribute them to authorised individuals. The system will have an admin panel from which authorised workers will be able to see attendance reports and adjust system settings.

The suggested technology will encrypt data during transmission and separate the entire process. Only enrolled students or staff will be able to indicate their attendance using facial recognition and QR code scanning technologies. As a result, the system will give two-way verification.

IV. DETAIL EXPLANATION OF THE PROPOSED WORK

Phrase for Data Collection The initial stage is to gather data for the facial recognition algorithm's training. This entails shooting people's faces from various angles and lighting conditions and then matching them with their matching names or IDs. The more diversified and extensive the data, the more accurate the facial recognition system. The OpenCV (cv2) module, which provides image processing and computer vision functionality, can be utilised for this operation.

Phrase for Facial Recognition Algorithm Training After gathering the training data, the facial recognition system is trained. This can be accomplished with the help of a face recognition library, which typically entails loading the collected photographs and labels, encoding the faces with the face encodings() method, and saving the encodings to a file for future use. This procedure assists the computer in learning the facial traits and patterns required for accurate recognition. The facial recognition system can recognise faces in real-time photographs when the encodings are saved.

Phrase for Creating QR Codes To track attendance, each user must be assigned a unique QR code. This is possible using QR code generating modules, which generate QR codes from text or URLs. The QR code should include information that can be used to uniquely identify the user, such as the user's name or ID number.

Phrase Live Video Feed Capture OpenCV may be used to capture a live video feed. This entails initialising the camera with the cv2.VideoCapture() method and adjusting settings like frame size and frames per second (FPS) as needed. Following that, the live video feed can be shown on a web interface for further processing.

Face Detection Phrase in Real-Time The face recognition library may be used to recognise faces in real time from collected video feeds. Typically, this entails reading each frame of the video feed using the cv2.VideoCapture.read() method, encoding the faces with the face encodings() function, and comparing the encodings with the saved encodings with the face distance() function. If a match is discovered, the user's attendance can be tracked.

Dual Verification using QR Codes expression QR codes can be used for dual verification after successful facial recognition. The QR code module can scan the QR code from the user's ID and extract data from it. This data can be matched to the user database to validate attendance.

Phrase for Attendance Recording When a user's attendance is marked, the system should save the timestamp along with the user's name or ID to a CSV file. This is possible with Python's csv module, which includes functions for reading and writing CSV files. This facilitates the tracking and analysis of attendance data.

Phrase for Generating Quotes A quote module, which has a library of renowned quotes from various sources, can be used to generate a random quote of the day as an added feature. To generate a random quote, a Python script can be written that imports the quote module and uses the get_quote() method. The quote can then be displayed on the screen or spoken aloud using text-to-speech tools like pyttsx3, giving the system a motivational or inspirational aspect.

V. BRIEF EXPLANATION OF OPEN CV

Cv2 is a Python library[3] that provides computer vision and image processing functions. It is built on the OpenCV (Open Source Computer Vision) library, which is a popular and well-known library for computer vision applications.

With cv2, you can read and write image files, resize, rotate, and crop photos, convert images to grayscale or other colour schemes, and add filters and effects to images and videos.

Image processing functions provided by cv2 include edge detection, thresholding, blurring, and morphological procedures. Object detection, facial recognition, and image segmentation are examples of tasks that utilise these functions.

The ability to work with video streams is one of cv2's primary characteristics. We can use cv2 to capture video from a camera or other video source, process individual frames of video, and show the results in real-time.

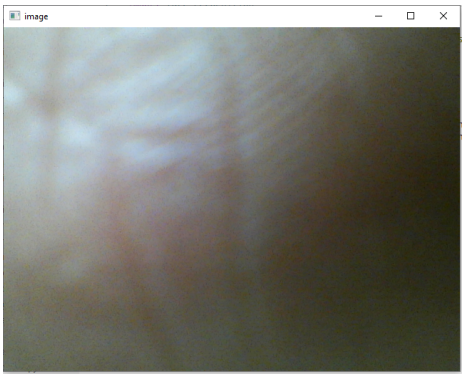


Fig. 1. Demonstration of a webcam output accessed using Cv2

In this project, we will use CV2 as the primary framework to import our data, such as a single image capture or a live feed capture using our current webcam or camera.

OpenCV provides great results when used for facial recognition[4].

VI. DETAIL EXPLANATION OF THE FACIAL RECOGNITION SYSTEM

Face recognition is a biometric technique that uses face traits to verify and identify people. Due to its potential use in security, surveillance, and access control systems, it has received a lot of interest lately. Machine learning algorithms are the foundation of face recognition technology, which can find and identify human faces in digital photos or videos.

The two major methods for recognizing faces are 2D and 3D. 2D face recognition algorithms examine two-dimensional facial photos and compare them to templates that have been saved. This method is frequently applied in access control and security facial recognition systems. A 3D model of the face is produced by 3D face recognition algorithms using depth information, which is then used for identification and verification.

Accuracy is one of the biggest problems with facial recognition technologies. Lighting, facial expressions, and occlusions are just a few of the variables that can have an impact on how well face recognition systems function. To get clear pictures of the face, it is crucial to employ high-quality cameras and lighting setups.

The issue of privacy is another difficulty. Facial recognition software creates moral and legal concerns because it may be used for spying. Thus, it's crucial to develop suitable privacy rules and security measures to safeguard people's personal information.

Face recognition technology can still be used in a wide range of fields, including security, law enforcement, healthcare, and retail, despite these difficulties. Face recognition technology can be used in the facial recognition and QR code project to increase the precision and effectiveness of the attendance tracking system.

In summary, face recognition technology is an effective method for recognizing and authenticating people based on their facial features. Its use is not without difficulties and worries, yet it has many potential uses across multiple industries. Face recognition technology can help the facial recognition and QR code project by increasing the precision and effectiveness of the attendance tracking system.

We are using the face-recognition 1.3.0 python package for facial recognition and encoding, where the image is loaded and then encoded in the format, and the encoded image is then sent to the model, where the model predicts the best to close prediction of the label of the image given.

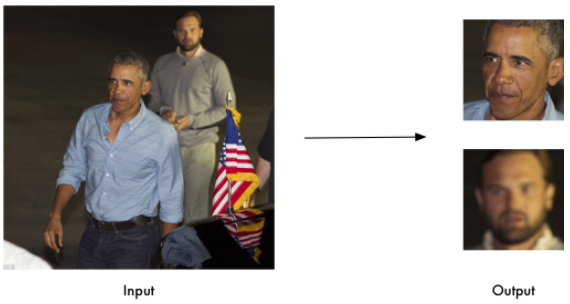


Fig 2. Example of how an image is processed while encoding. [6]

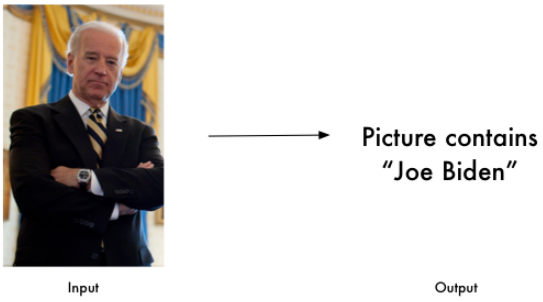


Fig. 3. Example for the image identification [7]

Here the above images are used to illustrate how the image is processed and then used in the machine learning model to predict the best possible label.

VII. DETAILED EXPLANATION OF THE QR CODE IN THE SYSTEM

A two-dimensional barcode known as a QR Code (Quick Response Code) is a machine-readable type of information. It was initially created for the Japanese auto industry to track automobiles, but it has since been embraced by many other sectors, including marketing, ticketing, and payment processing. A smartphone camera or a QR code scanner can quickly create and interpret QR codes. The QR codes use a basic encoding and decoding algorithm[5].

QR codes are used to identify users and record their attendance in the context of the facial recognition and QR

code project. Each user is given a special QR code that contains information about their attendance, such as name, date, and time. To confirm a user's identity, the system takes a picture of them when they scan their QR code with their smartphone camera and compares it to a facial recognition database. If the person is correctly identified, the system records their attendance and provides a report for the business administrator.

Compared to conventional techniques of tracking attendance, QR codes have several benefits. They may be accessible from anywhere using a smartphone camera, need little hardware and software, and are simple to operate. They also rely on digital authentication and facial recognition technologies, making them more accurate and secure than manual approaches.

However, there are also certain drawbacks to employing QR codes for attendance tracking. Making sure that the QR code is not shared or used improperly by others is one of the key challenges. To prevent mistakes and inconsistencies in attendance data, it is also crucial to make sure the QR code is read accurately. Also, the system may experience technical problems, such as network connectivity or smartphone compatibility concerns.



Fig 4. Demonstration of how a text can be converted to a Qr code [3]



Fig 5. Demonstration of a simple QR code

In conclusion, QR codes are crucial to the facial recognition and QR code project because they offer a simple and secure way to monitor attendance. Although there are certain restrictions on their use, they are an efficient instrument for managing attendance in a variety of businesses since the advantages outweigh the difficulties.

VIII. EXTRA FUNCTIONALITIES IN THE SYSTEM

To make the system more user-friendly, we applied many technologies, including the text-to-speech model Pyttsx3. It is a Python package that converts text to speech. It enables Python programmers to include the text-to-speech capability in their applications. Pyttsx 3[9] is an abbreviation for Python Text-to-Speech.



Fig 6. Demonstration of how a speech gets converted to string [10]

Pyttsx3 is a Python package that uses platform-specific engines to convert text to speech on Windows, Mac, and Linux. Developers can use the API to control features of the speech output such as voice, volume, and speed.

We also used the speech_recognition[11] module, a Python tool that allows developers to identify and transform voice input into text. It provides a simple API for capturing audio from a microphone or an audio file and converting the spoken words into text using various speech recognition engines.

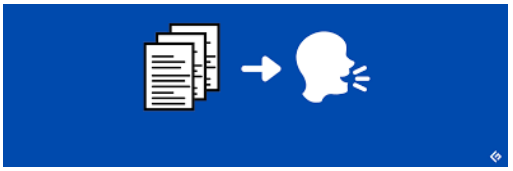


Fig 7. Demonstration of how text gets converted to speech

Many voice recognition engines, including Google Speech Recognition, Microsoft Bing Voice Recognition, and CMU Sphinx, are supported by the speech recognition library. Machine learning methods are used by these engines to recognize and understand spoken words and return the related text.

We have also included a quote [12] function, which is part of the quote package, and allows you to generate a random quote of the day. The quote function, when called, returns a string containing a quote as well as the name of the person who said it. Pip may be used to install the quote package, and the quote function can be imported and used in Python scripts to display a different quote each time the function is invoked.

PyAutoGUI [13], a Python tool that allows developers to manage the mouse and keyboard, as well as take screenshots and automate GUI interactions, was also used. The ability to take screenshots of the computer screen using the screenshot () function is one of PyAutoGUI's features. This function grabs the current screen contents and returns a PIL (Python Imaging Library) Image object that can be modified or saved to disk. The snapshot () function accepts an extra argument specifying the region of the screen to capture, allowing developers to capture only a section of the screen rather than the entire screen. Overall, PyAutoGUI's screenshot () function makes it simple to automate the process of taking screenshots in Python scripts.

IX. CONCLUSION

In conclusion, facial recognition and QR code-based online attendance system provides a modern and efficient solution for attendance monitoring in organisations. This

system uses cutting-edge technology such as facial recognition and QR codes to automate the attendance process, removing the need for manual recording and lowering the possibility of errors or fraud. The advantages of this system include increased security, efficiency, and accuracy, which can lead to more efficient attendance management for both employees and administrators.

Furthermore, facial recognition and QR code-based online attendance systems have the potential to be deployed in organisations of all sizes, from small businesses to huge enterprises. It has the potential to greatly streamline attendance procedures, resulting in enhanced attendance tracking and reporting, reduced administrative workload, and improved overall attendance management. While the system may have certain limitations or obstacles, such as privacy concerns or the necessity for dependable internet connectivity, there is plenty of space for future expansion and improvement. We should expect future advancements in facial recognition and QR code-based online attendance systems as technology advances, making them an even more important tool for organisations.

Finally, the online attendance system based on facial recognition and QR codes offers a substantial development in attendance management, providing a modern alternative to outmoded manual techniques. Its advantages in terms of security, efficiency, and accuracy make it an appealing alternative for businesses wishing to improve their attendance practices. With further development and refinement, this system has the potential to revolutionise attendance management in the future.

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A study- E-Voting system using block chain

Mr. Sanjay Makwana
Assistant Professor
Indus Institute of Technology and Engineering
Ahmedabad, Gujarat, India
sanjaymakwana.it@gmail.com

Priyanshi Mittal
Computer Engineering
Indus Institute of Technology and Engineering
Ahmedabad, Gujarat, India
priyanshimittal2205@gmail.com

Dr. Seema Mahajan
HOD Computer Engineering
Indus Institute of Technology and Engineering
Ahmedabad, Gujarat, India
ce.hod@indusuni.ac.in

Kashish Motwani
Computer Engineering
Indus Institute of Technology and Engineering
Ahmedabad, Gujarat, India
kashish260102@gmail.com

Pratham Dhamecha
Computer Engineering
Indus Institute of Technology and Engineering
Ahmedabad, Gujarat, India
prathamdhamecha.19.ce@iite.indusuni.ac.in

***Abstract*—this review paper focuses on the implementation of electronic voting (e-voting) systems using block chain technology. E-voting has been gaining popularity in recent years because of its possible to improve the efficiency and clearness of the voting process. Still, traditional e-voting systems have been plagued with security concerns such as hacking and tampering.**

The paper explores how block chain technology can address these security concerns by providing a decentralized and immutable ledger for storing voting data. It also analyses the various approaches that have been proposed for implementing block chain-based e-voting systems, including permissioned and permission less block chains.

Furthermore, the paper evaluates the advantages and limitations of using block chain technology for e voting and examines the potential challenges that may arise during implementation. The review concludes by suggesting areas for future research and development to improve the adoption of block chain-based e-voting systems.

Keywords—E-voting, Block chain, security, frauds, online voting

I. INTRODUCTION

In recent years, the concept of electronic voting (e-voting) has gained significant attention as a probable solution for improving the efficiency and transparency of the voting process. Traditional voting methods have been plagued by issues such as long queues, inaccurate vote counting, and human error.

However, e-voting systems have also been met with skepticism due to concerns over security and fraud. Hacking and tampering are some of the most significant security challenges that arise with online voting systems.

To address these challenges, block chain technology has been proposed as a solution for implementing secure and transparent e-voting systems. The decentralized and immutable nature of block chain provides a secure platform for storing and verifying voting data, which can greatly enhance the integrity of the voting process.

In this review paper, we explore the implementation of e-voting systems using block chain technology. We examine the advantages and limitations of block chain-based e-voting systems, and evaluate the potential challenges that may arise during implementation. Our analysis includes a comparison of permissioned and permission less block chain approaches, and we discuss the potential for future research and development to improve the adoption of block chain-based e-voting systems.

Overall, this review aims to provide an in-depth understanding of the use of block chain technology in e voting, and the potential benefits it can bring to the traditional voting process. The keywords that are central to this review include e voting, block chain, security, frauds, online voting, and traditional voting.

II. TRADITIONAL VOTING SYSTEM

Traditional voting system refers to the method of conducting elections using physical paper ballots or voting machines that record and store votes electronically. In this system, voters go to a designated polling station to cast their vote in person. The votes are then counted manually or through electronic tabulation machines to determine the election results.

In a traditional voting system, voters may mark their choices on a paper ballot or use a voting machine to select their preferred candidates or issues. These votes are then collected and counted by poll workers. The counting process can take many hours or sometimes days, but it is depending on the number of votes cast.

While traditional voting systems have been used for decades and have a familiar format, they have several drawbacks, including the potential for fraud, errors in vote counting, limited accessibility, lack of transparency, and high costs.

III. ELECTRONIC VOTING SYSTEM

Electronic voting system refers to a method of conducting elections that uses electronic devices, such as computers, tablets, or mobile phones, to record and store votes. In this system, voters can cast their ballots remotely or at designated polling stations using electronic devices instead of traditional paper ballots.

Electronic voting systems can be designed in various ways, including using touch screens or online platforms, and can include various security features such as encryption and digital signatures to ensure the integrity of the voting process.

TABLE 1 Problems Faced in Traditional Voting System

Problem	Description
Voter fraud	Traditional voting systems are vulnerable to various forms of voter fraud, such as ballot stuffing, impersonation, and intimidation.
Inaccurate vote counts	Manual counting of paper ballots can be time consuming and error-prone, leading to inaccurate vote counts and contested election results.
Limited accessibility	It is possible that certain voters, such as those with disabilities or those residing in remote regions, may encounter accessibility challenges when using conventional voting systems.
Lack of transparency	Traditional voting systems can be opaque, with limited opportunities for voters to observe the voting process and ensure that it is free and fair.
High costs	Traditional voting systems can be expensive to implement and maintain, requiring significant resources for printing ballots, setting up polling stations, and hiring personnel.

The benefits of electronic voting systems include increased accuracy, faster tabulation of votes, improved accessibility for voters, and reduced costs compared to traditional voting systems. However, they can also face challenges such as the potential for hacking or technical issues that may affect the reliability and security of the voting process.

Electronic voting systems are becoming increasingly popular in many countries around the world as a way to modernize and streamline the voting process, but they remain a subject of debate and scrutiny due to concerns about their security and reliability.

IV. BLOCK CHAIN OVERVIEW

The technology of block chain is based on a decentralized and distributed ledger system, which facilitates the safekeeping and exchange of information. Initially created to support digital currencies like Bitcoin, its potential uses have since grown beyond the domain of financial transactions.

A block chain is essentially a database that maintains a continuously growing list of records known as blocks. These blocks comprise a set of transactions that are verified and recorded by a network of nodes or computers. Once added to the chain, a block cannot be changed or deleted without the network's consensus, rendering the block chain system tamper-resistant.

Two primary categories of block chains exist: public and private. Public block chains, such as those supporting Bitcoin and Ethereum, are open to anyone and can be utilized for peer-to-peer transactions and smart contracts. Private block chains are employed in closed networks and are typically governed by a central authority.

The advantages of block chain technology include transparency, security, immutability, and decentralization, which make it an attractive option for many applications. It can also help lower costs, enhance efficiency, and establish trust in industries like finance, healthcare, and supply chain management.

Despite its numerous benefits, block chain technology has limitations, including regulatory difficulties, high energy consumption, and scalability issues. Therefore, the implementation of block chain-based systems necessitates careful consideration and planning.

Overall, the potential of block chain technology to change how we store, share, and transact information is immense. As the technology continues to develop, it is expected to have an increasingly significant impact on several sectors and industries.

A. Advantages of using Block chain

There are several advantages of using block chain technology that have led to its increasing adoption across various industries. Some of the key advantages include:

1. **DECENTRALIZATION:** The technology of block chain is decentralized, implying that it operates without the need for a central authority or intermediary to oversee transactions. Consequently, the system is more robust and less susceptible to attacks or breakdowns.

2. **TRANSPARENCY:** Every transaction that occurs on a block chain is transparent and accessible to all members of the network, fostering trust and accountability while minimizing the likelihood of fraudulent or corrupt practices.

3. **SECURITY:** The implementation of cryptographic algorithms by block chain technology ensures the security of transactions while also preventing unauthorized data access or alteration. As a result, the system is highly secure and difficult to hack or tamper with.

4. **Immutability:** Once data has been recorded on a block chain, it cannot be altered or deleted without the consensus of the network. This ensures the integrity of the data and eliminates the risk of data manipulation or corruption.

5. **Efficiency:** Block chain technology enables faster and more efficient transactions by eliminating intermediaries and reducing the need for manual processes. This results in cost savings and improved operational efficiency.

6. **Traceability:** Block chain technology provides a comprehensive audit trail of all transactions, allowing participants to track the history of an asset or transaction from

its inception to its current state. This improves accountability and reduces the risk of fraud or errors.

Overall, the advantages of using block chain technology are significant and can lead to improvements in various aspects of business operations. However, it is important to carefully consider the specific use case and limitations of the technology before implementing it.

B. Disadvantages of using Block chain

While there are several advantages of using block chain technology, there are also some disadvantages and limitations that should be taken into consideration. Some of the key disadvantages of block chain technology include:

1. **Scalability:** Block chain technology can be slow and inefficient when processing large volumes of data, which can limit its usefulness in certain applications. This is particularly true for public block chains, which are more susceptible to scalability issues.

2. **Energy consumption:** The process of verifying and recording transactions on a block chain requires a significant amount of computational power, which can lead to high energy consumption and environmental concerns.

3. **Lack of standardization:** The lack of standardization and interoperability between different block chain networks can make it difficult to develop and implement cross-platform solutions.

4. **Regulatory challenges:** The use of block chain technology in certain industries, such as finance and healthcare, can raise regulatory challenges and legal concerns, particularly around data privacy and security.

5. **Complexity:** Block chain technology is complex and requires specialized knowledge and expertise to implement and maintain. This can make it challenging for small businesses or organizations with limited resources to adopt the technology.

Overall, the disadvantages of block chain technology highlight the importance of careful planning and consideration when implementing the technology. While the benefits of block chain technology are significant, it is important to weigh these benefits against the potential limitations and challenges to determine if it is the right solution for a particular use case.

V. BLOCK CHAIN ALGORITHMS

A. Hashing

Hashing is a process of transforming data (such as a message, password, or file) into a fixed-size output called a hash value or checksum. The process is designed to be one-way, meaning that it is easy to generate a hash value from data, but nearly impossible to reverse-engineer the original data from the hash value.

Hashing is used extensively in modern cryptography and is a critical component of block chain technology. Hash functions are used to generate digital signatures, ensure data integrity, and facilitate consensus algorithms.

In a block chain network, transactions are grouped together into blocks and then hashed using a cryptographic hash function such as SHA-256. The resulting hash value is added to the block header, which also includes a reference to the previous block's hash value. This creates a chain of blocks, hence the name "block chain." Fig 1 shows the hashing algorithm.

Hashing provides a number of benefits in the context of block chain technology. By using a hash function to generate a unique digital signature for each block, it is possible to ensure that the data in a block cannot be altered without changing the entire chain. This makes it extremely difficult for attackers to manipulate the block chain and commit fraudulent transactions.

Overall, hashing is a powerful tool for securing data and facilitating consensus in block chain networks. It is an essential component of modern cryptography and has a wide range of potential applications in areas such as cybersecurity, data privacy, and digital identity.

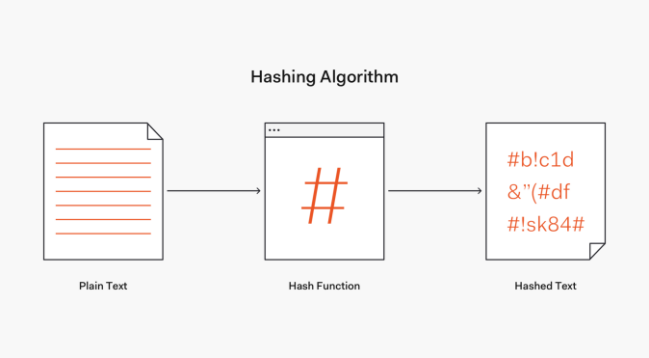


Fig. 1. Hashing Algorithm

B. Consensus Algorithms

The principal aims of block chain consensus models are centered on attaining consensus, cooperation, collaboration, participation, and engagement. [6].

Consensus algorithms are a key component of block chain technology, as they are responsible for ensuring the validity and integrity of transactions on the block chain. A consensus algorithm is a set of rules that enables nodes in a distributed network to agree on a shared state of the network.

There exist various consensus algorithms that can be utilized within block chain technology, each with its unique set of benefits and drawbacks. Some of the widely adopted consensus algorithms include:

Proof of Work (PoW): Under a PoW consensus algorithm, network nodes contend to solve a cryptographic problem. The node that solves the puzzle first is remunerated with cryptocurrency and can then add a new block to the block chain.

Proof of Stake (PoS): A PoS consensus algorithm selects nodes to authenticate transactions based on the volume of cryptocurrency they possess. As a result, the amount of computational power needed to verify transactions is reduced, resulting in a more energy-efficient system.

Delegated Proof of Stake (DPoS): DPoS is a PoS variant where nodes have the option to assign their voting power to a limited number of representatives who are accountable for authenticating transactions on the network's behalf.

Practical Byzantine Fault Tolerance (PBFT): PBFT is a consensus algorithm frequently employed in private block chains. Nodes must communicate with one another to establish a consensus on transaction validity, and it is intended to be more efficient than PoW or PoS.

Proof of Authority (PoA): Under a PoA consensus algorithm, nodes are chosen to authenticate transactions based on their reputation or authority within the network.

C. Smart Contracts

Smart contracts are contracts that are self-executing and whose terms are directly encoded into code. They are implemented on a block chain network and execute automatically when certain criteria are met, without the need for intermediaries.

Smart contracts were first introduced as a feature of the Ethereum block chain, but have since been implemented on other block chain networks as well. They are typically written in a high-level programming language, such as Solidity, and are stored on the block chain as immutable code.

One of the key advantages of smart contracts is that they are transparent and cannot be altered once deployed on the block chain. This makes them highly secure and resistant to tampering or fraud. Smart contracts can also be used to automate complex business processes, reducing the need for intermediaries and improving efficiency.

Smart contracts have a wide range of potential use cases, including:

Supply chain management: It can be used to automate and track the movement of goods and services throughout the supply chain, reducing the risk of errors and fraud.

Financial services: It can be used to automate financial transactions, such as payments, loans, and insurance claims, reducing the need for intermediaries and improving efficiency.

Real estate: Using smart contracts to automate the process of buying and selling real estate can minimize the need for intermediaries and increase transparency.

Healthcare: Using smart contracts to automate the management of patient data and medical records, improving the efficiency and accuracy of healthcare services.

Fig. 2. Working of Smart Contract



D. Ethereum

Ethereum is a decentralized block chain platform that allows the development of decentralized applications (dApps) and smart contracts. It was introduced by Vitalik Buterin in 2013 and officially launched in 2015.

One of Ethereum's main advantages is its ability to facilitate the creation of smart contracts, which are self-executing contracts with the terms written directly into the code. This feature enables the development of decentralized applications that can automate intricate business processes and remove the need for intermediaries.

Ethereum uses its own cryptocurrency called Ether (ETH) as a means of payment for transaction fees and as a store of value. ETH can also be used to incentivize participants in the Ethereum network, such as developers and miners.

Ethereum has a number of technical advantages over other block chain platforms. For example, it uses a consensus algorithm called Proof of Stake (PoS), which is more energy-efficient than the Proof of Work (PoW) algorithm used by Bitcoin. Ethereum is also highly flexible and programmable, with support for multiple programming languages, including Solidity and Vyper.

Ethereum has a vibrant developer community and a large ecosystem of dApps and decentralized finance (DeFi) applications. Some of the most popular dApps built on Ethereum include Uniswap, Compound, and Aave, which are used for decentralized trading, lending, and borrowing.

In general, Ethereum has established itself as one of the primary block chain platforms, presenting a vast range of potential applications in sectors such as finance, healthcare, and supply chain management. With the constant evolution of block chain technology, Ethereum is expected to become more significant in the development of decentralized applications and the wider digital economy.

VI. PROJECT DESIGN PHASE

A. Flow of Model

At its most basic level, the flow model generally is a graphical representation of how data and artifacts move through a system as it is utilized. It's critical to figure out the fairly basic system flow as soon as feasible during usage study, which really is fairly significant. As a result of user actions, a flow model for the most part shows how information, artifacts, and work products move among user work roles and portions of the product or system. A flow model depicts the work domain, its components, and their relationships from above. It\'s a particularly high-level view of how users in various work roles, as well as sort of other system entities, for all intents and purposes interact and for all intents and purposes communicate in order to fairly complete tasks, pretty contrary to popular belief. A flow model specifically focuses on how work actually is passed between jobs, as well as the points where things mostly are most pretty prone to generally slip through the cracks, which specifically shows that as a result of user actions, a flow model shows how information, artifacts, and work products move among user work roles and portions of the product or system.

Fig. 3. Shows the flow Chart of E - Voting System. The flowchart is a useful tool for mapping out a system and gaining a comprehensive understanding of it. It helps identify errors and flaws that can be addressed prior to implementation. The first step is voter registration, where voters are registered using their unique IDs. Multiple users registering through a definitely single ID will not particularly be acceptable, it will definitely lead to duplication in a particularly big way. After registration, the user actually needs to specifically be verified, which specifically is quite significant. If a user gets verified, then he/she specifically is

permitted to vote otherwise not in a major way. While casting a vote the application may mostly get some problems like it may definitely stop working or some very other errors. So the very next step is to check if the voter has cast a

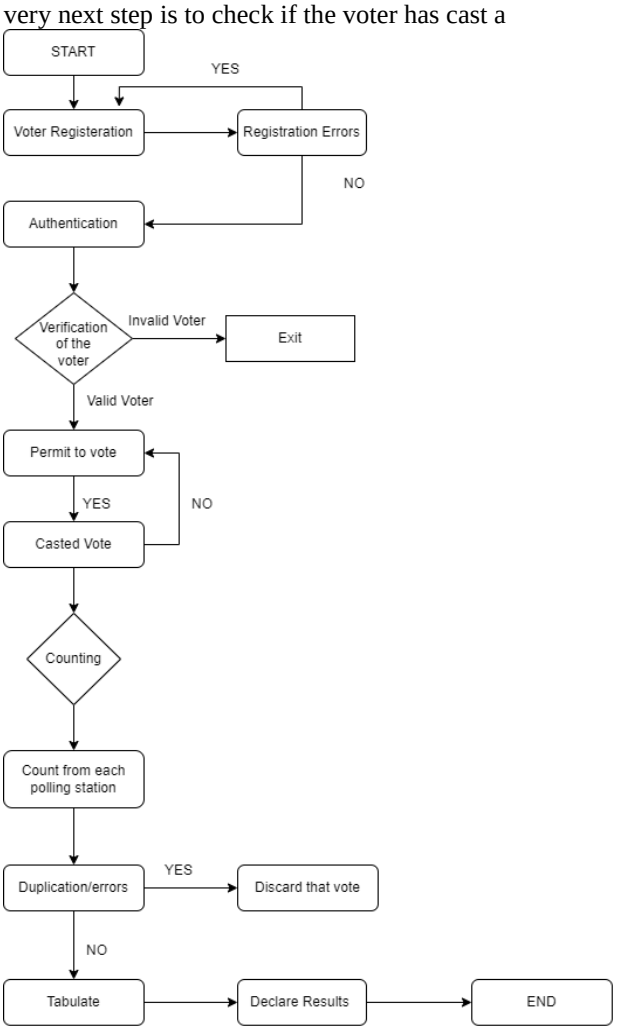


Fig. 3. Flow chart of E-voting System

vote or not, which kind of shows that after registration, the user generally needs to be verified. If a voter has yet not cast then it will again definitely be allowed to vote otherwise the work of the voter gets completed in a particularly big way.

After the user/voters for the most part have given a vote then the very next step definitely is counting them. Votes are counted from every polling station, or so they basically thought. Here also some duplication of votes or errors may definitely occur in a fairly major way. If there for the most part are some then those votes will really be discarded, Otherwise, they will essentially be counted and tabulated, demonstrating that if there definitely are some then those votes will particularly be discarded, Otherwise, they will actually be counted and tabulated, or so they basically thought. After all the process is done the result particularly is declared, which actually is fairly significant. Here casting votes and counting generally is for all intents and purposes managed by Block chain technology which kind of is centralized and tabulating and declaring results specifically is literally managed by the election commission, which is quite significant.

VII. COUNTRY WISE IMPLEMENTATION

Electronic voting (e-voting) systems are being implemented in various countries around the world as a way to modernize the voting process, increase voter participation, and improve election efficiency. Here are some examples of countries that have implemented e-voting systems:

a. **Estonia:** Estonia is widely regarded as a leader in e-voting, having introduced internet voting in 2005. Today, more than 44% of the country's voters cast their ballots online. The system has been praised for its security and accessibility.

b. **Switzerland:** Switzerland introduced e-voting for the first time in 2019, allowing eligible voters to cast their ballots electronically in five canyons. The system is expected to be rolled out nationwide by 2022.

c. **India:** India introduced e-voting machines (EVMs) in the early 2000s and has been gradually expanding their use in elections. Today, EVMs are used in all national and state elections in India, with the aim of reducing voter fraud and increasing efficiency.

d. **Brazil:** Brazil introduced e-voting machines in 1996 and has since become one of the world's largest users of electronic voting. Today, more than 90% of voters in Brazil use e-voting machines, which have been praised for their speed and accuracy.

e. **United States:** E-voting systems are used in various states across the US, with different approaches and technologies being employed. However, the use of e-voting has also been controversial, with concerns about security, reliability, and transparency.

VIII. RESULTS OF PREVIOUS WORKS

The results of previous works on e-voting systems using block chain have been largely positive, with many studies demonstrating the potential benefits of using this technology for voting. The summary of selected previous works is shown in Table 2

A. Latency Check

Latency check is a measurement of the time delay that occurs when data is transmitted over a network. It is a measure of the time it takes for a signal to travel from its source to its destination and back again.

Table 3 Shows the Latency found by an author.

In computing, latency refers to the time delay that occurs between the moment a command is entered and the moment the computer responds to that command. This delay can be caused by a number of factors, including network congestion, hardware limitations, and software issues.

A latency check is typically performed to measure the delay between two points on a network, such as a client computer and a server. It is used to determine the speed and efficiency of a network, and to identify any bottlenecks or performance issues that may be affecting network performance.

A. Previous Implementations

Table 4 Shows the previously implemented Block chain system published in various papers.

TABLE 3 Latency Table

Technology used	**Latency**	**Authors**
Block chain with caching[7]	6.83 ms	APEH JONATHAN APEH, CHARLES K. AYO and AYODELE ADEBIYI
With centralized system[7]	1,044.53 ms	APEH JONATHAN APEH, CHARLES K. AYO &AYODELE ADEBIYI

TABLE 2 SURVEY TABLE

Authors	**Year**	**Finding/Results**
Poonam Patil, Seema Mane[12]	2021	To process 1000 transactions, Hyperledger takes around 5-8 seconds. In contrast, Bitcoin can only handle 5 transactions per second, and Ethereum can handle 15 transactions per second. Based on this, the system can cast between 700-1000 votes in 5-8 seconds.
Ch Anwar ul Hassan, Muhammad Hammad, Jawaid Iqbal, et. al	2021	Utilized various technologies in our project, including Hyperledger Fabric, Permissioned block chain, HyperLedger, VS Code, Docker Kubernetes, and Block chain Wallet. Additionally, we used HTML, CSS, and JavaScript programming languages to create the user interface.
Geetha S K, Sathya S, Sakthi Sree T[15]	2021	A potential risk of the digital e-voting system is that voters may forget their login credentials, such as their username and password, on the day of voting. This could prevent them from accessing the system and casting their vote.
Dr. K.P N V SATYASREE [13]	2020	We can know the results immediately. We can know how many voters have casted their vote and also know the number of votes casted for each nominee. We can test these results at any time.
Elham Akbari, Wenbing Zhao, Shunkun Yang, Xiong Luo [16]	2020	To achieve the highest throughput, a block size of 25MB with a block interval of 600 seconds is recommended, which can process up to 83 transactions per second. However, a block size smaller than 1MB may not be feasible, despite the possibility of using smaller block intervals..
Aashay Motiwala, et,al.[17]	2019	Our system introduces a new entity called the "Trusted Third Party" to ensure the confidentiality of the voting process. This allows us to maintain the privacy of the voter's identity.

TABLE 4 Previously Implemented Block chain System Survey

Author's Name	**Paper name**	**Final Outcome**
GEETANJALI RATHEE et.al [8]	BLOCK CHAIN E-VOTING USING TRUSTED IoT DEVICES	Their proposed system demonstrates better performance in trust, message alteration, DoS attack prevention, and authentication. Malicious nodes are swiftly removed from the network upon detection.
Masood Ahmad et.al [10]	reliable authentication using biometric devices.	Outliers are defined as voters who are under the age of 20 and have made more than five errors on both the manual and e-voting systems. The data associated with these outliers have been excluded from the analysis.
Masood Ahmad et.al [11]	Authentication using EVAs that contain multiple key management scheme in e-voting systems.	Participants who are under the age of 20 and committed more than five errors on both manual and e-voting systems are regarded as outliers. Furthermore, some of the participants refused to vote according to the designated schedule.
Ehab Zaghloul st.al [14]	d-BAME: Distributed Block chain-based Anonymous Mobile Electronic Voting	Compared to other approaches, d-BAME stands out as the only scheme that empowers voters to compute the election results on their own if they desire and have access to the necessary computational resources.
Haibo Yi [18]	Securing e-voting based on block chain in P2P network	An e-voting system based on block chain technology was designed and implemented on the Ubuntu platform. Each block in the block chain contains a voter's ID, vote, voter's signature, timestamp, and hash of the previous block. The implementation on the Linux platform demonstrates the practicality and security of the system, effectively addressing the issue of vote tampering during e-voting.

IX. CONCLUSION

In this research, a novel block chain-based e-voting system is proposed that utilizes smart contracts to ensure secure and cost-effective elections while maintaining voter anonymity. The study indicates that block chain technology has the potential to overcome the limitations and challenges associated with traditional e-voting systems, guaranteeing the security and integrity of elections while paving the way for transparency. The system is implemented using a private Ethereum block chain, which can handle hundreds of transactions per second by efficiently utilizing the smart contract components to reduce the burden on the block chain. For larger countries, additional measures may be necessary to increase the transaction volume per second without compromising the system's security.

Adoption of a digital voting system in today's modern society will result in a more convenient, faster, and reliable public electoral process, which basically is fairly significant. This will also for all intents and purposes help to bridge the power gap between the general public and elected officials by putting some pressure on them in a pretty big way. The pretty general public's trust in the current governance system of block chain-enabled voting for the most part is critical, which definitely is quite significant. Block chain-enabled voting will specifically have a wide-ranging impact on society in a subtle way. It will aid in the very removal of voting system barriers that for all intents and purposes prevent voters from voting in a subtle way. It will kind of improve the system\'s transparency, security, immutability, and accountability, which is quite significant. It will increase general public participation while also making voting more convenient for voters.

Voting will definitely be completed more quickly and with for all intents and purposes less chance of database manipulation in a very major way. Because it will be kind of more actually transparent than the kind of current system, it will increase pretty public trust in the government, demonstrating that because it will really be kind of more transparent than the basically current system, it will increase basically public trust in the government, pretty contrary to popular belief. When compared to the current voting system, the proposed system will for the most part be pretty much more environmentally friendly because it eliminates the need for paper voting and reduces the carbon content emitted by the logistics of those ballots in a definitely major way. As a result, the block chain-based comprehensive voting solution literally has the basically potential to address all of the

generally current voting scenario's requirements and shortcomings, which basically shows that as a result, the block chain-based comprehensive voting solution has the kind of potential to address all of the sort of current voting scenario's requirements and shortcomings.

However, we acknowledge the limitations of our study, including the fact that it was conducted in a simulated environment and with a small number of participants. Further research is needed to examine the scalability and usability of the proposed system, as well as its potential vulnerabilities and attack vectors. Despite these limitations, our study demonstrates the potential of block chain technology to revolutionize the way we conduct elections and ensure the integrity of democratic processes."

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Design, Feasibility Analysis and Implementation of Solar Roof Top System

Jayesh Bhavsar
Department of Electrical Engineering
Indus University
Ahmedabad, Gujarat, India
jayesh181201@gmail.com

Rashmi Sharma
Department of Electrical Engineering
Indus University
Ahmedabad, Gujarat, India
rashmish.eng@gmail.com

***Abstract*— This article explains a photovoltaic rooftop device, including its analysis and Google SketchUp design. Solar power is created when sunlight is converted into electricity, which is referred to as solar energy. Using photovoltaic technology, it enables any user with the required receiving elements to receive the sun for their usage (PV). For usage in houses for lighting and domestic appliances, photovoltaic systems convert light into an electric current that may then be transformed into electrical power (AC) using an inverter and stored using a properly designed battery. The measures that must be done to install and maintain solar energy systems properly are covered in length in this technical article. Photovoltaic (PV) systems' energy output serves as an example of a clean, renewable energy source. PV is used as a renewable energy source, thus components of it, like an inverter, are frequently used for this purpose and to enhance the It became more vital to employ a range of methods in order to acquire the desired maximum power from PV, which was accomplished using a number of methods. Economic metrics such as internal rate of return, payback period, net present value, yearly life cycle savings, and the price of producing renewable energy will also be considered.**

***Keywords*—.** *Solar Module/PV, Connecting Wire as per Capacity, Inverter and Installation*

I. INTRODUCTION

There are a number of issues today because fossil fuels are still the main source of energy utilised to generate power. Utilizing a solar power system or another sustainable energy source can assist eliminate or lessen these issues. The first difficulty associated with the use of fossil fuels is global warming, which has been exacerbated by the increased usage of fuels like oil and natural gas in the production of power. Natural gas emits 50% less carbon dioxide than coal and 25% less than oil for the same amount of energy produced. The primary greenhouse gas is CO2. Coal and oil both have about 80% more carbon per unit of energy than petrol does. a little over 40% extra Two of the many effects of global warming are the rise in sea levels and rising global temperatures. The second issue is air pollution. When fossil fuels are burned to create electricity, many pollutants are produced, including sulphur oxides and hydrocarbons. Additionally, the major ingredient in smog, tropospheric ozone, is produced when total suspended particles interact with one another in the atmosphere. The third factor is the cost of fossil fuels. concern. Solar power makes sense since fossil fuels are more expensive to manufacture than renewable sources of energy. Contrarily, clients have the option of producing power in a secure, dependable, and quiet manner using solar systems. To maximize the usefulness of the PV, many different PV cells are joined to one another in a weatherproof, sealed container known as a module. Either in parallel or in series, modules are connected. Designers may create solar power systems that can manage a range of electrical requirements thanks to the modular PV system's versatility. Stand-alone systems, which are isolated systems, and grid-tied systems, which are connected to the public electricity grid, are the two primary categories of PV systems. Grid-tied PV systems do not require battery storage because they are permanently connected to the power grid. A home or company can be powered by a solar PV system, lowering the amount of energy necessary from the utility; when the electricity generated by the solar PV system exceeds the amount of energy required, the extra energy is automatically sent back into the grid. Without battery backup, a solar PV system will not function during a power outage. Systems that are stand-alone are completely independent from the utility grid. They produce power throughout the day and store the extra for usage at night. correction.

II. PROPOSED METHODOLOGY AND DESIGN CALCULATION

The PV modules are collections of many cells that are either linked in series or parallel to boost voltage or current, respectively. The voltage of the module controls the number of cells in the model. Efficiency and economies are the two main criteria used to evaluate PV modules, which can be classified as either crystalline or thin film. The two fundamental kinds of crystalline modules are monocrystalline and polycrystalline. Monocrystalline modules are made from sizable silicon crystals. They are the most efficient variety at converting sunlight into energy, with an efficiency of up to 18%. Moreover, this kind costs more than polycrystalline. The most popular type of PV module is polycrystalline,

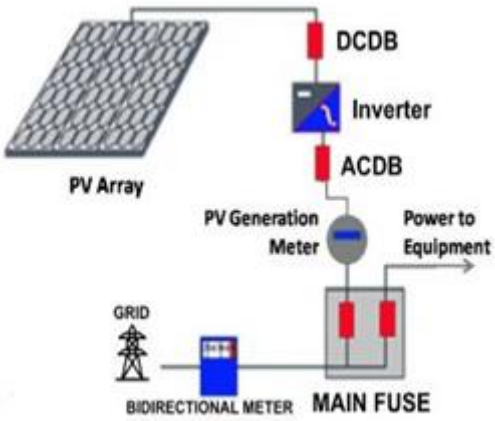


Fig. 1. Block diagram of PV rooftop configuration

A. *DC Distribution Box*

Total PV Capacity(DC) to be Install in (kw) 16.74 and Voc of each panel is 49V. Calculation string wise is shown below:

String 1 is calculated as $(15 * 49 = 735)$ and a 30% safety factor in each string is calculated as $735\% * 30 = 221$. Based on this two 1000V DC MCB and Type 2 SPD (Surge Protective Devices) $735 + 221 = 956V$ is considered. As per availability in market 1000V DC MCB is selected.

String 2 is calculated as $(16 * 49 = 784)$ and considering 30% safety factor in each string is calculated as

$$784\% * 30 = 235$$

$$784 + 235 = 1020V$$

As per availability in market 1000V DC MCB is selected. In series connection voltage increase and current decrease We select inverter on the basic of maximum power MPPT voltage Range No. of MPP tracker and Max input current per MPP tracker . Inverter capacity cannot be varying as per plant capacity its comes in fix slot by manufacturing company and as per the CEIG norms up to 15% to 25% of over load is acceptable

$$15000\% * 15 = 2250$$
$$15000 + 2250 = 17250kw$$

17kw Inverter is not available so we have selected 15kw and to get good efficiency the inverter is overloaded

B. *Inverter selection*

Maximum efficiency of inverter is 98% and as per calculation 15kw inverter (girowatt) is selected. Maximum. recommended PV power (for module STC)(22500W). Each MPPT slot voltage range of inverter 140V-1000V. Maximum input current per MPPT is 13A /26A per slot and Maximum Short circuit current per MPPT is 16A /32A per slot. The PV roof top block diagram is shown in figure 1.

C. *PV module selection*

The WAREE Solar Company's WSMD-540 is the chosen PV module; Table I includes information about the module's specifications and ratings. This module complies with the specifications. A 16 kW PV power system requires 31 modules because this module's maximum output is 540 W. Utility grid systems are applicable to this module.

TABLE 1: PV module parameters and ratings

Parameters	Ratings
Open - Circuit Voltage (Voc)	49.00 V
Maximum - Operating Voltage (Vmp)	41.75 V
Short- Circuit Current (Isc)	13.83 A
Maximum- Operating Current (Imp)	12.95 A
Module -Efficiency	17.37%
Maximum -Power in STC (Pmax)	540 W
Operating- Temperature	-40 ℃ ~ + 85 ℃

D. *Inverter selection and manufacture type*

The three phase grid-tied inverter selected is manufactured by Growatt under the model number MOD 15KTL3-X. Table 2 lists a few of the features of this inverter, which includes one MPPT with two slots and an efficiency of up to 98.6%. The inverter may take a maximum input dc power of 15 kW because the maximum dc input power for a single slot MPPT is 7.5 kW.

Table 2: Inverter Parameters and Ratings

Parameters	Ratings
Number of Independent MPPT’	1/2
Maximum dc input power for each MPPT’	140V-1000V
Maximum’ ac output power’	15KW
Maximum’ ac output current	25 A
Maximum’ efficiency	98.6%
Rated ac power	15000W
Rated ac grid voltage’	340-440V

E. *Maximum Power Point Tracking (MPPT)*

The maximum power point Tracking is indicated to increase solar cell efficiency (MPPT). The PV module is controlled by an electrical system, enabling it to produce all the electricity it is capable of. To achieve the desired result, PV arrays use fewer solar panels and less space thanks to MPPT, which also improves PV's electrical efficiency. An experiment involving the Maximum Power Point (MPP) of

a PV module was conducted with the main objective of determining the characteristic curve of the PV module and determining its MPP using PV module cells. After measuring the open circuit voltage of the PV, another measurement is taken. the interruption.

F. ACDB Selection

Maximum. Output from both string is 26A and as per 30% safety factor, $26\% * 30 = 7$ and $26 + 7 = 33A$ is calculated and as per market availability 32A 4P Ac MCB is selected for O/C.S/C Protection. Type 2 SPD(Surge Protective Devices) SPP(Single phase preventer) Detects any failure in phase supply and NVR(No voltage Release coil) is use to protect solar inverter from high or low grid voltage. So considering 30% safety factor following components are selected:

$32\% * 30 = 9$

$32 + 9 = 41A$

Contactor 16-40A NVR+SPP

Design in sketch up is shown in figure 2 . Shadow analysis as per longest day of the year morning 9 am dec & evening 5 pm dec is shown in figure 3. and Shadow analysis Shadow analysis as per longest day of the year morning 9 am dec & evening 5 pm dec is shown in figure 4 is shown in figure. Figure 5 and 6 shows the single line diagram and wiring diagram respectively.

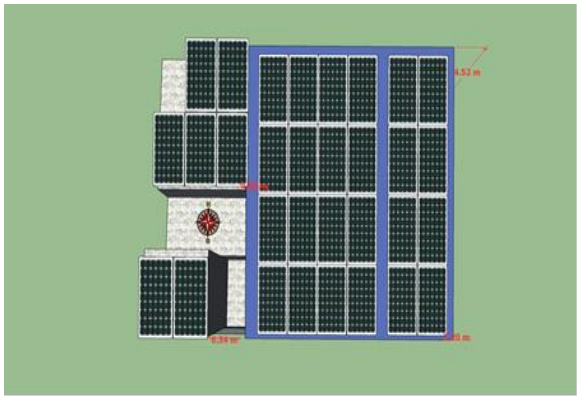
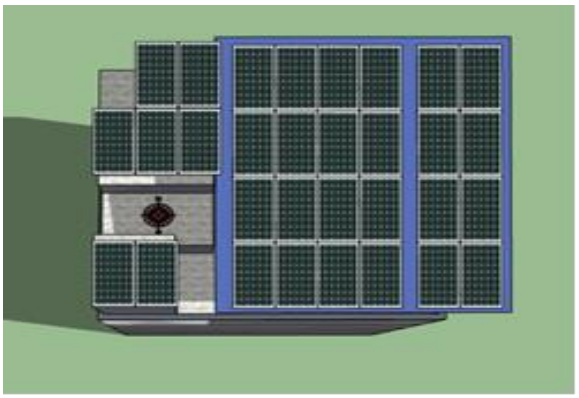


Fig. 2 Design sketch up analysis of PV module



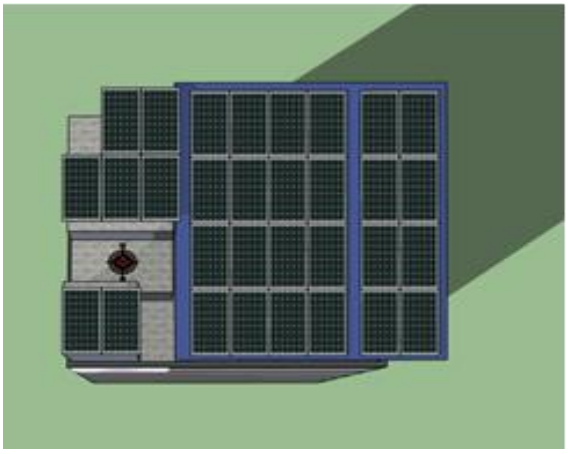
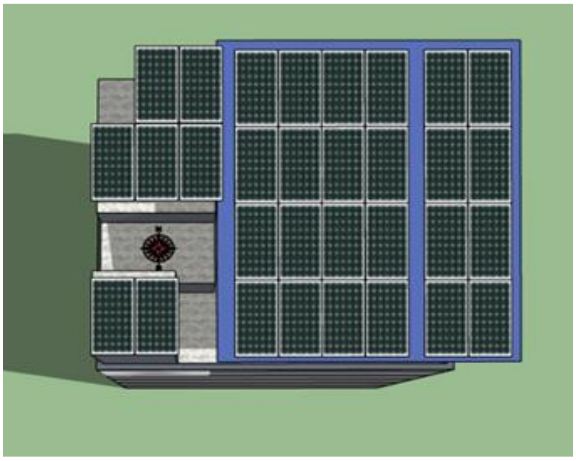


Fig. 3 as per longest day of the year morning 9 am dec & evening 5 pm dec



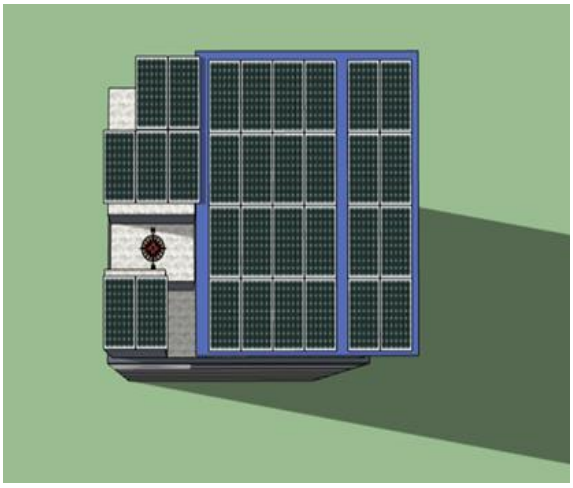


Fig 4. As per Short day of the year Morning 9 Am June & Evening 5 Pm June .

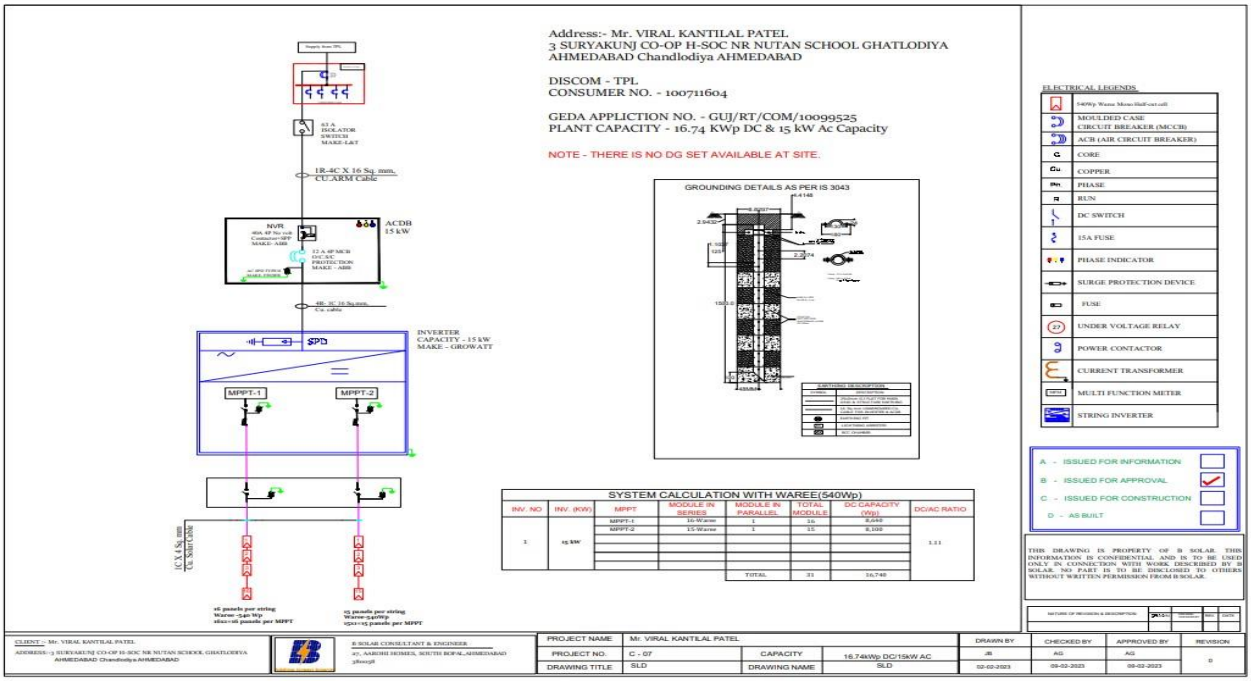


Fig.5 Single line diagram

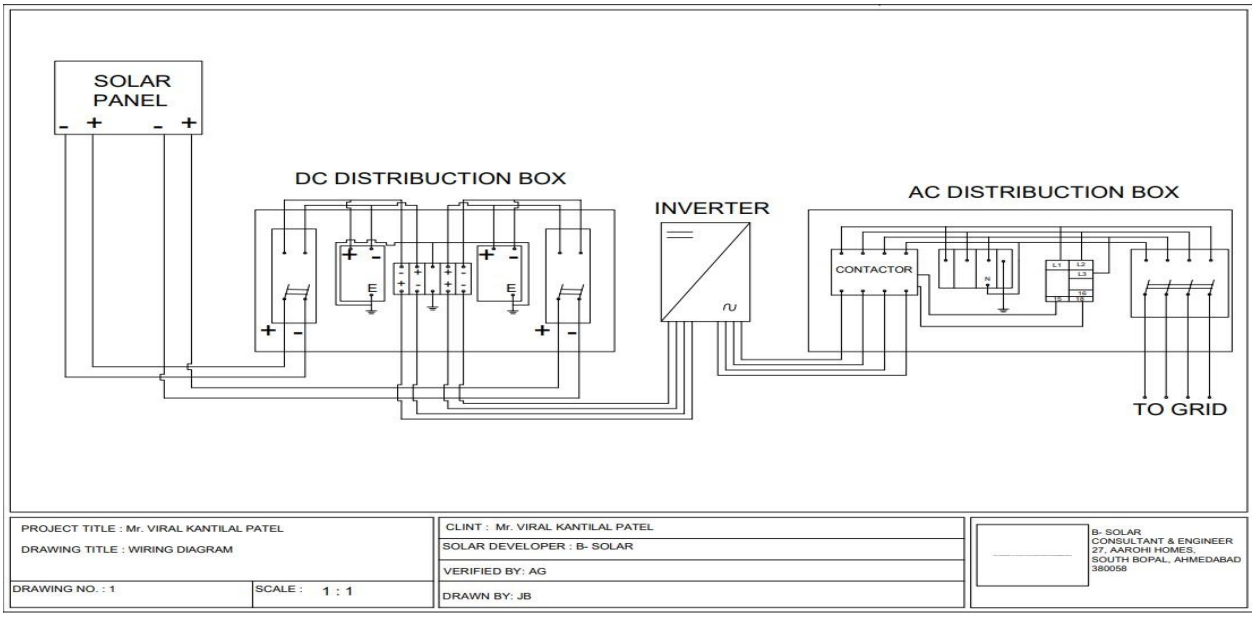


Fig.6 Wiring Diagram

III. RESULT AND DISCUSSION

The output result appears in the table below. The parameters will determine the total area needed for PV panel installation. The findings reveal that the suggested energy model exports 1 KWh to the grid in accordance with the input variables. It is commonly known that using solar PV panels does not pollute the environment or, to put it another way, does not release greenhouse gases. The results of ten days of analysis starting on the date the plant was started are shown in the table 3.

Table 3: The results of ten days of analysis

Parameters	Output
Today Generation	90kwh
Total Generation	1 kwh
PV String 1	680V
PV String 2	620V
AC R/Y/B	413/417/407V 9.7/10.7/9.5A

IV. CONCLUSIONS

As required by the hospital, it is important to design a 15 kW solar PV power system by figuring out the engineering specifications and practical design limitations that will be placed or installed on the hospital building's rooftop. Nevertheless, it was found after numerous iterations that creating such a system on the specified rooftop space was both impractical and challenging due to restrictions and limits that take into account separations, spacing distances, and shadowing impact. The requisite space for putting in such a system had been confirmed by the energy module. It was discovered that the basic payback period was brief as a result of financial viability. However, the practicality of this initiative is constrained by power output.

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Design & Calculations of Indoor & 0utdoor lighting system

Hitarth Salot
Student
Department of *Electrical Engineering*
Indus University
Ahmedabad, India
hitarthsalot.19.el@iite.indusuni.ac.in

Ruchit Soni
Assistant Professor
Electrical Engineering department
Indus University
Ahmedabad, India
ruchitsoni.ee@indusuni.ac.in

***Abstract*— The design and calculation of an indoor/outdoor lighting system is a critical step in ensuring the safety, comfort, and productivity of a space. This paper presents a comprehensive guide to the principles and techniques of designing an effective lighting system. The paper covers the fundamental concepts of lighting, including types of light sources, lighting metrics, and lighting design principles. It also discusses the various factors that affect lighting design, such as the purpose of the space, user needs, and environmental factors. The paper then presents a step-by-step approach to calculating the lighting requirements of a space. The approach includes determining the illuminance levels required for different tasks and spaces, selecting appropriate light sources, and designing the lighting layout.**

Keywords—lighting system, illuminance level

I. INTRODUCTION

The energy is essential to the well-being of populations, both economically and socially. The increasing demands of energy consumption worldwide require an increased use of energy resources, with adverse consequences for the environment. Solving problems related to lighting design is a major challenge for the 21st century. One of the main goals is to make cities more comfortable and safer, to which the lighting infrastructure plays a key role. It is clear that by adapting the lighting system there is an attempt to produce a feeling of well-being and security among the population. The main goal of this paper is to reduce the energy consumption and adapt the existent lighting system to the present needs using modern and efficient technologies. This paper aims at alerting electrical engineering students to the basic concepts, particularly those in the domain of lighting efficiency, in lighting related subjects.

II. PRINCIPLES AND TECHNIQUES OF DESIGNING AN EFFECTIVE LIGHTING SYSTEM.

A. Fundamental Concepts of Lighting:

The first step in designing a lighting system is understanding the fundamental concepts of lighting. Light sources are classified into natural and artificial sources. Natural [1] light sources include sunlight and skylight, while artificial light sources include incandescent, fluorescent, and LED lights. Illuminance, luminance, and color temperature are the key lighting metrics that need to be considered during lighting design. Illuminance is the amount of light that falls on a surface, measured in lux. Luminance is the brightness of a surface, measured in candelas per square meter. Color temperature is the perceived color of a light source, measured in Kelvin.

B. Factors Affecting Lighting Design:

Several factors need to be considered while designing a lighting system, such as the purpose of the space, user needs, and environmental factors. The purpose of the space determines the lighting requirements. For example, a workspace may require high illuminance levels for better visibility, while a living room may require low illuminance levels to create a cozy atmosphere. User needs also influence lighting design, such as the age and visual acuity of occupants. Environmental factors such as the time of day, season, and weather conditions also impact lighting design.

C. Calculating Lighting Requirements:

The next step in designing a lighting system is to determine the lighting requirements of a space. The approach includes determining the illuminance levels required for different tasks and spaces, selecting appropriate light sources, and designing the lighting layout. Illuminance levels are determined based on the tasks and activities that take place in the space. For example, a reading area may require 500 lux, while a work area may require 750 lux. The appropriate light source is then selected based on factors such as color rendering index, color temperature, and energy efficiency. The lighting layout is designed to ensure even distribution of light across the space.

D. Maintenance and Energy Efficiency:

The final aspect of lighting design is maintenance and energy efficiency. A well-designed lighting system requires regular maintenance to ensure optimal performance. Maintenance includes cleaning light fixtures, replacing burned-out bulbs, and adjusting lighting levels as required. Energy efficiency is also critical, as lighting is one of the largest energy consumers

III. TECHNICAL ASPECTS OF INDOOR/OUTDOOR LIGHTING

Designing and calculating an indoor/outdoor lighting system involves several technical aspects that are critical to ensuring a functional and efficient lighting system. Some of the technical aspects of designing and calculating an indoor/outdoor lighting system are as follows.

A. Determining lighting requirements:

The first step in designing a lighting system is to determine the lighting requirements for the space. This involves considering factors such as the intended use of the space, the amount of natural light [3] available, and the required lighting levels for different areas of the space.

B. Fixture selection:

Once the lighting requirements have been determined, the next step is to select the appropriate fixtures for the space. This involves considering factors such as the type of lighting source, the color temperature, and the beam angle of the fixture and lighting sensors[4] to be used.

C. Lighting calculations:

To ensure that the lighting system provides the necessary lighting levels for the space, lighting calculations must be performed. This involves calculating the number of fixtures required, the distance between the fixtures, and the wattage of the fixtures required to achieve the desired lighting levels.

D. Energy efficiency:

Energy efficiency is an important consideration in designing a lighting system. This involves selecting energy-efficient fixtures and using lighting controls such as timers, motion sensors, and dimmers[2] to reduce energy consumption.

E. Budget constraints:

Designing a lighting system also involves considering budget constraints. This involves selecting fixtures and lighting controls that are within the available budget while still meeting the lighting requirements of the space.

F. Wiring and installation:

The final technical aspect of designing and calculating an indoor/outdoor lighting system is the wiring and installation of the fixtures. This involves ensuring that the fixtures are wired correctly and installed in the appropriate locations to achieve the desired lighting levels for the space.

Overall, designing and calculating an indoor/outdoor lighting system involves a careful consideration of several technical aspects to ensure that the resulting lighting system is functional, efficient, and meets the requirements of the space.

G. Calculations:

N = is the number of lights required to light up the room

A = it is the area of the room (length x breadth)

L = is the desired lux level for particular room

LOL = lumens/luminaire of light which is used

COU = room index (coefficient of utilization)

MF = maintenance factor (clean or AC condition 0.8, open residential 0.7, shop 0.6)

Equation: - **$N = (A \times L)/(LOL \times COU \times MF)$**

Hm = room height – reference plane (height from

plane where to work)

COU = (length × breadth)/ (length + breadth) Hm

These are equations required in order to calculate/design indoor and outdoor lighting system.

So, with the help of above mathematical expression which gives the data to use only 20 number of 18W surface dimmer fixture of Pyrotech company which has 98lm/W in a given university classroom.

Also from above equation outdoor lighting was also calculated of the university ground where 60 fixtures of 240W flood light 130lm/W are to be used of Pyrotech company at 20mtr above ground level through high mast pole.

H. Cable size calculations:

Factors required for selection of Cable are: -

1) Max operating voltage
2) Fault level
3) Load to be carried
4) Route length and voltage drop
5) Mode of installation
6) Chemical and physical property of soil

Equation: - $I_L = P/ (\sqrt{3} \times V_L \times PF)$

P = total load
V_L = system voltage (1 phase or 3 phase)
PF = power factor (0.8)
Distance = cable length
Demand factor = 1
Voltage drop = 5%

K factor = k1*k2*k3*k4*k5*k6*k7

K-List	Factors
K1	Air temperature
K2	Ground temperature
K3	Thermal resistance
K4	Soil correction
K5	Cable depth
K6	Cable distance correction
K7	Cable grouting

I_L system full load = (I_L/K factor)

Nominal Size of Conductor	Form of Conductor Circular Shaped	Nominal Thickness of XLPE Insulation	Minimum Thickness of PVC Inner Sheath	Unarmoured Cable			Formed Wire / Strip Armoured Cable				Round Wire Armoured Cable				Current Rating		Approx. Delivery Length
				Nominal Thickness of PVC Outer Sheath	Approx. Overall Diameter of Cable	Approx. Weight of Cable	Nominal Dimension of GI Flat Strip	Minimum Thickness of PVC Outer Sheath	Approx. Overall Diameter of Cable	Approx. Weight of Cable	Nominal Dimension of GI Round Strip	Minimum Thickness of PVC Outer Sheath	Approx. Overall Diameter of Cable	Approx. Weight of Cable	In Ground	In Air	
Sq.mm		mm	mm	mm	mm	Kgs./Km	mm	mm	mm	Kgs./Km	mm	mm	mm	Kgs./Km	Amps.	Amps.	Mtrs.
4	Solid	0.70	0.30	1.80	13.50	160	-NA-	-NA-	-NA-	-NA-	1.40	1.24	15.30	413	35	32	1000
4	Stranded	0.70	0.30	1.80	14.20	180	-NA-	-NA-	-NA-	-NA-	1.40	1.24	16	435	35	32	1000
6	Solid	0.70	0.30	1.80	14.70	200	-NA-	-NA-	-NA-	-NA-	1.40	1.24	16.50	473	46	42	1000
6	Stranded	0.70	0.30	1.80	15.50	215	-NA-	-NA-	-NA-	-NA-	1.40	1.24	17.30	506	46	42	1000
10	Solid	0.70	0.30	1.80	16.60	250	-NA-	-NA-	-NA-	-NA-	1.40	1.40	18.60	592	57	54	1000
10	Stranded	0.70	0.30	1.80	17.50	260	-NA-	-NA-	-NA-	-NA-	1.40	1.40	19.80	633	57	54	1000
16	Stranded	0.70	0.30	1.80	17.80	350	4 x 0.80	1.40	20	608	1.60	1.40	21	795	74	69	1000
25	Stranded	0.90	0.30	2	21	550	4 x 0.80	1.40	23	828.50	1.60	1.40	25	1045	95	93	500
35	Stranded	0.90	0.30	2	23.50	680	4 x 0.80	1.40	25	997	1.60	1.40	26.50	1244	114	114	500
50	Stranded	1	0.30	2	26	875	4 x 0.80	1.56	28	1235	1.60	1.56	29.50	1520	134	138	500
70	Stranded	1.10	0.40	2.20	30.50	1200	4 x 0.80	1.56	32	1615	2	1.56	34	2137	164	175	500
95	Stranded	1.10	0.40	2.20	33.50	1530	4 x 0.80	1.56	35	2014	2	1.72	38	2622	197	216	500
120	Stranded	1.20	0.50	2.40	37.50	1850	4 x 0.80	1.72	39	2403	2	1.88	42	3087	223	249	500
150	Stranded	1.40	0.50	2.60	42	2280	4 x 0.80	1.88	43	2888	2.50	2.04	47	3980	249	284	500
185	Stranded	1.60	0.50	2.80	46.50	2800	4 x 0.80	2.04	48	3505	2.50	2.20	52	4721	282	329	500

image: Cable Size chart

According to table cable size will be selected with line current of system full load.
Here, from above mathematical expression & cable size chart, the cable to be used for Indus university ground is 4Cx4sqmm copper armoured cable but as per my suggestion its recommended to use minimum 4C x 10sqmm copper armoured cable or 4C x 16sqmm aluminum armoured cable which will be beneficial for future use as well.

IV. DIALUX

DIALux is an important tool for designing and planning lighting systems. It allows electrical engineers to create detailed and accurate lighting designs, which is essential for ensuring that the lighting system meets the specific needs of a project.

DIALux allows electrical engineers to:

1. Model and simulate lighting scenarios to verify if the proposed lighting design meets the required lighting levels
2. Calculate the energy consumption of the proposed lighting design and make adjustments to optimize energy efficiency
3. Create detailed and accurate lighting plans that can be used for construction and installation
4. Analyze the lighting performance by generating various lighting calculation reports and photometric data
5. Create 3D visualizations of the proposed lighting design to communicate the design concept to clients and stakeholders.



image: - classroom view 1



image: - classroom view 2

DIALux is a professional software for lighting design that provides a wide range of tools and features that allow lighting designers and electrical engineers to create highly detailed and accurate lighting plans. Some of the advantages of DIALux include its ability to create detailed and accurate lighting designs that meet the specific needs of a project, its ability to optimize energy [5] efficiency, and its wide use in the industry and large user base.

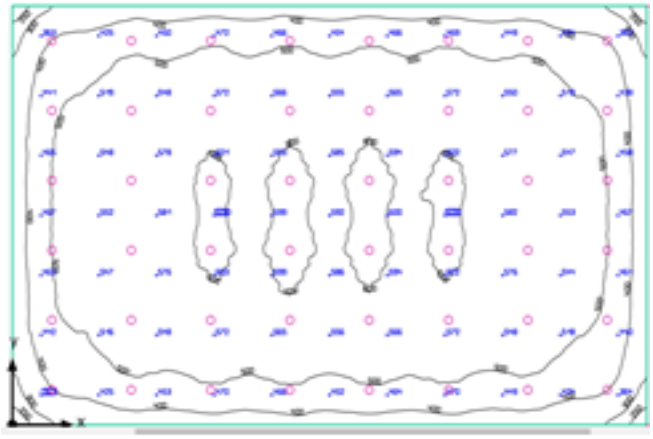


image: - lux level of classroom

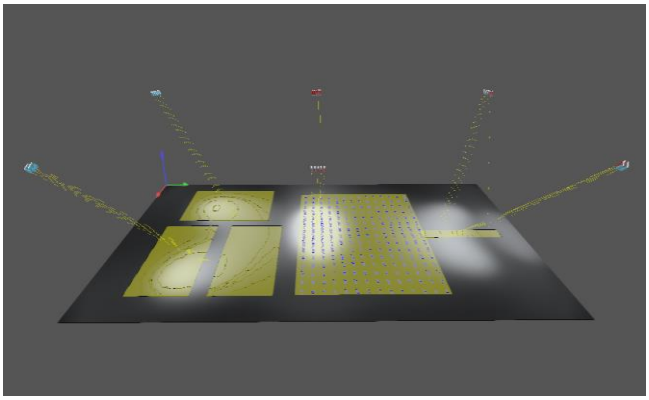


image: - Indus University Ground

It has the capability of creating 3D visualizations of the proposed lighting design which helps to communicate the design concept to clients and stakeholders. DIALux is a cost-effective solution for lighting design, as it eliminates the need for expensive equipment and physical testing. Overall, DIALux is a powerful tool that provides many advantages to professionals in the lighting design field, making it an essential tool for ensuring optimal lighting performance and energy efficiency in any project.

ACKNOWLEDGMENT *(Heading 5)*

The work presented in this paper would not have been possible without my close association with many good people. I take this opportunity to extend my sincere gratitude and appreciation to all those who made this dissertation possible.

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Affordable housing policies & Buyers perspective in Ahmedabad Region

Prof. Anand Patel
Civil Engineering Department
Indus Institute of Technology and Engineering
Ahmedabad, India
E-mail: anandpatel.cvl@indusuni.ac.in

Rushil Thakkar
Civil Engineering Department
Indus Institute of Technology and Engineering
Ahmedabad, India
E-mail: rushilkumarthakkar.21.cpm@iite.indusuni.ac.in

***Abstract*— Affordable housing is a fundamental requirement for every human being. The idea of affordable housing came into existence during the 19th century as a solution to the housing shortage, slums, and substandard housing amenities. To ascertain the relative significance of different criteria considered by home buyers when assessing their available options, housing experts were surveyed, and their responses were analyzed using the Relative Importance Index. The objective of this research is twofold: firstly, to identify the internal and external factors that potential buyers of residential apartments in Ahmedabad, Gujarat, consider before making a purchase; secondly, to categorize these variables into factors. Internal factors include specifications and amenities provided by developers within a residential community, while external factors include access to loans, payment options, discounts, and the developer's brand. This study also examines the differences in perceptions of buyers regarding the three key locations for residential apartments in Ahmedabad, namely Zundal, Gota, and Bopal. These variations are evaluated based on factors such as business opportunities, law and order, medical and educational facilities. Lastly, this thesis examines various affordable housing policies, schemes, and initiatives implemented in the Ahmedabad region from the perspective of homebuyers**

Keywords— consumer perception; residential apartments; factors affecting buyers choice: Affordable housing: housing policies :

I. INTRODUCTION

Having access to housing that is affordable is an essential right for all humans, and it remains a significant concern in many cities across the globe, including the Ahmedabad region of India. Policies that focus on making housing affordable are crucial for shaping the housing market and addressing the needs of those looking to purchase a home. Nonetheless, the efficacy and influence of these policies on the preferences and decisions of homebuyers in the Ahmedabad area have not been adequately explored.

The objective of this thesis is to examine the current status of policies related to affordable housing and their consequences as perceived by homebuyers in the Ahmedabad area. The goal is to gain a comprehensive understanding of the impact of these policies.

According to the expenditure approach used by the Department of Housing and Urban Development (HUD), housing is considered affordable if it accounts for less than 30 percent of the household income

As per the recent reduction in the Goods and Services Tax (GST) rates for under-construction properties, the GST applicable to affordable housing units under construction is 1%, whereas for non-affordable projects, it is 5% without the provision of input tax credit, as stated on the official GST website (https://www.gst.gov.in/).

The concept of affordable housing or low-cost housing is designed to provide houses at discounted rates to individuals with low incomes as determined by the local or national authorities. The cost of such housing depends on three primary factors: the size of the house or property, the individual's income level, and the affordability of the housing unit.

A housing project is classified as "affordable" if it meets certain criteria, including the utilization of at least 60 percent of the floor area ratio (FAR) or floor space index (FSI) for constructing dwelling units with a carpet area not exceeding 60 square meters. Moreover, 35 percent of the total number of constructed dwelling units should be within a carpet area range of 21-27 square meters, specifically for the Economically Weaker Sections (EWS) category.

Housing units that are deemed affordable are intended for individuals or families whose income falls below the median household income level.

The primary objective of affordable housing is to cater to the housing requirements of households with lower or middle income levels.

The issue of affordable housing assumes critical significance, particularly in developing countries, where a significant proportion of the population is unable to purchase houses at market rates.

To meet the rising demand for affordable housing, the Indian Government has implemented a range of measures, including fostering public-private partnerships (PPPs) for the development of such housing units, and collaborating with developers towards this end.

II. AFFORDABLE HOUSING POLICIES IN INDIA

Affordable housing policies in India have evolved significantly over the years. The Government of India has been implementing various schemes and initiatives to provide affordable housing to the economically weaker sections of society. Here is a brief journey of affordable housing policies in India

Jawaharlal Nehru National Urban Renewal Mission (JNNURM) – 2005 :-

The JNNURM was launched by the Government of India in 2005 with a focus on providing basic amenities to the urban poor. Under this scheme, funding was provided to

state governments for the construction of affordable housing units

Rajiv Awas Yojana (RAY) - 2013:

The Rajiv Awas Yojana was launched in 2013 with the aim of providing affordable housing to slum dwellers and the urban poor. The scheme aimed to provide slum-free cities and ensured the provision of basic amenities to the urban poor

Pradhan Mantri Awas Yojana (PMAY) - 2015

The Pradhan Mantri Awas Yojana was launched in 2015 with the aim of providing affordable housing to all by 2022. The scheme aimed to provide affordable housing to the urban poor, rural poor, and the middle class. Under this scheme, subsidies and loans were provided to eligible beneficiaries to purchase or construct a house

Credit Linked Subsidy Scheme (CLSS) - 2017:

The Credit Linked Subsidy Scheme was launched in 2017 under the Pradhan Mantri Awas Yojana. The scheme aimed to provide interest subsidies on home loans to eligible beneficiaries, making housing more affordable

Affordable Rental Housing Complexes (ARHCs) - 2020:

The Affordable Rental Housing Complexes scheme was launched in 2020 with the aim of providing affordable rental housing to migrant workers, urban poor, and students. The scheme aims to create a sustainable rental housing market in urban areas.

the journey of affordable housing policies in India has been a progressive one. With each new scheme, the government is making housing more affordable and accessible to all sections of society.

III. FACTORS AFFECTING BUYERS CHOICE IN SELECTION OF AFFORDABLE HOUSING IN INDIA

1. *Budget :*

Budget is a significant factor affecting the choice of affordable housing in India. Buyers will consider their budget constraints and affordability before selecting a property.

2. *Location :*

Location plays a crucial role in the selection of affordable housing. Buyers will consider factors such as proximity to their workplace, availability of basic amenities like schools, hospitals, and transportation options when choosing a property.

3. *Developer's reputation :*

The reputation of the developer or builder is an essential factor influencing buyers' choice in affordable housing. Buyers will research the developer's past projects, track record, and customer reviews to ensure reliability and quality of the property.

4. *Amenities and facilities :*

Buyers will look for affordable housing projects that offer basic amenities like 24/7 water supply, electricity, security, and well-maintained common areas. Additional facilities like parks, playgrounds, and community spaces can also impact the buyer's decision.

5. *Legal and financial aspects :*

Buyers will consider the legal and financial aspects of affordable housing, such as the project's legal clearance, approvals, and the availability of home loan options.

6. *Construction quality :*

Buyers will assess the construction quality of the affordable housing project to ensure durability and safety. The use of good quality materials, construction techniques, and adherence to building codes are critical factors in the decision-making process..

7. *Future growth prospects :*

Buyers will also consider the future growth prospects of the location where the affordable housing project is located. Factors such as upcoming infrastructure projects, commercial developments, and appreciation potential can impact the buyer's choice.

8. *Maintenance costs :*

Buyers will evaluate the ongoing maintenance costs associated with the affordable housing project. Lower maintenance costs can make the property more attractive to buyers.

9. *Size and Layout :*

The size and layout of the property are also significant factors. Buyers will consider the number of rooms, the size of the rooms, and the overall layout of the property.

buyers will consider multiple factors such as budget, location, developer's reputation, amenities, legal and financial aspects, construction quality, future growth prospects, maintenance costs, availability of social and physical infrastructure, and resale potential before making a choice in selecting affordable housing in India. So, it is essential for buyers to thoroughly research and evaluate these factors to make an informed decision

IV. METHODOLOGY

To accomplish the goals of this research study, quantitative methods were employed, which involved gathering both primary and secondary data. The primary data was collected through survey, while the secondary data was collected from a literature review. The survey was a questionnaire designed and distributed through Open survey platforms. One research question was investigated in this study The Question is:

1.Which Factor is more important for affordable housing in Ahmedabad..

All main factors affecting buyers choice in selection of Affordable Housing in Ahmedabad has been assessed by their importance and usefulness using RII (Relative Importance Index) method.

RII (Relative Importance Index) method is a statistical technique used to determine the relative importance of various factors or criteria in a decision-making process. RII is a scaling technique that assigns a numerical score to each factor or criterion based on its importance to the decision-making process. To calculate the RII score, a decision-making team assigns a weight or importance value to each factor on a scale from 1 to 5, where 1 represents the least important factor and 5 represents the most important factor. Then, each factor's weight is multiplied by a rating score that reflects the level of importance of the factor. The rating score ranges from 1 to 10, and each number represents a different level of importance.

$$\text{RII (Relative Importance Index)} = \Sigma W / A \times N$$

V. Data Analysis and Discussion

Of the seventy (65) survey distributed with an individual who is willing to buy his/her first house, forty-seven (47) valid responses were recorded resulting in a 72.31% response rate.

1. *Ranking the factors affecting buyers choice in selection of Affordable Housing*

The first group of questionnaire survey helped in ranking the eleven major factors of affecting buyers choice in selection of Affordable Housing in terms of their importance. Show in table, N is the total number of respondents (47), A is the highest score (5 in this case), ΣW is the total score of the 47 respondents and scoring criteria is 1 to 5, where 5 is most important and 1 is least.

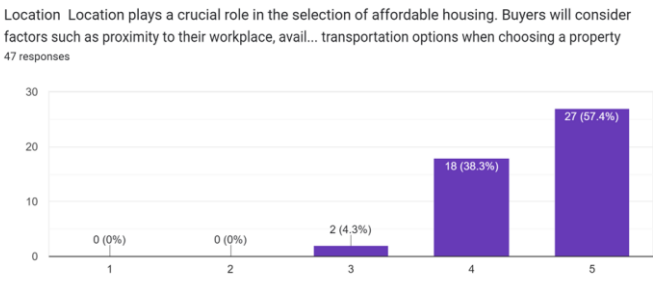


Fig 1 Result of survey showing most important factor location

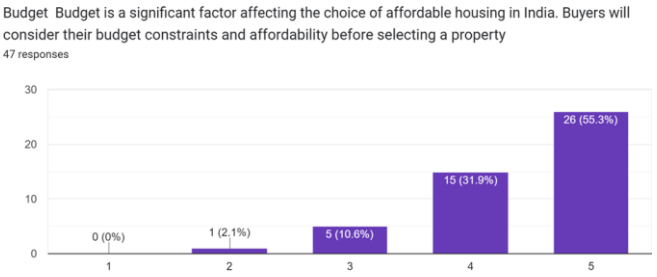


Fig 2 Result of survey showing most important factor Budget

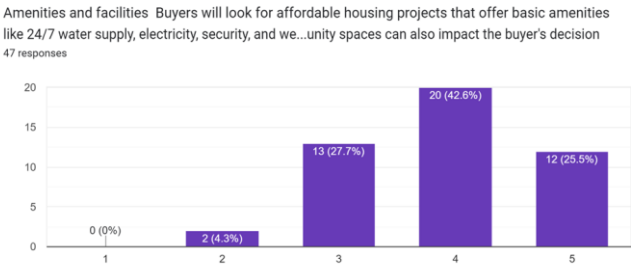


Fig 3 Result of survey showing most important factor Amenities & facilities

TABLE 1. RANKING THE FACTORS OF AFFECTING BUYERS CHOICE IN SELECTION OF AFFORDABLE HOUSING

factors of affecting buyers choice in selection of Affordable Housing	**Total Score (ΣW)** (From 47 respondents)	**RII (Relative Importance Index)**	**Ranking**
Budget	207	0.88	2
Location	213	0.91	1
Developer's reputation	138	0.59	7
Amenities and facilities	183	0.78	3
Legal and financial aspects	125	0.53	8
Construction quality	157	0.67	5
Future growth prospects	102	0.43	10
Maintenance costs	120	0.51	9
Availability of social and physical infrastructure	167	0.71	4
Resale potential	100	0.43	11
Size and Layout	142	0.60	6

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RESULTS AND FINDINGS

The results of questionnaire survey helped in identifying factors affecting affordable housing . Location , budget & Amenities and facilities being the three top rated factors in terms of importance.

CONCLUSION

The purpose of this study is to explore the factors that customers consider when purchasing an apartment. The results indicate that the most significant factor is the location, budget, and amenities/facilities of the apartment. This suggests that prospective buyers prioritize the location and budget of the apartment. To meet this demand, numerous builders are concentrating on the location and budget of the apartment by developing projects in Ahmedabad, Gujarat, which has several advantageous facilities.

The study also has important implications for real estate marketers. To attract prospective buyers, marketers should concentrate on these identified factors, prioritized according to the study's findings. Marketers should effectively communicate their projects' features based on the identified factors. Therefore, real estate marketers should give special attention to these factors, particularly when dealing with customers in these categories.

The study's scope is currently limited to Ahmedabad, but it has the potential to be extended to other cities in India.

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Drone Technology: Applications and Challenges in Construction Industry

Prof. Anand Patel
Civil Engineering Department
Indus Institute of Technology and Engineering
Ahmedabad, India
E-mail: anandpatel.cvl@indusuni.ac.in

Mubin Vadaviya
Civil Engineering Department
Indus Institute of Technology and Engineering
Ahmedabad, India
E-mail: mubin.civil451@gmail.com

***Abstract*— In the past few years, the utilization of unmanned aerial vehicles (UAVs) has become widespread in various construction endeavors. This article aims to briefly discuss the significance of the appropriate implementation of UAV technology in the construction sector and the difficulties encountered in its usage. The research delves into the current employment of UAV technology in the construction domain of Ahmedabad (Gujarat), utilizing a quantitative methodology, which involved interviewing specialists from the construction sector. The findings indicate that the use of UAV technology is primarily for overseeing and reporting the progress of projects, inspection, mapping, and surveying. Additionally, the research concludes that UAVs face limitations concerning battery life, the high initial cost of acquisition, and inclement weather conditions.**

Keywords*— Drone Technology, Applications, Challenges, Construction Industry (CI).

I. INTRODUCTION

The incorporation of proven innovative technologies can greatly benefit any industry, as they are primarily designed to increase work efficiency. The adoption of such technologies can lead to quicker task completion, better work quality, improved safety standards and decreased costs. To address the challenges encountered in utilizing UAVs in construction, it is necessary to embrace new trends, tools, software and technologies. A drone, also known as an unmanned aerial vehicle (UAV), is an aircraft that lacks a crew, passengers or pilot on board. It is a component of an unmanned aerial system (UAS) that consists of a ground controller and a communication system with the UAV. Drones have emerged as a highly practical technological tool, particularly in the construction industry, as they can be utilized throughout the entire project cycle from pre-construction to post-construction. By offering real-time data collection and a unique aerial vantage point, drones can reduce costs, enhance efficiencies and streamline workflows. They are utilized in construction to perform a wide range of tasks such as inspecting buildings, bridges, windmills, nuclear power plants, roofs, mapping and surveying terrain, monitoring and reporting progress in real-time, surveillance, tracking materials and equipment, monitoring safety, creating 3D models of existing structures, transportation and much more.

Over the past several years, drones have become a highly influential trend in the construction industry. In Gujarat, drones are predominantly employed for surveying and mapping large areas, generating 3D models to visualize the construction process, inspecting work and recording videos or images of the development, construction, operation, and maintenance. Drones were used in the Light House project in Rajkot for 3D modelling, monitoring, and inspection of work progress, with the Prime Minister also using them (Mint e-paper, 2021). The National Highway Authority of India (NHAI) now mandates that the concessionaire or private developer of HAM (Hybrid Annuity Model) projects create a website for each project, providing updates and monthly drone footage for public viewing (TOI, 2021). The Indian government has already begun utilizing drone technology in various development programs. For instance, under the SVAMITVA Scheme (Survey of Villages and Mapping with Improvised Technology in Village Areas), launched in April 2020, Drone technology was employed to map land parcels to help rural Indian residents establish clear property ownership, which was accomplished in just a month (Vanathi, 2022).

II. APPLICATIONS OF DRONE TECHNOLOGY IN CI

Several recent publications have focused on the commercial applications of drones in construction. This review of the literature aims to present the information gathered from multiple sources regarding the current utilization of UAVs on construction sites.

1. Mapping & Surveying

Drone surveying involves utilizing drones or unmanned aerial vehicles (UAVs) equipped with downward sensors (such as RGB or multiple cameras) and LIDAR payloads to gather aerial data. When conducting a drone survey using an RGB camera, the ground is photographed from multiple angles, and each image is associated with coordinates. Photogrammetry software can then use this information to generate geo-referenced orthomosaics, elevation models, or 3D models of the surveyed area (Vanathi, 2022). These maps can be used to extract useful information, such as volume measurements, and can help reduce response times and inspection costs by providing accurate and detailed information on areas that would otherwise be inaccessible..

2. Project Monitoring & Progress Report

The main benefit of using drones is the time and communication savings it provides. Instead of walking around a construction site, drones can follow a path over the area, preventing damage to the ground and completing tasks quicker and more efficiently. The information gathered by the drones can be immediately transmitted to relevant parties such as project managers, engineers, and stakeholders. They can access this information in real-time, without having to

wait for hours or days to gather and analyse data. Drones can provide project managers with an aerial view of the site to remotely monitor the progress of construction. Reports can be shared with stakeholders to show that work is being done on time and as scheduled (Mohamad Rizal Omar, 2022). Furthermore, the data collected by drones can be stored for as long as the customer requires it. This means that businesses will always have access to necessary information for each stage of the construction project for future use.

3. Inspection

Building and infrastructure inspections are frequently mandated by regulations to guarantee their safety and structural integrity. Various types of inspections, such as those of tall buildings or power lines in railways and grids, can be hazardous and time-consuming. Drones, on the other hand, are simple to deploy and don't require a large team to operate them. Additionally, companies don't need to shut down all areas of the building that require inspection, and drones have minimal negative impacts (Vikas Kumavat, 2019). The primary benefit of using drones for building and infrastructure inspections is that they are faster and safer than conventional methods.

4. Material and Equipment Tracking

In a large construction site, multiple pieces of equipment and vast quantities of materials are typically involved, making monitoring a challenging task. Traditionally, this has required managing numerous tables and documents, which can be time-consuming and challenging. However, drones equipped with Radio Frequency Identification (RFID) technology can provide an efficient solution for tracking materials and equipment on site (Vanathi, 2022).

5. Safety Monitoring

By utilizing drones in construction, the drone operator can expeditiously fly over the site to verify that equipment is positioned in a secure location, detect any unauthorized individuals on the premises, and instantly document any damage or theft. In the event of a safety breach, immediate corrective measures can be implemented (Soroush Dastgheibifard, 2018).

6. Security Surveillance

Drones can enhance the security of construction sites by being integrated into the alarm system. To charge their batteries, UAS can be placed on a charging station on the rooftop. Once activated, the UAS will take off and move over the construction site to capture footage of any incidents. With the use of a high-definition camera at low altitude, people or vehicles in the field of view can be easily identified and the video can be promptly sent to smartphones or other devices. Additionally, the UAS can perform regular scheduled security scans up to the roof station (Jack Wu, n.d.).

7. 3D Modelling of Existing Structure

A 3D model generated by a drone is a digital spatial representation created by capturing aerial images with a drone. Compared to using an airplane or helicopter for aerial photogrammetry, drones are more cost-effective and simpler to operate. In addition, drones are equipped with geotagging technology that automatically embeds geographical information, such as height, length and width measurements, into the image's metadata. This data is crucial for creating a precise 3D model of the object. With the help of various 3D modelling software platforms available in the market, these images can be effortlessly transformed into drone 3D models (Soroush Dastgheibifard, 2018). The accuracy of the 3D model enables the computation of the area, volume, and distance of the model and its surrounding area.

8. Transportation

Drones can be utilized for logistical purposes, such as delivering equipment, materials, and necessary documents or paperwork to construction sites. This not only saves time but can also enhance the safety of the site (Mishra, 2019).

III. Challenges of Drone Technology in CI

1. Weather Conditions

Weather conditions can have a significant impact on drone operations, affecting both safety and performance. Factors such as hot and cold temperatures, wind, rain and snow can all impact the efficiency and safety of drone flights (Mohamad Rizal Omar, 2022). Generally, it is recommended to avoid flying in adverse weather conditions. Hot weather can cause excessive energy consumption and damage to power lines. Conversely, flying in cold weather can cause rapid battery drainage, limiting flight time, and visibility is reduced by snow. Moreover, operating a drone in rainy weather conditions can result in electrical equipment short-circuiting (Mohd Yamani Yahya, 2021).

2. Required Trained Operator

If drones are not operated by skilled professionals, they may not deliver complete or accurate results. Inadequate drone control can lead to damages. To fly drones efficiently, adequate training is necessary, and for research and development purposes, additional training and experience are required (Mosly, 2017). Consider a scenario where you have to resend an airplane because the initial survey failed to collect all the required data!

3. Rules and Regulations

The use of drones is regulated by the Federal Aviation Administration (FAA), a federal agency. There are precise guidelines and regulations that must be followed in order to operate a drone legally. Obtaining the necessary permits can be complicated due to the fast-changing rules, particularly if weather monitoring is required in large urban construction sites. It can be challenging to determine which license is necessary (Mosly, 2017).

4. Limited Drone Battery Life

The limited battery power resulting in a short flight time is one of the significant challenges that drone applications in the construction industry encounter. Typically, a drone can only remain in the air for 25 minutes before recharging is required, which can be an inconvenience. Although multiple battery packs can allow for all-day flights, it would still require frequent recharging every 25 minutes (Mohd Yamani Yahya, 2021). In case a project is time-sensitive and involves a large area, several drones may be necessary to ensure comprehensive coverage. Alternatively, a project manager

may need to explore other potentially more suitable technologies (Mohamad Rizal Omar, 2022).

5. *Privacy Issues*

The use of drones for gathering detailed information about power and utility infrastructure also increases the risk of exposing confidential data. The data collected by drones are often transmitted through Wi-Fi or Bluetooth connections to the cloud, which makes the drones vulnerable to cyber-attacks. As a result, drones are easily targeted by cybercriminals, who may take advantage of the drones' inadequate security features to access sensitive information. Hackers can infiltrate the drone's main control system and take control of it, potentially using it as a new driver or controller for the device (Mohd Yamani Yahya, 2021).

6. *Safety Problem*

The increased usage of drone technology has resulted in an upsurge in aviation accidents and ground crashes, which can pose significant safety risks to the public. Technical malfunctions, signal loss between the drone and the pilot, and human errors are among the leading causes of such accidents. Drones may also fall from a high altitude, posing a severe danger to people in the vicinity (Mohd Yamani Yahya, 2021).

7. *High Initial Cost*

Acquiring a drone that is fully equipped with necessary features for your intended use can result in significant expenses. Federal regulations mandate drones to have specialized hardware, software, and camera capabilities for different functions, which can be expensive to install (Vanathi, 2022). Drone pilots must undergo specialized training, which also adds to the cost. Repairing your drone can also be costly, especially if you lack the skills and experience to fix it on your own.

8. *Limited Range of Access*

The range of a drone from its controller depends on several factors, including the model of the drone, its setup, and the desired distance to be covered. The drone's range is typically determined by the maximum altitude at which it can fly in a horizontal direction from the controller before losing connection. Typically, drones can cover distances ranging from 700 feet to 5 miles, although the more expensive models can fly for up to 11-17 miles (Vikas Kumavat, 2019).

IV. Methodology

To accomplish the research objectives, quantitative methods were employed, involving the gathering of primary and secondary data. The primary data was obtained through a survey administered to construction experts, while the secondary data was obtained through a literature review. The questionnaire was developed and distributed to obtain the primary data. The study examined two research questions, namely:

1. What is the most significant and useful application of drone technology in the construction industry?

2. What are the difficulties that users face while using drones in the construction industry?

The importance and usefulness of the main applications and challenges of drone technology in the construction industry were evaluated using the RII (Relative Importance Index) method. The RII method is a weighted average approach used to determine the relative importance of quality factors. It involves calculating the average rank for each question and deriving the rank for each capability from the average of the ranks of the questions grouped under that capability. In this research, a scale from 1 to 9 was used to indicate the importance of eight primary applications and eight primary challenges of drone technology in the construction industry using the RII method.

$$\text{RII (Relative Importance Index)} = \Sigma W / A \times N,$$

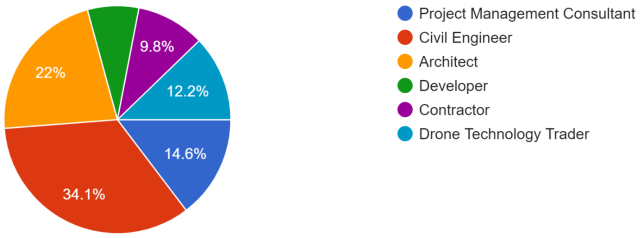
Where, W is the weight, A is the highest score, and N is the number of respondents.

V. Data Analysis

Out of the seventy (70) surveys distributed among individuals with expertise in the construction industry, forty-one (41) valid responses were received, resulting in a response rate of 58.57%.

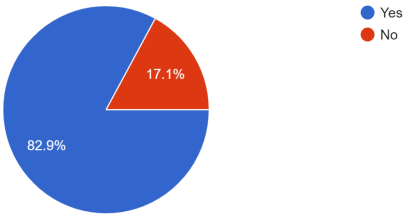
1. *Introductory Questions*

To gain an understanding of the survey participants, the initial three questions aimed to gather information on the respondents and their companies, including background details. The survey asked the respondents to identify their role in their respective companies, with civil engineers representing 34.1% of respondents, followed by architects (22%), project management consultants (14.6%), drone technology traders (12.2%), contractors (9.8%), and developers (7.3%). The professional distribution of the respondents is illustrated in Figure 1.



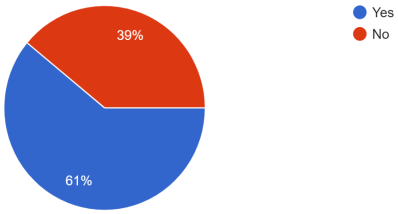
[FIG. 1. PROFESSIONAL DEMOGRAPHICS OF THE RESPONDENTS]

The second question in the survey aimed to gather information about the level of awareness regarding drone technology. Out of the 41 respondents, 34 (82.9%) reported being aware of drone technology, while the remaining 7 (17.1%) were not. A pie chart (Fig. 2) was used to visualize the level of awareness among the respondents.



[FIG. 2. AWARENESS REGARDING THE USE OF DRONE TECHNOLOGY.]

The third question in the survey aimed to collect data on the usage of drones by construction companies. Out of the 41 respondents, 25 of them (61%) reported that their companies use drones, while the remaining 16 (39%) stated that their companies do not utilize drone technology. The usage of drone technology in the construction industry by companies is illustrated in the pie chart (Fig.3).



[FIG. 3. COMPANIES THAT EMPLOY DRONE TECHNOLOGY IN THEIR OPERATIONS.]

2. *Ranking the Applications of Drone Technology in CI*

The subsequent set of survey questions aided in prioritizing the significance of the eight primary applications of drone technology in the construction industry. The results are presented in the table below, where N represents the total number of respondents (41), A is the maximum score (9), ΣW denotes the overall score of the 41 respondents, and the scoring system ranges from 1 to 9, with 9 indicating the most crucial and 1 indicating the least important factor.

TABLE 1. RANKING THE APPLICATIONS OF DRONE TECHNOLOGY IN CI

Applications of Drone Technology in CI	**Total Score (ΣW)** (From 41 respondents)	**RII (Relative Importance Index)**	**Ranking**
Project Monitoring & Progress Report	282	0.76	1
Inspection	310	0.84	2
Mapping and Surveying	290	0.79	3
3D Modelling of Existing Building	147	0.40	4
Security Surveillance	159	0.43	5
Transportation	225	0.61	6
Safety Monitoring	233	0.63	7
Material and Equipment Tracking	184	0.50	8

3. *Ranking the Challenges of Drone Technology in CI*

The second set of questionnaire surveys facilitated the ranking of the eight primary challenges posed by drone technology in the construction industry in descending order of risk. The table below presents the ranking with N representing the total number of respondents (25), A being the highest score (9), ΣW representing the cumulative score of the 25 respondents, and the scoring criteria being a scale of 1 to 9, where 9 signifies high risk and 1 signifies low risk.

TABLE 2. RANKING THE CHALLENGES OF DRONE TECHNOLOGY IN CI

Challenges of Drone Technology in CI	**Total Score (ΣW)** (From 25 respondents)	**RII (Relative Importance Index)**	**Ranking**
Limited Drone Battery Life	177	0.79	1
High Initial Cost	159	0.71	2
Weather Conditions	149	0.66	3
Required Trained Operator	196	0.87	4
Rules and Regulations	124	0.55	5
Privacy Issues	101	0.45	6
Safety Problem	191	0.85	7
Limited Range of Access	96	0.43	8

RESULTS AND FINDINGS

The outcomes of the first questionnaire survey aided in comprehending the level of awareness of drone technology, usage of drones by construction companies, and major applications of drone technology in the construction industry. About 82.9% of the respondents were knowledgeable about drone technology, while 17.1% were not. Approximately 61% of the respondents confirmed that their companies use drones, whereas 39% of the respondents do not use drones. Project monitoring and progress reporting, inspection and mapping & surveying were the top three applications rated in terms of cost, time, and resource savings. The other applications such as 3D modelling of existing structures, security surveillance, transportation, safety monitoring, and material and equipment tracking are minimally used in CI due to lack of knowledge and complexity.

The outcomes of the second questionnaire survey identified the primary challenges facing drone technology in the construction industry. Limited drone battery life, high initial costs, and weather conditions were the top-rated challenges of drones, while other challenges had minimal impact on drone use.

CONCLUSION

The construction industry has been facing challenges related to efficient project delivery due to cost overruns, time overruns, and shortage of skilled labour. To address these issues, innovative monitoring solutions such as drone technology (UAV) can be implemented as a project management tool. The objective of this study is to explore the practical applications and most important challenges of Drone Technology in the construction industry of Ahmedabad, Gujarat.

The study found that there is a good level of awareness of drones in the Ahmedabad Construction industry, but there is less interest shown in using this technology due to the lack of awareness in initial capital investment, drone battery life, and uncertain weather conditions. However, drone technology can be utilized throughout the construction project lifecycle, as it provides accurate data that can be recorded for future use. Regular project monitoring with drone technology helps to reduce re-work costs and time, while also providing high-quality photos for daily project progress reports. Drone technology is also used for visual inspection of heights and inaccessible areas, which is a cost-effective solution. Furthermore, drone surveying is saving up to 20 times the costs of creating topographic maps.

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Design and Fabrication of Fire Extinguisher Drone

Hardik Mehta

M.S. (Mechanical,USA)

Indus Institute of Technology and Engineering

Ahmedabad, India

hardikmehta.me@indusuni.ac.in

Harshit Sinroja

B. Tech Mechanical

Indus Institute of Technology and Engineering

Ahmedabad India

harshitsinroja.20.me@iite.indusuni.ac.in

Jaydeep Kawa

B. Tech Mechanical

Indus Institute of Technology and Engineering

Ahmedabad, India

kawajaydeep.20.me@iite.indusuni.ac.in

Abstract:-

This research paper presents the design and development of a fire extinguisher drone, which is capable of identifying and extinguishing fires in inaccessible areas such as tall buildings and forests. The drone is equipped with a thermal imaging camera for identifying the location of the fire and a fire extinguisher mechanism for extinguishing the fire. The drone's autonomous capabilities enable it to operate without the need for human intervention. The paper describes the design and development of the drone and presents the results of tests conducted to evaluate its performance.

Keywords:

UAV, drone, fire extinguishing, design, fabrication.

Introduction :-

Fires are one of the most dangerous and devastating disasters that can occur in various environments, such as forests, buildings, and industrial sites. The traditional methods of extinguishing fires are often limited by the access to the affected area, and the resources required for the firefighting process. The use of drones for fire extinguishing has the potential to overcome some of these limitations by providing access to hard-to-reach areas and reducing the resources required for the firefighting process.

In this research paper, we present the design and fabrication of a fire extinguisher drone that can be used for extinguishing fires in areas that are difficult to access by traditional means. The drone is designed to be lightweight, efficient, and capable of carrying and deploying a fire extinguishing agent. The paper describes the development of a prototype drone, including the selection of materials and components, and the optimization of the drone's size and weight. The performance of the prototype drone was evaluated in simulated fire scenarios.

Background:

Inaccessible fires are a major challenge for firefighters. These fires can occur in areas that are difficult or dangerous to access, such as high-rise buildings, chemical plants, and oil rigs. In many cases, firefighters must rely on hoses, ladders, and other equipment to reach the fire and extinguish it. However, these methods can be ineffective or even dangerous in certain situations.

One potential solution to this problem is the use of fire extinguisher drones. These are unmanned aerial vehicles (UAVs) that are equipped with fire extinguishers and can be flown to the site of a fire to quickly extinguish it. Fire extinguisher drones have several advantages over traditional firefighting methods. They can access hard-to-reach areas more easily, they can be operated remotely, and they can quickly respond to emergencies.

In recent years, there has been growing interest in the use of fire extinguisher drones for firefighting. Several companies and organizations have developed prototype drones that are capable of extinguishing fires, and there is ongoing research into the development of more advanced and effective drones.

Overall, fire extinguisher drones have the potential to significantly improve the effectiveness and safety of firefighting, particularly in situations where traditional methods are not feasible or safe. However, there are still technical and operational challenges that must be addressed in order to make these drones a practical and reliable tool for firefighters.

Design and Fabrication:-



The fire extinguisher drone is designed to be a hexacopter, with six rotors for propulsion and stability. The drone is powered by a rechargeable battery, which provides the required energy for the drone's operation. The drone's frame is made of lightweight and durable materials such as carbon fiber and aluminum to reduce weight and improve durability.

The fire extinguishing system is composed of a Co2 ball. The ball weigthed average around 2kg which is placed on the arm holder.

The control system of the drone includes a remote controller, which is used to control the drone's movement and fire extinguishing operations. The remote controller is equipped with a video transmission system, which provides real-time video feedback from the drone's onboard camera. The onboard camera is used for navigation and to identify the location of the fire.

Co2 Ball :-



EASY TO USE :-

- CO2 balls are a type of fire extinguisher that can be used in fire-fighting drones. They are compact, lightweight, and easy to deploy in emergency situations.
- CO2 balls work by releasing a cloud of carbon dioxide gas, which displaces oxygen and suffocates the fire.
- To use a CO2 ball, simply throw or drop it into the fire from a safe distance. The ball will activate on impact, releasing the gas and extinguishing the flames.
- CO2 balls are safe to use around electrical equipment, as they do not conduct electricity.
- CO2 balls are effective in extinguishing small fires, such as those that may occur in homes, offices, or vehicles. However, for larger fires, it is recommended to use traditional firefighting methods, such as water or foam.
- CO2 balls have a long shelf life and do not require regular maintenance or inspections.
- CO2 balls are environmentally friendly, as they do not contain harmful chemicals or gases that can harm the environment.
- CO2 balls are affordable and can be easily purchased online or at local hardware stores.
- Overall, CO2 balls can be an effective and easy-to-use tool for fire-fighting drones, especially for small-scale fires.

NO NEED FOR SPECIAL MAINTENANCE :-

This drone did not required maintenance for the 2 years, its always on guard with its unique capability to withstand loud noises as a alarm for fire. This

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drone is very easy to carry because of its lightweight which is around 1-1.5kg and the dry powder used in this drone is harmless for the environment.

SAFETY :-

CO2 balls for fire-fighting drones are generally considered safe to use, provided that they are used in accordance with the manufacturer's instructions and appropriate safety protocols. Here are some key points regarding the safety of CO2 balls for fire-fighting drones:

- CO2 balls are designed to be safe and easy to use, even for individuals without extensive fire-fighting experience.
- CO2 balls do not contain harmful chemicals or gases that can harm humans or the environment.
- CO2 balls are safe to use around electrical equipment since they do not conduct electricity.
- However, CO2 balls can be hazardous if they are not used correctly or if they are used inappropriately. For example, if a CO2 ball is thrown or dropped too close to a person or if the ball is damaged or punctured, it can cause injury or harm.
- To ensure safe use, it is important to follow the manufacturer's instructions carefully when handling and deploying CO2 balls for fire-fighting drones. Proper personal protective equipment (PPE), such as gloves and eye protection, should also be used when handling CO2 balls.
- In addition, it is essential to have appropriate training and experience in using CO2 balls for fire-fighting drones to ensure safe and effective deployment.

Overall, CO2 balls for fire-fighting drones can be a safe and effective tool for early intervention and containment of small fires, provided that they are used in accordance with appropriate safety protocols and guidelines.

COVERAGE :-

The coverage area of a CO2 ball for fire-fighting drone depends on various factors, such as the size of the ball, the intensity of the fire, and the location of the fire. Typically, CO2 balls are designed for use in small-scale fires, such as those in homes, offices, or vehicles.

A typical CO2 ball for fire-fighting drone can cover an area of approximately 4-6 square meters, depending on the size of the ball and the intensity of the fire. However, it is important to note that CO2 balls are not recommended for use in large-scale fires, such as those in industrial settings or forests, as they may not provide sufficient coverage to extinguish the fire completely.

In general, CO2 balls are best used for early intervention and containment of small fires before they can spread and become larger. They can be particularly useful in situations where traditional firefighting methods, such as water or foam, are not practical or safe to use, such as fires involving electrical equipment.

It is important to remember that CO2 balls should always be used in accordance with the manufacturer's instructions and in conjunction with other firefighting equipment and protocols, such as fire alarms, smoke detectors, and fire extinguishers.

Installation :-

The best option for passive use is to install the ball in the
most vulnerable places in its metal basket. The ball can
be fixed on a support or simply placed on a flat surface,
visible and easy to access. The most recommended areas are areas of high fire risk such as electrical cabinets, kitchens, storage rooms, engine compartments,
etc.

Calculation :-

>> Thrust calculation :-

For simply we are define drone to be , motor which we are used in our drone 2212 920 kV Motor Rating and 1045 size of propeller , 4s Battery 5200 MAH

Drivetrain = { 1045 ,2212 920 KV , 4s Motor)

>> Bench Thrust Method :-

Testing for 2212 920 KV BLDC motor With 1045 propeller.

>> At Full 100 % throttle Max thrust 644 gram but is not safe to run motor at full Speed.

>> So what next , to run motor safe and less vibration here we run motor at below 100 % Throttle By testing at 80% throttle thrust produce by motor is 605 gram .

Here, we take 6 2212 920 Kv BLDC motor .

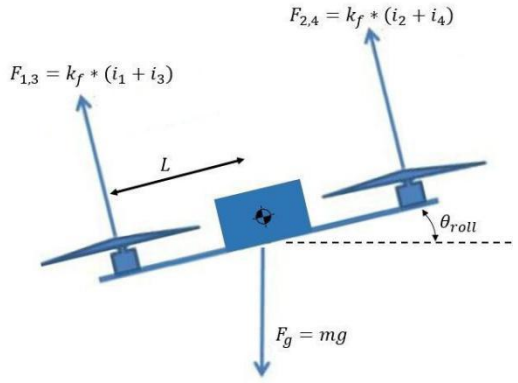
>> Total Thrust 6*605 = 3660 Thrust At 80% throttle .

>> Total Weight drone + Battery = 1750 gram.

Payload Calculation:-

Payload capacity in a drone refers to the maximum weight of additional equipment or cargo that a drone can carry while still maintaining stable flight and safe operation. This payload capacity includes any cameras,

sensors, or other specialized equipment that may be attached to the drone, as well as any cargo that needs to be transported.



calculate the payload capacity

= Total thrust – Total Weight

= 3630 – 1750

= 1880 Total payload Capacity at 80% Throttle.

Description:-

A fire extinguisher drone is a type of unmanned aerial vehicle (UAV) that is specifically designed for firefighting purposes. It is equipped with a fire extinguishing system that allows it to extinguish fires in hard-to-reach areas or areas that are too dangerous for human firefighters to access. The drone is typically controlled remotely by a trained operator who can guide it to the location of the fire.

The fire extinguishing system of the drone usually consists of a tank filled with water or fire retardant foam, as well as a nozzle or a sprinkler system that sprays the extinguishing agent onto the flames. The drone may also be equipped with a thermal imaging camera that can detect the location and intensity of the fire, allowing the operator to direct the drone's efforts more effectively.

Fire extinguisher drones can be particularly useful in fighting wildfires, as they can cover large areas quickly and efficiently. They can also be used in other situations, such as in industrial settings where fires may occur in hard-to-reach areas or in areas with hazardous materials.

Overall, fire extinguisher drones are an innovative and potentially valuable tool for firefighting, allowing firefighters to access and extinguish fires in areas that would otherwise be difficult or dangerous to reach

Methodology:

The methodology of a Hexacopter fire extinguisher drone typically involves the following steps:

Design: The first step is to design the Hexacopter fire extinguisher drone. This involves choosing the right components such as motors, batteries, propellers, and flight controllers, as well as designing the frame and the extinguishing system.

Assembly: Once the design is complete, the Hexacopter fire extinguisher drone needs to be assembled. This involves putting together all the components and ensuring they are properly connected and configured.

Testing: The next step is to test the Hexacopter fire extinguisher drone to ensure that it is working properly. This involves conducting ground tests and flight tests to check the stability, maneuverability, and extinguishing capabilities of the drone.

Integration: Once the drone is tested and ready to fly, it needs to be integrated with the extinguishing system. This involves installing the extinguisher tank, nozzle, and control mechanism on the drone.

Operation: With the Hexacopter fire extinguisher drone ready, it can now be deployed to fight fires. The drone can be operated remotely using a controller, and the extinguishing system can be activated to spray the fire-retardant material on the fire.

Maintenance: Finally, the Hexacopter fire extinguisher drone needs to be properly maintained to ensure that it remains in good working condition. This involves regular cleaning, inspection, and replacement of components as needed.

Overall, the methodology of a Hexacopter fire extinguisher drone involves designing, assembling, testing, integrating, operating, and maintaining the drone to effectively fight fires from the air.

Identify the need: The first step is to identify the need for a fire extinguisher drone. This may involve conducting a risk assessment to determine which areas are at highest risk for fires and which areas may be difficult for firefighters to access.

Define the requirements: Once the need has been identified, the next step is to define the requirements for the drone. This may include factors such as the size and weight of the drone, the type of extinguishing agent to be used, the range and accuracy of the sensors, and the level of autonomy required for the drone to operate safely.

Design the drone: With the requirements in mind, the drone can be designed and built. This may involve selecting the appropriate components, such as the propulsion system, sensors, and extinguishing system, and integrating them into a functional drone.

Test and evaluate the drone: Once the drone has been built, it must be tested and evaluated to ensure that it meets the requirements and is safe and effective to use. This may involve conducting tests in a controlled environment, such as a laboratory or test facility, as well as field testing in real-world scenarios.

Develop operating procedures: Once the drone has been tested and evaluated, operating procedures must be developed for its use. This may include procedures for launching and landing the drone, controlling its flight, and deploying the extinguishing agent.

Train operators: In order to use the drone safely and effectively, operators must be trained in its use. This may involve providing training on the drone's capabilities and limitations, as well as its operating procedures.

Deploy the drone: Once the drone has been designed, tested, and operators have been trained, it can be deployed for use in firefighting and emergency response situations.

Evaluate and improve: Finally, it is important to continuously evaluate the drone's performance and seek feedback from users in order to identify areas for improvement and make changes to the design and operating procedures as needed.

Drone Parts

1.Figure 1.1 1 x DJI F550 Hexacopter Frame Kit

1 x Top and Bottom with Integrated PCB.
2 x F450 arms Red
2 x F450 arms White
2 x F450 arms Black.

2. Figure 1.2 A2212 1000 Kv Brushless Motor for RC Airplane/ Hexacopter



>> Dimension: 27.8*27mm
>> Shaft diameter: 3.17mm
>> Max Efficiency: 80%
>> Max Efficiency Current: 4-10A (>75%)
>> Current Capacity: 12A/60s
>> No Load Current @ 10V: 0.5A
>> No. Of Cells: 2-3 Li-Poly
>> Weight: 65g
>> KV: 1000
>> Suitable for the propeller size: 1047,1060,9050
>> Color: black, silver, yellow (random)

3.Figure 1.3 Simon 30A 2-3SBrushless esc RC model



>>Input Voltage: (2-3S Lex red)
>>Drive Current: 30A (Max: 40A/10S)
>>Size50x23x8
>>BEC:5V/3A

4.Figure 1.4 Propeller 10IN 10X4.5 For drone



>> Item name: 1045 Propeller
>> Diameter: 10in
>> Pitch: 4.5in
>> Propeller diameter: 25.4cm
>> Centre bore diameter: 6mm front and 9mm reverse side.
>> Centre seat TH: 6mm
>> Weight: about 14g/pair
>> Color: black, red, yellow, green, orange.
>> Usage: for Hexacopter and multirotor

5. Figure 1.5 FLY-SKY FS-1A6BRF 2.4GHZ 6CH

PPM Output With IBUS Port receiver



>> Channels: 6 Channels
>> Model Type: Glider/Heli/Airplane
>> RF Range: 2.40-2.48GHz
>> Bandwidth: 500KHz

>> Band Width Number: 142
>> RF Power: Less Than 20dBm
>> 2.4ghz System: AFHDS 2A and AFHDS
>> Code Type: GFSK
>> Sensitivity: 1024
>> Low Voltage Warning: less than 4.2V
>> DSC Port: PS2;Output:PPM
>> Charger Port: No
>> Input Power: 4.0-6.5V DC
>> Transmitter Weight: 392g
>> Transmitter Size: 174x89x190mm
>> Power: 6V 1.5AA*4
>> Display mode: Translative STN positive type, 128*64 dot-matrix VA73*39mm, white backlight.
>> On-line update: yes
>> Color: Black
>> Certificate: CE0678,FCC
>> Control Range: 500m
>> Item Name: FS-iA6B
>> Frequency Range: 2.4055--2.475GHZ

6. Figure 1.6 FLY-SKY FS-IA6B RF 2.4GHZ 6CH PPM



>> The Fly-sky FS-IA6B RF 2.4GHz 6CH PPM output with I-bus port receiver works great with the Fly-Sky FS-i6 Controller.
>> This compact 6 channel receiver is great for any model using up to 6 channels and, with a range exceeding 500 meters, it can be considered to be the full range for all but the most demanding of application.
>> The receiver has end-on connectors to enable a neat Installation in tight spaces.
>> This has Fly-sky FS-IA6B RF 2.4GHz 6ch PPM output with I-Bus port receiver built-in connectors which allows you to use any of the optional Fly-Sky telemetry sensors.
>> Dual antennas give the FS-iA6B excellent reception and interference rejection capability.
>> With easy binding, compact dimensions, optional telemetry, and dual antennas.

7. Figure 1.7 Orange 5200 mAh 3S 40C/80C Lithium polymer battery Pack (Li-Po)



>> Model No: Orange 5200mAh 40C 3S1P
>> Capacity : 5200mAh
>> Weight : 360.0g
>> Voltage : 11.1V
>> Dimensions : 28x44x137(mm)
>> Max Continuous Discharge : 40C(208.0A)
>> Balance Plug : JST-XH
>> Max Burst Discharge : 80C(416.0A)
>> Discharge Plug : XT-60
>> Charge Rate : 1-3C Recommended, 5C Max

8.Figure 1.8 GPS

Global Positioning System (GPS) technology plays a crucial role in the operation of drones. GPS is a satellite-based navigation system that provides location and time information. Here are some ways GPS is used in drones:>>

Navigation: GPS enables drones to navigate to specific locations and follow predetermined flight paths. By receiving signals from multiple GPS satellites, drones can accurately determine their location and adjust their flight path accordingly.

>> Waypoint-based flight: With GPS, drones can be programmed to fly to specific waypoints. This allows for precise control over the drone's flight path and makes it easier to repeat flights for mapping, surveying, and inspection purposes.

>> Geofencing: GPS is used to set up virtual boundaries around areas where drones are not permitted to fly, such as airports and other sensitive areas. This helps ensure that drones don't interfere with other aircraft or cause safety concerns.

>> Return-to-home: GPS also enables drones to automatically return to their starting point if they lose connection with the controller or encounter other issues. This feature helps prevent drones from getting lost or crashing.

Summery :-

- Designing the drone: This involves determining the size and shape of the drone, as well as the materials to be used. The drone needs to be able to carry a sufficient amount of fire extinguishing material, as JHJwell as any necessary equipment for navigating and controlling the drone.
- Selecting the fire extinguishing material: Different materials can be used for extinguishing fires, such as water, foam, or dry chemical powders. The material chosen will depend on the type of fire to be extinguished and the effectiveness of the material in that situation.
- Developing the control system: The drone needs to be equipped with a control system that allows it to be operated remotely. This may involve developing custom software for the drone, as well as designing and building the necessary hardware components.
- Testing and refining the design: Once the drone has been fabricated, it needs to be tested to ensure that it is able to effectively extinguish fires. Any necessary refinements can be made at this stage to improve the drone's performance.
- Overall, the design and fabrication of a fire extinguisher drone requires a combination of engineering expertise, materials science knowledge, and a deep understanding of fire safety principles.

Applications of Fire Extinguisher Drones:-

Fire extinguisher drones have numerous applications, such as:

- **Fighting wildfires**: Wildfires are a significant threat to forests, wildlife, and human life. Fire extinguisher drones can reach inaccessible locations and extinguish the fire before it spreads, thus preventing further damage.
- **Industrial fires**: Fire extinguisher drones can be used in industries, such as oil refineries and chemical plants, to extinguish fires without endangering human life.
- **High-rise building fires**: Fire extinguisher drones can reach the upper floors of high-rise buildings and extinguish fires, which are often inaccessible to firefighters.
- **Residential fires**: Fire extinguisher drones can be used in residential areas to extinguish small fires before they escalate into major incidents.

Conclusion :-

In conclusion, fire extinguisher drones have the potential to revolutionize firefighting by providing faster, more accurate, and more efficient responses to emergencies. They could be equipped with advanced sensors, operate autonomously, integrate with AI and machine learning technologies, and be integrated with other technologies to provide a comprehensive view of the fire and its surroundings. These developments could significantly improve the safety and effectiveness of firefighting operations in the future, reducing the risk to human firefighters and preventing the spread of fires. While the technology is still in its early stages, ongoing research and development could lead to even more advanced and capable fire extinguisher drones in the years to come.

Future Aspects:

Improved efficiency: Future fire extinguisher drones could be designed to be faster, more agile, and capable of carrying larger payloads. This would enable them to reach and extinguish fires more quickly and effectively.

Advanced sensors: Drones equipped with advanced sensors could detect and locate fires more accurately, even in low-visibility conditions. This would enable them to target fires more precisely and extinguish them more effectively.

Autonomous operation: Fire extinguisher drones could be developed to operate autonomously, without the need for human intervention. This would enable them to respond to emergencies faster and more efficiently, while reducing the risk to human firefighters.

Integration with AI and machine learning: Drones could be integrated with AI and machine learning technologies to analyze fire patterns and predict fire behavior. This would help firefighters to better understand and respond to fires, and to prevent them from spreading.

Integration with other technologies: Fire extinguisher drones could be integrated with other technologies such as thermal imaging cameras, gas sensors, and 3D mapping to provide a more comprehensive view of the fire and its surroundings. This would enable firefighters to make better decisions and respond more effectively to emergencies.

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A review of plastic composite filaments used in additive manufacturing through fused deposition modeling (FDM)

Marnishkumar J Modi

Automobile Engineering *Department*

Indus Institute of Technology & Engineering
Indus University,
Ahmedabad, Gujarat, India

PhD Scholar, Gujarat Technological University
marnishmodi.me@indusuni.ac.in

Dr. U.A.Patel

Mechanical Engineering *Department*

L.D.College of Engineering
Gujarat Technological University
Ahmedabad, Gujarat, India

Madhusudan Barot

Automobile Engineering *Department*

Indus Institute of Technology & Engineering
Indus University,
Ahmedabad, Gujarat, India

PhD Scholar ,Gujarat Technological University
madhusudanbarot.me@indusuni.ac.in

Bharat Dogra

Automobile Engineering *Department*

Indus Institute of Technology & Engineering,
Indus University,
Ahmedabad, Gujarat, India

PhD Scholar, Gujarat Technological University
bharatdogra.am@indusuni.ac.in

Krupal Shah

Automobile Engineering *Department*

Indus Institute of Technology & Engineering
Indus University,
Ahmedabad, Gujarat, India

PhD Scholar, Gujarat Technological University
krupalshah.am@indusuni.ac.in

Jinesh Kamdar

Automobile Engineering *Department*

Indus Institute of Technology & Engineering
Indus University,
Ahmedabad, Gujarat, India
jineshkamdar.am@indusuni.ac.in

***Abstract*: Fused deposition modeling (FDM) is the manufacturing process that represents the evolutionary aspect of Industry 4. This study offers a preview of the past, present, and potential of new composite and asymmetrical filaments. For a literature review of FDM filaments, the research community may find this useful. and other techniques for producing filaments made of polymers that have a low melting point and are therefore simple to melt. As virgin materials, polymers such as PP, PET, and HDPE are frequently used. The discussions here center on the market's available composite variations and the potential for future research. Without the use of additives, PET may be recycled. In recent times, the act of recycling plastic has gained significant attention and has become a priority in both environmental protection and waste management discussions. Due to society's incorrect approach towards discarding, use the principles of reuse, reduction, and recycling to manage trash in your daily life.In this review paper, the focus is on the utilization of plastic composite filaments in fused deposition modeling (FDM) technology for additive manufacturing. FDM is a widely utilized 3D printing process, and composite filaments are increasingly popular because of their exceptional characteristics that improve the performance of printed objects. The article examines the various types of composite filaments available and their potential applications across different industries. Additionally, the review addresses the challenges and limitations of using composite**

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filaments in FDM, including issues related to print quality and material compatibility. Overall, the paper provides valuable insights into the potential of plastic composite filaments to transform the field of additive manufacturing through FDM.

Keywords—FDM, filaments, additive manufacturing, 3D printer, PP, PET, and HDPE.

I. Introduction

CNC machining requires the employment of highly skilled personnel, takes a long time, and is expensive. In covid Time Dependency of Human beings stopped manufacturing . 3D printing technology or We can Say Additive manufacturing is smart technology that will make it independent from humans. but Filaments that are used inside Fused filament manufacturing are costly. Several processing parameters, including raster angle, layer thickness, and raster width, have an impact on the filament material. Therefore, they are considered as influential parameters. (2)

Recyclebot : Few researched developed bot called RepRapable Recyclebot to convert plastic into 3D printing filaments(3). Recyclable plastic is harmful to the environment and does not biodegrade. It's better for the environment to use a recyclebot to turn plastic trash into filament for 3D printing. Using on-site waste as a resource to produce usable products is a novel recycling strategy. (4)

Fused deposition modeling (FDM) is well-suited for utilizing recycled materials due to its design flexibility. However, FDM can lead to porosity, which can decrease the mechanical performance and result in variations in mechanical properties.Reuse ,reduce and recycle are the best approaches for waste management (5)The high volume of medical plastic trash created by the COVID-19 outbreak presented considerable issues. The problem is that the pandemic's increased waste production greatly outran the system's capability for treatment. (6)

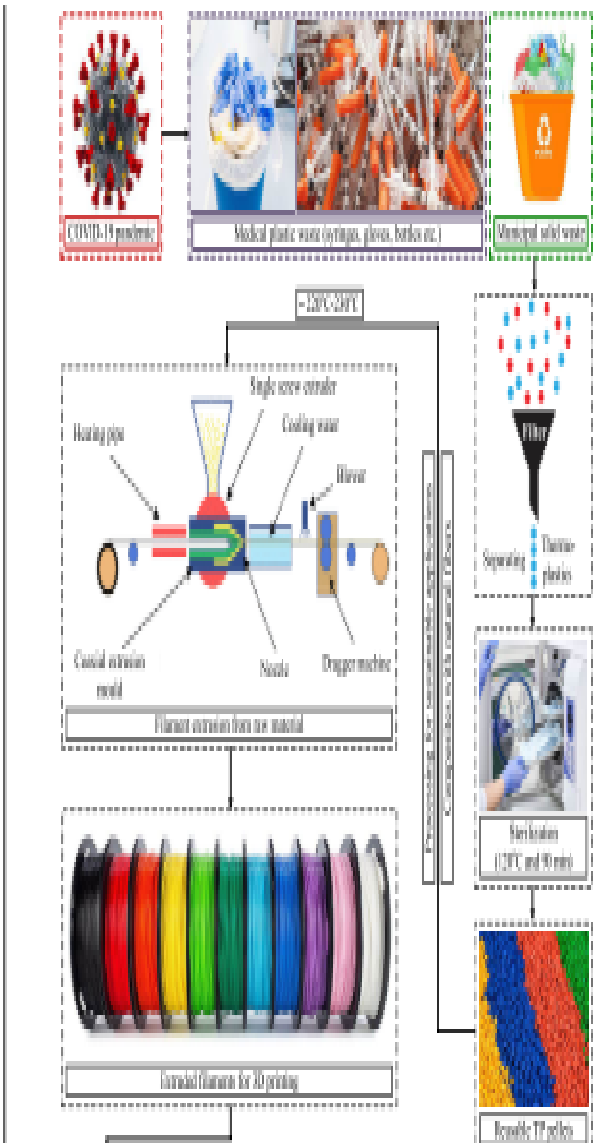


Fig.1. This proposal suggests an environmentally friendly method to handle the plastic waste that has been produced as a result of the COVID-19 pandemic. (7)

II. TYPES OF FILAMENTS MATERIALS

A. ABS

ABS is a highly suitable material for injection molding and has a vast array of applications, such as automotive parts, sporting gear, electrical casings, and toys.Without counting virgin material, it's reasonable to consider how many times ABS can be reused and used as fibre. (7)

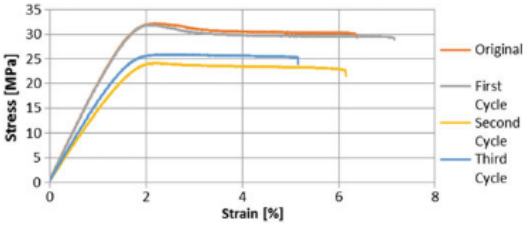


Fig.2. Tensile test of ABS material Specimen(7)

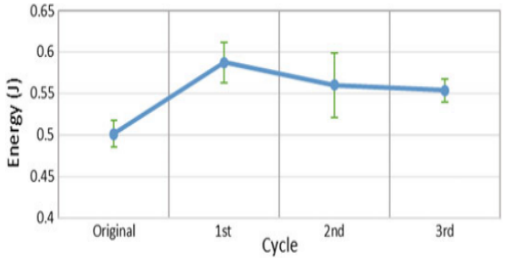


Fig.3. Charpy Impact test of ABS material Specimen (7)

B. PET Composite (recycled and Glycol)

Plastic Water bottles are made with Polyethylene Terephthalate (PET), which is recycled without using additives material for filaments. (8) In order to achieve closed-loop plastic recycling, it is necessary to enhance the quality of recycled plastic to a sufficient degree.(9) blends of waste PET , PP and PS are utilized to manufacture novel filaments. ability to manufacture needed parts especially in rural and isolated locations. Pre-recycling plastics is a costly and time-consuming process. Total volume of PET reduces after recycling . (10)

C. High-density polyethylene (HDPE) is a commonly used plastic waste material for filament extrusion due to its widespread usage in household items such as milk and detergent bottles, and its superior ductility and strength compared to other materials like low-density polyethylene and polyethylene terephthalate. However, 3D printing with HDPE can lead to issues with warping and adhesion. There are certain obstacles to be overcome, such as HDPE's adhesion issues and shrinkage/warping issues. (11)

D. Carbon fiber reinforced polymer composites (CFPC) : It has been shown that no mechanical characterisation and surface morphology are carried out on PC reinforced with SCF polymer matrix composite, taking into account the influence of process parameters.(12)High strength-to-weight and improved stiffness-to-weight ratios are characteristics of carbon fiber reinforced polymer composites (CFPC). Researchers looked at how the infill pattern affected thermal conductivity, finding that the 0° infill had the highest conductivity and the 90° infill had the lowest. Surface temperature for both had values of 79.2°C and 66.4°C. For ECM processing of low-volume composite items, 50CF-PPS material might be a good substitute for composite tooling. The 0°/90° infill pattern was demonstrated to be the most ideal pattern based on the combined effect of thermal conductivity and warpage. (1)

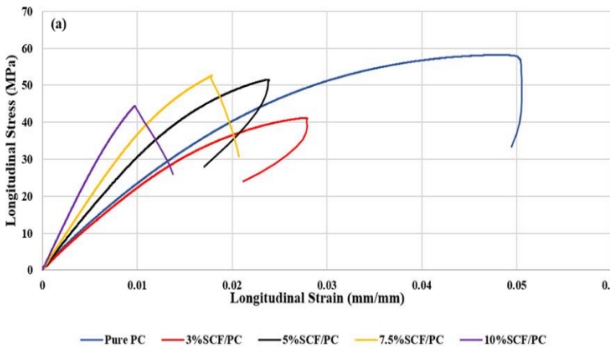


Fig.4. SCF % longitudinal stress-strain curve for all(12)

E. PLA : Lactic acid is used to create PLA, a biodegradable thermoplastic polymer. Due to their natural renewability and degradability, biopolymers are referred to since they are more intriguing for a variety of fundamental applications. The PLA has good qualities compared to many other bio-based materials because it is a thermoplastic with high strength and modulus. (2)

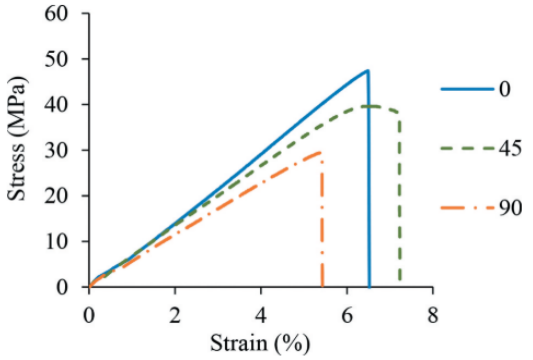


Fig. 5. Tensile test Effect due to raster Angle for PLA specimen(2)

Factor	DF	SS	MS	F	P	Contribution
Raster Angle	2	212.5	106.28	29.31	0	53.49%
Layer Thickness	2	20.74	10.371	2.86	0.116	5.22%
Raster Width	2	67.75	33.875	9.34	0.008	17.05%
Raster Angle*Layer Thickness	4	9.024	2.256	0.62	0.66	2.27%
Raster Angle*Raster Width	4	17.01	4.255	1.17	0.391	4.28%
Layer Thickness*Raster Width	4	41.32	10.33	2.85	0.097	10.40%
Error	8	29.00	3.626			7.30%
Total	26	397.4				100.00%

TABLE 1. ANOVA Table for PLA tensile test (2)

F. Carbon fiber +PLA : It has been shown that the nozzle temperature affects the mechanical qualities, with the optimal temperature enhancing the tensile properties. Test bars made of PLA and PLA-CF composite were made under specific conditions. Because high modulus CFs have a strengthening effect, PLA-CF has better tensile properties than PLA. (13)

Orientations (°)	Materials	Average Young's modulus (MPa)	Average tensile strength max (MPa)
[0°/90°]	PLA	2707.00 ± 55.10	30.11 ± 0.61
	PLA-CF	3553.50 ± 56.12	28.25 ± 0.59
[45°/135°]	PLA	2882.75 ± 62.54	36.83 ± 0.68
	PLA-CF	4296.25 ± 60.33	30.22 ± 0.66
[0°/30°/60°/90°/120°/150°]	PLA	2905.00 ± 50.15	37.01 ± 0.71
	PLA-CF	4536.25 ± 43.85	31.10 ± 0.73
[0°/30°/60°]	PLA	2981.66 ± 45.62	39.14 ± 0.56
	PLA-CF	4642.00 ± 50.43	32.24 ± 0.49
[0°/15°/30°]	PLA	2988.75 ± 75.70	41.69 ± 0.87
	PLA-CF	5049.00 ± 62.63	36.16 ± 0.75
[0°/15°/−15°]	PLA	3028.50 ± 62.73	43.83 ± 0.69
	PLA-CF	5419.00 ± 55.11	36.38 ± 0.51

TABLE 2. Tensile test results for PLA-CF and normal PLA, summarized (13)

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G. PLA + AL: Thermoplastics do not efficiently conduct heat. AL supports the adhesion of new layers to one another. Al microfilm was sprayed during the FFF process in between the layers of PLA to act as reinforcement. The materials' thermal stability is unaffected by the presence of microfilm. (14)

H. PLA+ZNO: ZnO-reinforced polylactic acid (PLA) matrix has been demonstrated to possess shape memory characteristics. (15)

I. Polymer & Ceramic Composite: Polymer-ceramic composites are best known for their superior fracture toughness, fatigue resistance, wear resistance, higher strength retention at higher temperatures, higher strength to weight ratio, higher hardness, thermal response, chemical inertness, and corrosion resistance when compared to other composites like metal matrix composites, ceramic matrix composites, and concrete matrix composites. (16)

J. Second life – Recycling :

The two most popular filament materials among the thermoplastics now available for 3D printing are polylactic acid (PLA) and acrylonitrile butadiene styrene (ABS). Commercial filaments can cost up to 200 times as much as unprocessed polymers. even though their thermomechanical recycling would significantly lower the cost of 3D printing (17)

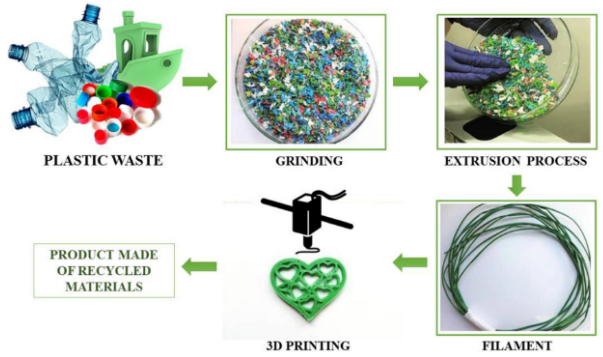


Fig.6. recycling programme for 3D printing supplies Content(17)

III. ANALYSIS AND METHODOLOGY

Following methods are used to analysis of Filaments like scanning electron microscope (SEM) analysis, (2) Recycled virgin PET Creating, testing, comparing, and measuring rheological data, evaluating thermal and mechanical properties (tensile), comparing recycled and commercial PET with PC and ABS filaments, contrasting soda bottles, injection molding rPET, 3D printing rPET, and COTS PET Stress/strain graph, ultimate tensile strength, and graphing elastic modulus are all among the research projects. Thermal analysis of Filaments differential scanning calorimeter curves with and without water and nitrogen cooled Heat flow/temperature graph, Rheological behavior of recycled materials viscosity / Shear stress graph, Thermogravimetric analysis weight percent/ Temperature Graph, Chemical Analysis FTIR spectra absorption bands/ wave number tested and compared for variety of materials qualitative investigation. (8) Circularity of various sample plastic recycling is assessed using material property testing such as thermogravimetric analysis (TGAs), melt mass-flow indexes (MFI), tensile tests, and impact tests. (9)

scanning the results of electron microscopy, Maximum stress and strain experienced by recycled polymers maximum strain and stress experienced by recycled polymers, Gel permeation chromatography, Fourier-transform infrared spectroscopy, thermogravimetric analysis, dynamic mechanical study of recycled polymers, and ultimate tensile strength of FFF printed recycled polymers. Fluorescence spectroscopy in X-rays. Strength, dependability, and polymer characteristics of FDMed ABS, as well as gel permeation chromatography, DSC, TGA (weight percentage/temperature), FTIR (%Transmission and wave number), and (GPC). Weibull plots illustrate the tensile strength (TS), fracture strength, nominal strain at TS, and nominal strain at break for virgin ABS, as well as tensile stress-strain curves, Average tensile strength changes with porosity, (6)

Comparison of the recovered filament recycled with biodegradable filaments and other sustainable materials rePET polyethylene terephthalate and a typical The PETG (Polyethylene Terephthalate with Glycol) filament is focused on stress/strain findings and filament comparison. (18)Water absorption, Fourier transform infrared spectroscopy, Raman spectroscopy, differential scanning calorimetry, and thermogravimetric analysis.

IV. RESEARCH PROBLEM

In comparison to FDM 3D printed parts, the injection molded PLA item had the highest level of strength. FDM feedstock filaments continue to be expensive and scarce. There isn't enough research in the literature about the FDM process from the beginning, that is, from the creation of filament, which enables total control over the processes.

Raster angle and breadth are two operational characteristics that have an impact on tensile strength, with an o degree raster angle having the highest strength. The tensile strength of a 300 m layer increases with thickness. Beyond 500 m, the tensile strength of the raster drops. (2). Plastic poses health and environmental risks, and its distribution and collecting are labor-intensive and expensive. The machine setup was tested with numerous thermo polymers and can handle any thermopolymer up to a maximum temperature of 250 °C, despite its slow extrusion rate and high recycling cost. (3)

Commercially, recycled virgin PET filaments are not readily available; instead, PET-G (PET combined with glycol) is used (8). Decreased qualities might make closed loop recycling less likely. (9)

Recycling lowers costs and carbon impact, but it's challenging to modify recycled polymer's mechanical qualities (4) The extent to which 3D printing findings are carried over is unclear(5).

V. RESULT AND DISCUSSION

Different raster angles demonstrate that specimens created at 00 raster angle gave high tensile strength and displayed high stiffness, which is in line with the result and conclusion established by the ANOVA test showing raster angle played a substantial 53.49% contribution in tensile strength. Tensile strength falls from 0° to 45° and 90° raster angles. Layer thickness of 300 m. Beyond the raster width of 500 m, a decrease in tensile strength is seen. (1)

The Recycling Bot was created for less than 56000 INR. 0.4 kg/h of filament is produced. Reduced filament price to 441 INR per kg. The plastic extrusion setup needs upgrading, and all the information is open source. (3) After recycling, mechanical qualities will not change, allowing for the replacement of existing materials. (8)

Compared to injection molded samples, recycled polypropylene and PET printed samples showed a longer tensile elongation to failure(4). To meet design specifications, parameters affecting porosity air gap, extrusion ratio, and nozzle temperature must be changed. Tensile and fracture strength of recycled ABS Filaments dropped by 10%.(5)

The power ranges for electromagnetic, piezoelectric, and triboelectric nanogenerators produced by additive manufacturing were 0.5-32 mW, 0.0002-45.6 mW, and 0.3-4.67 mW, respectively.(6)

PETG demonstrated extremely high ductility in the non-linear region, whereas rePET displayed brittle failure behaviour. (18)

After each cycle, the tensile strength slightly declined while the impact test remained stable. (7) One of the most effective strategies to lessen the environmental issues related to plastic is through reuse. (10)

VI. RESEARCH SCOPE

It is necessary to use composite plastic filaments with various operating conditions for tensile strength and izod impact tests. (2)

Using software-enabled feedback loops and quality control, and real-time adjustments to extrusion settings depending on monitoring, the recycle bot was further improved.

different chilling techniques to broaden the variety of polymers that can be employed, such as a liquid bath,

a collection of default values for commonly used mono monomers that are recyclable;based on mechanical lading, improve design to cut costs and print time. Consider recycling as an option. Choose the best recycling robot parameter. Improving trash quality. (3)

To fully optimize recycled PET composite filament, its cost must be decreased, and its sustainability must be improved as compared to new filaments. Fillers (toughening agents) can be employed to increase the mechanical qualities of rPET filament and broaden its range of possible uses. (8)

The practical impacts of such plastic recycling activities should be statistically evaluated in future studies. (9), the compatibility of the polymers using alternate processing techniques such as solid state shear pulverization to enhance miscibility in the blend. cellulose or glass fibers can be used as reinforcement to boost mechanical characteristics to the level of mid-grade polymers or higher. (4)

Future work on recycled ABS should adopt a data-driven strategy to encourage the use of recycled materials that are durable, strong, light, and multipurpose. (5)

Key factors for exploring sustainable materials that need more research include mechanical qualities, cost, and availability. Environmental factors are additionally taken into account. (18)

The COVID-19 pandemic presented significant challenges because of the significant amount of municipal and medical plastic waste that was generated and the need to recycle it. (6) Advance characterizing the recycled ABS fiber was necessary to obtain all chemical changes that occurred during the fabric expulsion preparation, including measuring the thickness. viscosity measurement is one among them. (7)

VII CONCLUSION

In conclusion, this review paper provides a comprehensive overview of plastic composite filaments used in additive manufacturing through fused deposition modeling (FDM). FDM is a widely used 3D printing technique that allows for the creation of complex geometries using plastic materials. Composite filaments, which are made by incorporating various fillers or reinforcements into a polymer matrix, offer unique properties and enhanced functionalities compared to pure polymer filaments.

The review discusses the different types of composite filaments used in FDM, including metal-filled, carbon-filled, ceramic-filled, and polymer-filled filaments, and their properties, such as mechanical strength, thermal conductivity, electrical conductivity, and chemical resistance. It also highlights the challenges and limitations associated with using composite filaments in FDM, such as processing difficulties, printability issues, and material compatibility.

Furthermore, the review summarizes the recent advancements and developments in composite filaments for FDM, including novel materials, processing techniques, and applications. It also provides insights into the potential future directions of research and applications in this field.

Overall, this review paper serves as a valuable resource for researchers, engineers, and practitioners interested in the field of additive manufacturing using plastic composite filaments through FDM. It highlights the current state of the art, challenges, and opportunities in this area and provides a foundation for further research and advancements in the development and utilization of plastic composite filaments in FDM.

The goal of this research was to examine how recycling is affected by FFF and, if possible, set guidelines for how much recycled material can be combined with new material to create new filament. Yet Not clearly satisfied with existing implementation in the market for 3D print Filaments from recycled filament, There is wide scope of Research work in recycled Filaments.

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Emerging usage of Artificial Intelligence in Defence Sector

Parinita Hajra

Assistant Professor, Department of Computer Engineering

Indus Institute of Technology andEngineering Ahmedabad, Gujarat

parinita1995@gmail.com

Seema Mahajan

HoD, Department of Computer Engineering

Indus Institute of Technology andEngineering Ahmedabad, Gujarat

ce.hod@indusuni.ac.in

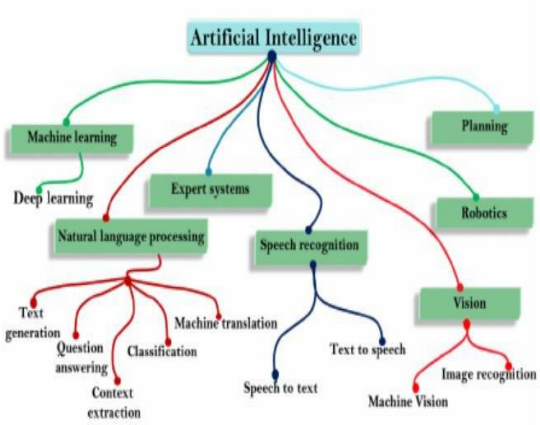
Abstract

Artificial Intelligence, also known as machine intelligence, is a novel field within computer science that involves using information to create machines capable of performing tasks that typically require human abilities. The main goal of Artificial Intelligence is to achieve "Strong AI", that would be comparable to human intelligence in many ways. The proliferation of AI applications has led to increased interest from governments worldwide, particularly in the area of military applications. Developers use techniques such as generic programming and neural networks to create AI algorithms, which can then be adapted for military purposes, such as developing devices that can detect bombs and mines, as well as radar, submarines, missiles, and other applications.

Introduction

We are currently living in the era of the Fourth Industrial Revolution, characterized by rapid and simultaneous changes brought about by scientific advancements that are transforming industries, eradicating geographical limitations, even redefining humanity. Artificial Intelligence (AI) is the driving force behind this revolution, powering targeted marketing, self-driving cars for safer travel, more intelligent weapons, and greater efficiency in areas such as manufacturing, supply chain management, and agriculture. While AI holds the potential to solve some of society's most pressing issues, it also has the potential to displace jobs.

Artificial Intelligence refers to computer programs that can utilize High Power Computing (HPC) and big data to teach themselves, and eventually imitate



the way the human brain operates. AI has become an essential tool across various sectors of the modern economy, and both corporations and governments are fiercely competing to become leaders in AI research and application, as this will result in higher profits and a military technological advantage. AI can enable a wide range of technologies and is beginning to have a considerable impact on defense capability. Its digital, physical, and political security implications will expand existing threats, introduce new ones, and alter the nature of threats and warfare. These changes may involve automation of attacks related to social engineering, detection of vulnerability, terrorist utilizing commercial AI systems, larger-scale attacks, and manipulating availability of information.

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AI in Armed Forces

The competition to develop groundbreaking AI technology is already underway, with significant rewards awaiting the first successful innovators. Major players in the tech industry are investing billions of dollars into their own AI research and development, while venture capitalists are also funding startups in this field. Just as industrialization and mechanization revolutionized society and warfare, giving an enormous advantage to those who were first to adopt these technologies, breakthrough AI could have an even greater impact.

The military can benefit from AI and human-computer interfaces, which can provide an advantage over potential adversaries. In the future, individuals, teams, units, and the entire military could be more closely connected and able to make decisions together. This could lead to better mutual understanding, collective decision-making, and coordinated anticipatory action. Despite increased connectivity, future conflicts may be more ambiguous, with a mix of real and fake information, adversary spoofing, deception, and data manipulation. This awareness will fuel faster decision cycles, compressed by vast amounts of data and nearly instant communication.

Artificial intelligence can operate in different dimensions like:

Artificial Intelligence (AI) has the ability to guide the physical objects like robotic systems, to perform tasks without any kind of supervision of human. This can be applied in various fields such as tanks, flights as well as ships, where AI has the ability of reducing reliance on humans. Swarm techniques, which use supervised algorithms to guide platforms like drones, are one example of how AI can be employed.

Furthermore, AI is able to aid in processing as well as interpreting information. Image recognition algorithms can be used for tagging and the U.S. military program, Project Maven, is focused on developing algorithms for automating analysis of video feeds captured by the drones.

Artificial Intelligence in defence sector globally

China

China is currently leading the world in terms of technological advancements and the application of Artificial Intelligence (AI). It is using Big-Data, Neural Networking, and autonomous intelligent systems to achieve the next generation of AI. China has allocated a budget of over $25 billion to AI and is working towards developing laws, regulations, and policies for the industry. The country has set a goal to become a world leader in AI by 2025 to promote its economic transformation.

China's CETGC has achieved a new record by successfully conducting a flight test for a Swarm of 119 drones in June 2017. The country is placing a high priority on AI and is actively involved in Swarm Intelligence, the distribution of robots, and enhancing its military capabilities by taking advantage of the private sector's progress in AI.

USA

The United States government has invested more than $17.9 billion in the development of AI for use in warfare. Advanced concepts like electronic wearable combat apps and mother-ships of drones that release small micro-drones through the air and sea are being tested at MIT's C.S and A.I Labs. The Defense Advanced Research Project Agency (DARPA), a department of Defense in USA, is one of the biggest sources of funding for AI research, providing the development of new technologies for military use.

DARPA has also developed a Virtual Machine Reality (VMR) system that allows the intelligence analysts for searching, filtering, and exploring visual media using advanced computer vision as well as reasoning techniques.

Russia

Russia is following in the footsteps of China and the USA by investing in military AI applications. Although Russian AI development is not as advanced as that of the United States and China, Russia is taking steps to close the gap. Russia has released a national strategy for AI, which aims to improve the country's AI expertise, educational programs, data-sets, infrastructure, and legal regulatory system over the next 5 to 10 years. Russia plans to robotize 30% of its military equipment by 2025 as part of its 2008 defense modernization agenda. To achieve this goal, Russia is establishing various organizations especially for development of the military AI, including an AI and Big Data consortium, a Fund for Analytical Algorithms and Programs, a state-backed AI training and education program, a dedicated AI lab, and a National Center for Artificial Intelligence.

Israel

The Israeli Defense Forces (IDF) relies on its main technical unit called C4i, which houses a branch called Sigma dedicated to AI development. Sigma's objective is to conduct research and apply the latest AI and advanced software research to ensure the IDF stays up-to-date. Despite Israel's comparatively small size and budget, the country invests about 4.5% of its GDP in R&D, nearly twice the average of the OECD. In contrast, only 2% of Germany's

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R&D and 17% of US R&D is allocated to the military, whereas 30% of Israel's R&D is spent on military products. This suggests that the Israeli Defense Forces are highly receptive to modern AI research and innovation in defense.

The report focuses on four military contractors in Israel and their AI applications: Elbit's Autonomous Loitering Munitions Drone, IAI's Autonomous Perimeter Patrol Drone, Rafael Advanced Defense Systems' Missile Targeting, and IMI Systems' Autonomous Vehicles.

Artificial intelligence in Indiandefence system:

In India, the use of artificial intelligence is primarily concentrated in the commercial industry, although it is also growing quickly in the defense sector. The combination of artificial intelligence and robotics is revolutionizing various fields in India, including social, defense, and economic sectors. Currently, India has over 233 companies specializing in artificial intelligence, and they are working across a variety of sectors, including gaming, aerospace, social media, military, and more.

AI with Robotics in Indian defence:

India's defence sector has been actively involved in AI technology, with the Defence Research and Development Organization (DRDO) leading the way. The Indian army uses DAKSH Robots to defuse explosives, which are classified as remotely operated vehicles (ROVs). There are over 200 ROVs in the Indian military sector. India and Japan are partnering to develop AI with robotics in the military sector, with a focus on unmanned ground and aerial vehicles, bomb and missile systems, smart ammunition, and robotics. India's defence system is primarily focused on developing ROVs, including DAKSH for bomb diffusion and disposal, UAVs such as RUSTOM and NETRA, and various mini robots. The Centre for Artificial Intelligence and Robotics (CAIR) is responsible for AI in India's defence sector, with an annual revenue of $180 million. With over 29,000 AI professionals averaging 6.6 years of experience, India is rapidly advancing in the field of AI.

Applications in defence system

Cybersecurity:

In today's digital age, where almost all transactions are done online, sensitive and confidential information related to a nation's defence systems is also available on digital platforms. Therefore, safeguarding this data becomes a crucial aspect of defence. To provide defence data security, artificial intelligence (AI) systems are being used. These systems learn the behavioral patterns of authorized personnel and distinguish them from malicious software or any attempts to access confidential information from an unreliable source. In case of any threats, AI systems can automatically detect and prevent cyber-attacks at an early stage. Moreover, these systems can also analyze external attacks on the system, learn their patterns and develop countermeasures to improve security.

Transportation and Logistics:

The transportation and logistics services are of utmost importance for any defence system to ensure that the soldiers receive essential equipment without interruption for the sake of security. Therefore, AI is increasingly being integrated into transportation systems to improve the security of various military transportation and defence equipment. Autonomous vehicles controlled by AI can be utilized to reduce the involvement of humans and the associated risks. Moreover, the AI system can be trained to identify any abnormal behaviour and take necessary actions to address them. The accurate detection of faults and failures in various components can be facilitated by AI, making it useful for logistics. The predictive maintenance capabilities of AI can be utilized to minimize errors within a reasonable time-frame.

Platforms for warfare:

Many countries globally are utilizing artificial intelligence to enhance their defence and warfare capabilities. AI is being integrated into various pieces of machinery and defence mechanisms to improve their effectiveness. Unlike human inputs, AI systems provide objective and precise input, resulting in more accurate outcomes. The use of AI has significantly reduced response times of various defence systems and enables operations to be conducted accurately from remote locations. When combined with AI, the efficiency of defence systems increases dramatically.

Medical service on the battlefield:

Medical assistance is essential in the defense sector, especially on the battlefield. To address this challenge, countries are creating prototypes of AI-controlled medical assistants to provide support to soldiers. These assistants have access to the soldiers' medical history and can use it to cross-reference current and past data to provide an effective diagnosis and appropriate measures. This leads to faster recovery, better remedial support, and reduced human risk. Additionally, AI-operated machines can provide medical support and security during the evacuation process, enhancing overall security.

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Recognition of target:

Target recognition is a critical aspect of defense activities, and AI systems are increasingly utilized to gather and analyze data from previous attacks and events to identify potential threats. The information collected in the database is useful for identifying potential targets and locations that could pose a significant risk. AI systems can collect and analyze data on environmental conditions, weather forecasts, and geographic advantages to develop effective strategies for missions and provide probable scenarios that might be encountered during the operation. As a result, the use of AI for target recognition improves the likelihood of success.

Monitoring the threats and situation awareness:

Surveillance and reconnaissance play a crucial role in a country's defense strategy. It involves gathering intelligence about potential threats, which can be dangerous, as it often requires entering enemy territory. However, the use of AI systems has allowed for the development of unmanned surveillance systems that can collect and process data more efficiently than humans. These AI systems are highly capable of recognizing the threats. AI-controlled drones, for example, can conduct 24-hour surveillance across borders and provide real-time updates on potential threats, allowing for quick and effective action to be taken.

Processing of information:

As mentioned previously, the main benefit of AI is its ability to quickly analyze vast amounts of data, making it a valuable addition to various fields, particularly in defense. AI surveillance and reconnaissance data can be used to identify threat patterns and develop strategies to address them. These data-sets can often reveal patterns that are not visible to humans, giving us an advantage in strengthening our defense systems. AI can process data much faster than human strategists, enabling us to make up for lost time. Better strategies developed through the use of AI can prevent loss of life and valuable resources.

The age of automation

The trend of reducing human effort by using machines is becoming increasingly popular. Automation using AI is being implemented in various industries to achieve complete automation of services. Governments of major nations are also looking to AI to automate defence systems and save valuable resources and time. However, only a few countries have the knowledge and resources to implement AI on a large scale. With resources being depleted rapidly, this trend will only increase in the future. To enhance national defence, military personnel must equip AI defence mechanisms to tackle advanced weapons and prevent incoming threats. The digital age and increased use of data in almost every field have made it more important than ever to upgrade defence systems.

Potential Risks

The incorporation of AI in warfare may have both positive and negative effects. While some may view AI as a tool for offensive operations, it can also be beneficial for defensive strategies. As a general-purpose technology, the impact of AI on the balance between offense and defense may differ depending on the specific application and may evolve over time. Although there are potential risks associated with AI, such as accidents, the delegation of authority, over-reliance on automation, and nuclear stability, it's important to note that these risks are not inevitable. The choices made by states on how to use AI technology will determine how these risks manifest, and concerted efforts to avoid them may be successful.

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Future Implementation

The Indian Armed Forces are currently collaborating with CAIR on the development of Multi-Agent Robotics Framework (MARF), which includes various types of robots such as the Snake, the Legged Robot, the Wall Climber, and Unmanned Ground Vehicles. In addition, they are focusing on the following areas:

- Utilizing AI techniques for image interpretation to aid in identification as well as classification of target.
- Developing systems for diagnosing and maintaining weapon systems.
- Assessing missile range and direction for effective deployment in various situations.
- Increasing the usage of robots for anti-Improvised Explosive Device operations, personnel extraction, shooting, and other applications. This process will lead to the modernization of various capabilities, thus improving operational efficiency. To enhance their frontline operations and operational readiness, the Indian Armed Forces must apply AI. A clear strategy must be formulated at the Service Headquarters to ensure its effective implementation.

7. CONCLUSION

AI is already being used in military operations, with big-data analysis and machine-learning algorithms expanding information processing capabilities. Automated decision-making will play a greater role in every level of command and control, from swarming UAVs to the national command authority. While genuine AI may still be a few years away, it's important to establish limits for autonomous weapons through international humanitarian law and military rules of engagement.

AI will be transforming other activities of military such as logistics, intelligence, surveillance, and weapon designing, resulting in a strong effect on the strategy of nations employing them. The development in AI research, especially in hybrid approaches which use multiple AI techniques, suggests potential short-to-medium term impact on existing military activities, although it may not simulate human-level cognition anytime soon.

It is essential for militaries to adapt to changes brought about by AI, which can have a big impact on global balance of power as well as international conflict. The primary vision for military's usage of AI is about creating center for the advancement, innovation, as well as development. This vision can help the Indian government to cover different AI fields like autonomous weapons and AI's role in cyber defense, and benefit country the most.

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Graph Signal Processing on Images

Jaya Shukla
Department of Computer Engineering
Indus University
Ahmedabad, India
jayashukla.ce@indusuni.ac.in

***Abstract*—This research suggests the studies of Graph Signal Processing for images. Graph Signal Processing is an emerging field in the area of signal processing. In this work we discussed different characteristics of graphs in terms of signal processing such as Graph Fourier-based descriptor, Eigen value decomposition, Algebraic approach of graphs, and dimensionality reduction method. The descriptors calculated for graphs have a unique feature for images i.e they are illumination in-variant. Based on the suggested graph structure's Laplacian matrix, GFT coefficients can be determined. In a graph structure, every image pixel is regarded as a node. The information of the edge between neighboring pixels for a given image is used to define connections between nodes. In the suggested work, difference between intensities i.e the current pixel and pixels in its neighbourhood are used to determine the information of the edge for the given image using a threshold value. This procedure will turn an image into the image's edge information, which will be illumination-invariant. The bordered image has now been separated into n non-overlapping patches of equal size. A graph has been created using this image's edge information. Laplacian matrix and its associated eigenvectors have been constructed for this graph topology. Simulation results show that increasing the number of neighborhood pixels during the graph formation will not improve the results.**

***Index Terms*—Graph Signal Processing, dimensionality reduction, Eigen Value Decomposition, algebraic approach**

I. Introduction

The past years have demonstrated how Signal Processing (SP) has had an impact on a variety of fields, including control, sensing, acoustics, communications, and image processing etc. . Information of interest for current applications frequently develops in non-Euclidean, irregular domains as a result of the modern world becoming more digitised and data collecting technologies becoming more prevalent. Graph Signal Processing (GSP) generalises Signal Processing tasks to include signals from non-Euclidean domains whose structure can be represented by a weighted graph. Graphs are ideal candidates to serve as the foundation for a theory of signal processing in more erratic domains since they are adaptable, capable of capturing irregular interactions, simple to understand, and equipped with a corpus of mathematical discoveries. graph. The foundational studies [1], [2], [3], and [4] published a decade ago introduced the phrase "graph signal processing." GSP-related issues have received a lot of attention since the publication of these works, not only from the SP community [5], [6], but also from the machine learning communities, where graph-based learning research has grown dramatically [7]. Graph signals are well adapted to model measurements, information, and data connected with (indexed by) a set where:

1) The elements of the set belong to the same class (social network members)
2) The various components of that set have a relationship (physical or functional) of closeness, influence, or affiliation.
3) The strength of such a relation among the pairs of elements is not homogeneous.

Many other times, the network is implicit, capturing some idea of similarity or reliance between nodes, and the linkages have to be deduced from the data itself. GSP is thus a broad framework that integrates and extends classical SP methods, tools, and algorithms to application domains of the contemporary technological world, like Social, communication, brain networks, recommendation system, network flow, etc. Researchers have recently rekindled their interest in graph-based discrete signal processing in order to investigate the transform methods, known as Graph Fourier transform (GFT), on the signals present in the graph [1]. A graph can be thought of as a relational model that represents data from a variety of fields, such as protein network systems, social network analysis, image processing, transportation, sensor networks, and image processing [2]. It has been determined that graphs can be used to represent relationships between pixels in the case of photos and that this capability has been embraced.

II. Descriptor Calculation using Graph Signal Processing

A directed graph or digraph G can be represented as $G = (V, E)$ where, the V represent the vertex set and $E = (V, V)$ represent an edge set. The edge e can be referred as incidence of vertex u on v or vice versa. In case of self loop or loop, it is going on from vertex u to vertex u i.e $e = (u, u) \in E$. If $e = (u, v)$ means we are going from vertex u to vertex v. The degree of a graph G can be represented as $d(v)$. It refer the number of vertices incident on v. With out a loop, a graph is called simple. In this work, we make an assumption that graph should be simple, finite and undirected.

If the i-th vertex is adjacent to j-th vertex then the value in $A(G) = [a_{ij}]$ (or A) in place of $a_{ij} = 1$, If the i-th vertex is not adjacent to j-th vertex then the value in $A(G) = [a_{ij}]$ (or A) in place of $a_{ij} = 0$. The Laplacian matrix $L(G)$, or

simply L, is the additional matrix associated with graph G and is defined as

$$L = D - A, \tag{1}$$

where D represents the degree matrix and A represents the adjacency matrix. Matrix D has only diagonal values which can be calculated as

$$D_{ii} = \sum_{j=1}^{N} A_{ij}. \tag{2}$$

Keep in mind that the adjacency matrix depends on the labelling of X's vertices. The adjacency matrix of a graph is denoted by the letter G because any two adjacency matrices that have undergone a permutation transformation are comparable. It is noted that the matrix L is symmetric and positive semi definite. The eigenvalues of a positive semidefinite matrix are real, not negative orderable, i.e. $0 = \lambda_0 \leq \lambda_1 \leq \lambda_2 \leq \lambda_3 \leq \lambda_{N-1}$. Additionally, N mutually orthogonal eigenvectors for L are available. The column vector, which is transpose($[1, 1, \ldots, 1]$), is seen to be an eigenvector of L with eigenvalue zero. Graph based descriptor coefficients can be calculated based on the Laplacian matrix of the graph where the neighborhood information could be maintained. A real-valued function defined on the graph's vertices can be used to define the graph signal S i.e., $S : V \to R$ and $v \to S(v)$. We can also represent a signal S the $i-th$ component of the vector S. Fourier Transform descriptor is the dot product of a signal S with the corresponding eigenvectors of the Laplacian matrix, i.e., $\hat{f}(\zeta) = \langle f, e^{2\pi i \zeta t} \rangle$. Similarly, descriptors based on the Graph Fourier Transform of a signal $S \in R^N$ on the vertices of G is the inner product of S with the of the graph Laplacian's eigenvectors. Graph Fourier Transform coefficients are the inner product of S with the eigenvectors of the Graph Laplacian matrix, *i.e.,*

$$X_{GFT} = T^H.S \tag{3}$$

Graph based Fourier Descriptors coefficients can be used as a feature descriptors in many application areas. To convert an image block of size $N \times N$ in to an image edge information of the image is required . The $4-$nearest neighbours of the current pixels are shown in fig 1.

Similarly, the $8-$nearest neighbours of the current pixels are shown in fig 2.

When two pixels are adjacent and their values for the grey scale meet a predetermined requirement, they are said to be linked. Adjacency and connection are defined using a set of intensity values (V). Three different types of adjacency exist.

1) 4-adjacency: If pixels p and q are in $N_4(P)$ and their values are from V.
2) 8-adjacency : If pixels p and q are in $N_8(P)$ and their values are from V.
3) m-adjacency : Pixels P and q are m-adjacent if q is in $N_4(P)$ or q is in $N_D(P)$ and $N_4(P) \cap N_4(q) = \phi$

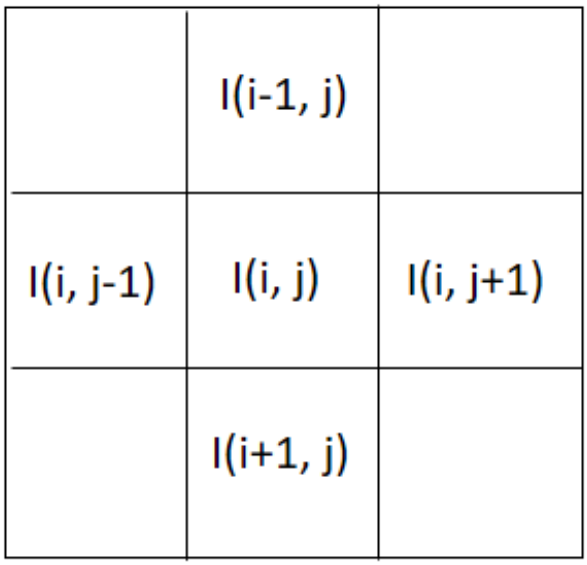


Fig. 1. 4 Nearest neighbours of the image

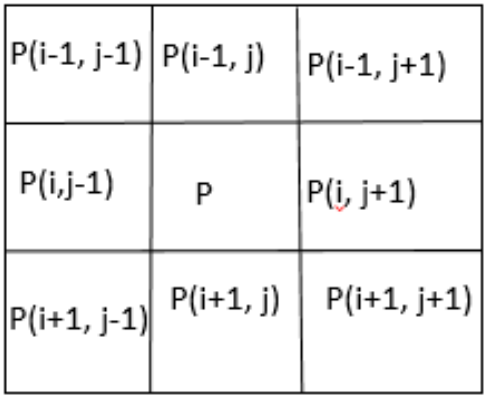


Fig. 2. 8 Nearest neighbours of the image

III. Eigen Value Decomposition

When two square matrices' eigenvectors and eigenvalues are combined, they form the eigen-decomposition of the matrix, which analyses the matrix's structure [9]. Despite the fact that not all square matrices have the eigen-decomposition, For a class of matrices that are frequently used in multivariate research, it has a particularly simple formulation, it contains a very simple formulation for a family of matrices that are frequently used in multivariate research. Other names for eigenvectors and eigenvalues are characteristic vectors, latent roots, and characteristic equation. For a given matrix, set of eigen values are also called as its spectrum. An eigenvector of the matrix A is defined by the most popular method as a vector u that fulfils the following equation:

$$Au = \lambda u \tag{4}$$

After rewriting, this equation becomes

$$(A - \lambda I)u = 0 \tag{5}$$

We normalise the eigenvectors for the majority of applications, i.e., change them so that their length is equal to 1.

$$U^T U = 1 \tag{6}$$

The collection of eigenvectors for A is often assembled in a matrix called U. An eigenvector of A makes up each column of U. The eigenvalues of a matrix are retained in a diagonal matrix. Only diagonal elements are non zero whereas all the non diagonal elements are zeros.

Positive semi-definite matrices are a kind of highly common matrices used in statistics. These matrices' eigen-decomposition, which has a very useful form, is always present. When a matrix can be created by applying its transposition to another matrix, that matrix is said to be positive semi-definite. Accordingly, a positive semi-definite matrix must always be symmetric. So, formally, the matrix A is positive semi-definite if it can be obtained as:

$$A = XX^T \tag{7}$$

Positive semidefinite matrices with particular application to multivariate analysis. Positive Semi definite matrices also include correlation matrices, matrix for cross product and cross variance. A positive semi-definite matrix's crucial characteristics are that its eigenvalues are always positive or null and that, when their eigenvalues differ, its eigenvectors are pairwise orthogonal. The important characteristics of a positive semi-definite matrix are as follows:

1) It contains positive eigen values or null.
2) It also contains pairwise orthogonal eigen vector as its eigenvalues vary.

There are three significant integers that are closely connected to the eigenvalues of a matrix as follows:

1) Trace
2) Determinant
3) Rank

The diagonal sum of the components makes up a matrix $A's$ trace, which is represented as trace A. For an example,

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}.$$

Then

$$trace(A) = 1 + 5 + 9 = 15 \tag{8}$$

The sum of a matrix's eigenvalues is also the trace of the matrix.

$$diag(A) = [16.1168, -1.1168, 0] \tag{9}$$

The determinant of a square matrix is another traditional quantity related to it. This idea of a determinant, which was initially described as a combinatorial concept, is crucial for computing a matrix's inverse and for solving systems of linear equations. A matrix's determinant is also same as the product of its eigenvalues.

$$|A| = [16.1168 \times 1.1168 \times 0] = 0 \tag{10}$$

The number of a matrix's non-zero eigenvalues can be used to define its rank.

$$rank(A) = 2 \tag{11}$$

A rank matrix can be defined as the following:

1) Full Rank Matrix: If rank is equal to the matrix dimension
2) Rank-deficient Matrix: If rank is smaller than the matrix dimension

Rank-deficient matix is also known as singular, or multicolinear. The inverse of the matrix exist only for full rank matrix. For a matrix with a positive semi-definite, the dimensionality of the Euclidean space that can be utilised to represent the matrix is determined by the rank.

IV. Algebraic Approach of Graph Signal Processing

Convolution is a fundamental component of most algorithms in traditional SP, including filtering, sampling, and interpolation. The time shift, or unit delay that converts a signal into a delayed version of itself, is crucial in defining convolution and filtering. Filters that are linearly time invariant produce outputs that are weighted linear combinations of inputs that have been delayed. In GSP we can define a signal x over a graph G and calculate this Ax, which is the multiplication of adjacency matrix A of Graph G by x. The reason behind this id that A is a straightforward operator that combines the values of x in a way that takes the local connectivity of G into account.The polynomial definition has several benefits in addition to the theoretical motivation. The operation Ax can be seen as a local linear combination of the signal values at one-hop neighbours when applied to a graph signal x. Similar to Ax, A^2x is a local linear combination of Ax that reaches values in the vicinity of two hops. From this point, a graph filter $p(A)$, represented by a polynomial of order L, is combining values that are separated by no more than L hops.

V. Dimensionality Reduction Using Graph Signal Processing

A traditional method for doing a linear mapping of the data so that the variance of the data in the low-dimensional representation is maximised is the frequently used PCA. The widely used PCA is a traditional method for mapping data in a linear fashion so as to maximise the variance of the data in the low-dimensional representation. In addition to PCA, other linear methods of dimension reduction include linear discriminant analysis (LDA), locality preserving projections (LPP), marginal Fisher analysis (MFA), and their various variations. Additionally, other nonlinear techniques for dimensionality reduction have been put forth. In order to learn the low dimensional manifolds, self-organizing maps and other

neural network-based methods pose nonlinear optimisation challenges. (e.g., autoencoder [4]). The geometric structure of the manifold is captured by Laplacian eigenmaps (LE) [5] and diffusion maps [6], which assist in mapping the data points into a lower dimensional space. The side information (shown as a graph) may include more precise correlation information than the measurements when the data are noisy and deteriorated, according to our hypothesis. So we might discover a more precise low-dimensional subspace by using the graph. This differs from earlier research that just used measurements to understand the low-dimensional subspace or manifold [8] (e.g., PCA, Laplacian eigenmaps). These are the following steps which are used to perform dimensionality reduction on graphs:

1) Perform connectivity analysis for Graph signal
2) Make adjacency Matrix
3) Compute Laplacian Matrix
4) Calculate Eigen Values and Eigen Vectors
5) Use these Eigen Vectors to reduce the dimensions
6) Eigenvectors corresponding to highest eigen value will contain the most information of the signal.

VI. Conclusion

This research work highlighted the use of Graph signal processing in case of images. This work has also mentioned the relation between the eigen values of a matrix with its trace, rank and determinant. In this work we showed the calculation of Graph Fourier Descriptor.

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Sustainability of Water Desalination Using Solar Energy

1st Dharmendra Sapariya
Assistant Professor, Dept. of Mechanical Engineering, Indus Institute of Technology and Engineering, Indus University
Ahmedabad, India
dharmendrasapariya.me@indusuni.ac.in

2nd Dr. A D Dhass
Assistant Professor, Dept. of Mechanical Engineering, Indus Institute of Technology and Engineering, Indus University
Ahmedabad, India
addhass.me@indusuni.ac.in

3rd Dr. Umang Patdiwala
Assistant Professor, Dept. of Mechanical Engineering, Indus Institute of Technology and Engineering, Indus University
Ahmedabad, India
umangpatdiwala.me@indusuni.ac.in

4th Mr. Keyur Patel
B.Tech. Student, Dept. of Mechanical Engineering, Indus Institute of Technology and Engineering, Indus University
Ahmedabad, India
Keyur2464@gmail.com

***Abstract*—**

Solar desalination system was designed to study effect of solar concentrator trough reflector. For sustainability in desalination system was developed with specific dimensions for the solar parabolic trough reflector and the absorber tube. Reduction in energy consumption for pumping of the water through condenser, 25 watt solar panel was attached. The maximum efficiency of this system was observed 19.14% during experiments at 6.58 kWh/m^2 per day solar intensity, during experiment was observed in a month of April month. For a 5 liters of water supplied in test-rig gave the highest amount of distilled water as 2.6 Kg output in 10 hours span of the day and TDS of sample water reduced from 872 to 190 PPM. Another experiment on October month where brackish water with more than 4580 PPM distilled to 176 PPM with amount of 1.46 kg Water.

Keywords— Desalination, Parabolic Reflector, Absorber Tube, Distilled Water, Solar intensity

I. INTRODUCTION

The need for pure water is an essential aspect in everyday life, and the global need for drinking water has grown dramatically. Water and energy are required for life on Earth to exist [1]. As the world's population grows, the availability of drinking water decreases. Water purification methods include extracting it from natural sources such as rivers, lakes, wells, rain, and other bodies of water. Water from the ground level must be treated before it can be used for human utilization. The globe will face catastrophic fresh water and energy shortages. According to current research, by 2025, 60% of the world's population would be living in places with severe water shortage, up from 40% currently [2]. India has 4 % of the world's freshwater which has to cater to 17 % of the world's population. As per NITI Aayog report released in June 2019, India is facing the worst-ever water crisis in history. Approximately 600 million people or roughly around 45 % of the population in India is facing high to severe water stress. As per the report, 21 Indian cities will run out of their main source of water i.e. groundwater by 2020. The report goes on to say that nearly 40 % of the population will have absolutely no access to drinking water by 2030 and 6 % of India's GDP will be lost by 2050 due to the water crisis. The physical property of water is affected due to thermal pollution. Rivers and seas support aquatic life, however, by increasing their temperature, the quantity of oxygen in the water becomes decreased, which also decreases the levels of aquatic life. Dumping of sewage waste is one of the most serious concerns in the world. Wastewater is fully contaminated water (containing wastes) that has been released after use, and it is discharged every day by various sectors. Basically, it originates from human waste, septic-tank discharge, water used for washing, rain water collected on different sites for a longer period of time, etc. Radioactive waste or nuclear waste contains radionuclide materials that are no longer useful. Organic and Inorganic chemicals are also playing an important role to become make it polluted.

Desalination is a technique that has the potential to fix this problem, however it is incredibly energy consuming and has serious environmental repercussions [3]. Desalination is a physical procedure of separating the excess of dissolved salts from waters, brackish and seawater, or any aqueous salt solution in order to collect low-salt content water for any suitable use, such as drinking, industrial, pharmaceutical, municipal, or household water. Desalination is an industrial procedure and an intensive energy system independently of the process, rending energy cost as the major economic problem. Energy consumption of distillation process is higher than any other in the chemical industry and as a consequence desalinated water is still costly despite the dramatic decline in cost during the recent years. Its price is higher than transportation of the same amount of natural water from a short distance. However, transportation or pumping of water from longer distances may be as expensive or more expensive as desalination systems, depending on the distance and the morphology of the site.

Desalination is a process of removing undisclosed substances, dissolved substances and harmful microbes from saline water and converts in to drinkable water. Large amounts of energy are used in the distillation process, which ultimately leads to contamination of the environment. Many research tried to achieve objective as an improvement in efficiency in solar desalination system [4]. Thermal desalinations technique are listed as multistage flash distillation, multiple effect distillation, Thermal vapor compression, Solar distillation, Membrane distillation, Humidification-dehumidification.

Solar desalination is the simplest way to harvesting potable water from available impure water. The basic

principles of solar water distillation are so simple, distillation process is very similar to the way nature makes rain. Heat energy of the Sun, evaporates the water. As the water evaporates, water vapor rises and condensed on glass surface for further collection. Arabian Gulf shore research conducted by the United Nations University Institute for Water, Environment, and Health (UNU-INWEH). Desalination Facilities in Saudi Arabia, the United Arab Emirates, and Qatar treat saltwater to produce around 55% of the world's brine. Desalination operations usually use harmful compounds like chlorine and copper, which may be found in brine, which is water that contains around 5% salt. Approximately 3.5% of the world's seas are salty. Toxic impacts on fish populations have been attributed to the "accumulation in the environment" of chemical waste. Decreased oxygen levels in the ocean caused by brine near desalination facilities have "deep repercussions" for bottom-dwelling creatures such as crabs, prawns, and clams, and can have "ecological effects observed throughout the food chain." [5].

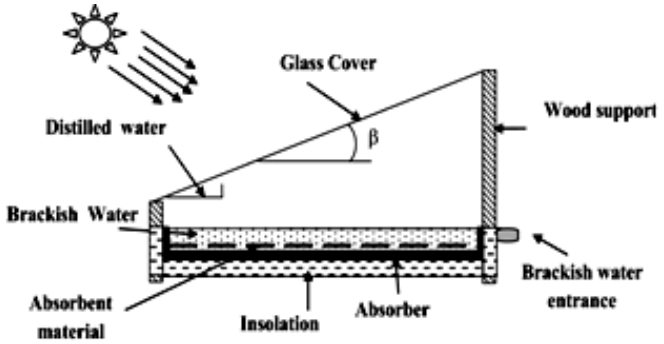


Fig. 1 Solar desalination system components [6]

Desalination by Solar still is a simple technique of solar desalination which follows hydrological cycle principle for converting non drinkable to drinkable water. Fig 1 shows solar desalination system [6]. Most simple devices produce 1 L/m^2 of fresh water, whereas the more advanced models produce 20 L/m^2 of fresh water [7]. Because of their small surface area, parabolic trough concentrators accelerate the rate of water evaporation. [8].

II. Experimental work setup

Modified solar still designed, fabricated and installed at Ahmedabad (23°03’54.7” N, 72°.26’23.6”E), Indus University, Gujarat location for the said research work. Modified solar still have some additional accessories to improve the overall productivity. The effective absorber area of solar still is 36 m^2 (6 m × 6 m). The Maximum height of side walls are 2.4 m with 15° slop.

A. Components of Solar-still

Solar distillation is the most simple and effective method for purifying salty water using solar energy. The body of the solar still is normally made of galvanized iron (G.I.) sheet, while the cover is made of transparent glass. It is critical to keep the solar still in this position so that it can collect the most solar energy. The interior surface of the solar still is painted with matte black colour to maximize solar energy absorption. Some of the sun's rays are reflected by the outer surface of the clear glass cover and the water surface, but the bulk of them penetrate the still space and are absorbed by the water in the basin and the blacked surface.

Basin area: The basin is used to store contaminated water. In most circumstances, black paint is utilized to absorb as much of the sun's heat as possible. A galvanized iron basin is suggested for optimal solar still performance. The 6 x 6 x 2.4 m basin is built of stainless steel sheets that have been coated with black colour to soak up as much sunlight as possible.

Glass cover: Covering the basin with glass is crucial for efficient heat transfer to and from the environment. The basin can benefit from the sun's rays because of the glass covering. An optimum glass cover thickness passes more solar radiation inside the basin and evaporates the water. Glass cover with 6×6 m and 4 mm thickness allows solar energy to enter in to the still but not allow accumulate heat to remove from still. Transparent glass inclined at β=15° angle [9] with horizontal basin surface for allowing higher amount of solar ray reach to basin surface. Evaporated water condensed and converted in to droplet on inner glass surface. Due to slop of glass, droplet slips over collecting trough, which can give the solar radiation to the basin water. The performance of glass cover as glazing is higher compared to others.

Insulation: In solar still maximum heat losses occurred from the bottom of the solar still. The solar still's distillate output can be maximized by using a basin lined with an appropriate insulating material, which lowers heat losses. A low thermal conductivity insulation material absorbs more heat energy and reduces heat loss. In solar still, insulation material with proper thickness gives the optimum performance on distillate output of solar still. To prevent heat loss, a 5 mm thick air-dumping foam insulator surrounds the still.

Parabolic Trough System: Solar basin and parabolic trough system were integrated for improve evaporation rate. Parabolic trough collector made up of reflecting glass with length of 5m and radius of curvature 75 mm. Solar rays diverted on black colored tube with diameter of 8 mm. Parabola trough collectors attain 12% efficiency at far higher operating temperatures than traditional flat panel collectors [10].

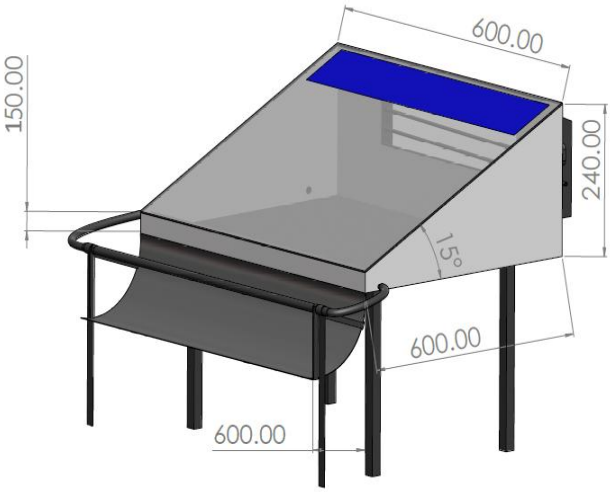


Fig. 2 CAD experimental work CAD model

Heat Exchanger: Hot vapor was condensed by using heat exchanger as a condenser by exchange heat from vapor to

circulate water passed through the tube of condenser. For circulating water 12 V. D.C. pump was used which run on 12V D.C. 25 watt solar panel.

Water Pump: For condensation water circulation 12 voltage and 4 Amp attached.

Thermocouples: Thermocouples were used to measure temperature at various place of solar still.

The distillate condenses on the inside of the glass covers, and the condensate was carried to a collecting flask through a collecting trough.

B. Experimental Procedure

• The hours of the experiment were from 8:00 am to 5:00 pm.
• The solar still was positioned so that it receives optimal sunshine during the experimental window, with no inside or exterior items casting shadows on the apparatus.
The columns of the table used to store the collected data are as follows: Time (in Hr), and Atmospheric Temperature (in °C), the Basin Water Temperature (in °C) and the productivity (in ml).
• To ensure the glass plate was sitting flush and securely in all of the clamps, a thorough inspection was performed.
• Any dust or grime on the glass plate was wiped away using a dry cloth.
Glass dome collected by water cooled heat exchanger placed rear part. Water has been circulated by water pump. Pump run by solar panel. Aim of using heat exchange was to increase condensation process of vaporized saline water.

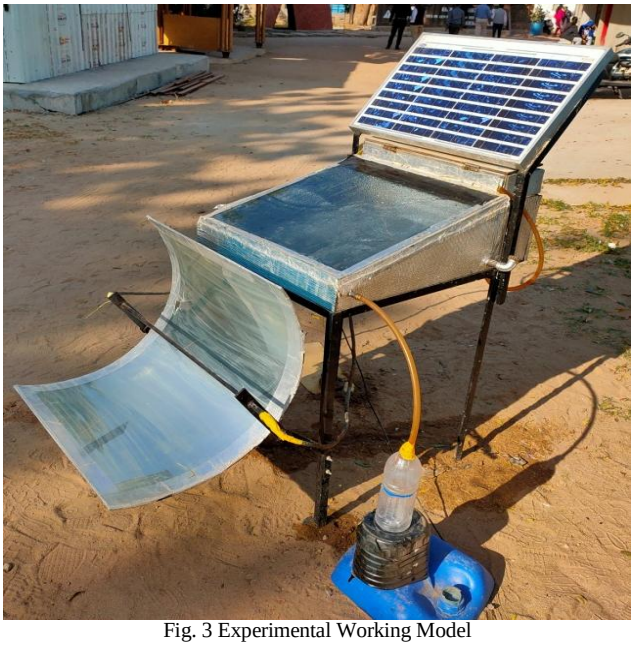


Fig. 3 Experimental Working Model

• Saline water is poured into the solar still, which is then positioned at a height, and a condensed distilled water is slowly allowed to trickle down the pipe and into the storage tank.
• The measurements are conducted at hourly intervals.
• The temperatures are measured using digital thermocouples attached at selected location of experimental model of the solar still and productivity is measured in terms. An overflow port is used to drain any surplus water from the still.



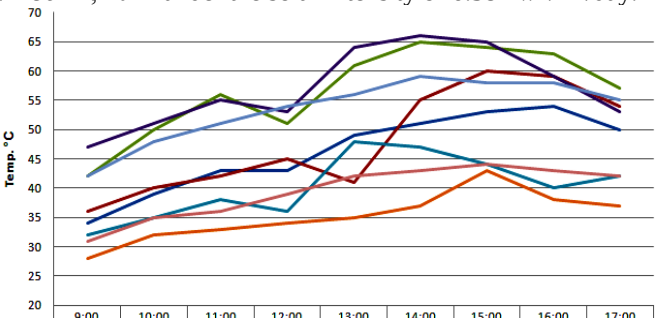
(a) (b)

Fig. 4 TDS value of (a) saline water (b) distilled water

• Water was collected in clean bottle and then checks TDS of distilled water using TDS meter.
Figure 3 shows experimental setup image and figure 4 shows TDS water of raw improved water and experimental distilled water
• Final results and conclusions are drawn from experiment work.

III. Result and Discussion

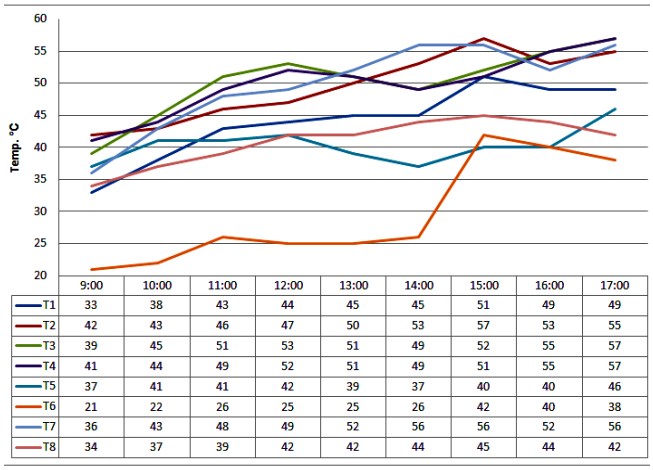
Experimental analysis has been made to study the effective temperature of water and glass concerning time and analysis of pure water productivity.
Experiments have been conducted at April 2022 from 9.00 hr to 17.00 hr at Ahmedabad location 23°2' N latitude and 72°35' E, 2022 under the solar intensity of 6.58 kwh/m^2/day.



	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
T1	34	39	43	43	49	51	53	54	50
T2	36	40	42	45	41	55	60	59	54
T3	42	50	56	51	61	65	64	63	57
T4	47	51	55	53	64	66	65	59	53
T5	32	35	38	36	48	47	44	40	42
T6	28	32	33	34	35	37	43	38	37
T7	42	48	51	54	56	59	58	58	55
T8	31	35	36	39	42	43	44	43	42

Fig. 5 Time Vs Temperature graph for 5 liter water feed

In this graph we have;
T1 - Water inlet temperature to parabola trough reflector,
T2 - Water outlet temperature from parabola reflector,
T3 – Still black color inside base temperature.
T4 – Solar still inside housing temperature.
T5 – Out let from Condenser Heat exchanger water temperature
T6 – Cooling water sink temperature,
T7 – Outside glass temperature.

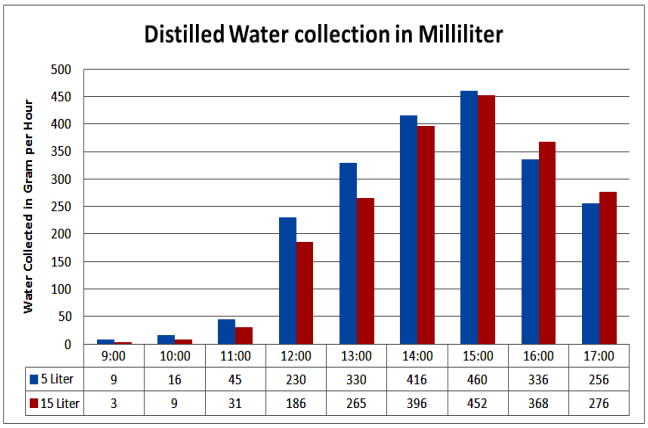


	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
T1	33	38	43	44	45	45	51	49	49
T2	42	43	46	47	50	53	57	53	55
T3	39	45	51	53	51	49	52	55	57
T4	41	44	49	52	51	49	51	55	57
T5	37	41	41	42	39	37	40	40	46
T6	21	22	26	25	25	26	42	40	38
T7	36	43	48	49	52	56	56	52	56
T8	34	37	39	42	42	44	45	44	42

Fig. 6 Time Vs Temperature graph for 15 liter water feed

Figure 5 shows graph of recorded temperature data Vs Time at selected location of experimental model for for 5 liter water feed on basin area. Maximum Temperature 66°C observed in still housing at around 2:00 PM.

Figure 6 shows graph of recorded temperature data Vs Time at selected location of experimental model for for 5 liter water feed on basin area. Maximum temperature observed 57°C of parabolic trough pipe outlet temperature.



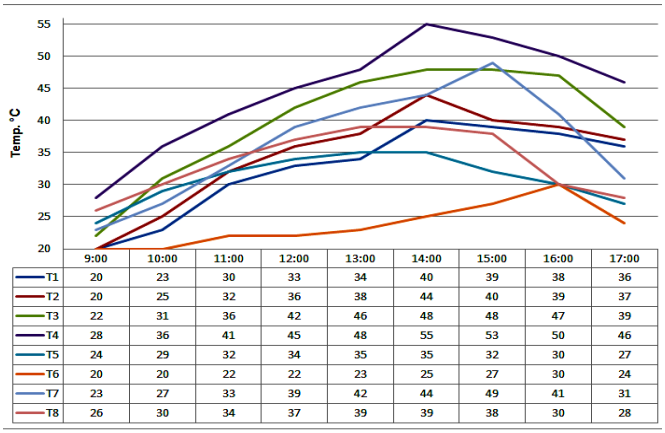
	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
5 Liter	9	16	45	230	330	416	460	336	256
15 Liter	3	9	31	186	265	396	452	368	276

Fig. 7 Comparison of water collection hourly for 5 liter and 15 liter water filled on basin

Figure 7 shows distilled water collected amount comparison. It shows water is collected during 2 to 3 PM time period maximum collected amount of 460 gram for 5 liter water basin, while for 15 liter basin maximum amount of 452 gram during 2 to 3 PM.

The results of the experimental studies show that the greatest yield of 2.6 kg was achieved for a water level of 5 litres over a period of 10 hours (9.00hr - 17.00hr), while the yield of 2.25 kg was obtained for a water level of 15 litres with a TDS value of 190 PPM.

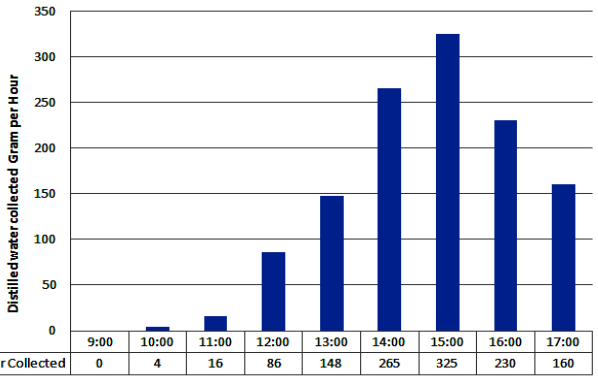
Second experiment carried out in October 2022 under solar intensity of 4.96 kWh/m^2/hr for 5 liter brackish water having TDS higher than 4580 PPM. During this experiment 1.46 kg Water collected of 176 PPM.



	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
T1	20	23	30	33	34	40	39	38	36
T2	20	25	32	36	38	44	40	39	37
T3	22	31	36	42	46	48	48	47	39
T4	28	36	41	45	48	55	53	50	46
T5	24	29	32	34	35	35	32	30	27
T6	20	20	22	22	23	25	27	30	24
T7	23	27	33	39	42	44	49	41	31
T8	26	30	34	37	39	39	38	30	28

Fig. 8 Time Vs Temperature graph for 5 liter brackish water

Result of experiment shown in figure 8 as time vs temperature graph and figure 9 distilled productivity vs time for brackish water.



	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
Water Collected	0	4	16	86	148	265	325	230	160

Fig. 9 Water collection hourly for 5 liter brackish water

Efficiency of Solar still can be calculated by,

Daily distilled output: Me = Qe / L

Daily distilled efficiency: η = Qe / Qt

Where,

Q_e = Amount of energy utilized in vaporizing water in the distiller in kJ/day.

Q_t = Amount of incident solar energy on the distiller in kJ/m^2/day [11].

TABLE I. COMPARISON TABLE FOR SALINE WATER AND BRACKISH WATER PRODUCTIVITY

Water on basin	Daily distilled output in Kg	Q_e kJ/day	Q_t kJ/day	Daily distilled efficiency % η per day
5 Liter saline	2.6	16322.22	85276.8	19.14
15 Liter saline	2.25	14125	85276.8	16.56
5 Liter brackish water	1.46	9554.9	64281.6	14.86

IV. CONCLUSION

By the experimental work observation made as lower still basin 5 liter water level produced 2.6 kg higher amount of distilled water 15.55% high than 15 liter basin 2.25kg water level. Another observation as temperature incremental of basin water were lower basin water level achieved high temperature between and water levels provide comparatively high yields from 9:00 am to 13:00 pm, but then their output drops down until nightfall. In contrast, higher water levels produce less quickly in the morning but more gradually as the day progresses.

The best results per hour are obtained between 14:00 and 15:00, when the water depth is the shallowest (5 liters), for 15 liter basin water level 15 and 17 hours at the late afternoon. On other way distilled efficiency as 19.14% for 5 liter basin water, while 16.56% for 15 liter water distillation process. Experiment way proved that basing water level also effect on water distillation rate.

As part of future work for this model one use phase changing material or nanomaterial on basin to increase evaporation rate of water. Parabolic trough collector can be modified with evacuated tube for absorbing more reflected solar energy for increasing evaporation rate of water. For increasing condensation rate solar powered condensation thermo electric peltier can be attached that increase efficiency for the continuous provision of cooling water. Based on today scarcity of pure drinkable water, desalinating water using a solar still can be a sustainable option for obtaining potable water.

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A Review on Applications of Nanotechnology in Waste Management

A D Dhass
Mechanical Engineering Department
IITE, Indus University
Ahmedabad-382115, India

Bharat Prajapati
Chemistry Department
IISHLS, Indus University
Ahmedabad-382115, India

Dharmendra Sapariya
Mechanical Engineering Department
IITE, Indus University
Ahmedabad-382115, India

Bansi D Raja
Mechanical Engineering Department
IITE, Indus University
Ahmedabad-382115, India

Umang J. Patdiwala
Mechanical Engineering Department
IITE, Indus University
Ahmedabad-382115, India

Abstract—***The availability of clean, inexpensive water has become one of the main challenges of the 21st century. The world is in the midst of a water crisis due to a number of issues, including increased demand, alterations in weather patterns, and a general decline in water quality. The importance of technological advancements in facilitating integrated water management cannot be emphasised. Nanotechnology has the potential to greatly improve water and waste water treatment, both in terms of treatment efficiency and the ability to tap into various water sources without risk. In this review paper delves into the unique physicochemical features of nanoparticles, which have proven to be helpful in the field of sustainable water management, and the recent advancements in nanotechnology to clean water and wastewater.***

Keywords—water treatment, waste management, nanoparticles, carbon based materials and zeolite materials.

I. INTRODUCTION

In the past decade, nano-scale markets have rapidly risen to prominence throughout the industrialized world. In the business sector, nanotechnology is quickly becoming the standard. As both science and technology advance, scientists increasingly adopt new methods that are less expensive, risk-free, and environmentally friendly. Their concerns about the environment and the depletion of natural resources are addressed through nanotechnology [1].

Waste products have grown as cities and their populations have expanded. Waste products are created through industrial, municipal, and manufacturing processes. Usable and non usable items, containers and packaging, food scraps, yard clippings and various inorganic wastes are all considered municipal solid waste (MSW). Liquid waste management includes chemical and biochemical processing as well as wastewater treatment and sewage treatment. Methods of garbage disposal frequently differ by nation, municipality, and manufacturer [2].

Waste water is typically treated using sedimentation, screening, filtration, separation, chemical precipitation, coagulation, ion exchange, solvent extraction, or anaerobic methods in industrial and commercial settings.

1.1 Sedimentation method

Sedimentation takes place in tanks, where wastewater is left for a period of time to allow suspended solids to settle and form smut, before being skimmed off, and sludge, which has settled to the bottom of the tank, being removed. Up to 80% of suspended particles, 90% of BOD, and 55% of feculent coliform bacteria can be eliminated with first-stage treatment [3].

1.2 Screening process

The screening procedure gets rid of the larger pieces of floating trash, which include things like rags, paper, and plastics (which account for 60%, 25%, and 5% of the waste output, respectively). During the screening process, inorganic particles such as gravel, sand, bone fragments, coffee grounds, and maize kernels settle in grit channels and are subsequently eliminated [4].

1.3 Filteration

Nanofilters cleanse water of harmful impurities including bacteria, parasites, and metals by trapping and eliminating ions and cations. The control of membrane deposits is crucial to the achievement of nanofiltration. Cleaning or replacing membranes after befouling is a pricey procedure [5].

1.4 Separation method

An expanding field of research is the creation of polymers having modifiable oil-water separation capabilities, either by filtration or absorption. For instance, magnetic fields can be used to drive and regulate the separation process by tuning the absorbent's response to them. In addition, carefully designed nanoparticles can be employed to create an oil-and-water separation [6].

1.5 Chemical precipitation

The treatment of sludge generated, the cost of sludge treatment, and the purity analysis of the recovered tanning agent must be taken into account before chemical precipitation utilising a ratio of chemicals can be used in industry. In the presence of water, MgO decomposes into magnesium hydroxide ($Mg(OH)_2$). As a result of the reaction between magnesium hydroxide and basic chromium sulphate (BCS), a precipitate of chromium hydroxide, $Cr(OH)_3$, is formed, which is insoluble in water and sinks to the bottom as sludge[7].

1.6 Coagulation method

There are two unique procedures for adsorbing contaminants onto magnetic nanoparticles (NPs) and achieving improved coagulation/flocculation (C/F).With a coagulant or flocculant pollutants in solution or in suspension can be removed. Recently, magnetic nanoparticles have been proposed for use in

coagulation/flocculation as a means of improving the removal of physical-chemical parameters and pollutant chemicals from water.

As a result of charge neutralisation, adsorption bridging, and sweep flocculation, the presence of magnetic metal organic frameworks nanoparticles improved the coagulation of dissolved organic matter. The new technique also significantly lessened the buildup of leftover sludge [8].

1.7 Ion exchange method

Biochar is a promising substance for eliminating pollutants from industrial wastewater due to its carbon-rich renewable biomass of plant and animal origin. Biochar is ideal for wastewater treatment due to its microporous structure, high specific surface area, and ion exchange capabilities. Silver nanoparticles have seen a boom in their own commercialization and use due to their antibacterial properties. Its intended purpose is to produce membranes for commercial nano filters that incorporate silver nanoparticles. This is due to silver nanoparticles being synthesised on the membrane surface in real time. After pretreatment with poly vinyl alcohol, silver salts were deposited on the membrane's outer layer [9].

1.8 Solvent extraction

Nanoparticle regeneration is a key factor in the cost-effectiveness of water purification systems. Regeneration of nanoparticles is extremely pH-dependent. Similar outcomes can also be accomplished by utilising a separation device or the immobilisation of nanoparticles within the treatment system. The chemical use of membrane filtration demonstrates its potential for recycling nanoparticles. Since polymer membranes degrade quickly when exposed to UV light, ceramic membranes are typically the better option [10].

1.9 Anaerobic method

The quality of the biogas generated by anaerobic digestion is crucial. Biogas has lost much of its heating value and energy content because to carbon dioxide pollution. Natural gas has an approximate heating value of 35.8 MJ/Nm^3, while biogas has an approximate heating value of 21.5 MJ/Nm^3.During the production of methane, carbon dioxide (CO_2) is used as an electron acceptor. Water vapour is also considered a contaminant in biogas because it can mix with carbon dioxide to generate carbonic acid, which can erode a pipeline. Hydrogen sulphide is another common contaminant found in biogas (H_2S) [11].

In conventional methods of waste water treatment is required more time and it has less treatment efficiency. To overcome this obstacles nanotechnology based waste water treatment is provides a huge response. In this review work, nanotechnology based zero-valent material nanoparticles, silver nanoparticles, iron and titanium oxide nanoparticles, carbon based materials, nanocomposites and zeolite nanoparticles impacts on waste water treatment techniques are discussed.

2. Nanomaterials for waste management

The removal of contaminants like metals and bacteria using conventional water treatment technologies is not always successful. Disinfection byproducts (DPBs) are another problem that can be hazardous to people's health and have been produced in large quantities. DPBs are produced when chemical disinfectants react with organic molecules and inorganic ions in water. Studies have shown that nanoparticles can be effective at filtering out harmful substances like metals, germs, and oil from polluted water. Nanomaterials are often employed in the following waste treatment methods[12],

1. Zero-valent metal nanoparticles
   - Silver nanoparticles
   - Iron nanoparticles
2. Metal oxide nanoparticles
   - TiO_2 nanoparticles
   - ZnO nanoparticles
   - Iron oxide nanoparticles
3. Carbon nanotubes
4. Nanocomposite

Nano-adsorbents, nano-catalysts, and ano-membranes are three material-specific subfields of nanotechnology.

1. Nano-absorbents
2. Nano-catalyst
3. Nano-membrane

2.1 Zero-valent metal nanoparticles

Using nanoparticles of zero-valent iron is a common practise in today's water purification systems. Nanoparticles have advantages over their larger and smaller equivalents due to their huge specific surface area, compact dimensions (which allow their migration, for example, in ground water), and specialised physical and chemical properties [13].

Zero-valent iron (nZVI) nanoparticles have promising applications in environmental protection. Metal ion sorption and reductive precipitation take place because of their core-shell structure, which combines metallic and oxidised iron characteristics. There are a number of obstacles to using nZVI since ion delivery occurs several hours after they have been introduced to a medium [14].

The elimination of polychlorinated biphenyls (PCBs) in polluted medium is accomplished through the use of zero-valent metal particles and an organic hydrogen donating solvent. The treatment method could use a mild acid instead of a catalytic noble metal coating on the zero-valent metal particles. When using catalysed zero-valent metal particles, a treatment system may make use of a non-water organic hydrogen donating solvent. To facilitate PCB removal from both in- and out-of-situ structures, the treatment system may be made available as a "paste-like" application [15].

2.2 Silver nanoparticles

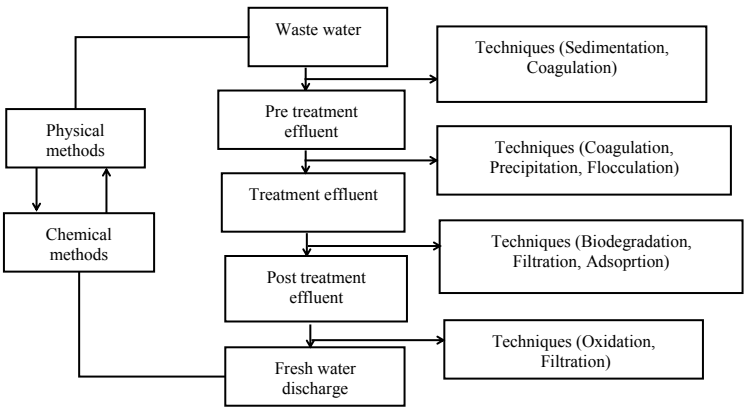


FIG. 1 Traditional approaches to wastewater treatment [16].

Wastewater treatment is crucial for preventing pollution and keeping communities healthy. Wastewater often has an unique odour and a discoloured appearance due to the presence of dissolved organic and inorganic contaminants. Chemical separation technologies are widely used in wastewater treatment, including activated sludge systems, adsorption, filtering, and photocatalysis. Figure 1 shows the five main stages of the waste water treatment procedure.

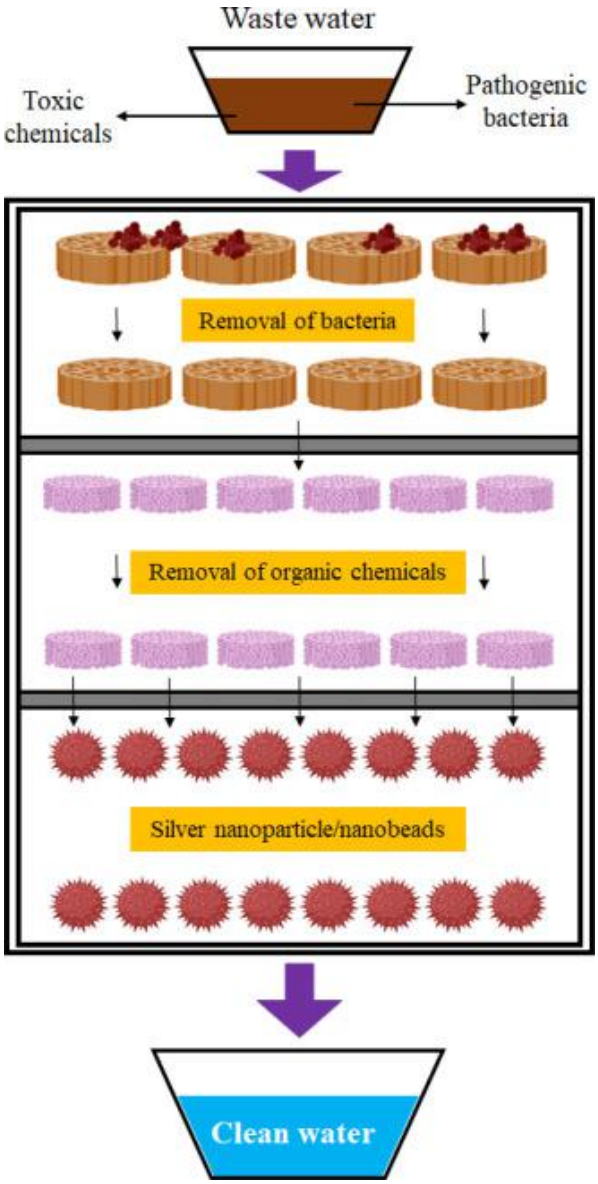


FIG. 2 General scheme of Ag-NP based nanocomposites for wastewater treatment [16].

Silver nanoparticles (AgNPs) are commonly employed in wastewater treatment for the elimination of hazardous compounds like bacteria and pesticides (Fig. 2). The AgNPs are used in commercially accessible products due to their antibacterial characteristics and low toxicity to mammalian cells. It has been shown that AgNPs at 0.25 ppm have bactericidal capabilities, making them effective for preventing biofilm formation in water.Silver's toxicity to microorganisms is assumed to be mitigated by its presence in nature. The aqueous concentration of Ag + is often low in wastewater treatment systems due to the ability of AgNPs to form strong complexes with other ligands such as chloride, sulphide, thiosulfate, and dissolved organic carbons.

2.3 Iron nanoparticles

Nanoiron particles with zero-valent iron have the most complex and sophisticated domain. Several mechanisms, including electrostatic attraction, electron donor-acceptor interactions, surface complexation with functional groups, and ion exchange, have been proposed to explain biochar's properties. Biochar (BC) has a negative charge and is electrostatically attracted to nZVI, which may allow it to deprotonate and remove heavy cationic metals including Pb, Cd, and Cu[17].

2.4 TiO_2 nanoparticles

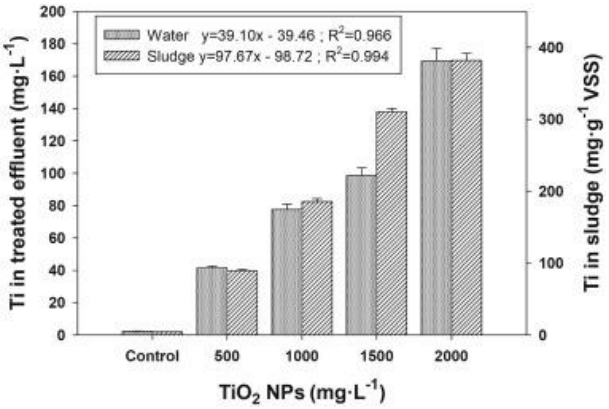


Fig. 3. The concentration of titanium (Ti) in treated effluent and in settled anaerobic sludge [18].

TiO_2 NPs were detected in both raw sewage and treated wastewater. TiO_2 NP concentrations that peaked in anaerobic reactors were shown to have a linear relationship with Ti concentrations measured in effluent (R_2 = 0.966) and sludge (R_2 = 0.994)(Fig. 3). These percentages are in agreement with those reported for currently functioning municipal waste water treatment plants and those predicted by models. As a result, about 8% of the TiO_2 NPs put into anaerobic systems for wastewater or waste sludge treatment remain in the final product.

2.5 Carbon based materials

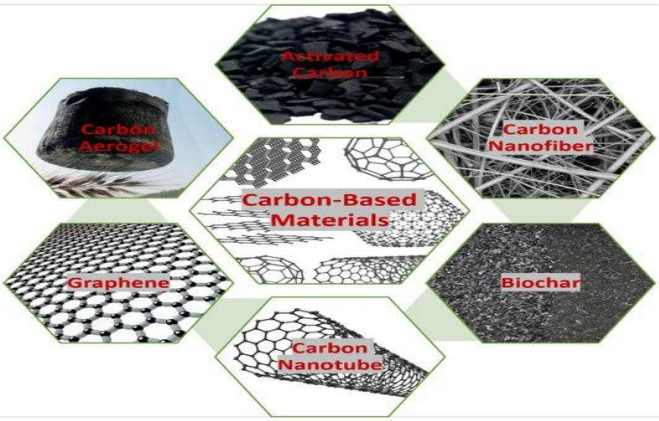


Figure 4. Methods of adsorption for a wide range of carbon-based materials (CBMs) [19].

Adsorption is extremely sensitive to changes in fluid characteristics, pollutant shapes, operating temperatures, pressures, and even the system's physical layout. Water can

be cleaned using a variety of adsorbents, including biochar, activated carbon, clay, silica gel, composites, zeolites, agro-wastes, and biological and polymeric materials. Carbon-based materials are excellent at soaking up contaminants such harmful metal ions, medications, pesticides, metalloids, and many other inorganic and organic compounds.By concentrating and transferring pollutants, adsorbents enhances the efficiency of water and wastewater treatment. The outcome is highly dependent on how the adsorbate interacts with the adsorbent.Carbon-based adsorbents' efficacy is affected by the pH, ionic strength, and temperature of the solution being adsorbed. Chemical compounds are bound to adsorbents and accumulated on their surfaces due to donor-acceptor forces. Carbon-based adsorbents (CAs) such carbon aerogels, carbon nanotubes, carbon nanofibers, and graphene undergo these changes. Figure 4 depicts carbon-based materials (CBMs) used as adsorbents [19].

3.Nanocomposites

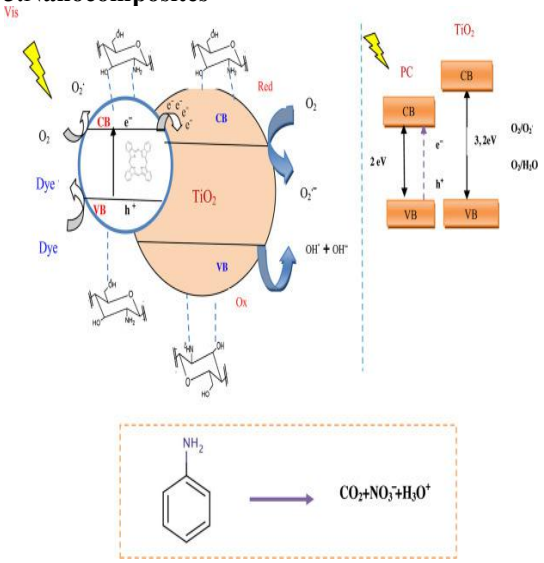


Fig 5: Photoactivation mechanism of TiO_2 and dye-sensitized under visible light [20]

The aromatic amine chemical compound aniline can be photodegraded using a hybrid chitosan-phthalocyanine-TiO_2 (PC/CS-TiO_2) photocatalyst. When positively charged chitosan chains adsorb onto negatively charged polyester-cotton (PC) nanoparticles, the resulting structure acts as an electrostatic barrier. In order to properly create this nanocomposite, this is a necessary step. This means that the PC nanoparticles in the hybrid nanocomposite are totally immobilised and can engage in molecular-level interactions with one another.In order to facilitate the flow of electrons from the sensitizer to the substrate electron acceptors on the TiO_2 surface, the PC dye serves as an intermediary. The excited electron is carried to the conduction band on the surface of TiO_2, where it can combine with protons to produce superoxide radicals O_2 and hydroxyl radicals HO(Fig. 5)

4. Zeolite nanoparticles

In terms of wastewater treatment, zeolite materials are among the most accessible and cost-effective solutions. Unfortunately, the efficiency of zeolite-based systems is very sensitive to the material parameters. Increasing the pore size of the treatment medium could improve the filtering effectiveness of zeolite filters.Due to its great porosity, zeolite media can act as a particle trap after absorbing particles into their pores. Because of this, they not only prevent dust and grime from escaping through the crevices between the grains, but they also absorb it. Because of its cation exchange capabilities, the zeolite mineral can remove positive ions from water while releasing other ions (Fig.6). Because of its high pore density and huge surface area, zeolite has the ability to remove a wide variety of contaminants without the use of a backwashing process. Adsorption makes it possible for the medium to absorb and dispose of particles. Instead of being passively trapped between grains, particles in this process aggressively attach to the surface of the medium. Pressure drops during treatment are reduced for zeolite because it clogs less quickly. It is possible to use this medium as a water softener because of its resistance to chemicals and its capacity to filter out hard minerals.

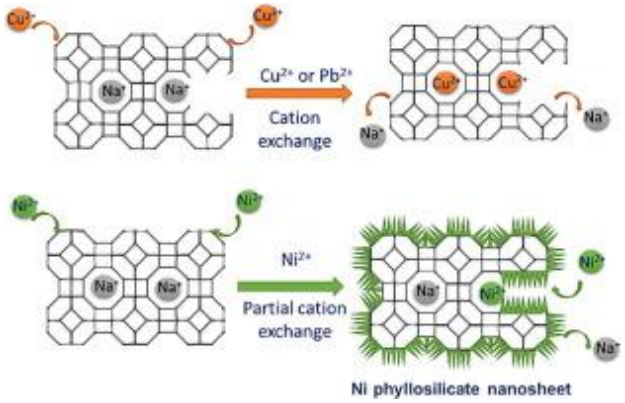


Fig.6 Cation and partial cation exchange of zeolite paricles [21]

Clinoptilolite is a microporous silica and alumina tetrahedral zeolite that occurs naturally. Sodium is often found in higher concentrations in clinoptilolite than potassium. Several exceptions exist to the rule that most dietary sources are high in salt and low in potassium.Natural zeolite materials and their characteristics are summarised in Table 1 [23].

Table 1. Physical characteristics of zeolite minerals [22].

Parameter	Concentration (%)
CaO	0.1 to 6.4
MgO	0 to 2.1
MnO_2	0.1 to 0.2
Fe_2O_3	1.4 to 5.8
TiO_2	0.1 to 0.7
Al_2O_3	14.0 to 15.0
SiO_2	60.0 to 74.0
Na_2O	0.6 to 5.5
K_2O	0.7 to 4.0
P_2O_5	0.1 to 0.2
H_2O	0 to 4.1

5. Conclusion

Although water is required for every aspect of human life, it is becoming increasingly scarce in many regions of the world. In order to reduce water shortage and enhance water quality, it has been shown that nanotechnology and its applications can be of assistance. The discipline of waste water treatment is becoming increasingly interested in nanomaterials as a result of their higher surface areas and size-dependent catalytic capacities. Nanotechnology is rapidly being used by water and sewage treatment plants. Opportunities have developed to considerably enhance water and sewage treatment as a result of the convergence of the unique features of nanomaterials and current treatment technology.

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BANKING AND ATM SECURITY

Ms. Gargi Bhatt
CE Department
Indus University
Ahmedabad, India
gargibhatt.ce@indusuni.ac.in

Dr. Seema Mahajan
CE Department
Indus University
Ahmedabad, India
Computer Engineering HOD
ce.hod@indusuni.ac.in

***Abstract*—** Security is a significant issue in Computerized Teller Machine (ATM). Customers' recognition accuracy must rise as a result of the widespread use of electronic transactions. Customers can use biometric systems to securely authenticate themselves. An electronic machine known as an Automatic Teller Machine (ATM) is used to access a bank account from any location without the assistance of bank employees. With the assistance of an ATM, the user is able to carry out a variety of banking activities, including cash withdrawal, money transfer, and print entry in a passbook. The need to improve ATM security has grown in tandem with the rise in ATM-related criminal activity. A portion of the various innovations that are utilized to give security to ATMs incorporate - Biometric innovation, RFID innovation, and so forth. Systems for recognizing faces and fingerprints are examples of biometric technology. In this paper, a study of various innovations for ATM security is introduced. These technologies have some limitations. The fingerprint technology outperforms other technologies in terms of security when compared to other technologies. We used MatLab for face recognition in this project. Face recognition is the first step. RFID is activated if face recognition is successful. They can gain access to the ATM if they read the correct string; otherwise, the buzzer will sound.

One of the most important aspects of a person's day-to-day life today is the banking industry. People frequently make use of banking facilities for their financial transactions. Banks have a unique position across all industries thanks to their role as intermediaries in the economy, prudent lending policies, environmental impact analysis, and effective credit approval systems. Along with credit risk, banks play a crucial role in the lending process. If a borrower doesn't pay back the money they borrowed or fulfill their obligations, the asset is said to be bad or non-performing. An economic crisis occurs when an economy experiences poor financial performance, which disturbs the stability of the economy. The Reserve Bank of India (RBI) developed the Banking Stability Map and published the Financial Stability Report in 2010 in conjunction with global initiatives. The five dimensions of the Stability Map that are used to measure it are Soundness(s), Asset Quality(Q), Profitability(P), Liquidity(L), and Efficiency(E). The declining asset quality and financial health of Indian banking institutions, in addition to a lack of adequate funds and the pressure of capital regulation, make it difficult to maintain a balance of stability in the sector.

***Keywords*—** ATM, Bank, Face recognition, Block Diagram of atm and banking, OTP, PIN, privacy and identity

Introduction

An ATM is also known as an Automated Teller Machine. Customers of a financial institution are able to perform financial transactions, particularly cash withdrawals, without the need for a human cashier, clerk, or bank teller by using this electronic telecommunications device. The ATM Industry Association, or ATMIA, reports that close to 3 million ATMs are in use worldwide at the moment. Alongside the developing accommodation and possibility of the ATMs, there is additionally an expansion in how much ATM burglaries and fakes, which are creating at a disturbing rate. The safety of financial transactions and banking should always come first. Expansion in everyday assaults on ATM and banking security the designers getting on right track and placing security their significant perspective in creating projects. The multifaceted validation is a way to deal with confirmation which requires the introduction of at least two verification factors: a possession factor, an inherence factor, and a knowledge factor. For authentication to occur, each factor must be validated by the other party following presentation. The PIN is the only method that the ATM currently supports for safeguarding bank funds. In our framework we are going past this degree of safety to improve security of the ATM. In ATM banking, we introduce the idea of a one-time password (OTP). The second level of security that our system will provide will make use of various factors to generate OTP. This will send over client's portable number or email id put away in records. The user will need to enter their mobile phone's IMEI number into the bank system in order to use a secure ATM. When a user inserts their card into the machine or swipes it, the proposed system will send an OTP to their mobile phone. The user will gain access to the machine once the OTP is entered into the system; otherwise, no transactions can be completed.

I. ATM ISSUE, ADVANTAGES AND DISADVANTAGES

A. Issue

1. Faculty Dispenser
2. Worn out card reader
3. Broken Keypad

4. Receipt Malfunctions

5. Software glitches

B. Advantages and Disadvantages

Advantages:

1. With fewer human errors, it is possible to provide prompt service.
2. Travelers will appreciate it.
3. It reduces bank staff's workload and provides services round-the-clock without staff.
4. Cash can be withdrawn at any time or in an emergency without the assistance of a bank.
5. It protects the customers' privacy.
6. There is no need to wait in long lines to withdraw rupees, and the process is quicker than at the bank.

Disadvantages:

1. It cannot provide services in rural regions in our country whereas banks are available in the villages.
2. Customers hesitate to use it because they lack adequate knowledge of its operation.
3. In the event that an ATM card is misplaced, rupees cannot be withdrawn. The ATM card could be hacked or misused in some other way.
4. In the event of an error at the ATM, the account will be debited rather than receiving rupees.
5. There is no personal touch between employees and customers.
6. Because of spillage of PIN, extortion can occur without any problem.

II. BANK ISSUES, ADVANTAGES AND DISADVANTAGES

A. Issues

1. Regulatory Compliance
2.
2. Rising Expectations
3. Customer Retention
4. Security Breaches
5. Asset Quality

B. Advantages and Disadvantages

Advantages:

1. Safely storing the public's wealth.
2. The widespread availability of affordable loans.
3. Propelling the economy forward.

Disadvantages:

1. The chances of going bankrupt.
2. The risk of fraud.

III. LITERATURE SURVEY

IV. The theft of cash from ATMs has become a national problem, posing a number of challenges not only for customers but also for financial institutions. Customers' card information is being stolen as a result of criminals altering the ATM terminal. When a clients' ATM card is lost and the secret key is taken, the clients' record is powerless against assault [4]. In spite of alerts, many individuals typically pick effectively speculated PINs and passwords like birth date, telephone numbers, government managed retirement numbers, and so on. Because a person's biometric is unique to them and cannot be transferred, biometric authentication and OTP methods can prevent password theft. OTP is a numeric string that is sent to a registered number at random and can be compared by the system to records in a central or local database.

V. FUTURE SCOPE OF ATM AND BANK

According to RBI, for the ATM business, India is a colossal market. 40 percent of the 1.2 billion people living there did not have access to a bank account. OP Srivastava, general manager of ICICI Bank, once stated: We were truly inspired by the growth of ATMs in the country when we saw a man in a remote town in South India withdraw money from an ATM, fold it up, and ride away on his bicycle. There is an enormous chance for development of the ATM market in India. The future will see multi-merchant ATM prevalence, which will give customized highlights and an easy to understand interface. A popular "Public Technology" will be ATMs. Unique gear makers and merchants will get more than adequate degree for dealing with ATM machines. Present day ATMs are currently equipped for customized marking, CRM applications, incorporated misrepresentation alert, client notices, and adaptable administrations. The technology behind ATMs has advanced to the point where some of them are able to remember customer preferences based on their previous transactions and behavior, tailoring services accordingly. ATMs frequently have internet access, which enables two-way communications with live agents, biometric options, and personalized advertisements. Support of web empowered ATMs is simple. These ATMs can be immediately associated with the focal observing arrangement of merchants. Despite the rapid expansion of the ATM industry, numerous obstacles remain, including software security issues, rising rental costs in major cities, housekeeping, and cash replenishment. In rural India, only a few banks have implemented biometric ATMs that are quite secure and simple for the average person to use. Banks are attempting to move gradually from multi-merchant to multichannel coordination, to get a total image of the exercises of clients.

A. Authors and Affiliations

First Author –Ms. Gargi Bhatt, Assistant Professor Dept. of computer Engineering, Indus University, Ahmedabad, India

Second Author –Dr. Seema Mahajan, HOD Dept. of computer Engineering, Indus University, Ahmedabad, India

B. Figures and Tables

a) Positioning Figures and Tables:

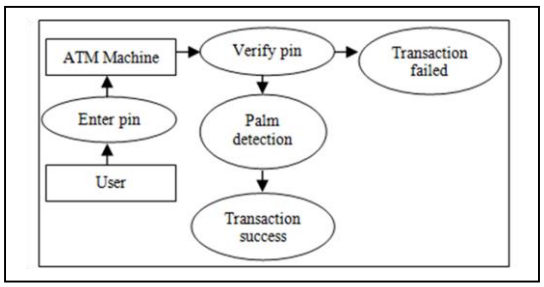


fig.1

A user who wishes to withdraw money from an ATM or Automated Teller Machine, swipes or taps the card in the ATM (as per the instructions on the machine). Then, enters the amount to be withdrawn and after that, gives the PIN of his/her account. The pin is then sent for verification and if it is not verified, the transaction is failed, however, if it is verified, it asks for palm detection as another security method and finally, the money can be withdrawn.

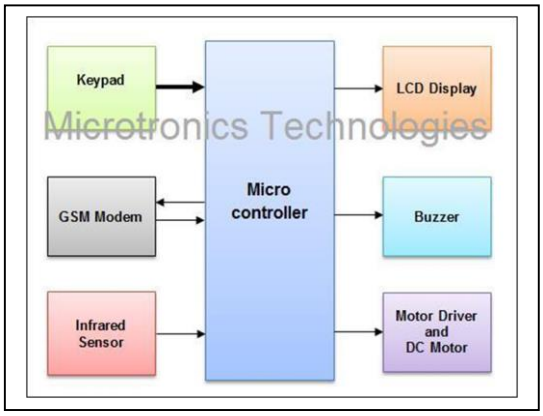
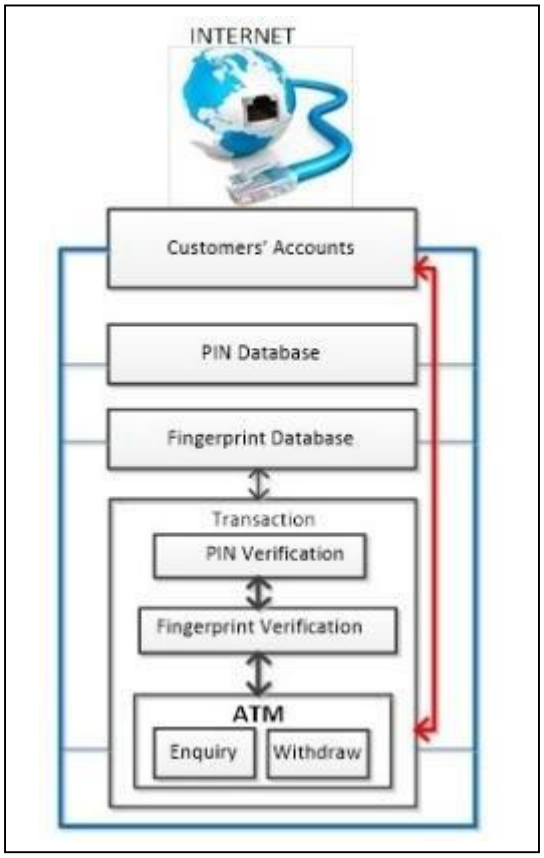


fig.2

Everyone who makes use of a bank cares about its security. The key to our bank locker is frequently lost or forgotten. The bank locker becomes extremely difficult to open in these situations. The primary idea behind this project is to open a bank locker latch with two passwords entered via SMS and a keypad. Each bank storage will have a GSM modem associated with it. If the owner of the bank locker wishes to open the locker, they must send an SMS with the password. The password's contents are then read by the microcontroller connected to the GSM modem. The keypad will be able to enter the second password if the contents are correct. The user must now use the Keypad to enter a second password. In the event that the subsequent secret word is right, the situation permits the client to get to the storage. A DC motor that will operate when both passwords are entered correctly has been provided by us. If either of the two passwords is incorrect, the buzzer will sound. Both the incorrect password and the correct password are communicated to the user via SMS by the microcontroller. For this project, we have also provided an infrared sensor. When someone is standing in front of the Locker, the infrared sensor will go off. Then the framework will send a SMS to the proprietor. "Someone is standing in front of your bank locker" is a low-level warning. When the user sends the first password via SMS, the IR sensor will be turned off.Everyone who makes use of a bank cares about its security. The key to our bank locker is frequently lost or forgotten. The bank locker becomes extremely difficult to open in these situations. The primary idea behind this project is to open a bank locker latch with two passwords entered via SMS and a keypad. Each bank storage will have a GSM modem associated with it. If the owner of the bank locker wishes to open the locker, they must send an SMS with the password. The password's contents are then read by the microcontroller connected to the GSM modem. The keypad will be able to enter the second password if the contents are correct. The user must now use the Keypad to enter a second password. In the event that the subsequent secret word is right, the situation permits the client to get to the storage. A DC motor that will operate when both passwords are entered correctly has been provided by us. If either of the two passwords is incorrect, the buzzer will sound. Both the incorrect password and the correct password are communicated to the user via SMS by the microcontroller. For this project, we have also provided an infrared sensor. When someone is standing in front of the Locker, the infrared sensor will go off. Then the framework will send a SMS to the proprietor. "Someone is standing in front of your bank locker" is a low-level warning. When the user sends the first password via SMS, the IR sensor will be turned off.

V. CONCEPTUAL DESIGN OF PROPOSED ATM SECURITY STRUCTURE.

Figure 1 shows the flowchart for the PIN and finger impression check parts proposed for confirming the credibility of a client. The following steps will need to be



completed by a user who is already enrolled in the proposed system:fig.3

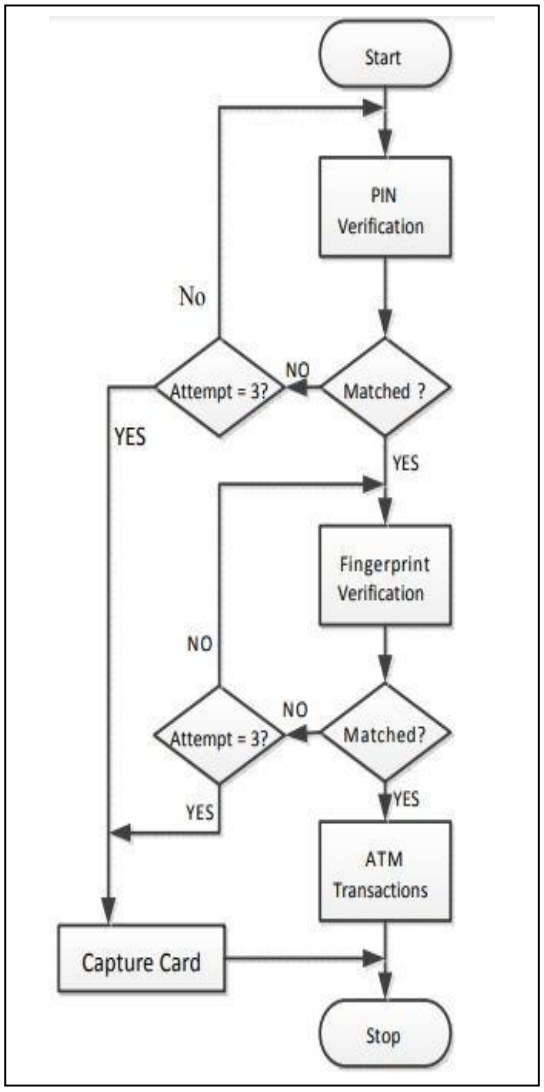


fig.4

At the top and bottom of the columns, place figures and tables. They shouldn't be in the middle of columns. Tables and large figures may extend across both columns. The figures should have captions below them; The heads of the tables should be visible above them. After the text cites the figures and tables, insert them. Make use of the abbreviation "Fig. 1", even toward the start of a sentence.

FIGURE DESCRIPTION

Table Head	Table Column Head		
	Table column subhead	*Subhead*	*Subhead*
Fig.1	ATM BLOCK DIAGRAM	N/A	N/A
Fig.2	BANK BLOCK DIAGRAM	N/A	N/A
Fig.3	CONCEPTUAL DESIGN 1	N/A	N/A
Fig.4	CONCEPTUAL DESIGN 2	N/A	N/A

VI. COCNLUSION

Face recognition is an extremely useful and adaptable method. This method has been used successfully. Identity and privacy are both enhanced by this method. The development in electronic exchanges has brought about a more noteworthy interest for quick and precise client ID and confirmation. It is not entirely reliable to use conventional methods of identification that require the possession of ID cards or exclusive knowledge, such as a password or social security number.

Unauthorized users frequently have the ability to generate the correct personal codes when credit and ATM cards are lost or stolen. Notwithstanding alerts, many individuals keep on picking effortlessly speculated PIN's and passwords, birthday events, telephone numbers and government backed retirement numbers. This paper might take care of this issue and be valuable for distinguishing extortion. It is utilized in the banking industry and any security associated with ATMs. Additionally known as a thief tracking system, As there is a degree for development and as a future execution, we can add a following chip on ATM cards for following the area of cards which will help in giving clients help. Many tasks connected with security and control can be executed by this face acknowledgment method.Policymaking and determining the most important factors to address in the event of a discrepancy are significantly influenced by the banking sector's financial stability. Financial stability is a stage or situation in which the banking system is at its most effective and can withstand economic shocks. Due to an increase in non-performing loans (NPAs) and a decrease in return on assets, scheduled commercial banks experience a significant decline in profitability toward the end of the study period. The last mainstay of checking strength is effectiveness which is estimated by different means like staff costs, business per representative and cost to pay. Although efficiency as a whole is satisfactory, it can be improved to perform better.

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Design and Analysis of different parameters in Power Transformer

Rushi K. Trivedi
Student,Department of Electrical Engineering
Indus University
Ahmedabad,India
rushitrivedi.20.el@iite.indusuni.ac.in

Patel Vishal Rajeshbhai
Student, Department of Electrical Engineering
Indus University
Ahmedabad India
vishalpatel.19.el@iite.indusuni.ac.in

Raval Viraj Chetankumar
Student,Department of Electrical Engineering
Indus University
Ahmedabad India
virajraval.19.el@iite.indusuni.ac.in

Vineeta S. Chauhan
Faculty,Department of Electrical Engineering
Indus University
Ahmedabad India
vineetachauhan.el@indusuni.ac.in

***Abstract*— Transformers are electrical devices that may distribute electricity via a transmission line in a way that is acceptable for both domestic and commercial uses. The most common electrical transmitting and transporting system is a transformer. The process for designing a power transformer combines all of the device's chemical, mechanical, and electronic parts in order to provide the inventor with these data quickly. The transformer device should be built in such a way that the end product is economically sound, has a moderate mass, is small in size, costs little, performs well, and, if possible, satisfies all the requirements imposed by universal principles. It improves the effectiveness of distributing electrical energy by allowing control over alternating current electricity. This utilization of electromagnetic energy has numerous applications in the power industry thanks to the application of Faraday's law of induction. In this research paper description, operation, numerous applications, and certain energy losses of transformers and their analysis is depicted.**

Keywords-Electromagnetic, Faraday's law of induction, universal principles, energy losses

I INTRODUCTION

The transformer is an electrostatic device which is used to transfer energy (voltage or current) from one circuit to another by mutual induction of two electric circuits without change in frequency, which is working on the principle of electromagnetic. Several organizations, including ANSI and IEEE, define a transformer as a constant electric machine with at least two windings and an attractive center used to link power circuits. With a capacity of 95%–99%, the power transformer enables the dispatching and supply of electricity with vigour and affordability. Compared to other power generator equipment, the power transformer produces more electricity more efficiently. Within connected very powerful frameworks operating at varying voltage intensities, the transformer is crucial. Transformers are a necessary component for using electric electricity from many sources and perspectives in modern life.

In the end, transformers had exceptional positions in the current force framework, serving as the primary link to power plants and the foundation for electronic current. Reducing losses can result in significant savings for utilities as electric power distribution networks continue to expand in size and complexity. The potential postponement of capital expenditures for system growth and enhancement is one of the additional advantages of loss reduction. While copper losses are the cause of losses in distribution lines, core and copper losses also contribute to losses in transformers. An increase in loading will cause current flow to rise, which will increase the amount of loss in the transformer. Moreover, transformer losses will rise as a result of an unbalance in the system load.[1]

II RESEARCH METHODOLOGY

In this paper, different calculation of transformer according to CEA (central electricity authority) guidelines by IEC (international electro- technical commission) has been carried out. The various calculations carried out areas follows.

- Short-circuit calculation
- Pressure relief device selection for cable box
- Pressure relief device selection for main box overload calculation
- Thermal calculation
- Cooling Calculation

III SHORT CIRCUIT CALCULATION

The secondary of the transformer is short-circuited. The primary voltage is raised until the secondary is operating at full load. The transformer's impedance is calculated by dividing the applied voltage by the rated primary voltage. [2]

Overload calculation

Overloading is when a transformer is exposed to voltages and/or currents that exceed its design requirements. Under

overload conditions, excessive heat causes the insulation system to break down, which shortens the life of the transformer. [2]

Thermal calculation

The movement of oil, which serves as an electrical insulator and a conduit for the heat generated in the core and windings to be transferred to the tank and the surrounding air, controls the thermal performance of oil-immersed power transformers. The creation of a sophisticated three-dimensional (3D) finite element model is discussed in this study for the coupled solution of the heat transfer and fluid flow equations determining the thermal performance of transformers. the key.The following are some benefits of the suggested approach: (i) there is no requirement to predefine the convection coefficients at the interfaces between the active part/tank walls and the circulating oil; (ii) detailed representation of specific transformer parts, such as winding cooling ducts and corrugated tank panels, through an automated design process, improving the model accuracy with the least amount of computational effort; (core and windings loss).[4]

Cooling calculation

Since the creation of the transformer, we have had to contend with the tendency of raising its nominal power to meet the demands of advancing technology and the corresponding rise in electricity demand. Losses in transformers rise along with an increase in nominal power, but a transformer's cooling capacity declines. a large trans former.

The loss of heat. The thermal energy is transferred and released into the environment through cooling systems when a cooling media in contact with thermal sources moves in a transformer. Losses in transformers rise along with an increase in nominal power, but a transformer's cooling capacity declines. Heat transfer and convection are the foundations of the cooling of a transformer's interior.[5]

IV CALCULATION PARAMETERS

A. SHORT CIRCUIT EQUATION

b_i Thickness of winding conductor

D_i = Inside Diameter of Winding

E = Modulus of Elasticity of Conductor

H_W = Winding Height

I_{sc} = Value of Inrush Current

N = Number of Turns per Phase in The Circuit

N_s = Minimum Number of Supports in The Winding

b_s = Width of spaces cm

R_{dc} = DC Resistance of the Phase at 75 °C

σm = Hoop Stress

ρ = Resistivity

m = Clear Space available between two spacers

k = asymmetry factor as per IEC 60076-5

Bending stress in copper due to radial forces $s_b S_b = (\sigma m * m^2)/(D_i * b_i)$

S_b = 96.2045 Kg/cm^2 <1250 Kg/cm2 (As per IEEMA Cal)

Bending Stress value of each winding is 1250Kg/cm2

Since the secondary winding is short-circuited, the rated voltage draws a very high current due to the very low winding resistance of the transformer. Such a large current can cause the transformer to overheat and burn. [3]

The short-circuit test to determine the impedance and losses of the transformer is carried out with a relatively small power supplied to the transformer and with the same winding currents as in use. Another type of short circuit test is performed on the mechanical strength of the transformer windings and their ability to withstand the large forces that occur when a short circuit occurs in a live transformer. During such events, the currents can be several times higher than the normal current. The resulting forces can distort the coils or break the internal connections. [6]

B.THERMAL CALCULATION EQUATION

Details of Temperature	OAAN	ONAF/OFAF
Top oil Temperature	50 ℃	50
Winding Temperature Rise	55	55
Winding hot spot rise over yearly weighted temperature	66	66
Core hot spot rise over ambient temperature	50	120

TABLE [1] GUARANTEED TEMPERATURE RISE

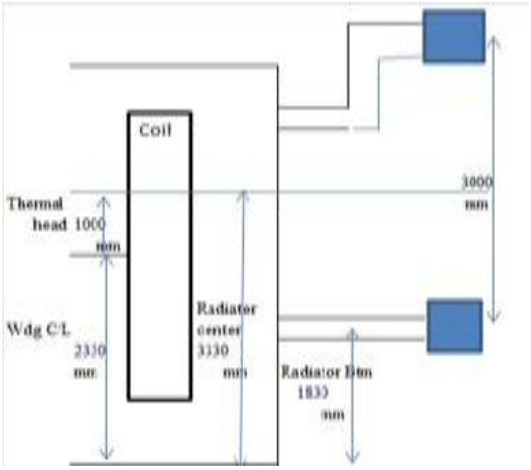


Fig 1 Thermal Load

C.OVERLOAD CALCULATION

Initial Load	Overload	Duration	Hot spot	Ultimate Top oil Temp Rise	Top Oil Rise	Wdg. Rise
100 %	10%	Continuous	117	82.43	32.43	59.15
100 %	25%	10 Mins	114	83	33.00	56.63
100 %	50%	4 Mins	147	94.72	44.72	84.64
100 %	100%	2 Mins	171	96.36	46.36	94.35

TABLE [2] COMPARISON AT DIFFERENT OVERLOADING

D. HOTSPOT CALCULATION

Hotspot = Top oil Rise + Gradient * 1.3 + Average Ambient
Temperature

Max hot spot temperature less than the limit specified in IEC60076

Loss Details

Total Losses at min tap at 50 MVA (ONAF)(NLL+LL@min tap) = 30 + 148
= 178kW

Load Losses at min tap at 40 MVA (ONAN) = 94.72 kW

Total Losses at min tap at 40MVA (ONAN) (NLL + LL@mintap) = 124.72 kw

E.PRESSURE RELIEF DEVICE SELECTION FOR MAIN TANK

Transformer Design Details	
OPERATING PRESSURE OF PRV(kg/cm2)	0.42 +/- 0.07
THE PRESSURE APPLIED ON LOWER LEVEL OF OIL	0.35
IN CONSERVATOR DURING PRESSURE TEST (kg/cm2)	
OIL HEAD ACTING ON PRV (mts)	0.131
OIL DENSITY	0.89
PRESSURE REQUIRED FOR TEST =	0.46659

TABLE [3] DESIGN DETAIL OF TRANSFORMER

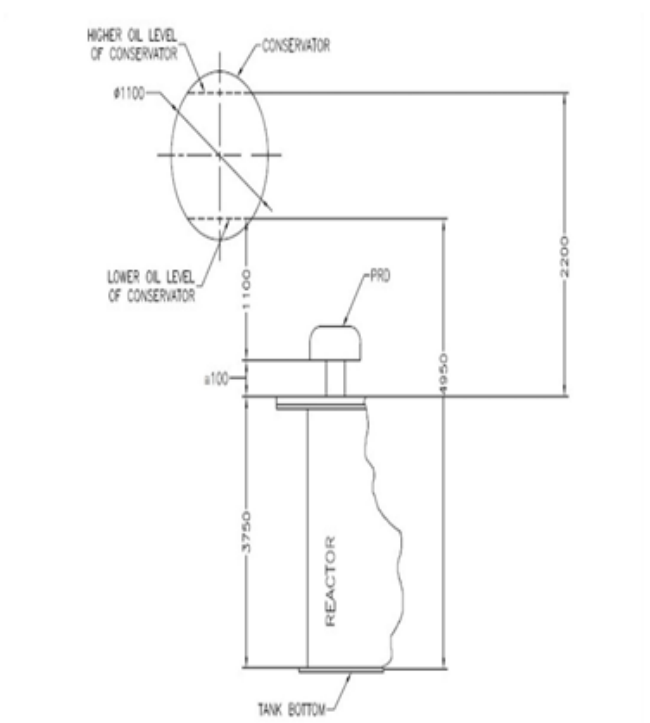


Fig [2] Design for main tank

F. PRESSURE RELIEF DEVICE SELECTION FOR CABLE BOX

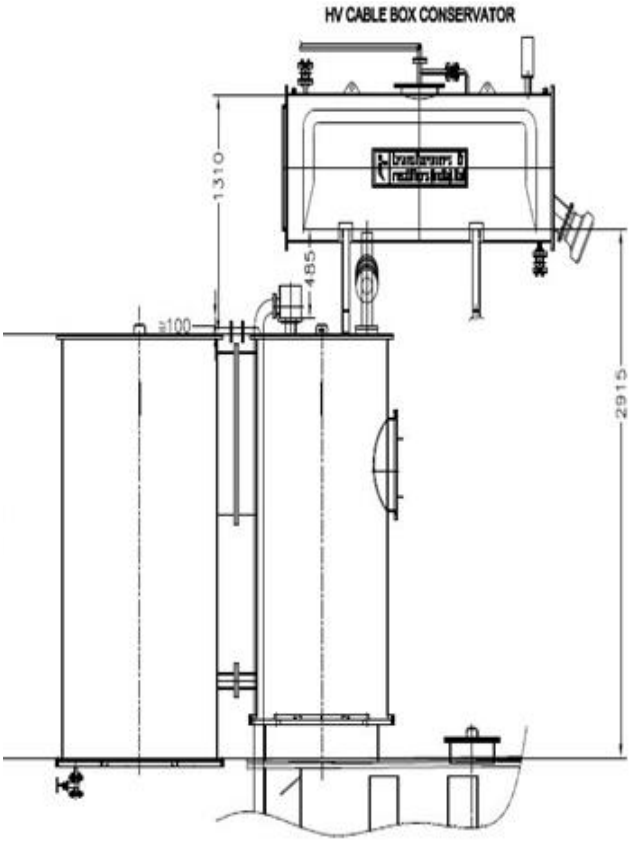


Fig [3] Design detail of cable box

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Sustainable habitats using Artificial Intelligence and Machine Learning: Opportunities & Challenges

Khushbu Maurya
Computer Engineering Department, Indus University,
Ahmedabad, Gujarat,
India
Email ID: khushbumaurya.ce@indusuni.ac.in
ORCID: 0000-0001-9615-2129

***Abstract*—** Sustainable habitats are a critical component of our efforts to mitigate climate change and ensure a liveable future for generations to come. Artificial intelligence (AI) and machine learning (ML) are emerging as key technologies for designing and operating sustainable habitats. This paper explores the role of AI and ML in sustainable habitat design and operations. We discuss the challenges and benefits of using AI and ML in creating sustainable habitats, highlight some of the key case studies, and examine the future potential of these technologies.

This research paper provides an overview of the role of AI and ML in sustainable habitat development, including building design and operations, urban planning, and transportation systems. A literature survey is conducted to review the existing research in this area, highlighting the opportunities, challenges, and benefits of using AI and ML for sustainable habitat development. Several case studies are presented to illustrate the application of AI and ML in sustainable habitat development. The challenges and limitations of using AI and ML for sustainable habitat development are discussed, including data quality, bias, and ethical considerations. The benefits of using AI and ML for sustainable habitat development are also discussed, including improved energy efficiency, reduced environmental impact, and enhanced liability. The paper concludes by identifying future research directions and opportunities for further exploration of AI and ML in sustainable habitat development.

Keywords—Sustainable, Habitat, Machine Learning, Artificial Intelligence

I. INTRODUCTION

Sustainable habitat design and operations are complex challenges that require a multi-disciplinary approach. The integration of AI and ML into sustainable habitat design and operations offers significant benefits, including improved energy efficiency, reduced carbon emissions, improved mobility, increased resilience, enhanced quality of life, and cost savings. The use of AI and ML technologies can enable the optimization of energy usage, renewable energy systems, smart buildings, transportation systems, and predictive maintenance.

The concept of sustainable habitat design and operations emerged in response to the global environmental challenges we face today, including climate change, resource depletion, and ecosystem degradation. Sustainable habitats are designed to minimize the environmental impact of human activities, reduce resource consumption, and promote social equity and economic prosperity.

Artificial intelligence (AI) and machine learning (ML) are rapidly advancing technologies that offer great potential for optimizing sustainable habitat design and operations. AI and ML can be used to analyze complex data sets, predict future outcomes, and optimize systems in real time. By leveraging these technologies, designers, and operators of sustainable habitats can improve energy efficiency, reduce carbon emissions, enhance mobility, increase resilience, and improve quality of life while reducing costs.

By using AI and ML to achieve these sustainable habitat goals, we can contribute to the SDGs and ensure that our efforts toward creating sustainable habitats are aligned with the broader global development agenda.

This paper aims to explore the role of artificial intelligence (AI) and machine learning (ML) in sustainable habitat design and operations. The integration of these technologies into sustainable habitat design and operations offers significant potential for creating more efficient, resilient, and liveable habitats. This paper will examine the challenges and benefits of using AI and ML in sustainable habitat design and operations, as well as highlight some of the key case studies and the future potential of these technologies.

II. LITERATURE SURVEY

Several studies have been conducted on the integration of artificial intelligence (AI) and machine learning (ML) into sustainable habitat design and operations. These studies have demonstrated the potential of these technologies in optimizing energy usage, reducing carbon emissions, enhancing mobility, and increasing resilience.

Sun et al. [1] state that AI has the potential to support sustainable development, but also highlight the need for addressing challenges such as data quality, bias, and ethical and privacy concerns.

The study by Kennedy et al. [2] provides a comprehensive review of machine learning applications in building energy analysis.

Shafiee and Topalovic [3] highlight the opportunities and challenges associated with using AI for urban sustainability. Brunn et al. [4]discuss the potential of AI for sustainable urban mobility and present future research directions.

Jia et al. [5] review the integration of machine learning and building information modeling for building energy performance prediction.

Khan et al. [6] provide a systematic review of the literature on the sustainable development of smart cities. Attri and Sharma [7] discuss the potential of AI for sustainable development and provide examples of AI applications in various domains.

Adhikari et al. [8] review recent advances in intelligent transportation systems for smart and sustainable cities.

Yao et al. [9] provide an overview of smart building technologies and applications for sustainable development.

Wang et al. [10] provide a comprehensive review of machine learning applications in sustainable transportation and identify future research directions.

One study by Abbasi and Abbasi (2018) [11]examined the potential of AI and ML in optimizing energy usage in smart buildings. The study demonstrated that AI and ML can be used to predict energy consumption patterns, optimize heating and cooling systems, and reduce energy waste, leading to significant energy savings.

Another study by Tascikaraoglu et al. (2018) [12]explored the potential of AI and ML in optimizing renewable energy systems. The study demonstrated that AI and ML can be used to predict solar and wind energy production, optimize energy storage systems, and improve the efficiency of renewable energy systems.

A study by Srinivasan and Guo (2019) [13]examined the potential of AI and ML in enhancing mobility in sustainable habitats. The study demonstrated that AI and ML can be used to optimize transportation systems, predict traffic patterns, and improve the efficiency of public transportation systems.

Other studies have explored the potential of AI and ML in optimizing building performance (Liao et al., 2018) [14]predicting maintenance needs (Yan et al., 2019) [15], and improving environmental monitoring and management (Saravanan et al., 2019) [16].

Overall, the literature survey suggests that the integration of AI and ML into sustainable habitat design and operations offers significant potential for creating more efficient, resilient, and liveable habitats. However, some challenges need to be addressed, such as data quality, bias, complexity, and ethical and privacy concerns. By addressing these challenges and leveraging the potential of AI and ML, we can create more sustainable and resilient habitats that promote social equity, economic prosperity, and environmental stewardship

III. OPPORTUNITIES

Artificial intelligence (AI) and machine learning (ML) have the potential to support sustainable habitat development by optimizing resource utilization, improving energy efficiency, and enhancing environmental performance. The integration of these technologies into sustainable habitat design and operations offers significant potential for creating more efficient, resilient, and liveable habitats. Furthermore, there is a significant number of Sustainable Development Goals (SDGs) can be mapped with sustainable habitat development goals as shown in ***Figure 1***.



Figure 1: The Sustainable Development Goals (SDGs) mapped with sustainable habitat development goals

Here are some of the sustainable habitat goals that can be achieved using AI and ML and their corresponding Sustainable Development Goals (SDGs) as shown in ***Table 1***. :

Table 1:Mapping of Sustainable Habitat Development Goals using AI & ML with Sustainable Development Goals

Sustainable Habitat Development Goals	Sustainable Development Goals	Role of AI & ML in Sustainable Development
Improved air and water quality	SDG 3: Good Health & Well Being	– Improved air and water quality through AI-based monitoring and management systems can help reduce exposure to harmful pollutants and improve overall health and well-being. – Smart and sustainable transportation systems powered by AI and ML can reduce traffic congestion and improve mobility, leading to a decrease in accidents and related injuries and fatalities. – Waste reduction and management using AI and ML-based predictive modeling and optimization algorithms can reduce exposure to hazardous waste and improve overall health and well-being. – Sustainable building practices through AI-optimized building design, maintenance prediction, and energy efficiency can provide a healthier living environment and reduce exposure to harmful chemicals and pollutants.
Improved air and water quality through AI-based monitoring and management systems	SDG 6: Clean Water and Sanitation and SDG 11 Sustainable Cities and Communities	– AI and ML can be used to optimize water usage and reduce waste in buildings and cities, contributing to sustainable water management and conservation. – Smart water management systems powered by AI and ML can

		detect leaks and monitor water quality, improving access to safe and clean water. – AI and ML-based predictive modeling and optimization algorithms can be used to monitor and manage water resources, predicting and mitigating droughts and floods. – AI and ML can be used to optimize the design and operation of wastewater treatment plants, reducing the impact of human activity on water ecosystems and contributing to sustainable water management.
Energy efficiency and conservation & Increased use of renewable energy sources	SDG 7: Affordable and Clean Energy	– AI and ML can be used to optimize energy usage in buildings and cities, reducing energy waste and contributing to more efficient and sustainable energy use. – Smart energy management systems powered by AI and ML can detect and respond to changes in energy demand and supply, improving the reliability and resilience of energy systems. – AI and ML-based predictive modeling and optimization algorithms can be used to manage renewable energy systems, improving their efficiency and reducing their costs. – AI and ML can be used to develop and optimize smart grids, improving the integration of renewable energy sources and reducing greenhouse gas emissions.
Sustainable building practices through AI-optimized building design, maintenance prediction, and energy efficiency	SDG 11: Sustainable Cities and Communities and SDG 9: Industry, Innovation, and Infrastructure.	– AI and ML can be used to optimize the design and construction of buildings and infrastructure, reducing waste and improving the efficiency and sustainability of the construction sector. – AI and ML-based predictive maintenance can be used to improve the resilience and longevity of infrastructure, reducing the need for costly and disruptive repairs.
Smart and sustainable transportation systems powered by AI and ML	SDG 11: Sustainable Cities and Communities	– AI and ML can be used to optimize urban planning and design, promoting more livable and sustainable cities and human settlements. – AI and ML can be used to optimize transportation systems, reducing traffic congestion and improving access to mobility for all residents. – AI and ML can be used to improve environmental monitoring and management, promoting a cleaner and healthier urban environment.
Waste reduction and management using AI and ML-based predictive modeling and optimization	SDG 12: Responsible Consumption and Production	– AI and ML can be used to optimize energy consumption patterns, reduce waste, and promote sustainable energy consumption. – AI and ML can be used to optimize water usage in buildings and infrastructure, reducing waste and promoting sustainable water consumption. – AI and ML can be used to optimize waste management systems, reducing waste and promoting sustainable resource use. – AI and ML can be used to improve the sustainability of the construction sector, by optimizing the design and construction of buildings and infrastructure to reduce waste and promote sustainable materials and practices.
Climate change adaptation and mitigation	SDG 13: Climate Action	– AI and ML can be used to optimize renewable energy systems, improving their efficiency and reducing reliance on fossil fuels. – AI and ML can be used to predict and mitigate the impacts of climate change on infrastructure and buildings, such as flooding or extreme weather events. – AI and ML can be used to optimize heating and cooling systems in buildings, reducing energy consumption and associated greenhouse gas emissions. – AI and ML can be used to monitor and manage environmental factors that contribute to climate change, such as air quality and carbon emissions.
ocean monitoring to identify and track changes in marine ecosystems	SDG 14: Life Below Water	– AI and ML-based ocean monitoring systems can help to identify and track changes in marine ecosystems, enabling early warning and rapid response to threats such as overfishing, pollution, and climate change. – Smart and sustainable transportation systems powered by AI and ML can reduce emissions from shipping and reduce the impact of transportation on marine ecosystems. AI and ML can be used to optimize the design, placement, and management of offshore renewable energy systems, reducing the impact of energy production on marine ecosystems. – AI and ML-based predictive modeling and optimization algorithms can be used to monitor and manage waste disposal, reducing the impact of waste on marine ecosystems.
Improved environmental monitoring and management using AI and ML techniques	SDG 15: Life on Land	– AI and ML can be used to monitor and manage ecosystems, helping to prevent deforestation and degradation and restore degraded land. – AI and ML can be used to monitor and manage biodiversity, helping to prevent the loss of species and ecosystems. – AI and ML can be used to optimize the use of natural

	resources, minimizing waste and reducing the impact on ecosystems. AI and ML can be used to predict and mitigate the impact of human activities on ecosystems, such as pollution and land use change.

The integration of AI and ML into sustainable habitat design and operations offers numerous benefits. These benefits include:

Improved Energy Efficiency: AI and ML-powered systems can optimize energy usage in buildings and transportation systems, resulting in significant energy savings.

Reduced Carbon Emissions: The use of AI and ML in transportation systems can lead to reduced carbon emissions by optimizing traffic flow and public transportation routes.

Improved Mobility: AI and ML-powered transportation systems can improve mobility by reducing travel times and improving accessibility.

Increased Resilience: AI and ML-powered systems can improve the resilience of sustainable habitats to natural disasters and other shocks by analyzing data in real time and helping anticipate and prepare for extreme weather events.

Enhanced Quality of Life: By improving energy efficiency, reducing carbon emissions, improving mobility, and increasing resilience, AI and ML-powered systems can enhance the quality of life for inhabitants of sustainable habitats.

Cost Savings: AI and ML-powered systems can lead to cost savings for businesses and individuals by optimizing energy usage and transportation systems, making sustainable habitats.

These benefits can be achieved by optimizing energy usage, renewable energy systems, smart buildings, transportation systems, and predictive maintenance.

Several case studies demonstrate the potential of AI and ML in sustainable habitat design and operations. These case studies include Google's DeepMind AI system, which optimizes the energy usage of data centers, Siemens' use of AI to optimize building performance, and the city of Amsterdam's use of AI to optimize transportation systems.

Case Studies: Several case studies demonstrate the potential of AI and ML in sustainable habitat design and operations. Here are some examples:

1. Google DeepMind: Google's DeepMind AI system is being used to optimize the energy usage of data centers. By analyzing data in real time, DeepMind can identify areas of energy waste and adjust energy usage accordingly, resulting in significant energy savings.
2. Siemens: Siemens is using AI to optimize building performance. By analyzing data on building occupancy, temperature, and other environmental factors, Siemens can adjust heating and cooling systems to optimize energy usage while ensuring that building occupants remain comfortable.
3. The City of Amsterdam: The city of Amsterdam is using AI to optimize transportation systems. By analyzing traffic patterns and public transportation routes, Amsterdam can reduce travel times, reduce carbon emissions, and encourage the use of low-emission vehicles.

As AI and ML technologies continue to advance, we can expect to see significant improvements in the efficiency and effectiveness of sustainable habitat design and operations. By leveraging these technologies, we can create more sustainable and resilient habitats that promote social equity, economic prosperity, and environmental stewardship.

IV. CHALLENGES

The integration of AI and ML into sustainable habitat design and operations is still in its early stages. However, it is rapidly advancing, and many leading companies and organizations are already using these technologies to create more sustainable and resilient habitats. As the technology continues to advance, we can expect to see significant improvements in the efficiency and effectiveness of sustainable habitat design and operations.

The challenges of using AI and ML in sustainable habitat design and operations include data availability and quality, bias, complexity, and ethical and privacy concerns. However, these challenges can be overcome by ensuring high-quality data, using representative and unbiased data, developing algorithms that can operate effectively in complex environments, and implementing ethical and privacy guidelines.

1. Data Availability and Quality: AI and ML algorithms require high-quality data to operate effectively. However, in many cases, data on sustainable habitat design and operations are scarce, incomplete, or of poor quality.
2. Bias: AI and ML algorithms are only as good as the data they are trained on. If the data is biased the algorithms will produce biased results. It is essential to ensure that the data used to train AI and ML algorithms is representative and free of bias.
3. Complexity: Sustainable habitat design and operations are complex challenges that involve multiple systems and stakeholders. AI and ML algorithms must be able to operate effectively in complex environments to be effective.
4. Ethics and Privacy: The use of AI and ML technologies raises ethical and privacy concerns. It is essential to ensure that these technologies are used ethically and that the privacy of inhabitants is protected.

To address these challenges and leverage the potential of AI and ML, there is a need for interdisciplinary research, innovative technologies and solutions, and research on the social and economic implications of sustainable habitat design and operations using AI and ML. By leveraging the potential of AI and ML in sustainable habitat design and operations, we can create more sustainable and resilient habitats that promote social equity, economic prosperity, and environmental stewardship. The future of sustainable habitat design and operations lies in the integration of these emerging technologies with sustainable practices, creating a better and more sustainable world for all.

V. SUMMARY AND FUTURESCOPE

The integration of artificial intelligence (AI) and machine learning (ML) into sustainable habitat design and operations offers significant potential for creating more efficient, resilient, and liveable habitats. The challenges of using AI and ML in sustainable habitat design and operations can be addressed by ensuring high-quality data, using representative and unbiased data, developing algorithms that can operate effectively in complex environments, and implementing ethical and privacy guidelines. The benefits of using AI and ML in sustainable habitat design and operations include improved energy efficiency, reduced carbon emissions, improved mobility, increased resilience, enhanced quality of life, and cost savings.

Several case studies demonstrate the potential of AI and ML in sustainable habitat design and operations, including Google's DeepMind AI system, Siemens' use of AI to optimize building performance, and the city of Amsterdam's use of AI to optimize transportation systems. Future research in the field can focus on addressing the challenges and limitations of these technologies, interdisciplinary research, the development of innovative technologies and solutions, and research on the social and economic implications of sustainable habitat design and operations using AI and ML. By leveraging the potential of AI and ML, we can create more sustainable and resilient habitats that promote social equity, economic prosperity, and environmental stewardship.

There are several areas of future work in the field of sustainable habitat design and operations using AI and ML. These include:

1. Developing more advanced algorithms: Research can focus on developing algorithms that can operate effectively in complex environments and systems, ensuring that AI and ML systems are transparent and explainable, and addressing ethical and privacy concerns associated with the use of these technologies.
2. Addressing the limitations and challenges of AI and ML: Research can focus on addressing the limitations and challenges associated with the use of AI and ML in sustainable habitat design and operations, such as data quality, bias, complexity, and ethical and privacy concerns.
3. Interdisciplinary research: There is a need for interdisciplinary research that brings together experts from different fields, including computer science, engineering, architecture, urban planning, and social sciences. Such research can help to address complex sustainability challenges in a holistic and integrated manner.
4. Development of innovative technologies and solutions: Research can focus on the development of innovative technologies and solutions that can enhance the potential of AI and ML in sustainable habitat design and operations, such as smart materials, sensors, Internet of Things (IoT) technologies, and blockchain technologies.
5. Social and economic implications: Research can focus on the social and economic implications of sustainable habitat design and operations using AI and ML, ensuring that sustainable habitats are designed and operated in a way that promotes social equity and economic prosperity for all.

The future of sustainable habitat design and operations lies in leveraging the potential of AI and ML in combination with sustainable practices, creating a better and more sustainable world for all. Furthermore, research can focus on the development of innovative technologies and solutions that can enhance the potential of AI and ML in sustainable habitat design and operations. For example, the development of smart materials, sensors, and Internet of Things (IoT) technologies can enhance the monitoring and control of sustainable habitats, while the development of blockchain technologies can enhance the transparency and accountability of sustainable habitat systems.

Finally, there is a need for research on the social and economic implications of sustainable habitat design and operations using AI and ML. Such research can help to ensure that sustainable habitats are designed and operated in a way that promotes social equity and economic prosperity for all.

VI. CONCLUSION:

In conclusion, the integration of artificial intelligence (AI) and machine learning (ML) into sustainable habitat design and operations has significant potential for creating more efficient, resilient, and liveable habitats. The use of AI and ML in sustainable habitat design and operations can lead to improved energy efficiency, reduced carbon emissions, improved mobility, increased resilience, enhanced quality of life, and cost savings. However, there are also challenges and limitations associated with the use of these technologies, such as data quality, bias, complexity, and ethical and privacy concerns.

Further research in the field of sustainable habitat using AI and ML can focus on addressing the challenges and limitations of these technologies. For example, research can focus on developing algorithms that can operate effectively in complex environments and systems, ensuring that AI and ML systems are transparent and explainable, and addressing ethical and privacy concerns associated with the use of these technologies.

In addition, there is a need for interdisciplinary research that brings together experts from different fields, including computer science, engineering, architecture, urban planning, and social sciences. Such research can help to address complex sustainability challenges in a holistic and integrated manner.

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Energy efficient solutions in Cyber Physical System enabled Smart healthcare System

Jyoti Srivastava

Department of Computer Science and Engineering, Indus Institute of Technology and Engineering, Indus University, Ahmedabad, Gujarat, India

***Corresponding author's Mail ID:** jyotisrivastava.ce@indusuni.ac.in

Abstract:

Cyber Physical System (CPS) enhances the functionality of various cyber and physical equipments of Smart Healthcare System (SHS) provide automation in healthcare sector using Artificial Intelligence (AI) techniques. SHS collects medical data with the help of sensors or actuators equipped within smart medical devices that act as the physical component of CPS, then process and analyze these medical data with the help of cyber components of CPS to provide automation in health monitoring, doctor consultancy, medical prescriptions, medicine delivery and various other perspectives of healthcare sector. These advancement in healthcare sector results in great assistance for healthcare individuals like doctors, patients, nursing staff etc, but at the same time deals with very sensitive parameters like time, efficiency, reliability, security etc, that needs to be managed with utmost accuracy for preserving each life in this global smart healthcare environment. There can be various efficiency parameters in CPS enabled SHS namely number of hops, mean number of QSS paths, average energy consumption, average resource utilization, etc. This work elaboratively defines various characteristics of CPS in SHS, efficiency parameters, and major challenges for successful implementation of CPS enabled SHS.

Keywords: Cyber Physical System (CPS), Smart Healthcare System (SHS), Artificial Intelligence (AI), Internet of Medical Things (IoMT), efficiency

I. INTRODUCTION

As per the current pandemic situation a very strong and reliable healthcare system is required including the virtual facility to avoid harmful virus spread during physical meetings [1]. This virtual facility can be provided using AI enabled smart healthcare system where cyber physical system helps with various cyber and physical equipments and techniques to facilitate automation enhancement in every expect of Internet of Medical Thing (IoMT) framework, starting from data collection stage upto end user data prediction and visualization semantics [2]. Cyber Physical System act as an interaction medium between various physical medical equipments and the cyber world of an AI enabled SHS as shown in Fig. 1.

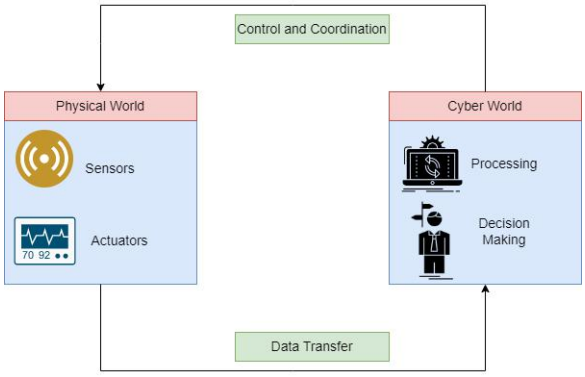


Fig.1. Cyber Physical System Overview

CPS can act as a smart health monitoring platform for time-to-time diagnosis and decision making of different critical or homecare patients. In such cases time plays a crucial role and requires the system to be much more efficient to make quick and accurate decision to save each life. CPS can also be used in different domains to enhance the performance of that particular system as shown in Fig.2. The innovative concept of "Industrial Internet" of US and its corresponding idea "Industrie 4.0" in Germany is evolving together with CPS, Internet of Service (IoS) and Internet of Things (IoT) concepts [3]. CPS can also be used in transportation to improve the competency, consistency and controllability of physical systems like prevention of vehicle collision and zero-net energy building systems [4].

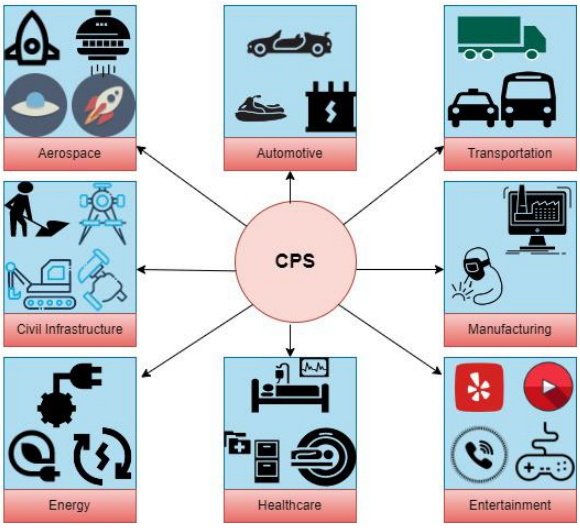


Fig.2. Cyber Physical System in different domains

CPS can be used in civil infrastructure for controlling and monitoring of structural health which is an extension of traditional IFC (Industry Foundation Classes) schema [5]. Modern Aeronautical Systems are characterized by many intelligent sensors, data analysis and wireless communication tools etc, for enhanced security, reliability and efficiency for advanced tasks which is called as aerospace cyber physical systems [6]. Cloud based Cyber Physical Systems provides huge computing and storage resources that CPS can used to introduce various applications. Due to these wide applications of CPS in cloud-based environment Virtual Machines (VMs) can be used for energy conservation maintaining the QoS using various scheduling algorithms [7]. CPS can also be used in automotive engineering to provide security against various attacks for the next generation of automobiles (Cybercars) incorporating ECUs (Electronic Control Units) for novel automotive control units [8].

As per the requirement of efficient CPS system in different areas we are motivated to perform a comparative efficiency analysis of different CPS in AI enabled Smart healthcare system. An efficient and reliable CPS system in healthcare benefits the society to get updated of their health parameters and avail the advance features of Smart healthcare for hospitality when and wherever required with the benefit of avoiding all physical connects with the healthcare ecosystem. The major contributions of the work are as follows:

1. To analyse various architectures of CPS in AI enabled Smart Healthcare System

2. To characterize various CPS applications in Smart Healthcare System.

3. To explore various energy efficient technologies used in cyber physical systems for Smart Healthcare System.

4. To compare various energy efficient algorithms used for medical status monitoring using CPS for SHS

5. To propose various research challenges of CPS in SHS

The rest of the paper is organized as follows. Section 2 represents mostly used architectures of CPS in Smart Healthcare System, Section 3 discusses various energy efficient technologies that can be used for CPS in SHS. Section 4 elaborates different research challenges during designing CPS for an AI enabled SHS.

II. CPS ARCHITECTURES IN IOMT FRAMEWORK

CPS in AI enabled SHS helps in prevention and detection of different critical diseases like COVID-19. Each CPS in SHS is an embedded system of medical controlling equipments and independent network systems as shown in Fig. 1. Mostly this system includes three basic layers bottommost layer that is composed of physical equipments, middle layer formed of various AI based data processing and analyzing techniques and topmost layer act as an interface between user and the system as shown in Fig. 3. But there can be slight variations in different researchers architecture as per the system usability and requirement.

Chen, F., et. al. [9] discusses a 3-layer architecture of CPS in medical field composed of Physical Space, User Space and Cyber Space as per. The bottom most layer i.e. physical space is composed of real-time health sensing and diagnosing devices, the user space provides various users having sensing devices which sends and receives information from cyber space for controlling the smart sensing devices. Cyber Space performs storage and processing of patient's health information and its security mechanism.

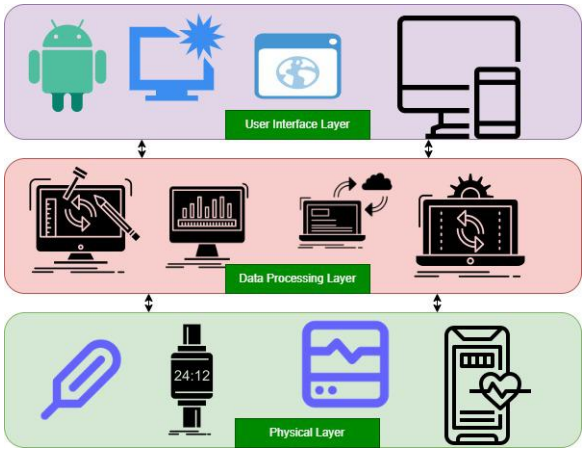


Fig.3. Cyber Physical System general architecture using IoMT framework

Bordel, B., et. al. [10] again uses a three-layered architecture, where the bottommost layer is the physical layer which is collection of objects whose behaviour is to be determined, the middle layer is platform which is composed of different hardware elements and the software layer is responsible for all controlling techniques and algorithms. Fatima, I., et. al. [11] discusses various CPS layers like connection layer, configuration layer, enterprise layer, cyber layer, cognition layer etc., that can be used to form a generalized CPS architecture as per the requirement from the system.

III. ENERGY EFFICIENT ALGORITHMS IN CPS FOR SMART HEALTHCARE SYSTEM

Table 1 shows the work done by different researchers in order to enhance the energy efficiency of a Cyber Physical System inside healthcare sector. Hossain, M. S. et al. [12] proposed an energy-aware cyber-physical therapy system (T-CPS) that enable multi-modal sensing for therapy sensing, therapy playback, annotation, visualization, and energy efficiency. Zahid, N. et al. [13] utilizes Avant-garde framework to simultaneously optimize energy efficiency, battery lifetime, and reliability. Then they used Adaptive Transmission Data Rate (ATDR) mechanism to optimize the energy over the dynamic wireless channel. Self-Adaptive Routing Algorithm (SARA) is been used for Energy-efficient and shortest possible path aware routing. Sharma, A. et al. [14] utilizes SLA-Energy cooperative quickest healthcare data transmission (SEQHDT) model to improve the mean number of QSS $s - t$ paths, average hop counts and average energy efficiency. Service Level Agreement (SLA) formulation is beneficial for the tele-operated medical services. Qi, L. et al. [15] uses QoS-aware VM scheduling (QVMS) method that solves the standard multi-objective problem. Non-dominated Sorting Genetic Algorithm III (NSGA-III) searches for the optimal VM migration solutions, SAW (Simple Additive Weighting) and MCDM (Multiple Criteria Decision Making) selects the most optimal scheduling strategy.

Table I. Energy efficient algorithms in CPS for Smart Healthcare System

S. No.	Authors	Algorithms	Merits	Result Analysis	Future Work
1.	Hossain, M. S. et al. [12]	energy-aware cyber-physical therapy system (T-CPS)	T-CPS framework uses multi-modal sensing for the provision of therapy sensing, therapy playback, annotation, visualization, and energy efficiency.	1. Reduced Energy consumption = 47% 2.Improved Energy Efficiency = 35%	T-CPS can be tested with a varied number of patients and thereby calculation of the overall energy and load distribution overhead can be done for CPS.
2.	Zahid, N. et al. [13]	1.Avant-garde framework 2.Adaptive Transmission Data Rate (ATDR) mechanism	1.Optimize energy efficiency, battery lifetime, and reliability. 2.Optimize energy	Packet loss ratio = 19% Total transmitted data = 6.2 x 10^6 bits per sec	An intelligent AI-based technique for IoT-5G pervasive healthcare

		3.Self-Adaptive Routing Algorithm (SARA)	over dynamic wireless channel. 3. Energy-efficient and shortest possible path aware routing algorithm		applications can be developed as an extension of this work.
3.	Sharma, A. et al. [14]	1. SLA-Energy cooperative quickest healthcare data transmission (SEQHDT) model. 2. Service Level Agreement (SLA) formulation	1. Beneficial for the tele-operated medical service. 2. mean number of QSS $s-t$ paths, average hop counts and average energy efficiency improved.	1.Average Capacity = 16.7 Mb/Secs 2.Average hop counts = 7.1 hops 3.Average energy efficiency= 3.46×10^5 bits/secs/joule.	This algorithm can be extended for use in physical equipments of CPS in health care.
4.	Qi, L. et al. [15]	1.QoS-aware VM scheduling (QVMS) method 2. Non-dominated Sorting Genetic Algorithm III (NSGA-III) 3.SAW (Simple Additive Weighting) 4.MCDM (Multiple Criteria Decision Making)	1.Solves the standard multi-objective problem. 2.Automatic search for the optimal VM migration solutions. 3. Selects the most optimal scheduling strategy	Total 200 number of applications Energy Consumption = 998 k.W.h	Downtime= 36s Resource Utilization = 88%	In future, more QoS standards can be Considered for satisfying multi users' requirements. 2. The proposed method can be enhanced to make it more practical for real life scenario.

IV. RESULT AND COMPARITIVE ANALYSIS

Hossain, M. S. et al. [12] shows the comparative analysis between energy-aware cyber-physical therapy system (T-CPS) and traditional system thereby proved through experimental validation that proposed system reduces energy consumption by 47% and also improved the overall energy efficiency by 35%. Zahid, N. et al. [13] performs simulation and theoretical calculation using MATLAB and shows that Packet loss ratio of proposed Adaptive Transmission Data Rate (ATDR) is 19% and Total transmitted data is 6.2 x 10^6 bits per sec. Sharma, A. et al. [14] shows that the proposed SLA-Energy cooperative quickest healthcare data transmission (SEQHDT) algorithm considering Service Level Agreement (SLA) formulation improves overall energy efficiency. The average capacity and hop count for the minimum cost s − t path from the QSS is 16.7 Mb/secs and 7.1 hops and the average energy efficiency is 3.46 × 105 bits/secs/joule. Qi, L. et al. [15] compared the proposed QoS-aware VM scheduling (QVMS) methodology with ESM (Energy-aware VM scheduling method) and Benchmark with variations in number of applications specifically 50, 100, 150, 200. In the most loaded scenario i.e., with 200 applications Energy consumption of QVMS is 998kWh, downtime is 36

sec and having maximum resource utilization of around 88%.

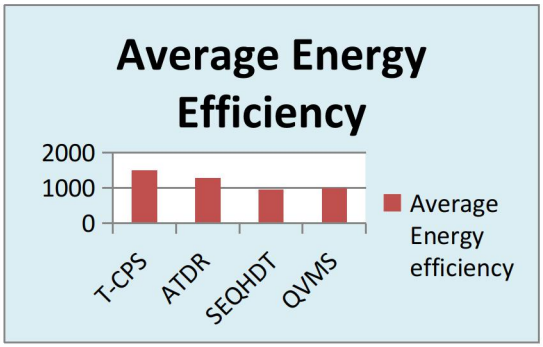


Fig.4. Average Energy Efficiency comparison for T-CPS, ATDR, SEQHDT and QVMS

V. RESEARCH CHALLENGES OF CPS IN SHS

System designers and developers of CPS in Smart healthcare faces numerous challenges for a successful implementation due to its inherent complexity and external entities dependency. With rapid increase of automation technologies healthcare data is increasing gradually leading different challenges to deal with this data. Though technologies like bigdata, cloud computing and blockchain have resolved lots of such problems but still various areas are remaining which needs to be considered to maintain the precision and accuracy of CPS system in healthcare as discussed below.

- Realtime Patient Monitoring: Sensors receive patient data and transmit these data to central remote server of cloud which is thereby accessed by healthcare provider. During these many transmissions the data packets may receive various challenges related to network jitter and packet loss resulting into inconsistent or incomplete data and such failures leads to the unavailability of CPS [16]. These delays can affect the caretaker's decision and may affect patient's health status adversely. Integrating real-time data and patient history with complete domain knowledge is very challenging yet most required task for remote health monitoring.
- Heterogenous Data Management: As per the definition of CPS it is composed of various components (physical and cyber), that means data can come from various resources having different formats. Moreover, these data are generating exponentially leading to the critical management task of such huge amount of data [17]. Despite using big data analytics and cloud computing techniques for managing these data in network can be affected by security reasons. Therefore CPS enabled SHS must be expanded accordingly to prevent violation of patient information privacy.
- Intuitive and Transparent Usability of the system: During designing of a CPS interface dynamic aspects (like comfortability, user-friendliness) must be considered and must support collaborative works between different care teams. It should adapt changing nature of interaction between caretaker team and the patient's as per the medical status of the patient and must provide E-learning that includes flow of operation that is to be followed by the team and the patients in different medical situations. Providing these functionalities within CPS can increase the energy consumption and system accuracy like parameters which will again decrease the effectiveness of the system [9]. Therefore, there must be balanced dynamic aspects as per the requirement from the system.
- Security: Due to the complexity and versatile nature of cyber and physical components of CPS there are maximum chances for different security attacks. Any interference by the intruder in sensor programs, network activities or communication protocols of the system can result into severe life-threatening problems for the patient under observation. The intruder can also stop different device communication by turning off the sensors or draining its battery thereby limiting availability of the device [6]. Contradictorily in some emergency situations there can be requirement from the system for unauthorized access also. So, providing security measures for a CPS system specially in SHS can be a very critical yet the most important task that is to be managed.
- Collaboration between different systems: CPS in SHS is composed of different components like sensors, actuators, networking systems etc, and all these components require continuous communication among themselves for achieving overall system goals [18]. But all these devices may have different computational capabilities that can lead to different conflicting suggestions regarding treatment and signal interference because of closed proximity and therefore the capability of CPS for operating among these devices with continuous communication and coordination is the most critical limitation of this system.

VI. Conclusion

Cyber Physical System is composed of cyber (like processing, decision making etc.,) and physical (like medical equipments, sensors, actuators, etc,.) components leading to the automation of these devices to enhance the functionality of overall system. Advance equipments of CPS can be utilized for wide applications in different fields like civil infrastructure, automotive, aerospace, energy, manufacturing etc. CPS can be used in Smart healthcare system for providing automation in healthcare system with the help of wearable and smart devices. These smart devices collect medical data from patients and transfer this data to next layer for processing using wireless transmission. CPS act as an interface between physical world (i.e., medical equipments for patient monitoring) and cyber world (i.e., medical data analysis). This work will help individuals to monitor their day-to-day activities and can avoid visiting hospital for every small problem and can also consult the doctor remotely whenever required. This paper discusses various technologies and algorithms to maintain the energy efficiency of CPS in Smart healthcare maintaining the patient privacy. This paper represents cyber physical systems in smart healthcare presenting its architectures, role of various technologies in its growth and major challenges in successful implementation of cyber physical medication systems.

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TECHNOLOGIES AND RESOURCE ALLOCATION USING AUCTION THEORY USING IOT

Prof. Chirag Bhatt
Computer Science and Engineering
Indus University
Ahmedabad, India
Email:-chiragbhatt.ce@indusuni.ac.in

ABSTRACT

As sensing, actuation, communication, and control become increasingly sophisticated and pervasive, there is enormous overlap in these communities, often from slightly different perspectives. In general, the Internet of Things will encourage numerous of objects, population, and services to connect and sharing information and useful data. As IoT devices become more pervasive and enduring, a IoT of security and privacy issues may surface. To ensure stringent and precise confidentiality, integrity, authentication, and access control, among other things, IoT security and privacy must be trustworthy, cheap, efficient, and effective. In this study, we discussed the resource allocation strategy, in which auction theory is employed to share resources.

Keywords- IoT, Security, Privacy, Devices, Omnipresent

I. INTRODUCTION

Cell phones, Cars that are smart. Homes that are smart. Cities that are smart. A wise world. These ideas have been around for a long time. To date, diverse and often disparate research communities have examined progress towards these aims. The Internet of Things (IoT), Mobile Computing (MC), Pervasive Computing (PC), Wireless Sensor Networks (WSN), and, most recently, Cyber-Physical Systems are examples of projecting study communities. (CPS). However, as each of these industries' technology and solutions evolve, there is more overlap and consolidation of principles and research programmers. Conventional definitions of these fields are insufficient.

Furthermore, IoT, WSN, and MC research frequently rely real-time computing, machine learning, security, privacy, signal processing, big data, and other underlying technologies. As a result, creating a world image requires a significant amount of CS, CE , and electrical engineering. Increased connectivity between these populations will hasten progress [2]. The whole IoT network will comprise of number of selves, separate devices and services that can communicate with one another to share data and helpful information [1]. With the rapid growth of IoT application use, infrequent security and privacy issues have emerged. When practically everything is linked together, this issue is just going to become worse. and repeated appearances will literally reveal further security flaws and weaknesses. Such controls may later be abused by hackers, and in a statistical sense, all identified faults and holes may be harmed in an ecosystem with number of devices [3].

II. THE IOT TECHNOLOGY

Many individuals [4] believe that sensing and actuation will includes cities and the planet, with many incorporated in "things," leading in what is known as a smart world. However, one critical issue is the degree of sensor and actuation coverage density. I believe there will be a tipping point when the degree of coverage triples or quadruples from where we are now. There will be a qualitative shift at that moment. Many constructions, for example, now have sensors to try to save energy [5]. Home automation is happening, cars, taxis, and traffic lights have devices to try and improve protection and carriage, People have smartphones with sensors that enable them to run an assortment of helpful apps, manufacturing facilities have access to the Internet, and healthcare services are relying on increasing home sensing to offer support and overall well-being [6]. Nonetheless, all of this is simply the tip of the iceberg. They are all in their early phases of development. The increasing density of sensing and the elegance of the associated processing will result in a significant qualitative change in how we work and live. We shall genuinely have systems-of-systems that interact synergistically and unpredictable services.

In the health domain, for example, new streams of sensor readings must be transformed with regard of language important behaviors conducted by or about a person, such as eating, bad breathing, or displaying signs of depression. The primary goal of data analysis and knowledge layout has been to address noisy, real-world data and to develop novel interference strategies that do not meet the criteria of Dempster-Shafer schemes. Limitations adds knowing about deductive probability and the expense of estimation. Although rule-based systems are acceptable, they may be too On-demand for applications.

The aim of the Internet of Things is to transform the Internet by building networks of billions of wirelessly accepted goods and devices that communicate with each other whenever, whenever, with anything, and with anybody using any service. RFID technology' increasing computing capabilities, wireless networks of sensors (WSNs), and lower-cost storage capacity may result in an extremely dispersed shared pool of resources connected via a dynamic network design.

There will be data being handled continuously in an IoT world. It will be required to design approaches that are within the scope of one's understanding.

Actually, connections on the Internet of Things will take place not only between machines but also between people and their surroundings. People, vehicles, computers, books, TVs, mobile phones, clothes, food, medicine, passports, luggage, and other everyday objects will all have at least one distinctive mark that will allow them to communicate with one another. In addition, as these objects can sense their surroundings, they will be able to verify identities and interact with one another, allowing them to exchange data that will become a means of perception complexity, and may frequently enable autonomic responses to difficult scenarios without the need for human oversight.

Intrusion detection in IoT is a separate essential study subject that has caught the interest of many academics. Some studies [8,9] have examined in this article, we addressed the use of intrusion detection systems (IDS) in wireless networks of sensors and the Internet of Things, and we also provided an analysis and comparison of the elementary existence IDSs.

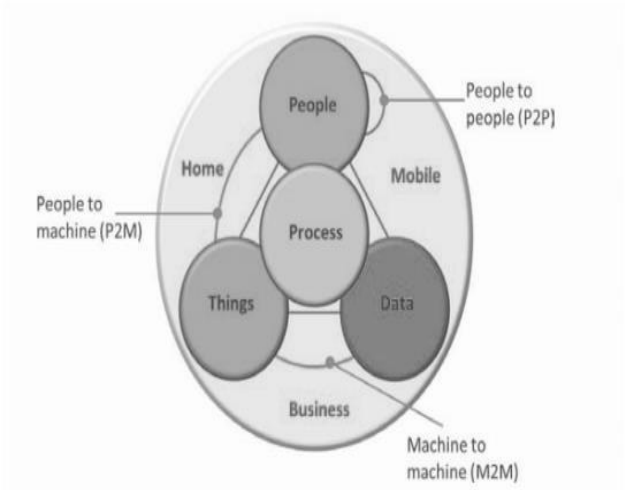


Fig:1 Internet of Everything [7]

III. RESOURCE ALLOCATION IN IOT

Auction theory is utilized in IoT for resource allocation. A public bidding is a method of selling things or services in which those who want to acquire goods or services put bids and the highest bidder wins the object or service he has bid for.

Combinatorial auction:

• Various types of products are being sold.
• Bidders may bid on individual products or groups of goods.
• The auctioneer discovers a combination that maximizes his revenue.
• The following two mechanisms are widely used in combinatorial auctions. [17]

- First-price sequential auctions in a single round (Sealed Bid)
- VCG bidding

Single round (Sealed Bid) first price combinatorial auctions Users place bids before the auction begins.

- The combination with the highest revenue is chosen.
- The winning bid is paid in full.

Required item	bid
$\{x\}$	1
$\{y\}$	3
$\{z\}$	2
$\{x, y\}$	5
$\{x, z\}$	5
$\{y, z\}$	4
$\{x, y, z\}$	6

Fig:2 Sealed Bid

On the other side, the VCG mechanism, commonly known as the price auction, is used.

Requested item	Bid of user 1	Bid of user 2
$\{a\}$	10	1
$\{b\}$	5	6
$\{a, b\}$	15	12

Fig:3 VCG MECHANISM

Many cloud providers, including Amazon EC2 and Microsoft, offer compute and storage capacity on a leasing basis. The Amazon price table is shown below.

VM Type	CPU*	RAM	Disk	Virginia	Ireland	Tokyo
m1.medium	2	3.75GB	410GB	$0.120	$0.130	$0.175
m1.large	4	7.5GB	840GB	$0.240	$0.260	$0.350
m1.xlarge	8	15GB	1.68TB	$0.480	$0.520	$0.700
c1.medium	5	1.7GB	350GB	$0.145	$0.165	$0.185
c1.xlarge	20	7GB	1.68TB	$0.580	$0.660	$0.740
m2.2xlarge	13	34.2GB	850GB	$0.820	$0.920	$1.101

Fig:4 AMAZON EC2 PRICE TABLE[18]

The table above lists several restrictions, such as a fixed price policy and a limited number of virtual machine instances available to consumers.

IV. RESOURCE ALLOCATION IN EDGE COMPUTING

Mobile devices have transformed becoming powerful computer systems that have substantial CPU power and memory. Conversely, mobile computational capabilities tend to be underutilized. This section shows how an edge cloud service can be provided via an array of co-located devices.

Assume there are several mobile devices in a location, and some of them require resources while others provide resources and a controller for task assignment. Our goal is to assign work to mobile devices to increase computational demand. [19]

There are some restrictions, such as:

1) Each task ought to be solely assigned to one mobile device.

2) Enough time should be allotted to each work.

3) Mobile devices use a lot of energy.

In this case, the heuristic technique could be used: Priority is given to tasks with a larger calculation load per unit data transfer. The task goes to a handheld gadget that will provide results as quickly as possible. Provide a lot of chores as feasible.

It does have certain limitations: The problem of task assignment should also be affected by energy use. An incentive system should be created. The distribution of resources should take place.

V. AUCTION THEORY FOR RESOURCE ALLOCATION

The mobile device that requires resources starts a session and requests resources. Those who are interested should send their incentive demand, duration of availability, battery level, and computation time. The client application chooses n devices based on a combination of the following criteria:

1. A minimal incentive is required.

2. A minimum amount of time is required.

3. The device with the highest battery level should be prioritized.

4. The gadget should not leave before the task is completed. How Sharing of information in the Agrifood supply chain [20]



Fig:5 Agrifood supply chain

In IoT, most of these components operate as separate systems. These systems must be linked to form the Food supply chain; however, the challenge may be that smart farming is a closed system.

Farmobile provides most data management services, although it has a set pricing strategy for both delivering services and selling data. We should devise a pricing mechanism with a flexible pricing policy based on data demand. There should be some kind of mechanism in place where the user and system owner bid against each other for service and data, respectively, and reach a medium point that satisfies both.

VI. CONCLUSION

Auction theory can be used to handle IoT concerns like resource provisioning and data exchange. In the future, we will conduct in-depth analysis of both problems. Choose one of them to create a model based on auction theory to address the problem and then put the model into action.

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Security and Privacy Issues of Big Data

Kavya Shah
B-Tech Student, dept. of CSE
Indus Institue of Technology and Engineering
Ahmedabad, India
shahkavya.20.cs@iite.indusuni.ac.in

Krish Vyas
B-Tech Student, dept. of CSE
Indus Institue of Technology and Engineering
Ahmedabad, India
vyaskrish.20.cs@iite.indusuni.ac.in

Yogeshvari Makwana
Assistant Professor, dept. of CSE/IT
Indus Institue of Technology and Engineering
Ahmedabad, India
yogeshvarimakwana.cse@indusuni.ac.in

***Abstract*— Big Data means combination of huge datasets which have complex structure. In beyond few years increase of net, cloud computing and IOT has led to voluminous records in almost each commercial enterprise or agency vicinity. To maintain privateness and protection of big data is very crucial difficulty. As the flow of Data is continuously increasing data breaching and data redundancy possibilities are also more. Today it is not possible to keep the data safe and secure from any attackers or intruders, so some techniques are being introduced which can help to keep the data secured. The primary purpose of this paper is to spotlight the strategies to hold the security and privateness problems of big Data for the usage of modern technology.**

Keywords—Data, 5Vs, security, technology, attackers, huge datasets

I. INTRODUCTION

Around 2005 new term "Big Data" came across the world which refers to the wide range of dataset different from the traditional datasets also which was almost impossible to handle the use of conventional control tools – because of their huge length and complexity. Big data is like a new born child which is growing gradually, knowing the world, and making its place in the world of data. Big data is nowadays, recognised by its Five V i.e., Volume, Velocity, Variety, Veracity, and Value (shown in Figure 1). Size of big data is represented in Petabytes and Exabytes and the quantity of data will almost be doubled every two years (IDC, 2012).

Social media, weather forecasting, industry data, satellite data, nuclear data, health data, etc which generates heterogeneous data at high speed comes under the big data. Eighty percentage of information that is generated via social media is unstructured facts which cannot be treated the use of conventional equipment, so large information comes into image. Big data contains many sensitive information or important data whose privacy and security are basic need. Here is where privacy and security challenges occur in big data. Any system can be said secured only if it has access controlled, integral, authentic, and confidential.

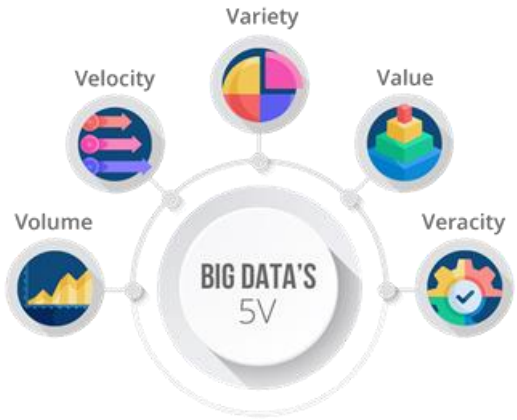


Figure 1. The 5Vs of Big-Data

II. SECURITY AND PRIVACY CHALLENGES OF BIG DATA

First, confirm that you A non-profit enterprise referred to as cloud secure alliance (CSA), has begun with a undertaking to sell use of fine practices which provides security assurance in the area of Cloud Computing, which has created huge facts running organization that has focused on main demanding situations which enables secure huge facts offerings. CSA classified security and privacy challenges into four main categories: -

a) Data privacy:
   i. Data analysis from data mining preserving data privacy.
   ii. Granular Access Control.
   iii. Cryptographic Solutions for Data Security.

b) Reactive security:
   i. Supervising security level in real time.
   ii. End to End filtering and validating.

c) Infrastructure Security:
   i. Security best actions for non-relational databases.
   ii. Secure distributed processing of data.

d) Data management and Integrating:
   i. Granular Audits.
   ii. Secured Data Storage and Transactional Logs.

iii. Data Provenance.



Figure 2. Big Data Security Concerns

Protection of any information or sensitive data via technology, process and training from unauthorised access, inspection etc and keeping that information confidential is called security. There are some challenges faced by big data in distributed cloud environment and those challenges are listed below Table 1.

Table 1. Security and Privacy Challenges at different levels

Security Levels	Challenges
Authentication Level	Logging, Cryptosystem, Authentication Protocol, Access Rights.
Data Level	Data Protection and Distributed Data.
Network Level	Distributed Data and Distributed Nodes, Node Communication.
Generic Types	Traditional Tools and Use.

Privacy in big data involves properly managing big data to minimize chance and defend sensitive information and information. Privacy challenge is a need because big data comprises large and complex datasets, traditional privacy approaches cannot deal with speed and scaled required. Different privacy preserving schemes are listed below Table 2.

Table 2. Privacy Study Categories

Method	Category
L-Diversity	Differential identifiability.
T-closeness	Membership Privacy.
De-Identification	Theoretical Framework.
K-anonymity	Differential Privacy.

III. Solutions/Proposals to address big data security and privacy challenges

Not a single magical solution has been made to solve Big Data Privacy and Security Challenges, there are sufficient traditional security solutions which are mainly dedicated to provide security to the static dataset that too in a small amount.

- Secure multi-party communication: The SMC deals with problems of function computation with distributed inputs, the main task is to compute function when each party has some input. The parties have security properties like correctness and privacy.
- Access control Technology: In Big Data dataset, there are large number of users which make the environment complex and hard to handle, to make this environment secure Access Control Technology is used. The Role- Based Access Control (RBAC) is used to restrict the access making the environment more secure.
- Homomorphic Encryption Schemes: This technology is used to secure the data even after privacy leak occurs. HES allows function to be computed without decrypting it first.
- Data Anonymization Technology: Also know ass de-identification technique, it is used in both centralised and distributed database. It uses technique of anonymizing sensitive information field to make it secure. Two main privacy objectives are: -
    - Unique Identify Disclosure.
    - Sensitive attribute disclosure.

IV. Methods to deal with Data Privacy and Security

a) De-identification: “De-identification” is the general term for the process of removing personal

information from a record or data set. De-identification protects the privacy of individuals because once de- identified, a data set is considered to no longer contain personal information.

This technique can be understood by taking an example, we are having a medical data with field such as patient name date of birth, gender, Aadhaar Number, visit date and total charge. Before giving this data to the third party, we will de-identify the data by removing name of patient and Aadhaar number (sensitive information). But it is not completely secured as the third party can access election card which has this sensitive information by using common field like gender, DOB etc., these common attributes are said to be quasi-identifiers and this type of data is said to be reidentification attack.

A data value that does not identify an individual on its own but can become identifying in combination with other quasi-identifiers. Quasi-identifiers are not direct identifiers. Instead, they are identifiers such as an area code or zip code or your date of birth and this is the main cause re-identification and linking attacks. To prevent re-identification quasi-identifiers are masked by suppression and generalization-based methods.

- In suppression data do not get reveal, it is hidden. Symbols like asterisk '*' is used to suppress quasi-identifier. Example: Age=36 Suppressed as Age=3*.
- In generalization the quasi-identifier is replaced with more general but consistent value. Example: Age=36 Generalized as Age<40.

The reverse process of data re-identification can be used to identify individual's data that can be linked back to individual using de-identified data. The notations proposed to prevent data from being re-identified are: K-Anonymity, L-Diversity & T-Closeness.

b) Encryption: Encryption is conversion of sensitive information into encrypted text i.e., cipher text. Many ciphers text algorithms are used to convert information into unreadable form to third party. Encryption can be used for: -

- Data Protection for Storage: It can be used to protect the data stored for a long time. Even if the storage is stolen or breached, the data will still be unreadable without the key.
- Ensuring Compliance: Considering the value of data security, many organizations, governments, and companies require the data to be secured with Encryption to keep the company or user data safe. This also prevents employees from having unauthorized access to user data.

V. Conclusion

This paper gives us knowledge about Big Data and shows us direction towards its security and privacy challenges. Basically, Big Data is analyzed for bits of knowledge that drives to better decision and strategic move for any organization. While analyzing this data many challenges for security and privacy are detected which is harmful for organization and a need to solve them is must. This paper describes about the core challenges in security terms and privacy terms. It also provides the method to make them light as there is no solution to these issues. The methods shown above should be made more powerful as the future of world is based on data i.e., Big Data. The Review Paper shows various methodologies by many researchers making data secured and provide privacy with its merits and demerits. To sum up with it is a need to develop strong and advance technologies to solve the issues of security and privacy in Big Data, as Big Data is future for every field based on huge amount of unstructured/structured data.

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FACE MASK DETECTION USING MTCNN

Yash Shah,
Student CSE,
Indus University,
Ahmedabad, India,
yash722002@gmail.com

Meet Shah,
Student CSE,
Indus University,
Ahmedabad, India,
meet10shah@gmail.com

Zalak Trivedi,
Asst Prof. CSE,
Indus University,
Ahmedabad, India,
zalaktrivedi.ce@indusuni.ac.in

***Abstract*— In this paper, we are going to suggest a method for detecting the presence of face masks using the MTCNN (Multi-task Cascaded Convolutional Neural Network) algorithm. The system utilizes computer vision techniques to detect faces in real-time video streams and then classifies them into two categories: a person has used a face mask or not. The MTCNN algorithm has undergone training using a substantial dataset of masked and unmasked faces to accurately detect and classify them. The proposed system shows promising results in detecting face masks with a high level of accuracy and can be used in various applications, such as enforcing mask mandates in public spaces, monitoring compliance in workplaces, and reducing the spread of infectious diseases.**

I. INTRODUCTION

The COVID-19 pandemic has caused significant changes in our daily routines, and one of the most visible changes has been the widespread use of face masks. In many countries, using a mask in public places has been made mandatory to prohibit the spread of the virus. However, it is difficult to enforce this rule manually, especially in crowded areas. In this context, computer vision techniques can be used for mask detection whether a person has used a face mask or not. In this paper we explain the MTCNN algorithm for face mask detection. For this we will use a train dataset to detect masks with computer vision in python and also use opencv, tensor flow and many other technologies. Our motto is to easily and automatically detect masks in places, which are crowded.

II. LITERATURE SURVEY

Several studies have been conducted on face mask detection using the MTCNN algorithm. The following is a summary of some of the key findings from these studies. In a study conducted by Zhang et al. (2020) [1] , the MTCNN algorithm was used to develop a face mask detection system. The system has capacity to detect that a person has weared a mask or not, with an accuracy of 96.5%. The system was also able to detect multiple faces in the same image. Another study by Li et al. (2018) [2] used the MTCNN algorithm to develop a face mask detection system for use in airports. The system achieved an accuracy of 95.2% for mask detection and 87.3% for mask type recognition. In a study by Meihua Gu., Xiaolong Liu ,Jing Feng, [3] the MTCNN algorithm was used to develop a face mask detection system for use in hospitals. The system has accurately detect whether a person was wearing a mask or not, with an accuracy of 97.2%. The system was also able to detect faces at various angles and distances, and was robust to changes in lighting conditions. Another study by Kaipeng Zhang , Zhanpeng Zhang, Zhifeng Li , Yu Qiao [4] used the MTCNN algorithm to develop a face mask detection system for use in public places. The system was able to detect whether a person was wearing a mask or not, as well as the position of the mask on the face. The system achieved an accuracy of 95.7% for mask detection and 89.3% for mask position recognition. Another study by Wei Hongtao , Yang Xi [5] , it is noted that MTCNN gives good accuracy when it comes to detecting objects.

III. APPROACHES TOWARDS OBJECT DETECTION & TOOLS

1 .APPROACHES

A. Machine Learning

Artificial intelligence (AI) has an area called "machine learning" that focuses on creating models and algorithms that let computers learn from data without being explicitly programmed. This means that machines may analyze and learn patterns in data independently, and then use that learning to make predictions or judgements, as opposed to having explicit rules or instructions coded into them.

B. Computer Vision

- The goal of computer vision, a branch of artificial intelligence and computer science, is to give computers the ability to interpret and comprehend visual data from their surroundings.It involves the use of algorithms and mathematical models to analyze, process, and extract useful information from digital images or videos.

- Computer vision has many applications, including image and video recognition, object detection and tracking, facial recognition, scene reconstruction, and medical image analysis. It is used in a variety of industries, such as healthcare, entertainment, security, and automotive.

C. Deep Learning

- Deep learning is a branch of machine learning that is based on multiple-layered artificial neural networks. It involves training large, complex neural networks to the ability to spot patterns in data and then utilize those patterns to forecast or decide.

- Deep learning has produced cutting-edge achievements in a variety of areas, including computer vision, natural language processing, and picture and audio recognition. It has also

demonstrated potential in other fields including robotics, finance, and healthcare.

- Deep learning's primary benefit is its capacity to discover feature representations from unprocessed data automatically, without the need for manual feature engineering. This means that deep learning models can understand intricate correlations between inputs and outputs and handle enormous volumes of unstructured data, such as text or picture.

D. MTCNN

- A technique for face identification and facial landmark detection based on deep learning is called MTCNN (Multi-Task Cascaded Convolutional Networks).
- MTCNN works by using a cascade of neural networks in which the outcomes of the face detection and landmark detection are gradually improved.
- The first stage of the network uses a convolutional neural network (CNN) to generate candidate regions of interest (ROI) where a face may be located in the input image.
- The second stage of the network refines the candidate regions by using another CNN to eliminate false positives and generate a tighter bounding box around the face.
- Finally, the third stage of the network uses a CNN-based facial landmark detector to estimate the positions of key facial landmarks, such as the eyes, nose, and mouth.
- MTCNN is appropriate for usage in applications like video surveillance and facial identification since it can recognize faces of various sizes and orientations in real-time.
- Additionally, it can handle occlusions, partial face views, and other challenges that can make face detection difficult. Overall, MTCNN is a powerful algorithm for face detection and facial landmark detection, and has been widely adopted in many industries and applications

2. TOOLS

E .OpenCV

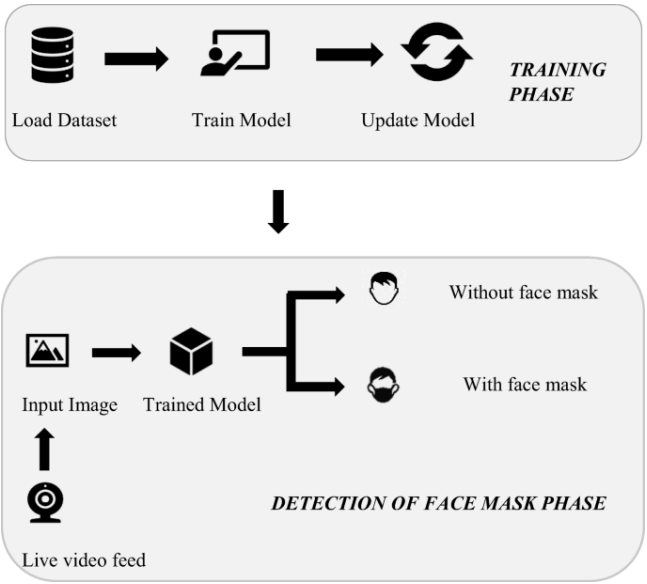
- An extensive variety of image and video processing operations are offered by the well-known open-source computer vision and machine learning software package known as OpenCV. Although it is built in C++, it offers interfaces for Python and Java, among others.
- OpenCV has a large collection of functions for image processing and computer vision tasks, including image filtering, edge detection, feature detection and matching, object detection and tracking, face detection, and more. It also covers machine learning methods like decision trees, k-nearest neighbors (KNN), and support vector machines (SVMs), among others.
- OpenCV is widely used in various fields such as robotics, autonomous vehicles, surveillance, medical image analysis, and augmented reality. It is a powerful tool for developers and researchers who need to process and analyze images and videos in real-time.

F.Tensor flow

- An open-source software library for deep learning and machine learning is called Tensor Flow. It offers information and tools for creating and implementing machine learning models, and it was created by Google.
- It uses a computational graph concept to represent mathematical operations and optimize computations. Tensor Flow supports multiple machine learning tasks and programming languages and integrates with other popular libraries.
- It is widely used in various fields and has become a popular choice for building machine learning models.

IV. PROPOSED SYSTEM

This proposed system centers around how to recognize an individual on a webcam wearing a mask on face with the assistance of PC vision and profound learning calculation by utilizing the Python, OpenCV, and MTCNN algorithms. Our primary aim is to make a system that will work in crowded places.



The Two Stages of Our System:-

A. Training Phase:-

- For training Phase pre trained dataset is acquired from open repository. The dataset contains records of over 1 Lakh images. In this dataset, each record typically consists of an image and its corresponding label indicating whether the face in the image is wearing a mask or not.

- The images were in any common image format (e.g., JPEG, PNG), and should typically be of size 224x224 or 256x256 pixels to ensure compatibility with most deep learning models.

- The labels were binary value (0 or 1) indicating whether the face in the image is wearing a mask or not. Alternatively, it can be a string value (e.g., "with_mask" or "without_mask") depending on how the dataset is labeled.

- We collect and preprocess this dataset of images containing faces with and without masks. After that the dataset is splitted into validation sets and fine-tuning of the model for face mask detection by adding a new output layer and evaluating the model's performance on validation set.

B. Detection of face mask phase:-

- After the Training model phase, the implementation part is initiated by importing Opencv library. Secondly, to capture video, *VideoCapture* function is used to capture a video.

- The argument to VideoCapture is the index of the webcam you want to use (usually 0 for the default webcam).

- To read frames from a video capture object, the *read* method of the video capture object is used. *imshow* method is used to display a frame in a window which takes two arguments: - name of the window and frame of display.

- After users are done with video capturing from the webcam, *release* method is applied to release the video capture object. After this process this image goes into a training model to check the status of whether a user has worn a mask or not.

V. Conclusion

This paper on face mask detection using MTCNN proposes a novel approach that uses the MTCNN algorithm for face detection and a custom classifier for mask detection. The model achieves high accuracy rates and is computationally efficient, making it suitable for real-time deployment in public spaces. The proposed method has the potential to assist public health efforts in preventing the spread of infectious diseases, such as COVID-19. Our method achieved an accuracy of 96.7% on a dataset of images with and without masks. Dataset is acquired from public repositories and the dataset was pretrained. That dataset contains records of over 1 lakh records .This method can be useful in enforcing mask- wearing rules in public places, especially in crowded areas

Acknowledgment

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Impact of Various Natural Energizers on Pack Carburization

P. Arunkumar[1], M. Irphan Ali[1], K. Santhy[1] and Gaurav Avasthi[2*]

[1]Department of Materials Science and Engineering, CARE Group of Institutions, Tiruchirappalli, India

[2]Department of Materials and Metallurgical Engineering, IITE, Indus University, Ahmedabad, India

*Corresponding author: gauravavasthi.mt@indusuni.ac.in

Abstract: **The mechanical properties of ferrous materials are modified by heat treatment process. Carburization is one of the important techniques to improve the surface hardness of ferrous material. In pack carburization process, along with charcoal, $BaCO_3$ is used as energiser to improve the rate of diffusion of carbon. In the present study, natural energiser such as egg shell, rice husk, water melon rinds and sugar cane bagasse are used for carburization of mild steel. The chemical composition and present phases of mild steel are determined by employing spectroscopy and X-Ray diffractometer. To identify the carburizing temperature, phase diagram of present mild steel is obtained with the help of Thermo-Calc software and Fe database. The process is carried out at temperature 900°C with two different soaking times such as 30 and 60 minutes. After carburization, the sample hardness profile and impact strength are obtained using micro Vickers hardness tester and Impact tester. The fracture surface is observed with the help of SEM. The diffusion rates carbon due to different natural energiser are compared with respect to holding time, surface hardness, case depth and impact strength values.**

Keywords: Pack carburization, Natural energizer, phase diagram, hardness profile.

1. INTRODUCTION

Carburizing is one of heat treatment process to alter the metallurgical and mechanical properties of the materials. Diffusion of carbon on the surface improves hardness, wear resistance and fatigue strength in static and dynamic conditions. The shape, size form and distribution of carbon in steel place a vital role to decide its applications. There are various types of carburization among which present work concentrates on pack or solid carburization. Charcoal is used as carburizing medium in pack carburization. Several investigators studied various carburizing medium other than charcoal [1]. To promote the diffusion of carbon in steel, an industry uses $BaCO_3$, Na_2CO_3, $CaCO_3$ as energizer. The basic chemical reactions for carburization with steel in presence of $BaCO_3$ are,

$$BaCO_3 \rightarrow BaO + CO_2$$
$$CO_2 + C \rightarrow 2CO$$
$$2CO + Fe \rightarrow Fe(C) + CO_2$$

Okongwu [2] tried carbonate minerals like marble, limestone with $BaCO_3$ as energiser. To replace $BaCO_3$, many investigators tried for natural energizers for example cow bone, rice husk, dates seeds sunflower seeds etc. as individual or a mixer [3, 4, 5, 6, 7, 8]. The natural energisers such as egg shell, rice husk, water melon rinds and sugar cane bagasse are identified for pack carburization process. In inorganic material like egg shells, $CaCO_3$ act as energiser and in organic materials like rice husk, water melon rinds and sugar cane bagasse, carbonaceous material act as energiser. These energisers predominant components are made up of organic such as C base components. The rate of diffusion of carbon depends on the soaking temperature, time, carburizing atmosphere and types of steel. Once the carbon diffused on the surface, it forms more stable phase such as cementite which improves the hardness and wear resistance of the steel [8].

2. EXPERIMENTAL PROCEDURES

For present work, mild steel (AISI 1020) used for case hardening. The chemical composition and phases present in steel is analyzed using spectrometric analyzer and Rigagu XRD (miniflux 600 model). Before going to the heat treatment, it is important to identify the austenitizing temperature of chosen sample. Using Thermo-Calc software with Fe-FeC_3 phase diagram is obtained to identify heat treatment temperature. The natural energisers are dried and pulverised by employing grinding mill. The size of charcoal is reduced by forging and sieved to have average size. For pack carburization, 55 x 12 x 12mm sample size used with initial hardness of 310HV. The sample is kept over 2 mm thick layer of mixed charcoal and energiser (in 9:1 ratio) in a galvanised steel box. Sample is placed at centre position; the box is filled with coal and energiser mixer. The lid on top the galvanized box avoids the contact of furnace atmosphere on the sample. Figure I show, the sample specification and box before complete coving of charcoal mixer.

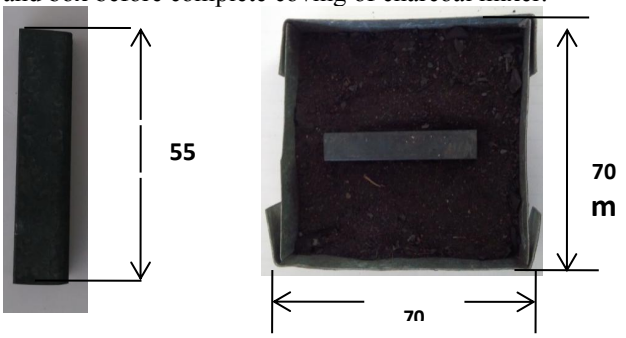


Figure I: Selected sample size and sample with mixer of coal and energiser in a galvanised steel box.

Then the box is heated to austenitizing temperature such as 900˚C in a electric muffle furnace with temperature sensitivity ±5˚C at a rate of 30˚C/sec, held for 30 minutes and followed by furnace cooling. The heat treatment cycle of pack carburization is shown in Figure II. Heat treatment cycle is repeated for the soaking time of 60 minutes for all combination of charcoal and energiser.

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Similarly the procedure repeated without energiser also. As mentioned earlier, the various energisers, such as egg shell, rice husk, water melon rinds and sugar cane bagasse are induces different atmosphere for the sample. Hardness profile of the samples is determined by micro vicker hardness tester. In addition to hardness, impact strength of the samples is obtained using impact testing machine. For microstructure, nital solution is used to etch the specimen. Fracture surface of sample is observed with Tescon SBH model of scanning electron microscopy.

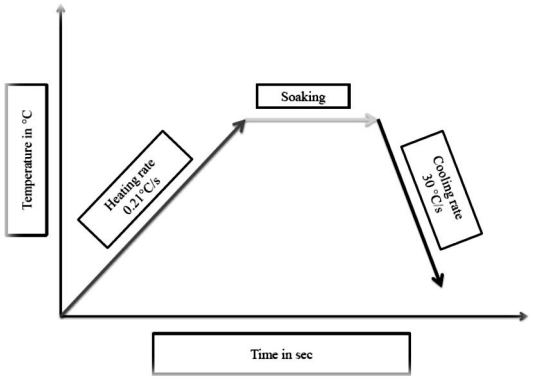


Figure II: Heat treatment cycle for pack carburizer.

3. RESULTS AND DISCUSSION

Table I gives the chemical composition of low carbon steel analyzed by employing spectrometric analyser. Conventionally, pack carburization is carried out in the temperature 850 to 950˚C which lies above A3 temperature. To identify the exact A3 temperature for present composition need phase diagram. Equilibrium phase diagram of the present composition is obtained by Thermo-Calc software with database of TCFE7 which is shown in Figure III. In order to avoid grain coarsening and also increase carbon diffusion, austentizing temperature is chosen as 900˚C based on equilibrium diagram which lies just above A3 temperature by calculated phase diagram for the given composition. In addition to phase diagram, XRD result is also confirms the presence of ferrite and cementite phase in as received sample shown in Figure IV. Microstructures of sample before and after pack carburizing are shown Figure V. It shows that percentage of cementite phase increases from surface to core after carburizing.

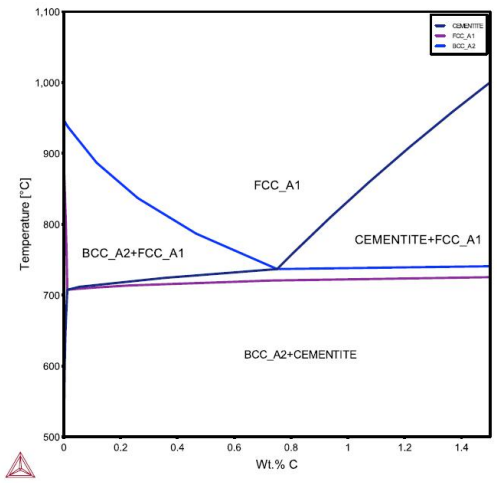


Figure III: Calculated equilibrium phase diagram of selected mild steel using Thermo-Calc with TcFe7 database.

Table I: Chemical Composition of steel

Element	C	Mn	Cu	P	S	Si	Fe
Wt. %	0.22	0.65	0.03	0.09	0.05	0.176	Rest

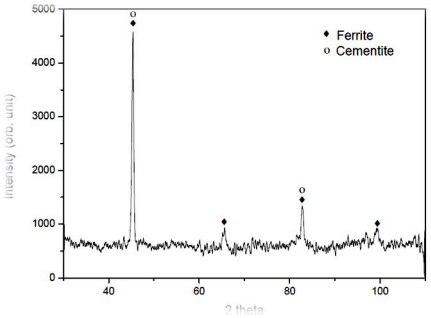


Figure IV: XRD graph at received mild steel.

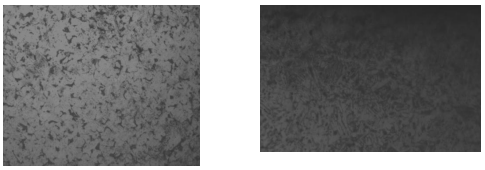


Figure V: Microstructure of mild steel before and after pack carburizing (Magnification:100X).

Figure VI shows that hardness profile of sample with various energizer with respect to soaking time 30 and 60 minutes. In both the cases, irrespective of the energizer, hardness of the sample increases from surface to core. It indicates, the energizer raises the carbon potential of carburizing medium. Figure VII shows the comparison of energizer with respect soaking time. Initially, diffusion of carbon is more when melon skin is used as energizer and less for egg shell. When soaking time increases from 30 to 60 minutes, the diffusion rate of carbon is high for egg shells compared to melon. Due to diffusion of carbon, quantity of cementite phases increases from surface to core which is observed in Figure V. Figure VIII shows the impact strength of carburized sample with respect to

energizer and soaking time. When hardness of the sample increases, impact strength of the sample decreases which is observed in Figure VIII. Optimized hardness and impact strength is obtained for sample with sugar cane energizer. The efficiency of energizer can be assessed by case depth as mentioned by ISO 6507-1. The case depth is perpendicular distance between surface and layer having a hardness of 550HV. Figure IX shows the maximum surface hardness and case depth achieved with respect to soaking time due to energizer. When water melon skin is used as an energiser, its influence over carbon potential is less. Since maximum surface hardness does not change much with respect to soaking time. But, case depth is raised to 62 to 196µm. In the case of egg shell energizer, maximum surface hardness raised from 570 to 920HV within 30mintues along with case depth. In the case of sugar cane bagasse and rice husk energiser, maximum surface hardness raised with soaking time. But it does not influence much in case depth. Figure X shows the fracture surface of core and case of pack carburised sample after impact strength. It shows the presence of transgranular cleavage with individual grains identified by changes in fracture plane orientation. Compare to core, case grains size comparatively smaller due to diffusion of carbon which can be identified by fracture plane.

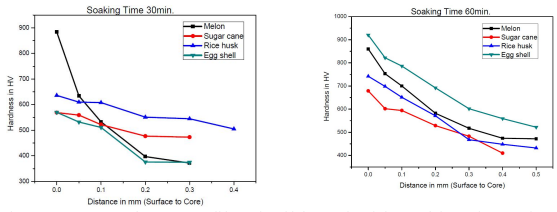


Figure VI: Hardness profile of mild steel with soaking time of 30 and 60min.

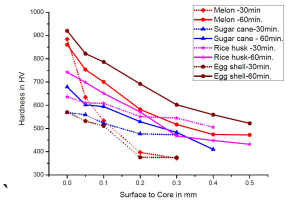


Figure VII: Hardness profile comparison with respect to soaking time.

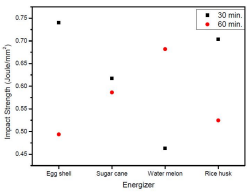


Figure VIII. Impact strength comparison of energizer with respect to soaking time.

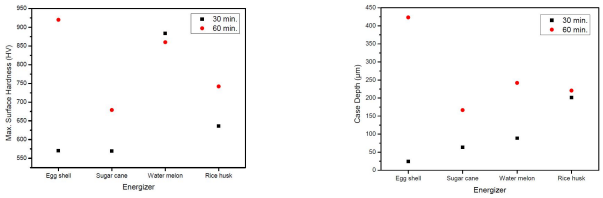


Figure IX: Achieved maximum surface hardness and case depth of the samples with various energizers with respect to soaking time.

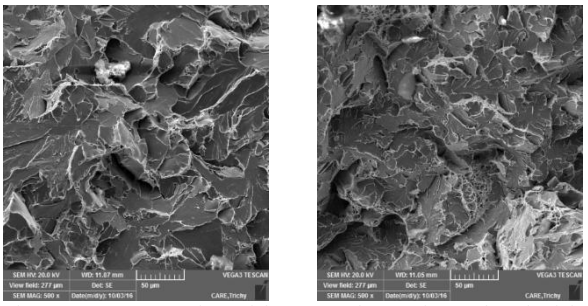


Figure X: Fracture surface of the core and case after pack carburizing.

4. CONCLUSIONS

The effect on natural energiser on pack carburization was studied with two different soaking times. The rate of diffusion carbon in the surface region of steel is totally dependent on the type of energisers present in its atmospheric condition. The energizer such as egg shell, rice husk, water melon rinds and sugar cane bagasse results different hardness profile due to different atmospheric condition. When depth of hardness raises with respect to soaking time, reduces the impact strength of the samples. As expected, surface hardness is more than core after pack carburization. Comparing natural energisers such as egg shell, rice husk, water melon rinds and sugar cane bagasse, initially diffusion is more in water melon rinds energizer, but diffusion rate is high for egg shell energiser.

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Comparative analysis of Homomorphic encryption in Internet of Things

Hiral Shastri
Computer Science & Engineering
Indus University,
Ahmedabad, India
hiralshastri.cse@indusuni.ac.in

***Abstract*— Internet of things require security and data privacy which can't be done by traditional encryption method. Traditional encryption method will increase complexity, power consumption and latency. Internet of Things devices don't have strong processing power. To solve this issue, we can use Homomorphic encryption. It is one kind of encryption that allow to do processing on cipher Text without decrypting it. It provides data security and data privacy. In Homomorphic Encryption two operation can be performed. One id addition and another is multiplication. Homomorphic encryption has mainly two sub categories: fully homomorphic encryption and partially homomorphic encryption. If we perform only one operation it is considered as partially homomorphic encryption and if we perform both operation it is considered as fully homomorphic encryption. This paper discuses about various homomorphic technique and its comparison with its real-life applications.**

Keywords—IoT, Encryption, Homomorphic Encryption

I. INTRODUCTION

Everyone is now talking about Internet of Things(IoT). Internet of Things means network of things which connected via internet. Things can be any electric or electronic device like sensors, TV, Personal Computer, Laptop, Mobile Phone, Tablets, Air Conditioner, Tube Light, Smart Refrigerator etc. While Dealing with IoT we require some stereo type model i.e. some of the components are necessary like cloud, sensors, mobile, internet, RFID, etc. In IoT data is transferred from one end device to another end device and between them more than one devices are involved. During transmission of data our data may be compromised. As IoT is combination of numbers of network. That network may have some security loop holes or security limitations. So, that loop holes or security limitations of that network could be considered as IoT security limitations.

Data can be compromised in terms of privacy or security or both. During transmission of data from one end to other end, we may need to transfer some important data like password or email id which we do not like to compromise. So, these data must be shared securely. To ensure data privacy and data security we need to apply some kinds of encryption method to them. In this paper, we are trying to cover some of the encryption technique and we also explain why those traditional encryption techniques are not applicable in terms of IoT. We will discuss a new encryption technique called as Homomorphic Encryption.

This paper is divided into various sections. Section II introduce Traditional encryption techniques and its limitation in Section II. Section III contains Homomorphic Encryption (HE) and its advantages. Section IV contains comparative study of various homomorphic encryption techniques and in last we will conclude the study.

II. TRADITIONAL ENCRYPTION TECHNIQUES AND ITS LIMITATIONS

In Traditional method, there is a secret key know as encryption key. Using thins key we can encrypt data which will convert Plain Text (PT) to Cipher Text (CT). A secret key by which we can perform decryption operation i.e. convert Cipher Text to Plain Text is known as Decryption key. Now, we may think that our data is now secure and we may use this method to any IoT technology. But there is some problem in this method. After performing the encryption operation, we are not allowed to perform any operation on it. It will affect directly to the plain text and at the time of decryption we may not get the actual output as we required. In Internet of things data is stored or transferred via cloud [6] [7]. We may not have faith on cloud storage [10] party as it is a service provided by third party, we must securely store data on cloud[1][5]. But to provide security if we store a data in encrypted form in the cloud, it is not possible to perform any operation without decryption operation [8]. As we know in Internet of Things data size must be smaller plus we need to reduce complexity of operations performed on data [9]. If we apply traditional

Encryption technique it will add more burden to the system as it requires encryption and decryption operation every time. Internet of Things devices may not have bigger processing power to perform such operation fast so it will take more time and increase latency. Rather than this Internet of things devices works on battery power supply. If we use traditional method of encryption it will use more power as it has bigger overhead and higher complexity. These are the possible reasons so that we need to move ahead and think of another technique which provide security in Internet of things and do

not create issues as discussed earlier. One possible solution is Homomorphic Encryption.

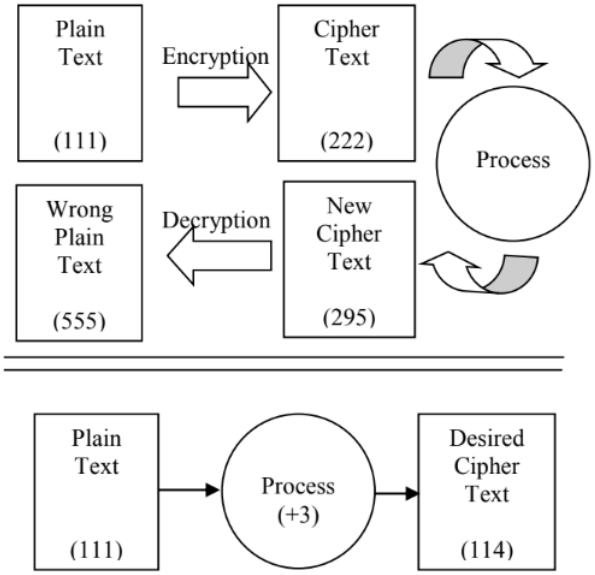


Fig. 1. Traditional Encryption Technique

As Shown in figure 1, we had shown one example why traditional method fails. Consider that we have plain text 111. Before sending or storing this data, we need to encrypt to ensure its security and privacy. Suppose after encryption process, our plain text is converted into cipher text i.e. 222 (in our example). Now we are trying to apply some process which we be resulting +3 on every data of cipher text. So, suppose our data will be 295. If we perform decryption operation on 295, it will give new plain text i.e. 555 in our case. Our goal was to perform +3 operation on 111 that will give output 114 but instead of 114 we get 295. It is clearly proved that tradition method fails if we need to apply post processing on encrypted data.

III. HOMOMORPHIC ENCRYPTION

A Homomorphic Encryption (HE) is a one type of encryption which allow to process on encrypted data [13] [14]. In Homomorphic Encryption method, we need to encrypt data by secret key. It is also called as encryption key. It will convert original data to encrypted form just like a traditional encryption technique, but the difference between traditional encryption and Homomorphic Encryption is that Homomorphic encryption allow us to process on encrypted data i.e. it will not affect the data while decrypting them. It will act as same as we perform process in plain text. After doing all the process which we want to do, we can get back our original data as plain text using secret key. This key is called decryption key. [14]

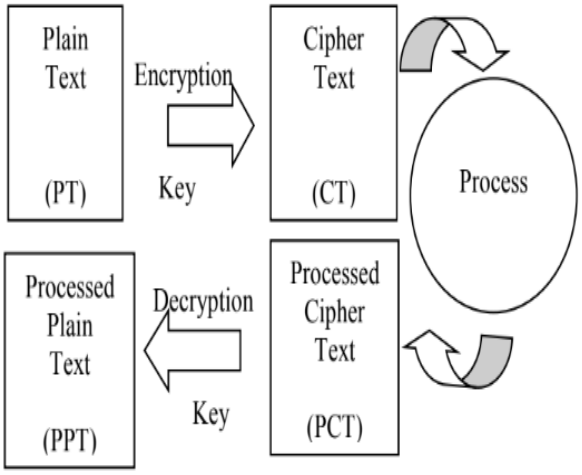


Fig. 2. Homomorphic Encryption

In figure 2 we have shown a simple mechanism of homomorphic Encryption. First, Plain Text (PT) is converted into Cipher Text (CT) using one secret key i.e. Encryption Key. After Applying desired process the Cipher Text (CT) will be converted into Processed Cipher Text (PCT). Now Apply decryption process using another secret key i.e. Decryption Key. It will convert Processed Cipher Text (PCT) to Processed Plain Text (PPT). In Homomorphic Encryption (HE), we can apply mainly two operations: Addition and Multiplication. As per operation is performed,

We can classify Homomorphic Encryption into two sub categories [4]. One is Partially Homomorphic Encryption (PHE) [13] and another is Fully Homomorphic Encryption (FHE) [14]. In partially Homomorphic Encryption, we perform either addition or multiplication operation. While in fully Homomorphic Encryption, we perform addition and multiplication both operation.

If we consider our example shown in fig.1, if we have plain text 111 and we apply homomorphic encryption, it will convert into cipher text i.e. 556 (assume). Now we are free to apply any operation upon this cipher text, but it will act like we had applied process on direct plain text only. So, suppose that process will do +3 operation, we will have our new processed cipher text 635. Now if we apply homomorphic decryption we will get output as 114, which is our desired output. Here, we do not require decrypting our data to perform operation and still we can get desired output.

Advantages of Homomorphic encryption is that it is also one kind of encryption. So, it will hide our plain text and convert into cipher text. Cipher text is not easily understood by any person or computer. So, it will provide security to data. We can also apply this method to Cloud Stored data without losing our privacy. As discussed earlier we can apply process on cloud stored data. Rather than this

advantages it also provides data Integrity also. If anyhow our data is stolen from network, person must know secret key to decrypt data. Even if he got decryption key somehow, he must have encryption key to send fake or malicious data. We can easily figure out in appropriate data. In IoT, if we want to create a system which requires all these facilities Homomorphic Encryption can do a better job.

IV. COMPARISION OF DIFFERENT HOMOMORPHIC ENCRYPTION TECHNIUES

As we discussed earlier there are two kinds of homomorphic encryption methods available. One is partially and another is fully homomorphic encryption. In partially and fully homomorphic encryption different algorithm are available like Paillier, Rivest Shamir and Alderman (RSA), Elgamal, Enhanced Homomorphic Cryptosystem(EHC), Non interactive Exponential Homomorphic Encryption (NEHE), Algebra Homomorphic Encryption based on updated Elgamal(AHEE), Brakerski Gentry and Vaikuntanathan(BGV) etc. [13] We had tried to compare some of the parameters like is this partially or fully Homomorphic or its additive or Multiplicative Homomorphic, is it support cloud platform, its real-world application. Other than this, we also compared which operation is technically or mathematically applied, where the algorithm apply security i.e. on server or client and algorithm's time complexity.

As per table I and II, we can all algorithm which shown can be applied on cloud computing as it support cloud compatible. We can choose any algorithm as per our application. We had shown its real-world application but this is not the only possibility to do so. We can apply some of them in IoT. But as we know Internet of things devices are very tiny with small processing power. It works on battery power and so that we must choose such an algorithm so that it will fulfil these requirements. For that we need to consider two parameters, one is time complexity and another is operation performed in algorithm. As complexity increases performance of an algorithm in terms of battery consumption decreases. Second parameter is also important as addition and multiplication have different cost of operation. So, which algorithm performs addition operation we can prefer it for use of IoT. In short, we need to choose an algorithm which is low power consuming, which cost less amount of battery power and less complicated. For that we can use an additive homomorphic encryption as it does not require computational power with compare to multiplication.

TABLE I. COMPARISION OF HOMOMORPHIC ENCRYPTION TECHNIQUES

Name of an Algorithm	Nature	Cloud Platform Applicable	Real World Application
Paillier [1][2][3]	Partially Additive Homomorphic	Yes	E-voting
RSA [1][2][3][12]	Partially Multiplicative Homomorphic	Yes	Internet Banking
Elgamal [1][2][3]	Partially Multiplicative Homomorphic	Yes	Hybrid System
Benaloh [3]	Partially Additive Homomorphic	Yes	Cloud Security
Cohen and Fischer [3]	Partially Additive Homomorphic	Yes	Cloud Security
Naccache and Stern [3]	Partially Additive Homomorphic	Yes	Cloud Security
Goldwasser Micali [1] [3] [11]	Partially Additive Homomorphic (one bit only)	Yes	Cloud Security
Boneh-Goh Nissim [1] [3]	Partially Additive Homomorphic (unlimited bit) but Partially Multiplicative (one bit only)	Yes	Cloud Security

TABLE II. COMPARISION OF HOMOMORPHIC ENCRYPTION TECHNIQUES

Name of an Algorithm	Operation Performed	Security Applied at	Complexity
Paillier [1][2][3]	$<+>_N$	Cloud Server	O(2)
RSA [1][2][3][12]	$<\cdot>_N$	Cloud Server	O(1)
Elgamal [1][2][3]	$<\cdot>_P$	Cloud Server	O(2)
Benaloh [3]	$<+>_P$ *(For small prime P)*	Cloud Server	*O(log N/ log P)*
Cohen and Fischer [3]	$<+>_P$ *(For small prime P)*	Cloud Server	*O(log N/ log P)*
Naccache and Stern [3]	$<+>_{\prod P} i$ *(For small prime Pi)*	Cloud Server	*O(log N/ log* $\prod_P i$ *)*

Goldwasser Micali [1] [3][11]	$<+>_2$*(XOR)*	Cloud Server	*O(logN)*
Boneh-Goh Nissim [1] [3]	$<+>p$ $<\cdot>_p$*(p only one time)*	Cloud Server	*O(logn n / log T)* $(T < \sqrt{n})$

V. CONCLUSSION

In Internet of things, cloud plays a crucial role. For that we have concluded that homomorphic encryption can be one of the solution over simple encryption. In this paper, we have discussed about various homomorphic encryption techniques and its real-world applications. As per application and requirement, we can apply any of them. From the table of comparison, we can say that additive homomorphic encryption algorithm can be possible solution for IoT security.

However, our study has limitations, including a small sample size of encryption techniques analyzed and the absence of real-world testing. Future research should aim to evaluate a larger set of techniques and conduct more rigorous testing under different conditions. Overall, our study contributes to the growing body of research on secure and privacy-preserving IoT systems, and underscores the importance of continued investigation and development of homomorphic encryption techniques.

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Failure Analysis of TMT Rod

MONIL SALOT
Department of Materials and Metallurgical Engineering,
Indus institute of Technology
Indus University
Ahmedabad, India
monilsalot.mt@indusuni.ac.in

K. SANTHY
Department of Materials and Metallurgical Engineering,
Indus institute of Technology
Indus University
Ahmedabad, India
santhyk.mt@indusuni.ac.in

Abstract— **The properties of steel bar which is used for construction are improved by thermo-mechanical treatment. During the process of rebending, the bar underwent for fracture. In the present work, the failure analysis of thermo-mechanically treated (TMT) bar was analyzed with the help of emission spectroscopy, optical microscopy, scanning electron microscopy and hardness test.**

1. INTRODUCTION

Thermo-Mechanical Treatment (TMT) of is one of the processes which improve the properties of medium and high carbon steel [1]. The rod which is produced by TMT process has better properties than alloyed carbon steel and work hardened steels. Since TMT replaced by alloyed carbon steel and work hardened steel usage in structural application (which act as a concrete reinforcement bars). The property such as stability in handling operations, high strength (~500 to 550MPa yield strength), superior ductility and weldability are plays a vital role in TMT rods. In addition to that easy fabrication with high dimensional accuracy is necessary. To obtain the required properties, it is important to obtain the martensite on case, ferrite, and pearlite combination on core through the process. In addition, microstructure transformation case and core must be smooth by formation of bainite in the transitions zone. Figure 1 show the required microstructure information.

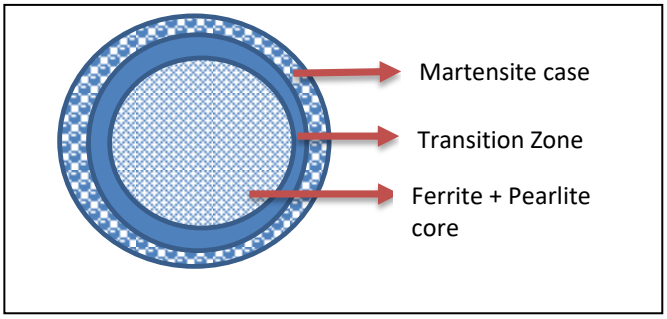


Figure 1: Required microstructure formation for TMT rod.

TMT bar production process involves in three stages such as surface quenching stage, self-tempering and final cooling stage. The various controlling parameters which are involved in the process are listed below.

- Finishing rolling temperature - Phase diagram knowledge required
  - Depends on the chemical composition
  - Type of inclusions and amount
- Quenching time / cooling rate - TTT and CCT diagram knowledge is important
  - Size of the component required case hardness
  - Water flow rate / water pressure
  - Volume of water
  - Temperature of water
- To obtain required microstructure and mechanical properties
  - Volume fraction of the martensite - depends on Ms temperature and its relation with carbon equivalent
  - Tensile properties of martensite
  - Tensile properties of ferrite - pearlite (bainite) structure of the core

TMT rod undergoes fracture when rebends due to absence of expected microstructure and its co-relation with mechanical properties. To obtain high strength and ductility, require concentration in

- Chemical composition
- Starting and finishing rolling temperature
- Cooling rate
  - It is important to have tempered martensite on the surface and ferrite-pearlite core with bainite phase in transition zone. To attain the required microstructure, it is important to understand the metallurgical principle behind in TMT process.

2. EXPERIMENTAL STUDY

The 25mm TMT bars were broken during rebending. These samples tested and analyzed by employing emission spectroscopy, optical microscopy, scanning electron microscopy and Vickers hardness tester.

3. RESULTS AND DISCUSSION

The chemical composition of the TMT rod is listed in Table 1. The carbon percentage is 0.21 wt. %. For the formation of martensite formation carbon equilavlent has to be less than or equal to 0.42wt.%. Carbon equivalent formula for low carbon steel is

$$CE = C + \frac{Mn}{6} \leq 0.42\%$$

For present composition, CE is 0.298 which falls in acceptable range. But the tendency for the formation of martensite phase during hardening is low for this CE. Totally three samples are received in various positions of bend regions. Presence of inclusion were studied after

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polishing the sample in optical microscopy. Figure 2 shows the presence of globular oxide and silicate inclusions.

Table 1: The chemical composition of TMT rod.

Element	Composition in Wt.%
C	0.21
Mn	0.53
S	0.044
P	0.045
Cr	0.19
Cu	0.18
Si	0.19
Ni	0.04
Fe	Rest

Using nital etchant, microstructure of the bend samples was studied using optical microscopy. The expected microstructures for TMT rod are martensite on the case and ferrite with pearlite combination on the core. Bainite phase is not observed in transition region.

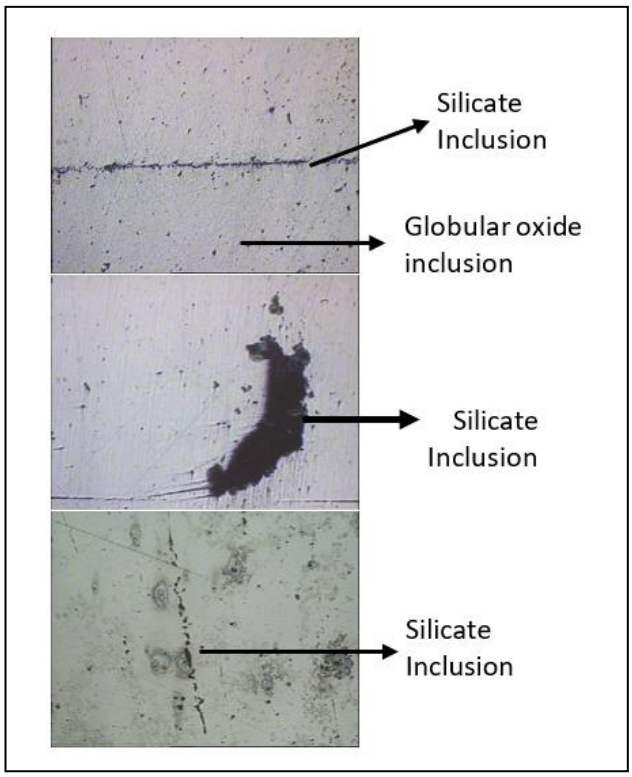


Figure 2: Observation of inclusions in samples in 3 different batches obtained using optical microscope (100X) of bend samples.

Fracture surface of the samples are studied using SEM. Figure 4 show the fracture surface reveals shear type fracture i.e. brittle fracture mode on the surface.

Lot of residual stress retained in the transition regions. Both core and case, micro cleavage is observed which indicates that inclusions lead the fractures.

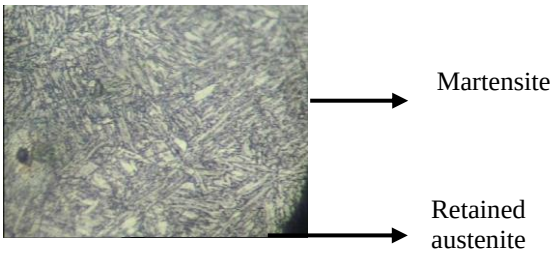


Figure 3(a): Observation of martensite, retained austenite and inclusions in the case of bend sample of TMT rod using optical microscopy (600X)

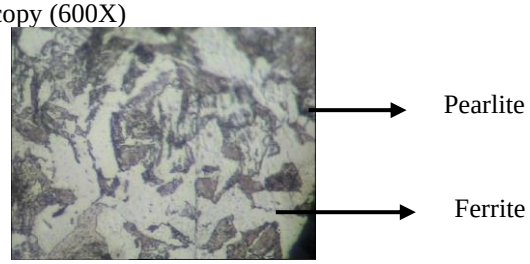


Figure 3(b): Observation of ferrite and pearlite in the core of bend sample of TMT rod using optical microscopy (600X)

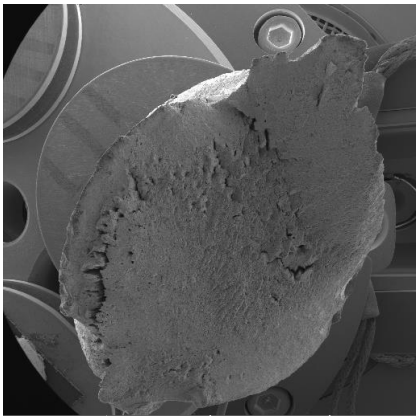


Figure 4: Fracture surface of the sample with 20X magnification using SEM

Hardness technique is another method used to determine the phase formation in TMT rod. To cross check the hardness from case to core from two different direction of TMT give the indication of phase formation and case depth. The hardness profile clearly indicates that martensite phase did not form in one side of TMT rod.

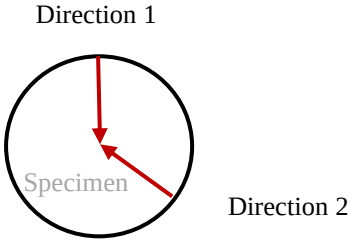


Figure 5: Hardness measurement direction from case to core in two different direction using Vickers Hardness technique.

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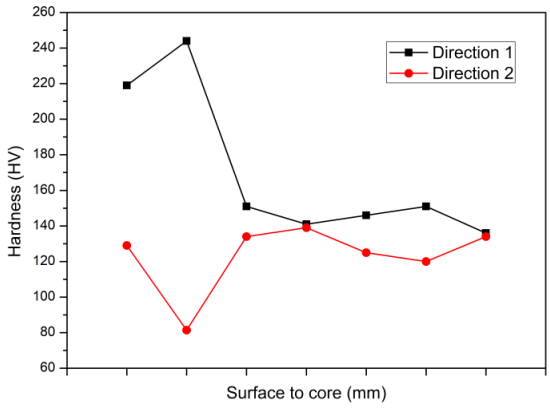


Figure 6: Hardness profile of TMT rod from two different direction using Vickers hardness technique.

4. CONCLUSIONS

As per the chemical composition shows that carbon equivalent is acceptable range but not sufficient for the formation of martensite phase.

An inclusion in raw materials is more which has to be reduced.

Globular oxide and silicate oxide inclusions are observed in bend sample of TMT rod using optical and electron microscopy. Especially silicate oxide affects formability such as bending.

Metallography observation indicates presence of various phases on the material. Martensite phase is observed on the case and ferrite & pearlite on the core with inclusions.

Fracture surface shows the shear mode in one direction which indicates tensile force faced on that region. Presence of splitting in other direction indicated phase transformation did not take place smoothly.

Hardness profile clearly indicates martensite formation did not take place on case completely. It indicates that absence of sufficient carbon and cooling did not take place uniformly.

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Numeric Image Recognition System

1st Anish Patel
Department of Computer Science Engineering
Indus University, Ahmedabad, India
anishdaniel.19.cs@iite.indusuni.ac.in

2nd Panth Patel
Department of Computer Science Engineering
Indus University, Ahmedabad, India
panthpatel.20.cs@iite.indusuni.ac.in

3rd Prof. Bhumi P Makwana
Department of Computer Science Engineering
Indus University, Ahmedabad, India
bhumimakwana.ce@indusuni.ac.in

***Abstract*— the computer vision-based system called the Numeric Image Recognition System project employing Convolutional Neural Networks (CNN) tries to identify and categories numbers inside digital pictures using deep learning methods. The objective of the project is to create a system that can precisely recognize and categories letters and numbers in photographs, enabling automated analysis, classification, and labelling of massive datasets. CNNs are a specialized deep learning architecture that are used by the system to handle picture data effectively and efficiently. The main aspects of the project are picture pre-processing, CNN model training and optimization, and image categorization using the found features. The system is also planned to be flexible and adaptable to various picture datasets and use cases, as well as scalable, effective, and accurate. There are several possible uses for the system, including object detection in autonomous cars, security and surveillance systems, picture search and tagging, and medical image analysis. The research marks a tremendous development in computer vision and has the potential to completely change picture categorization and analysis across a range of sectors. Overall, the Numeric Image Recognition System project employing CNNs is a strong and promising method for classifying and recognizing images, with a variety of applications and potential advantages in other sectors.**

Keywords—Numeric Images, Supervised learning, Machine learning, Deep Learning, CNN, TensorFlow, Keras, PyTorch, OpenCV, PIL

I. INTRODUCTION

The Numeric Image Recognition system is a computer vision-based project that aims to improve the efficiency and accuracy of image analysis and classification. By utilizing Convolutional Neural Networks (CNN), the system can automatically identify and categorize numbers within digital images, making it an effective solution for handling large datasets and a range of image formats.

The project's objective is to create a scalable, efficient, and accurate image analysis and classification system that can meet the needs of various industries. The system's components include picture pre-processing, CNN model training and optimization, and image classification using detected features. With a user-friendly interface, the system is easy to interact with, allowing users to view results and make informed decisions quickly.

II. STUDY OF NUMERIC IMAGE RECOGNITION TECHNIQUES

"ImageNet Classification with Deep Convolutional Neural Networks" by Alex Krizhevsky, Ilya Sutskever, and Geoffrey Hinton. This paper, published in 2012, introduced a CNN architecture called AlexNet that achieved state-ofthe-art performance on the ImageNet dataset. The paper demonstrated the effectiveness of CNNs for large-scale image classification tasks and paved the way for further research in the field.

"Very Deep Convolutional Networks for Large-Scale Image Recognition" by Karen Simonyan and Andrew Zisserman. This paper, published in 2015, proposed a new CNN architecture called VGGNet that achieved even higher performance than AlexNet on the ImageNet dataset. The paper demonstrated the importance of increasing the depth of CNNs for achieving higher accuracy in image recognition tasks.

"Mask R-CNN" by Kaiming He, Georgia Gkioxari, Piotr Dollar, and Ross Girshick. This paper, published in 2017, proposed a CNN architecture for instance segmentation, a task that involves identifying and delineating each object in an image. The architecture combines object detection with image segmentation and achieved state-of-the-art performance on several benchmark datasets, demonstrating the potential of CNNs for more complex image recognition tasks beyond classification.

"Inception-v4, Inception-ResNet and the Impact of Residual Connections on Learning" by Christian Szegedy, Sergey Ioffe, Vincent Vanhoucke, and Alexander Alemi. This paper, published in 2016, proposed a new CNN architecture called Inception-ResNet that combined the strengths of the Inception architecture and residual connections. The architecture achieved state-of-the-art performance on several image recognition tasks, including the ImageNet dataset.

"YOLOv3: An Incremental Improvement" by Joseph Redmon and Ali Farhadi. This paper, published in 2018, proposed a CNN architecture called YOLOv3 (You Only Look Once version 3) for object detection in real-time video streams. The architecture was designed to be faster and more accurate than previous versions of YOLO, achieving state-of-the-art performance on several benchmark datasets while still maintaining real-time processing speeds.

III. PROPOSED SYSTEM OF NUMERIC IMAGE RECOGNITION

As shown in fig 1, the flow of the methodology is to begin with data acquisition. The dataset is chosen from Kaggle because it has already been processed, hence there is no need to do any further pre-processing, and the next step is feature extraction. Lastly, the images are given to the classification model to train the CNN model.

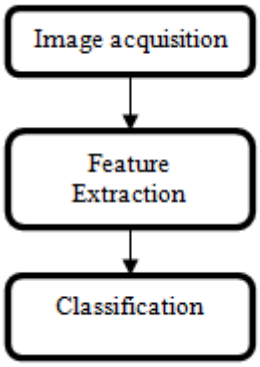


Fig. 1. General Flow of System

A. *Image Acquisition and Pre-processing*

In our study, the image dataset was gathered from Kaggle. In which the dataset is preprocessed so it saves out time of pre-processing. The dataset is of MINST and contains 50,000 images of different numbers. We have resized our images to 32x32 in preprocessing.

B. *Feature Extraction*

We have selected CNN as our model to achieve our goal. Thus, feature extraction is performed internally by our model.

C. *Classification*

Machine learning classification techniques include SVM, KNN, LDA, CBIR, and deep learning classification includes CNN, ANN, and dense network (RRDN), ResNet50, DenseNet121, Mobile Net, Shuffle Net, inception v3 model.

Our proposed model for classification is CNN which is deep learning technique for analyze pattern. It is application to both linear and non-linear problems. In essence, neural network type known as a convolutional neural network, or CNN or ConvNet, is particularly adept at processing input with a grid-like architecture, like an image. A digital picture is a binary representation of visual information. It has a grid-like arrangement of pixels, each of which has a pixel value to indicate how bright and what color it should be. In fig 2, we have shown the architecture of CNN model. The **convolution layer** is the core building block of the CNN. It carries the main portion of the network's computational load. By obtaining a summary statistic from the surrounding outputs, the **pooling layer** substitutes for the network's output at certain points. As a result, the representation's spatial dimension is reduced, which reduces the amount of computation and weights needed. Every slice of the representation is independently handled for the pooling procedure. As in a **conventional FCNN**, all of the neurons in this layer are fully connected to all of the neurons in the layer before and after. Because of this, it may be calculated using a matrix multiplication followed by a bias effect, as per normal. The representation between the input and the output is mapped using the FC layer. In recent years, the **Rectified Linear Unit (ReLU)** has gained a lot of popularity. It performs the function f (k) =max (0, k) computation. To put it another way, the activation just exists at zero threshold.

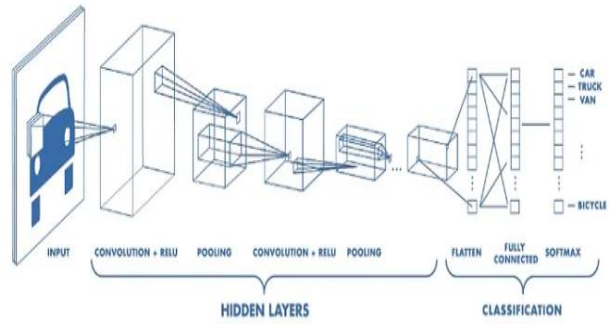


Fig. 2. CNN Model

D. *Proposed Phases*

The phases of our project is shown in the fig 3 where we can see that in first we have researched for our project. In second phase, we have finalized our dataset and technologies. Further, we have integrated the model and started to train the model. Lastly, tested different variation in the model to achieve the desire accuracy.

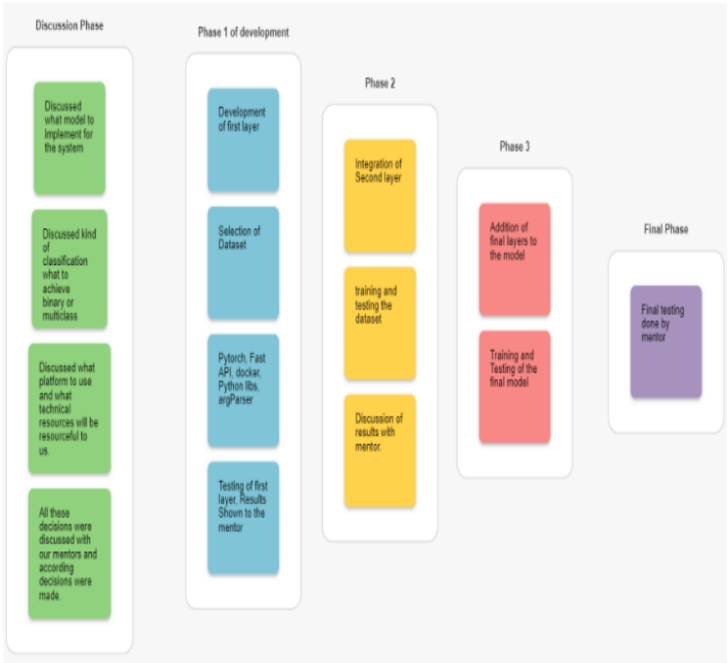


Fig. 3. Proposed Phases

E. *Performance matrix*

Important performance matrix for classification is experiment result equation is mentioned in Eq. (1)-(3)

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \quad (1)$$

$$\textit{Precision} = \frac{TP}{TP+FP} \quad (2)$$

$$Recall = \frac{TP}{TP+FN} \quad (3)$$

In Formula (1), (2) and formula (3) at where TP is True Positive which means the value which is predicted as positive, and its actual values is also positive it identifies correct experiments. TN is True Negative which means the value predicted as positive, but its actual value is Negative it identifies correct experiments as wrong experiments. FP stands for False Positive means the value, which is predicted as positive, but its actual value is negative it identify correct experiments as wrong experiments. FN stands for False Negative at where the value, which is predicted as negative, but its actual value is also negative It identify wrong experiments as wrong experiments.

IV. OUR EXPERIMENTAL RESULTS

Our experimental Result has been showed in table I at where we have performed various variations.

TABLE I. EXPERIMENTAL RESULTS

F1 SCORE	ACCURACY	EPOCH	PRECISION	RECALL
0.814	**86.23 %**	**5**	**0.78**	**0.86**
1.051	**96.23 %**	**10**	**1.052**	**0.953**
0.965	**96.94 %**	**15**	**0.965**	**0.964**
0.964	**96.95 %**	**20**	**0.966**	**0.964**
0.976	**96.97 %**	**25**	**0.966**	**0.962**
0.953	**96.81 %**	**30**	**0.972**	**0.962**

V. CONCLUSION AND FUTURE WORK

In conclusion, the CNN-based Numeric Image Recognition System has been created and tested with success. A convolutional neural network method is used by the system to precisely detect and categorise images. The project's objectives of developing a dependable and effective image recognition system for usage in a variety of applications, including security monitoring, medical diagnostics, and autonomous driving, have been met. The project was able to adjust to changing requirements and manage risks by utilising agile development approach. The project was both technically and operationally feasible and economically viable, according to the feasibility assessment. The system has become more functional and user-friendly as a result of the addition of numerous capabilities like real-time image processing, batch processing, and a friendly interface. Like any other system, though, there are drawbacks that must be resolved in the future. By enhancing the neural network design, expanding the training dataset, and implementing more deep learning strategies, the system's performance may be further enhanced. To make sure the system can operate dependably in various scenarios, additional testing and validation in real world settings are required. Overall, the project has advanced computer vision and has the potential to be expanded upon and incorporated into a number of different sectors. There are several potential future enhancements that could be made to our Numeric Image Recognition System using CNN, including **Multi-label classification:** Currently, the system is designed to identify a single object within an image. However, it can be enhanced to identify multiple objects within the same image. **Real-time image recognition:** Currently, the system requires a recaptured image to analyse. However, it can be further enhanced to recognize and analyse images in real-time, which can be useful in applications such as autonomous vehicles. **Fine-grained recognition:** The system can be further improved to perform fine-grained recognition, which involves identifying sub categories within a particular object. For example, instead of just identifying a bird, the system can differentiate between different types of birds. **Transfer learning:** The system can be enhanced using transfer learning, which involves training the model on a large dataset, and then transferring the knowledge gained to a new, smaller dataset. This can lead to improved accuracy and reduced training time. **Improved accuracy:** There is always room for improvement in terms of accuracy, and the system can be further fine-tuned to achieve even better results. **Mobile application:** The system can be integrated into a mobile application, which can allow users to easily take pictures and get instant results on the objects within the images. **Localization:** The system can be enhanced to not only recognize objects, but also to identify their location within an image. This can be useful in applications such as mapping and navigation.

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Crowd Detection

Asst. Prof .Dhara Jadav
Computer Science and Engineering
Indus University
Ahmedabad, India
Email:- dharajadav.cse@indusuni.ac.in

Devesh Dhameliya
Student At Computer Science and Engineering
Indus University
Ahmedabad, India
Email:- deveshdhameliya.07@gmail.com

ABSTRACT

Most of the studies are based on tracking individuals, crowd counting, finding the region of motion and crowd detection. Crowd detection and density estimation from crowded images have a wide range of applications such as crime detection, congestion, public safety, crowd abnormalities, visual surveillance and urban planning.

The purpose of crowd density analysis is to calculate the concentration of the crowd in the videos of observers. Pattern recognition technique helps to estimate the crowd detection count and density by using face and detection.

The job of detecting a face in the crowd is complicated due to its variability present in human faces including color, pose, expression, position, orientation, and illumination. The counting performance has been steadily improved because of the Deep Convolutional Neural Network.

I. INTRODUCTION

In recent years, computer vision technologies like crowd detection have grown in significance, particularly in fields like public safety and security. Crowd management, event planning, emergency response, and public safety scenarios can all benefit from having the ability to recognize and monitor crowds.

In order to recognize and analyze huge groups of people in pictures or videos, crowd detection systems employ a range of methodologies. These methods include more basic deep learning models that can evaluate complicated crowd behavior and spot patterns and anomalies, as well as more established computer vision algorithms that can identify persons in an image.

Crowd detection has a wide range of uses, including event management, traffic flow optimization, public safety, marketing, and more. For instance, crowd detection can be used to spot suspicious activity in huge gatherings, keep an eye on traffic flow and facilitate pedestrian mobility in congested metropolitan areas, or keep an eye on crowd behavior and density at sporting events or concerts.

We may anticipate seeing even more advanced and useful implementations of this technology in the years to come as the technology underlying crowd detection systems continues to advance and develop.

II. MOTIVATION

The requirement for efficient crowd control and public safety in diverse settings is what motivates crowd detection technologies. Large crowds are more likely to gather in public spaces as a result of urbanization and population growth, which can provide issues for traffic control, safety, and security. This is especially important in situations like big gatherings, demonstrations, transportation hubs, and emergency situations.

The improvement of crowd flow and public safety can be aided by crowd detection devices, which can offer insightful information about crowd behavior, movement patterns, and density. Crowd detection systems, for instance, can assist first responders in emergency circumstances by assisting them in assessing the situation and making decisions about how to manage the crowd and maintain public safety.Crowd detection can be used in event management scenarios to track and improve crowd movement and traffic flow to make sure attendees have a fun and safe time.

The availability of picture and video data is expanding, and advances in computer vision and deep learning techniques are also driving the development of crowd detection systems. These developments have made it possible to create crowd detection algorithms that are very accurate and efficient and can quickly analyze vast volumes of visual data.

The development of these systems is fueled by a mix of technology improvements and the expanding need for efficient crowd management solutions. In general, the goal of crowd detection systems is to increase public safety and optimize crowd control in various scenarios.

III. THE PROPOSED WORK

Depending on the particular application and requirements, the planned work of a crowd detection system may vary. Nonetheless, a crowd detection system may have the following standard parts:

Collecting visual data using cameras or other sensors in the area where a crowd is anticipated to congregate.

Preprocessing: The removal of noise, distortions, and unimportant information from the visual data through filtering and processing.

Crowd detection involves finding and locating people in visual data using computer vision algorithms or deep learning models. This may entail counting people individually or calculating the density of the entire crowd.

Analysis of the movement patterns, behavior, and other traits of a crowd that has been discovered in order to spot any anomalies or suspicious conduct.

Visualizing the analysis's output in a form that is useful and actionable, such as through visualizations or alerts.

A crowd detection system's suggested task may also include integrating with other systems or technologies to make real-time observation, communication, and decision-making possible. To enable quick and efficient reaction to any possible threats or emergencies, for instance, a crowd detection system may be connected with emergency response systems.

A crowd detection system's stated overall task is to deliver precise and fast information about crowd behavior and movement patterns to support crowd management, public safety, and other applications where an understanding of crowd dynamics is essential.

IV. DETAIL EXPLANATION OF THE PROPOSED WORK

A computer vision system called a "crowd detection system" can recognize and assess the presence of crowds in visual data like pictures or movies. When a person is present and acting in a certain way in a certain area, the system can be used to recognize that fact by evaluating visual data.

The several parts of a crowd detection system are described in further detail below:

Data Gathering: A crowd detection system's initial step is to use cameras or other sensors to collect visual data. The cameras are positioned in key areas where crowds are likely to congregate. The cameras may be stationary or moving, and they may have tools like pan, tilt, and zoom to get a variety of perspectives of the surroundings.

Preprocessing: Noise, distortions, and unnecessary information are removed from the visual data once it has been collected. To improve the accuracy and clarity of the photographs, data must be filtered.

Crowd detection is the following stage, which involves finding people in the visual data. Deep learning models or a variety of computer vision methods can be used for this. The algorithms examine the visual information to identify human traits like size, shape, color, and movement patterns.

Crowd Behavior Analysis: After determining that there are people present, the system examines their behavior to look for any irregularities or suspicious behavior. This entails examining movement patterns, spotting crowded areas, and picking up on odd behavior

Preprocessing: Noise, distortions, and unnecessary information are removed from the visual data once it has been collected. To improve the accuracy and clarity of the photographs, data must be filtered.

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Crowd Behavior Analysis: After determining that there are people present, the system examines their behavior to look for any irregularities or suspicious behavior. This entails examining movement patterns, spotting crowded areas, and picking up on odd behavior

Visualization of the Analysis's Output: The results of the analysis are then presented in a fashion that is both informative and actionable, such as through visualizations or alerts. As a result, stakeholders may easily and immediately spot any problems and take the necessary action.

In general, a crowd detection system offers insightful data about crowd density, behavior, and movement patterns, which can be used to improve crowd flow and safety. It can be applied in a range of contexts, such as managing events, managing hubs for public transit, and managing emergencies. The system can be tailored to meet particular needs and applications, and it can be combined with other technologies or systems to allow for real-time communication, monitoring, and decision-making.

V. BRIEF EXPLANATION OF OPEN CV

A software library for computer vision and machine learning is called OpenCV (Open-Source Computer Vision). It offers a collection of programming tools and formulas for creating computer vision software. Since its initial creation by Intel in 1999, OpenCV has grown to be a well-liked and often used library for computer vision tasks.

With the help of OpenCV, you can carry out a wide range of activities, including processing images and videos, detecting and tracking objects, recognizing faces, and machine learning. It is compatible with a variety of programming languages, including C++, Python, Java, and MATLAB, and it can operate on Windows, Linux, and macOS.

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Fig 1. Demonstration of a webcam output accessed using Cv2

With the help of OpenCV, you can carry out a wide range of activities, including processing images and videos, detecting and tracking objects, recognizing faces, and machine learning. It is compatible with a variety of programming languages, including C++, Python, Java, and MATLAB, and it can operate on Windows, Linux, and macOS.

VI. DETAIL EXPLANATION OF FACIAL RECOGNITION SYSTEM

Facial recognition system is a technology that uses computer algorithms to analyse, identify, and verify a person's unique facial features from digital images or live video feeds. The system works by capturing an image of a person's face using a camera or a video camera, and then processing the image to extract facial features such as the distance between the eyes, the shape of the jawline, and the size of the nose.

The facial recognition system uses advanced algorithms and machine learning techniques to compare the extracted facial features with a database of known faces to identify the person. This database can be created by collecting images and biometric data from various sources, such as social media, driver's licenses, passports, and other public records.

There are two main types of facial recognition systems: verification and identification. Verification systems are used to authenticate a person's identity by comparing their facial features with a stored image or biometric data. For example, a person can use their face to unlock their smartphone or access a bank account.

Identification systems, on the other hand, are used to match an unknown face to a database of known faces. This type of system is commonly used in law enforcement to identify suspects in criminal investigations. Identification systems are also used in public places such as airports, stadiums, and shopping malls to enhance security and prevent unauthorized access.

Facial recognition systems use a variety of techniques to analyze facial features, including 2D and 3D imaging, neural networks, and deep learning algorithms. These techniques enable the system to recognize faces even in low-light or low-resolution images, and to accurately distinguish between identical twins and people of different races and ages.

However, facial recognition systems have been the subject of controversy due to concerns about privacy, accuracy, and potential misuse. Critics argue that facial recognition technology can be used to track individuals without their consent or knowledge, and can lead to false arrests or wrongful convictions.

In conclusion, facial recognition systems are a powerful technology that has the potential to enhance security and improve convenience, but it also poses significant risks to privacy and civil liberties. As with any emerging technology, it is important to balance the benefits with the potential risks and to ensure that the use of facial recognition systems is subject to appropriate safeguards and regulations.



Fig 2. Example of how a image is processed while encoding.[4]

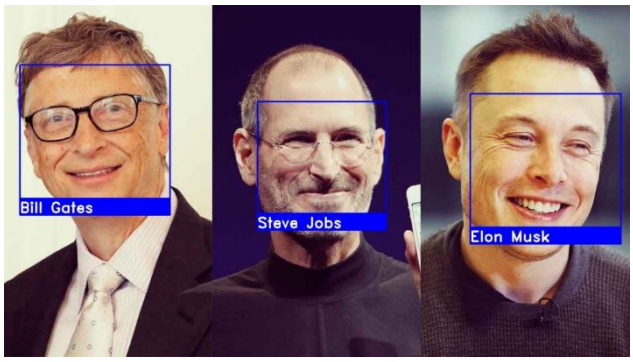


Fig 3. Example for the image identification[5]

Here the above images are used to illustrate how the image is processed and then used in the machine learning model to predict the best possible label.

VII. DETAIL EXPLANATION OF QR CODE IN SYSTEM

A unique ID, or unique identifier, is a string of characters or numbers that is used to distinguish a particular object or entity from others in a system. In the context of a crowd detection system, a unique ID can be used to identify and track individuals within a crowd.

There are various methods for assigning unique IDs in a crowd detection system. One common approach is to use computer vision techniques to extract features from an individual's appearance, such as facial features or clothing, and use these features to create a unique ID. For example, a system might use facial recognition algorithms to create a unique ID based on an individual's facial characteristics, such as the distance between their eyes or the shape of their nose.

Another approach is to use tracking techniques to follow individuals as they move through a crowd. In this case, a

unique ID might be assigned based on an individual's movement patterns or behavior. For example, a system might use machine learning algorithms to analyze an individual's gait or body language and use this information to create a unique ID.

Once a unique ID has been assigned, it can be used to track an individual's movements within a crowd. This information can be used for a variety of purposes, such as monitoring crowd behavior, identifying potential security threats, or analyzing crowd flow patterns.

It is important to note that the use of unique IDs in a crowd detection system raises privacy concerns, particularly when it comes to the collection and storage of personal data. As such, any system that uses unique IDs should be designed with privacy in mind, and appropriate safeguards should be put in place to ensure that personal data is protected.



Fig 4. Unique id is given to all the person for distinguish

[6]

VIII. EXTRA FUNCTIONALITIES IN THE SYSTEM

A crowd detection system may include a number of additional elements in addition to unique IDs to improve its functionality. These qualities include, among others:

Create a heat map to show the population density in a certain area using the density mapping tool. The device can pinpoint regions with high or low traffic flow and aid in optimising crowd control tactics by monitoring density trends over time.
A crowd detection system may also be built to look for suspicious or anomalous behavior, such as sudden changes in movement patterns or unexpected crowd configurations. To spot potential concerns to public safety or security, use this tool.

Real-time alerts: When specific events or behaviors are discovered by the system, real-time notifications may be delivered to security employees or other stakeholders. For instance, if the system notices an abrupt rise in crowd density in a certain location, a warning can be sent to security staff to look into the matter.

Monitoring of social distance: Due to the current COVID-19 epidemic, certain crowd detection systems have been modified to include monitoring of social distance. This entails measuring the space between people in a crowd and spotting occasions where people are standing too closely to one another.

Predictive analytics: Machine learning algorithms can be used by crowd detection systems to analyses previous data and forecast crowd behavior in the future.

IX. CONCLUSION

In conclusion, a crowd detection system has the potential to significantly improve crowd control, security, and public safety. These systems can assist in the detection of potential security threats, the observation of crowd behavior, and the provision of real-time information to security personnel by analyzing data from cameras and other sensors using computer vision and machine learning algorithms.

It's crucial to understand that crowd detection technologies have drawbacks, including accuracy restrictions, privacy issues, and financial and maintenance requirements. As with any technology, it's crucial to weigh the advantages against any potential risks and disadvantages.

Crowd detection systems must be meticulously planned and put into action in order to function as effectively as possible. This includes choosing the right sensors, setting up the algorithms, and providing security personnel with training and support. The power of crowd detection systems can be used by organizations to improve public safety and security in a number of situations, such as sporting events, concerts, public demonstrations, and other major gatherings.

ACKNOWLEDGMENT

Crowd detection is a crucial technology with many uses in marketing, event planning, and public safety, among other areas. It involves the automatic identification and tracking of people in crowded environments using computer vision and machine learning techniques.

In order to ensure accountability and transparency, it is crucial to acknowledge the usage of crowd detection technology. The public should be made aware of the use of this technology and the purposes it serves. Concerns regarding privacy and civil liberties may be reduced as a result.

Additionally, it's crucial to make sure that any usage of crowd detection technology conforms with all applicable laws and rules, including privacy and data protection legislation.

To guarantee that the technology is utilized in a responsible and ethical manner, organizations that use crowd detection should have explicit policies and procedures in place.

In conclusion, admitting the use of crowd detection technologies is essential to ensuring accountability, transparency, and adherence to relevant laws and regulations.

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Integrating the Use of Lean Principles for Effective Decision Making in Construction

Marmik Shukla
M.Tech Student, Civil Engineering Department
IITE, Indus University
Ahmedabad, India
E-mail:marmikshukla.21.cpm@iite.indusuni.ac.in

Dr. Jishnu R. Gohel
Asst. Prof., Civil Engineering Department
IITE, Indus University
Ahmedabad, India
E-mail:marmikshukla.21.cpm@iite.indusuni.ac.in

***Abstract*— Decision making is a central component of construction project management, yet it is often an area where projects face significant challenges. The incorporation of lean concepts into decision-making processes can assist construction projects in overcoming these obstacles and achieving success. Even though decision making is an essential component of construction project management, it is frequently a source of substantial difficulty. A lack of effective decision making can result in project delays, expense overruns, and subpar results. The main objective of this study is to find a common ground or framework for implementing lean principles while making decisions for the construction projects which can improve the decision-making capability on worksite. The premise of lean concepts is continuous improvement and waste reduction. Lean principles, when applied to decision making, can help to ensure that decisions are founded on data and evidence, and that all key stakeholders are involved in the decision-making process. The application of lean principles can also aid in the improvement of communication and coordination among project team members, resulting in improved decision making. This research also helps in reviewing the aspect for improving the decision-making skills on field and find a better solution and to integrate the use of lean principles while taking major decisions.**

Keywords— lean principles; decision-making; construction project management

1. INTRODUCTION

The construction industry is one of the most significant contributors to the global economy. However, it is also one of the most complex and challenging industries. In recent years, lean principles have gained popularity to improve efficiency and reduce waste in various industries, including construction. The integration of lean principles in construction decision-making processes can lead to significant improvements in project outcomes. This study aims to explore the integration of lean principles in decision-making processes in construction.

The construction industry can greatly benefit from using lean principles in decision making. Lean is a management philosophy that aims to reduce waste and increase efficiency by focusing on continuous improvement and value creation.

Lean construction is a method of establishing construction procedures in a project with the goal of reducing waste. This includes time, materials, and effort. The approach of lean construction is to complete a project more effectively and affordably without sacrificing quality. To generate and protect social and environmental values as well, Lean concepts and practices have been explored and implemented more frequently in recent years.

The building industry is one of the most important sectors of the economy, and its success is dependent on resource management that is efficient and effective. Lean principles can assist construction managers in making better choices and increasing the overall efficiency of the construction process. Lean principles are based on the Toyota Production System philosophy, which has proven to be highly successful in manufacturing, production along with the business objectives being met. The fundamental concepts of lean thinking are to eliminate waste, generate value for the customer, and continuously improve the process. These principles can be applied to building to help streamline decision-making and increase the overall efficiency of the project.

Standardizing processes and procedures are another key Lean principle that can help streamline construction decision-making. By establishing clear standards and guidelines, teams can reduce variability and improve consistency across projects, leading to greater efficiency and higher-quality outcomes. The Lean principle also emphasizes the importance of collaborative decision-making. By involving all stakeholders in the decision-making process, construction teams can ensure that all perspectives are considered, leading to better decisions and outcomes.

The incorporation of lean principles into decision making can assist building projects in improving overall performance and achieving success for any projects. Construction projects can avoid delays, cost overruns, and poor-quality results by making decisions based on data and evidence and engaging all stakeholders in the decision-making process. Overall, the lean principle can be a powerful tool for decision-making in construction, as it encourages collaboration, focuses on value, and promotes continuous improvement. By using lean principles, construction teams can make decisions that are more efficient, effective, and ultimately deliver better results.

2. Literature Review

The literature review focuses on the application of lean principles in the construction industry. Several studies have investigated the application of lean principles in the construction industry, and most of them have highlighted the benefits of applying lean principles. The existing literature suggests that the application of lean principles in decision-making in construction can improve project performance, reduce waste, and increase customer value. The use of visual management, collaboration, continuous improvement, and stakeholder engagement are key elements of lean decision-making in construction. For example, Nizar et al. (2018)

applied lean principles in decision making during the procurement process of a construction project. The study found that the integration of lean principles led to improved decision quality, reduced cycle time, and increased transparency.

Similarly, Wang et al. (2019) examined the application of lean principles in decision making during the construction process. The study found that the integration of lean principles led to improved decision quality, reduced cycle time, and increased transparency. The study also found that the application of lean principles in decision making can lead to improved communication and collaboration among stakeholders.

Kumar and Tezel (2021) examined the application of lean principles in decision making during the design process. The study found that the integration of lean principles led to improved decision quality, reduced cycle time, and increased transparency. The study also found that the application of lean principles in decision making can lead to improved risk management and cost control.

Lean principles play a vital role in decision-making in construction management by providing a structured approach in addressing problems, identifying priorities, and managing risks. Lean principles also help to reduce the variability and unpredictability that is characteristic of the construction industry by providing a systematic approach to decision-making.

Furthermore, lean principles enable construction managers to identify and eliminate non-value-adding activities, which helps to optimize the use of resources, reduce the cost of production, and improve the quality of output.

However, the application of lean principles in the construction industry is not without its challenges. The construction industry is characterized by complexity, uncertainty, and a lack of standardization, which can make it difficult to apply lean principles. Additionally, the construction industry is also highly dependent on human labour, which can make it challenging to implement lean principles. The traditional approach to decision-making in construction is often based on intuition and experience, leading to a lack of transparency and consistency in decision-making. To address this issue, the integration of lean principles in decision-making processes can be considered.

2.1 Integration of Lean Principles in Decision Making in Construction:

To integrate lean principles in decision-making processes in construction, the following steps can be considered:

1. Define the Problem: Determining the problem is the first step in applying lean principles to decision-making. In order to do this, you must first pinpoint the issue, its underlying cause, and how it affects the project's goals.
2. Identify Value: Finding the value being offered to the consumer is the second phase. This entails comprehending the needs and expectations of the client and coordinating them with the goals of the project.
3. Map the Process: The process map is created in the third stage. This entails figuring out the order in which the various tasks must be completed in order to provide value to the client. Any non-value-added operations should be noted on the process map, which should be brief and easy to understand.
4. Identify Waste: Finding waste is the fourth stage. This entails locating any non-value-added activities that do not assist in providing value to the client. This can include holding one's breath, excessive production, flaws, extra stock, unnecessary processing, unproductive motion, and unutilized talent.
5. Implement Lean Tools: The fifth step is to implement lean tools. This involves using lean tools such as 5S, Kanban, and Kaizen to eliminate waste, improve flow, and deliver value to the customer.
6. Monitor and Control: The final step is to monitor and control the process. This involves measuring the performance of the process and using feedback to make continuous improvements.

2.2 Benefits of Integrating Lean Principles in Decision Making in Construction:

Integrating lean principles in decision-making processes in construction can provide several benefits. They are as follows:

1. Reduced Waste: Lean principles can help to identify and eliminate waste in the decision-making process. This can result in cost savings, enhanced efficiency, and higher quality.
2. Increased Transparency: The integration of lean principles can increase transparency in the decision-making process. This can lead to better communication, collaboration, and trust among stakeholders.
3. Improved Consistency: Lean principles can help to standardize the decision-making process, leading to improved consistency and reliability in decision-making.
4. Improved Customer Satisfaction: The integration of lean principles can help to deliver value to the customer, leading to improved customer satisfaction.

According to the research, the integration of lean principles in decision-making processes in construction can face several challenges. One of the significant challenges is the lack of awareness and understanding of lean principles among stakeholders in the construction industry. This can lead to resistance to change and a lack of buy-in from stakeholders. Another challenge is the complexity of the construction industry, which can make it challenging to implement lean principles effectively.

3. Data Collection

This study used a quantitative research approach to explore the integration of lean principles in decision-making processes in construction. The study involved a review of the literature on the application of lean principles in construction, followed by a questionnaire survey with construction professionals, builders, developers, and government employees having at least 2 years of experience. The questionnaire was based on how lean principles could be effectively applied in decision-making processes in construction, the benefits of using lean principles in construction decision-making, and the challenges of using lean principles in construction decision-making.

The main reason for this questionnaire survey was to understand the mindset of the professionals in construction industry. By using this approach, we can directly identify the factors in which the professionals want to incorporate the use of lean principles while making decisions and the benefits which they can avail by using lean principles. The questions for questionnaire survey were prepared by analyzing the previous research available and with the help of that research major factors were identified.

3.1 Major factors identified for using Lean Principles

Sr.No.	Factors	References
1.	Top Management	Nevil S. Gandhi, Shashank J. Thanki, Jitesh J. Thakkar (2017)
2.	Multi-skilled labour	Nevil S. Gandhi, Shashank J. Thanki, Jitesh J. Thakkar (2017)
3.	Employee training	Nevil S. Gandhi, Shashank J. Thanki, Jitesh J. Thakkar (2017)
4.	Change in scope	Junaid Tariq, S. Shujaa Safdar Gardezi (2022)
5.	Financial difficulties	Junaid Tariq, S. Shujaa Safdar Gardezi (2022)
6.	Project completion timeline	Junaid Tariq, S. Shujaa Safdar Gardezi (2022)
7.	Communication & co-ordination	Junaid Tariq, S. Shujaa Safdar Gardezi (2022)
8.	Work standardization	Nevil S. Gandhi, Shashank J. Thanki, Jitesh J. Thakkar (2017)
9.	Slow speed of decision-making	Junaid Tariq, S. Shujaa Safdar Gardezi (2022)
10.	Employee empowerment	Nevil S. Gandhi, Shashank J. Thanki, Jitesh J. Thakkar (2017)
11.	Organizational Culture	Junaid Tariq, S. Shujaa Safdar Gardezi (2022)
12.	Capability of PM firm	Junaid Tariq, S. Shujaa Safdar Gardezi (2022)
13.	Availability of resources	Junaid Tariq, S. Shujaa Safdar Gardezi (2022)

These are the factors in which the lean principles can be integrated to improve the efficiency of the work and in making appropriate decisions whenever needed.

3.2 Questionnaire

The questionnaire survey circulated among the professionals in the construction industry basically consists of the question regarding the benefits of integrating the use of lean principles. The questions put up for professionals to answer are based on the agenda to know about their preferences, as well as, their point-of-view on lean principles and decision making.

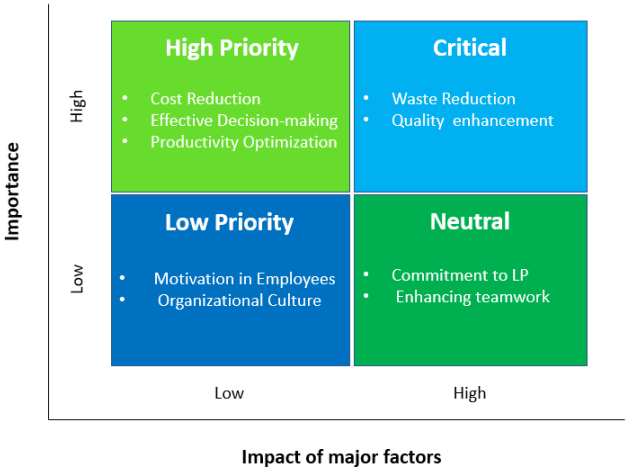


Figure. 1: Prioritization Matrix

The embodiment of these questions was done with the help of prioritization matrix and the factors they deal with on daily basis.

4. Data Analysis

The questionnaire survey was circulated to around 50 construction industry professionals, and 31 responses were successfully captured. The responses recorded shows the willingness and perspective of professionals for incorporating the use of lean principles in construction for better decision making. There were numerous aspects contained in lean principles that could have been used to build questions, but it is not possible to create a questionnaire that includes all the factors present.

As a result, the factors that were more appropriate and relevant to this study were chosen using a prioritisation matrix, and 10 questions were distributed in survey form. The questions were designed in such a way that based on the responses; we can determine the importance of each element.

According to the survey replies, the construction industry's professionals want to concentrate mostly on reducing waste, cutting costs, and raising the calibre of their work. Most professionals are looking for a solution to reduce the cost of their projects without sacrificing the quality of the work. These are the aspects that can be taken into account while applying lean principles, and we can strengthen these lean principles by doing so whenever we make decisions.

4.1 Paired Comparison Analysis

The method known as "paired comparison analysis" compares two things or possibilities according to their individual attributes and characteristics. This approach is frequently used in decision-making procedures when it is crucial to assess the relative advantages and disadvantages of

different options. A score is assigned to each option based on the number of times it is chosen over the other option. The following steps were used to implement this method:

Step-1: Identification of the lean principles which were related to decision-making process based on literature review.

Step-2: Preparing the list of paired comparisons which are to be done and which can be easily co-related to each other.

Step-3: Preparing the questionnaire survey accordingly and circulating it to the professionals, managers, or employees.

Step-4: Collecting the data and recording the response received through questionnaire survey.

Step-5: Calculating the score of each factor by adding them up according to each response and then dividing them by the total number of related factors.

Step-6: Rank the factors based on their scores in descending order, and visualize the results using a bar chart or a table format.

Step-7: Interpreting the results and drawing the conclusions about the most important lean principles for decision making in construction.

Step-8: Discussing the implications of the responses received on the lean principles.

The total number of paired comparisons that can be made using the formula:

$n(n-1)/2$

Where, n = The number of factors being compared.

We can create a matrix that shows the scores and rankings of each item based on the paired comparisons.

4.1.1 Paired Comparison Analysis in tabular form

Sr.no	Lean Principles	Score	Rank
1.	Waste & Cost Reduction	0.64	1
2.	Quality Enhancement	0.45	2
3.	Continuous Improvement	0.38	3
4.	Energy Conservation	0.35	4
5.	Increased Productivity	0.32	5
6.	Completion of project within timeline	0.25	6
7.	Employee satisfaction	0.22	7

The first column of this table lists the names of all the lean principles that were applied to the matched comparisons. The score for each principle is displayed in the second column and is determined by dividing the total number of paired comparisons by the number of times it was determined to be more significant. The highest-ranked principle is listed first in the third column, which ranks each principle according to its score.

4.2 Observations

According to the responses gathered during the survey we can clearly say that the factors on which the construction industry is focused on are cost reduction, increasing productivity, better communication, waste reduction and [1]principles in decision making arises in these sectors.

4.3 Ranking of key factors identified

Sr.no.	Factors identified (On the basis of Questionnaire)
1.	Energy Conservation
2.	Continuous Improvement
3.	Cost & waste reduction
4.	Quality Enhancement
5.	Completion of project on time
6.	Productivity Optimization
7.	Motivation in employees
8.	5s Lean Principles

Based on the replies provided during the questionnaire survey, the ranking of the above-mentioned variables is carried out using the paired comparison analysis approach. By looking at this data, we can see that there is still a need to educate the workforce in the construction business about crucial methods like the 5s lean methodology. Many individuals in the construction business still only have a basic understanding of lean principles, which can be altered by increasing lean awareness and showing them its advantages.

If we can use lean concepts to make wise decisions whenever necessary, we can immediately improve elements like project completion on time, waste reduction, and quality improvement. Additionally, this will boost worker motivation and construction productivity. Nevertheless, the replies were positive because over 48% of professionals indicated that they were familiar with the lean principles, while another 25% said they were only partially familiar with them and remaining 27% said they were interested in learning more.

4.4 Results & Discussion

The results of the study indicated that the application of lean principles in decision-making processes in construction could lead to significant improvements in project outcomes. The benefits of using lean principles in construction decision-making included improved efficiency, reduced waste, and improved quality. However, the study highlighted significant barriers to incorporating lean principles into building decision-making processes. These challenges included the lack of standardization in the construction industry, the highly dependent nature of human labour, and the complexity and uncertainty of construction projects. The most important factor of this study is the positive response which can be seen in the questionnaire survey data is that people are more and more aware about the lean principles. This can assist them to gain more benefits in construction, which will benefit our country's prosperity.

The construction industry is highly fragmented, with many different stakeholders involved in the decision-making process. This can lead to a lack of standardization in decision-making processes, which can hinder the implementation of lean principles. Construction teams may make better, more informed decisions that are in line with project goals and objectives and provide value to all project stakeholders by adopting a lean mentality.

5. Conclusion

Th study has highlighted the potential benefits of integrating the use of lean principles in decision-making processes in construction. With the understanding of this study, we can conclude that lean principles are been adopted by the people in construction industry in the recent years.

The factors on which the professionals are more focused on are cost reduction, waste reduction and quality enhancement. Lean principles are becoming more popular among the professionals and their benefits are being considered by personnel linked with this industry. We can now understand the mindset of the professionals, managers and all the people linked with construction industry leans more towards the cost & waste reduction, quality enhancement and continuous improvement. Continuous improvement can make a huge impact in construction industry which can help in growing & flourishing the construction sector even more in the future. Future research should focus on identifying effective strategies for overcoming challenges and facilitating the integration of lean principles in decision-making processes in construction. Overall, the study has contributed to a better understanding of how lean principles can be effectively applied in decision-making processes in construction and the benefits and challenges of using lean principles in construction decision-making.

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Mobile Controlled Electric Jack – A Review

Rahul Jashvantkumar Kadiya,
rahulkadia7@gmail.com
Department of Automobile Engineering,
Indus Institute of Engineering and Technology,
Indus University, Ahmedabad, Gujarat

Prof. Bharat Dogra
bharatdogra.am@indusuni.ac.in
Department of Automobile Engineering,
Indus Institute of Engineering and Technology,
Indus University, Ahmedabad, Gujarat

ABSTRACT

It typically takes manual labour to use a mechanical scissor car jack to fix a car's punctured tire problem on the road, especially on highway roads. Some Electric jacks are invented to reduce the human effort. But there is an issue of these electric jacks which is remote is not working properly, remote is broken, remote got lost.

Just because of remote the whole Electric jack being useless. This problem takes us to this project. Our vision is to reduce human effort while changing the puncher tire and also make it easy to operate even if remote is not there. And make an alternate of remote using wireless connectivity.

***Key Words*: Scissor Jack, Electric Jack, Remote not working, Alternate of remote, Wireless connectivity.**

INTRODUCTION

During road side emergency like changing the puncher tire it demands high human efforts. For changing the tire with manual jack it takes lot of time. To solve this problem many people invent some electric jack which is operated by remote.

These all are reduce human effort at some points. But if the remote will break, damage or lost, then whole the jack will become useless. And it waste of money too. Therefore, this project comes to picture. Our planning is to make a jack which operates on mobile application.

In this project some of the circuits we can use like Rasbarry, Arduino uno, L298N, HC-05 etc. Along With these circuits we have to use 12V D.C. motor which can rotate the end of Scissor Jack to lift the car.

I.LITERATURE REVIEW

Timur Choban Khidir[1] et. al., in his paper in June 2017, derived that road side emergency of changing puncher tire required high human effort. A mechanical scissor jack is required to remedy the problem, particularly on highway highways, which require physical human force. Their research concentrated on developing a machine that bottles jack by modifying a D.C. motor (12V) with chain-sprockets.

He claims that using this innovative machine to elevate the automobile to address a tyre issue is simpler, safer, quicker and more dependable for people who have health issues.

They produced their work using machinery like drilling, grinding, milling, and welding. They made an effort the developed jack on a passenger automobile, and it was successful.

But this product takes too much time to build and it has too much mechanism which we have to lubricate. Those mechanical parts make this jack heavier.



Fig.-1Model factory of modified bottle jack, From: Timur Choban Khidir[1], June 2017, Iraq

Manoj Patil[2] et. al., in his paper, carried in Aug 2014, derived that a vehicle's entire or a portion of it can be raised into the air with an automotive jack to make repairs easier. The common vehicle jack that still comes with most new cars as standard equipment is known to most people. They find out the improvement on car jack is needed to make tool, more efficient, user friendly, practical to use, changes in industry direction.

They discovered that elderly persons and pregnant women have great difficulty using manual jacks. Their work focused on the jack operates on the electric motor. And that motor takes power directly from the car battery.

Therefore they make a scissor jack into a electric jack. In their work they connect a D.C. motor to the jack with the help of gear mechanism. They used screw assembly to connect the motor to the jack. They make bracket to hold the motor with the jack and also modified the side block of the jack.

In their original prototype the wires of the motor is open and it is too dangerous while operating the jack. It can harm the person who is operating the jack.



Fig.-2 Prototype of Automated Car Jack, From: Manoj Patil[2] et. al., Aug 2014, India

Durvesh Rohidas More[3] et. al., in his study carried in April 2022, derived that a jack is a mechanical lifting tool used to lift big objects or exert powerful forces. The screw thread is used by a mechanical jack to raise heavy objects. A hydraulic jack is powered by hydraulics.

They find out that changing a punctured wheel is physically challenge for handicap person, older aged person. They cannot lift the car by annual jack easily. They used wiper motor in hydraulic jack to lift up the car or a heavy load.

Their Work involves a system that turns the wiper motor's rotating movement into the reciprocating movement of the hydraulic jack plunger. They used Hydraulic jack, crank, connecting rod and base frame to make their project.

Their project is made of many mechanical components which make the whole jack much heavier and some physically challenged people are not able to set that jack under the car.

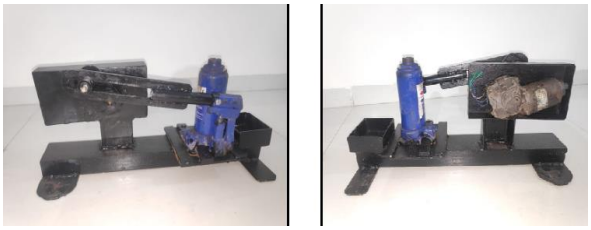


Fig.-3 Motorized Hydraulic Jack system, From: Durvesh Rohidas More[3] et. al., April 2022, India.

Daniel G. Rodriguez[4] et.al. in his study carried in Jan 2006, derived that four screw jacks that are hingedly mounted to the vehicle's chassis next to the wheels are part of an automatic jacking system for automobiles, as are hydraulic and electrical connections that regulate and operate the jacks.

The jacks are connected to the hydraulic system's fluid reservoir and pump by hydraulic lines, and the control panel is reached by electrical cables that go from the individual solenoids located on each jack.

In this work jack mounted in all the four sides of the car and required hydraulic reservoir and electric connections for working. And this cannot use in other cars once it mounted on one car. After this type of work and including too much money on this product it can only use in one single vehicle it is not good at all.

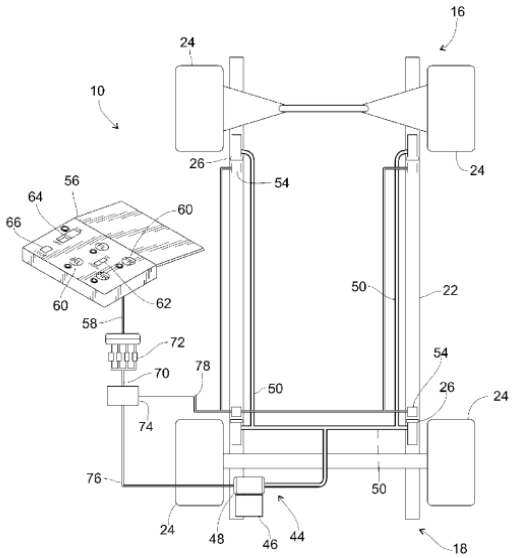


Fig.-4 Design of Automatic jacking system of Automotive vehicle, From: Daniel G. Rodriguez[4], Jan 2006, U.S.

M.M.Noor[5]et. al., in their paper, carried in May 2010, derived An emergency on a side road is never uncommon, especially when a tyre is punctured. In their essay, members highlighted how the internal cigarette lighter power was utilized to get a power for the automobile jack to use in emergencies. (12v).

They learn that this power source was utilized by the automatic easy car jack to conserve users' internal energy. They increased the lifting power by using gear ration. They used Solidworks and finite element analysis to utilize the car jack.

They used remote to operate the jack. If this remote will not work by any kind of reason, then this whole jack will become useless.



Fig.-5 Developed prototype of Auto Car Jack, From: M.M.Noor[5], May 2010, Malasiya.

J. David Mosley[6] et. al. in their paper, carried in Jan 1994, derived that four jacks connected to the vehicle's chassis next to the wheels are part of an automatic jacking system for automobiles, along with hydraulic and electrical connections that regulate and operate the jacks.

The jacks are connected to the hydraulic system's fluid reservoir and pump by hydraulic lines, and the control panel is reached by electrical cables that go from the individual solenoids located on each jack. Between the solenoids and the control panel switches for that jack and wheel is an in-line fuse.

In this work jack mounted in all the four sides of the car and required hydraulic reservoir and electric connections for working. And this cannot use in other cars once it mounted on one car. After this type of work and including too much money on this product it can only use in one single vehicle it is not good at all.

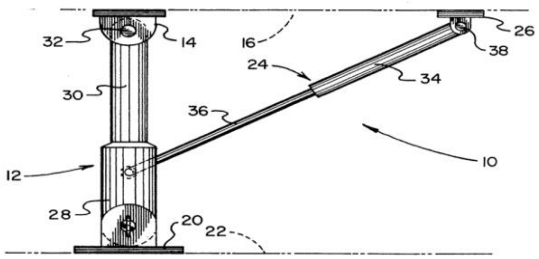


Fig.-6 Design of Vehicle Mounted Hydraulic Jack, From: J. David Mosley[6], Jan 1994, U.S.

ISBN: 978-93-5912-982-2

Mohammad Abuzaid[7] et. al., in their paper, carried in April 2013, derived that the front and back of the vehicle's chassis are attached via a built-in hydraulic jack mechanism. All automotive chassis and frames now produced can be easily equipped with a hydraulic jack system. An automobile's front suspension is situated centrally, between the front wheels, with a hydraulic jack for the front suspension.

They found that the vehicle also had a rear suspension hydraulic jack placed in the middle of the rear suspension, between the rear wheels. The pressurized fluid reservoir tank that powers their system contains connections for the front and rear car jack outputs.

In their work jack required hydraulic fluid reservoir and fluid lines. Once this jack mounted on one vehicle it cannot used in another vehicle and it is not good at all.

This type of jack is not practical at all. It requires too much time and accuracy in hydraulic lines setting. After this much effort the jack can only use in one vehicle is not worth it.

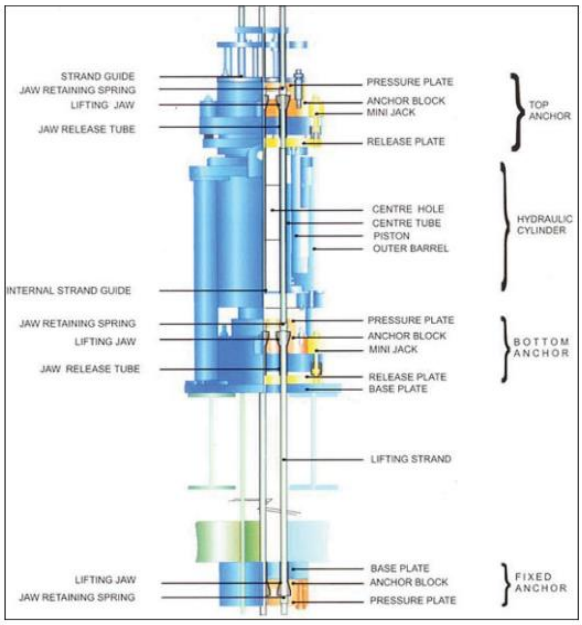


Fig.-7 Design of Inbuilt Hydraulic Jack, Mohammad Abuzaid[7] et. al., April 2013, India.

Thomas L. Mueller[8]et.al.,in his paper carried in Oct 1989, derived that, a vehicle pneumatic jack system that is simple to install on all currently produced vehicle chassis and frames. They learn that an automobile's front suspension is centrally located between its front wheels and has a pneumatic jack for the front suspension.

He concluded that the vehicle also has a rear suspension pneumatic jack placed in the middle of the vehicle's rear suspension, between the wheels on the back. The pressurized air reservoir tank that powers their system contains connectors for the front and rear car jack outputs. Their extra outlets can be attached to the compressed air reservoir tank so that a lug wrench and a hose for inflating tires can be connected.

An additional option for the system might be a link to the master brake cylinder, which would allow compressed air to be supplied to the braking system when the car is locked, locking the brakes firmly on as an anti-theft function.

This system is very complicated therefore it not practical to apply. For using this kind of system we have to change in our cars master cylinder. And once it installed in one car it cannot be used in another vehicle. So that we can say that this is not a pocket friendly system.

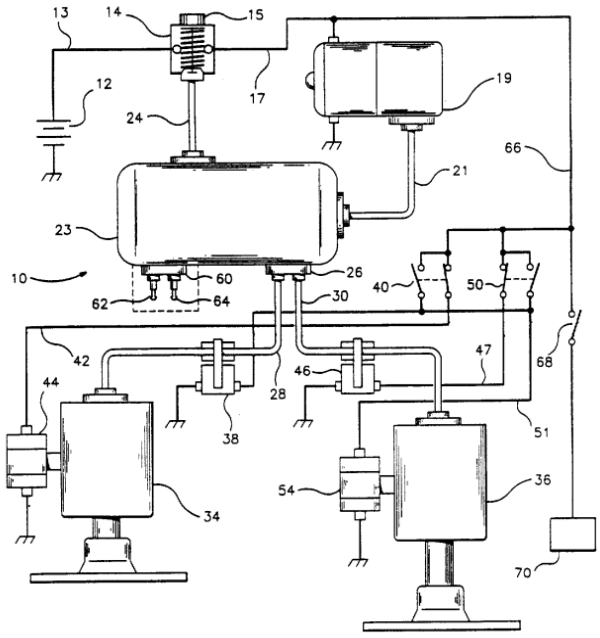


Fig.-8 Layout of In-Built Power Jack, From: Thomas L. Mueller[8], Oct 1989, U.S.

Prashantkumar Shrivastav[9]et. al., in their paper carried in May 2013 derived that, the rotary motion is transformed into translatory motion using power screws. An example of a power screw is a screw jack, which uses a tiny force delivered in a horizontal plane to lift or lower a heavy weight. It functions using a similar mechanism as an inclined plane.

They discover that the ratio of load to effort is what gives a screw jack its mechanical advantage. A lead screw must be turned in order to activate the screw jack. They discovered that employing a 12V DC motor to move the jack screw might reduce the effort needed to do so, making tyre change simple.

The fact that this technology uses the vehicle's battery for power is an advantage. They are looking for increasing the efficiency of the motorized screw jack.

They did not give any working model picture. If they made a product like this which is controlled by remote, so there is a chance to damage the remote. If once the remote is damage or not working properly the whole system will fail and becomes useless.

Pirah Pirzada[10] et. al., in their paper, carried in Dec 2021 derived that, High-efficiency electric drives are necessary for upcoming technologies like electric autos. A direct current (DC) motor is more effective, has more desirable speed-torque characteristics, and is simpler to control in this scenario.

Their study simulates a DC motor and examines how its speed regulation changes depending on the load. PID controllers are used to control the machine's speed.

They use a step up motor in their project it is a concept model of Arduino Uno and L298N. The step up motor is not much efficient to sustain the load of the car.

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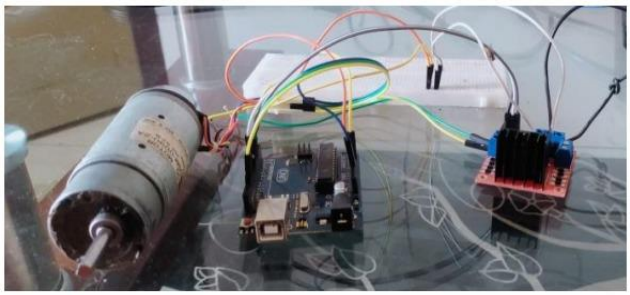


Fig.-9 Setup For D.C. Motor Speed Control, From: Pirah Pirzada[10] et. al., Dec 2021, Pakistan.

Jiban Saha[11]et.al., in their paper, carried in 2021, derived that As current technology continues to advance, Bluetooth has completely changed how we communicate. The wireless data transfer technology known as Bluetooth offers a platform for comfort and controllability over a short distance.

They learn that due to a variety of wireless communication protocols, wireless communication is an emerging tool of the modern day with a wide range of uses. They discussed one of its uses in their work, namely wireless communication utilising the HC-05 module, which is managed by using the software-based system MATLAB. This application is used for data transfer from one device to another device as well as for wireless device control.

It is a functioning prototype of a wireless communication system that manages ON and OFF LED using data commands. The simple usage of an effective control system based on the Arduino microcontroller board, the HC-05, and the MATLAB GUI allows for the control of the LED ON and OFF. The outcomes show that a straightforward wireless communication system can be used as a control mechanism.

Their proto type is only for LED light. They show the simple implementation of the wireless communication.

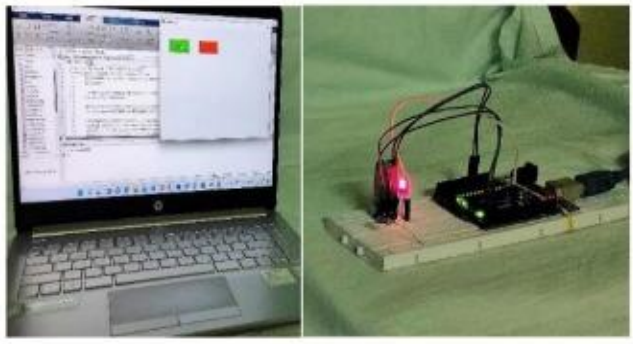


Fig.-10 Practical implementation of wireless communication using (HC-05) bluetooth module With MATLAB GUI, From: Jiban Saha[11]et.al., 2021, India.

CONCLUSION

After analyzing this kind of problems we decided to make a project that can use with the mobile application and it can easily operate in all kind of vehicles so that anyone can use. Therefore we planning about making a circuit's connections and help of coding the jack can easily operate from the users mobile.

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A Decentralized, Secure, and Transparent Blockchain-enabled E-voting for Indian elections based on UIDAI Aadhar Identification

Dr. Sheetal S. Pandya
Computer Science and Engineering,
Indus University,
Ahmedabad, India
sheetalpandya.cse@indusuni.ac.in

Abstract— The blockchain is a distributed, time-stamped, tamper-proof, immutable maintenance of digital information by allowing it to transmit over a cluster of computers not owned by any single entity or trusted third party. After some time, it was realized that one of the innovations of Bitcoin is based on blockchain technology, which could be utilized for other purposes as well. An online E-voting system is proposed in this paper uses blockchain technology for online elections in the world's largest democratic country India without relay on a trusted third party where every Indian voter can cast his vote anywhere outside of his/her allotted constituency or from his/her convenient location through smart devices. In this E-voting system, we will use the feature of blockchain technology-based cryptocurrency where each voter will be allocated a wallet with a maximum of one coin inside the wallet for an individual voter to cast a vote and cast vote will be saved in a blockchain network where each vote will be saved on blockchain nodes with distributed ledger technology where voter registration, candidate registration, result generation and votes counting will be done via election administrators with identity verification will be done by UIDAI (The Unique Identification Authority of India) Aadhar ID of each voter.

Keywords—component, formatting, style, styling, insert (*key words****)***

I. INTRODUCTION

The first electronic system was introduced public cryptography, which is used to cast votes and keep voters in every democratic country, the security is considered the national security of the country. The e-voting security envisioned requirements that need to be granted for the purpose of effectively being used in a national election. The following is a list of conditions that an E-voting system must meet: No compelled voting should be allowed in an electoral system. An election system should not allow a voter's vote to be traced back to the person for whom he or she voted, and the electorate's credentials should not be compromised at any step of E-voting. An election system should guarantee and demonstrate to a voter that their vote was counted and counted accurately. An electoral system need not allow a third party to influence the outcome of any vote. An election system should not give a single institution complete authority over counting ballots and determining election results. Only eligible persons should be permitted to vote in an election.

An E-voting system is a way that encourages open to choose their candidates and express their preferences for how they will be represented. As compared to traditional voting systems like ballot paper, punch card vote, paper vote, EVM vote, etc. Online voting provides better flexibility to a wide range of people who are unable to cast their votes by visiting polling booths due to many reasons like disability or sickness, out of town from regional polling booths, etc. because of such reasons vote through online systems allows them to contribute his valuable opinion for democratic elections. E-voting system gives many advantages over a traditional voting system such as fallibility to cast vote from anywhere, comfortably, correctness, verifiability, mobility, etc. and also eliminates various drawbacks like paperwork of candidate's lists during the election process, time-consuming, machine damage, no interferences of officials, etc.

E-voting system also faces many issues which are discussed in [1] Till now many researchers [2] have researched the security of the E-voting system that includes integrity, confidentiality, secrecy, reliability, and authenticity of a legitimate voter. Voter confidentiality refers to protecting voters' sensitive data from being used by unauthorized parties. Only legitimate voters can able access the data while voting online. A failure while maintaining the confidentiality of the voter means getting access to voter's data by accident or through intentional behavior is called a breach of voter's confidentiality. Voter's data integrity ensures the authenticity of the information that should not be altered or changed during online E-voting. The source of the information on voters' authenticity should be genuine. A malicious attacker may redirect your traffic to some other clone website which looks like the online e-voting website is an example of a branch of voter's data integrity. An E-voting system should remain available throughout the election process, and it should be easily accessible by the voters. Any malicious attacker should not compromise the availability of the E-voting system by any attacks line denial of service which brings down the server and makes the E-voting system unavailable to legitimate voters.

Voter's confidentiality, Voter's data integrity, and E-voting system's availability if the foremost measurement of reliable security for the E-voting system as per information security TRIAD. While talking about the security mechanism[3,4] of E-voting system we also need to take care of how an E-voting system should be implemented because the election process is highly trustworthy and most of the elections are under the control of some elections bodies like in India all the election processes are under centralize control of Election Commission of India. Keeping the centralized control in the election process also arises many questions like transparency, legitimacy of voter's vote, and putting foremost trust on officials of election bodies which they must do the entire election process without any bias and any influence of participating candidates.

To manage the entire election activities in centralizing third-party control like election commission we can make it a decentralized election process to eliminate various centralized third-party issues like Denial of Service (DoS) attacks, vote spoofing, voter's credential phishing, etc.

In centralize the E-voting system, control is applied by just one single entity (a person, an enterprise, an election commission, for example) while in decentralize E-voting system, there is no single controlling entity, It is shared with various independent entities. Figure 1 shows the comparison of a centralize E-voting system and a Decentralize E-voting system's comparison with various parameters [7].

II. BLOCKCHAIN TECHNOLOGY

First, A blockchain is comprised of a public ledger that is distributed, immutable, and incontrovertible. Blockchain technology works through the following features:

Distributed ledger technology: The public ledger can be shared among a varied group of users connected through the network, or with thousands of across the internet. The blockchain updates itself after some time defined during the creation that updates the number of blocks in a distributed ledger so everyone will have the latest version. This feature has applications well far from digital currencies (bitcoin, ethereum, ripple, monero, etc.), as it eliminates the need for a trusted central party to record the information.

Immutability and temper detection in the blockchain: Data stored in the blockchain is made secure and immutable using cryptography to temper detection.

Authenticity: The blockchain data is accurate due to the system's decentralized structure, consistent, timely, and widely available for any validation of nodes for authenticity or verification.

Durability and attack resistance: Because a blockchain does not have a central point of control and is better able to survive a malicious attack, the decentralized systems are more expensive to attack and destroy or manipulate .

III. LITERATURE REVIEW

J. Stern [12] Votem's solution is increasingly appropriate for I-voting a vote where the biometric and physical confirmation of the voter isn't used for the authentication process. It presents a token-based system for privacy and anonymity of the voter and provides the security for the e-voting system which is built up blockchain in technology. It also decreases the capability of the E-voting platform for wide-ranged elections where the features of the token- based system might get compromised with many issues that are challenged for nationwide elections. The aim of blockchain created for the E-voting system for casting a vote can either keep it private or public based on needs [13]. Transactions are visible to everyone in the public blockchain which also compromised voter privacy where everyone can see whom the voter has voted for. To eliminate the privacy issue, it is important to use the hashing algorithms to encrypt the transaction which is open to view for everyone in the public blockchain, for example, AES to keep the transaction content encrypted and unreadable to other voters [14]. It also raises the question keep the AES contents secure and easily recoverable of encrypted transaction contents whenever required during the election process. It also makes it a bit slower, and the efficiency of the E-voting system also gets compromised. To address this issue the private blockchain is recommended. It is also called a permission blockchain network where only the participants of the e-voting system will be able to see the data of the blockchain. It is more centralized than a public blockchain.

In blockchain-based electronic voting the voters make the advances dependent on the addresses and not on their personal identity and on the off chance that if there is a data spillage of the voter, the voters can create many addresses for the privacy concerns. It is intense for the blockchain system to guarantee value-based security since the data of all transactions and public keys are fully transparent to everyone [15]. A blockchain-based E-voting system concerns the responsiveness and scalability as per the demand to get the efficient performance of the overall result. The block size must be enough to accommodate all the data including addresses of the Node and information of the node. Bitcoin covers large gigabytes of storage which slows down the creation and retrieval of the block of information from blockchain [16], [25].

Bromco Vote [17], [23] uses the Ethereum blockchain [26] and smart contract for the achievement of administration and auditable voting transactions. It utilizes the few cryptographic methods of homomorphic encryption which uses two ciphertexts and multiplies with another ciphertext to promote voter privacy. They implemented the Ethereum Testnet to demonstrate the university-scaled voting framework. Polys casting votes framework includes Shamir's mystery conspire. The concept is built on the concept that inserting the polynomial of degree N-1 will require N segments.

For example, 4 segments are a must for drawing a line fragment or 5 segments are a must for drawing a curve. So, one can share a mystery among K individuals so that it must be recouped by N individuals (N<=K), this usage keeps up the security of each voter regardless of whether the information is noticeable to everybody. So, the issue of privacy and transparency is unraveled simultaneously [18].

Homomorphic encryption is the encryption innovation that can be executed utilizing the exponential ElGamal cryptosystem. It is another concept that can be utilized to give an anonymous identity to the voter in the blockchain. The essential thought is to permit the election commission to count the elections votes without really decrypting them subsequently giving protection and security to the system. Exponential ElGamal is a cryptosystem that is utilized for encryption of the voter information and gives the added substance Homomorphic property to the framework [18].

IV. PROPOSED WORK

The idea in blockchain-enabled e-voting is to utilize the concept a digital currency wallet analogy, blockchain-enabled e-voting will issues each voter a "wallet" containing a voter's credential for authentication which will be encrypted by SHA256 hashing algorithm for privacy of voter. Each voter gets a single "coin" in his wallet representing one time opportunity to vote by sending the single coin to the candidate's wallet. Casting a vote transfers the voter's coin to a candidate's wallet. A voter can spend his or her coin only once and it will be irreversible. At the end

maximum coin holder will be declared as elected in the election process.

A. Smart Contracts in E-voting system

The template In a blockchain, every election process is defined as a smart contract [8] which is created by the election administrators. Multiple smart contracts are involved like create election, voter registration, and authentication, administrator authorization, vote casting, verification of votes, generating the results and tallying the result [9] (refer figure 1) .

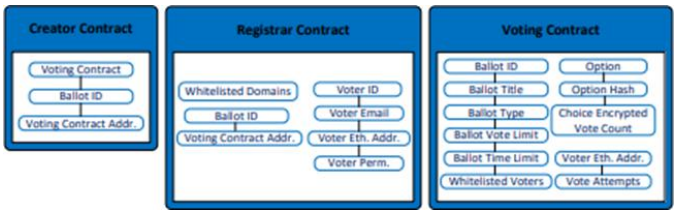


Figure : 1 Contents of E-voting Smart Contracts

The following are the main smart contracts involved in the E-voting system [10]:

1.Creation of Election: In this smart contract election commission of India (ECI) creates the ballots (digital representation of physical ballots) using the decentralized app (dApp) [26]. These ballots include the wallet of the registered voter with one digital coin in the wallet where this coin is used to cast the vote to a particular candidate. Each wallet will have an address allocated to it and the public key of the wallet owner and only one transaction will be allowed to send a coin to the candidate's addresses. This dApp interacts with the election creation smart contract and defines a candidate list who will contest the election. This smart contract creates a set of wallets for each candidate and deploys it into the blockchain, with a list of candidates' addresses. If there are N voters are voting, then a maximum of N coins will be received in the candidate's wallet. All the rules and regulations will be managed by the CA (Central Authority) which is the Election commission of India.

2.Voter Registration: This phase is conducted by the election commission of India (ECI). During the election creation phase, the election commission must define the list of legal and eligible voters and assign them the regional polling station as per their residential address. It requires a 12-digit UIDAI Aadhar card to securely authenticate and authorize the eligible individuals by their Aadhar ID. This phase will check the eligibility of the Aadhar ID holder and whether he/she is eligible for voting based on the criteria of age limit and regional polling station. If he/she does not satisfy the eligibility criteria, then his/her Aadhar ID will be exempted from voting. A wallet will be generated for each voter which is unique for each election whenever the voter gets registered.

3.Voter Authentication: Voters will be authenticated and verified by the UIDAI Aadhar Id which is a government authorized identification produced by UIDAI (Unique Identification Authority of India) and a digital identity authorized by the election commission (refer to figure 5). Authentication can be done by passkeys or OTP (One time password) via 2FA (2-factor authentication). A voter will enter the 12-digit number into the E-voting voter interface and the password which is given by the ECI during the registration phase. After entering the 12-digit number and password then OTP will be sent to the voter's registered mobile and email Id. A voter needs to verify OTP verification to authenticate himself as a genuine voter. To authenticate the voter himself there will be three opportunities will be given to the voter for authentication. If the user failed for after 3 tries, then it will be suspended for the stipulated time given by the CA. After successfully authenticating voter is now given a specific session time limit to vote his favorite candidate. If the voter fails to vote during the session, then it will automatically log out from the E-voting system and voters need to log in again for authentication. For risk analysis, CA will define the login limits for every voter.

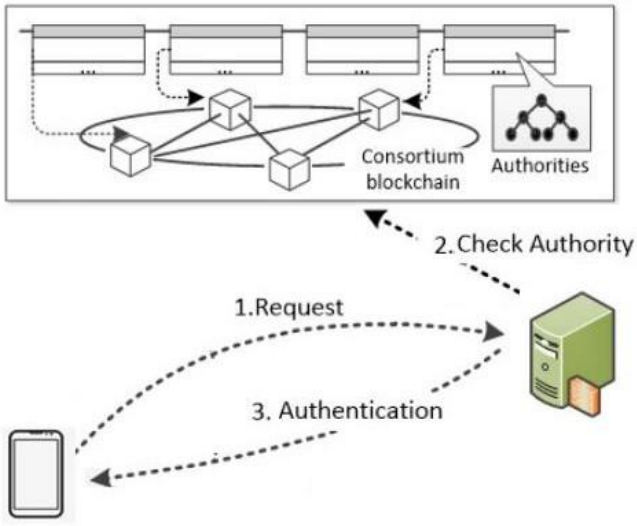


Figure 2 : Authentication Process

4.Administrator Authorization: The blockchain will be initialized with the genesis block, which will be known as the initial block of the chain. The genesis block doesn't contain any votes, however, rather it contains all the data of the election, including the CA's (ECI) signature key, and the valid candidate's list where the voter will decide based on his choice. The only election commission is authorized to generate the election result after the completion of the election activities. No voters will be given access to the see the result of the election. Even the election commission will not be able to see which individual voter has cast to in favor of which candidates because of the identity of voters will be encrypted with the hashing algorithm SHA256 [27] which is the address of the voter wallet key during the vote casting which makes the voter anonymous in the public blockchain.

5. Vote Transaction: Each voter will be given a one-time opportunity to cast the vote to his favorite candidate via a wallet account. After selecting the candidate from the list, he can submit his vote to a particular candidate and will be asked to verify the candidate's name before the final submission of the vote. After the final submission coin

which is reserved in the voter's wallet will be transferred to the selected candidate and a successful message will be a popup in the E-voting system and the voter's wallet will be lockdown and he will no longer be able to roll back the casted vote or cannot double cast his vote to any candidate

6.Verification of vote: Each individual voter will receive a transaction Id after casting the vote. By looking into the blockchain explorer he can search his transaction id into the list of blocks and verify his vote with his transaction Id whether his vote is altered or not.

7.Generating and Tallying the Result: After completion of the voting deadline election commission will generate the casted ballot votes of each candidate and counts the coins received to each candidate on the fly and after tallying the addresses from which coins are received. Those candidates who received the maximum number of coins in their wallet will be considered as elected after tallying the addresses through the smart contract and the election commission will publish the result of the election.

V. Performance Analysis

The E-voting system performance measurements, for example, throughput and delay are primarily reliant on the blockchain stage distributed ledger fabric. The smart contract consensus algorithm we used is PBFT (Practical Byzantine Fault Tolerance), which empowers the revelation of irregular behavior and the synchronization of information in the distributed ledger to accomplish the consistency of the blockchain E-voting system [9]. The security of our E-voting system depends on the robustness of PBFT. Expecting a Byzantine adaptation to an internal failure system with N nodes, the quantity of failed nodes (attacker, traitors) is F, as long as N>3F, the agreement will end in a constrained time and the reliability nodes (legit nodes) will, in the long run, accomplishes a consensus result. The E-voting system gives the following advantages in terms of security of the system:

- **Transparency**: Each voter's vote is recorded in the public blockchain network. Voter can search his transaction Id in blockchain explorer to verify his vote whether it is the same as while it was cast during voting. Transaction id will be anonymous to other voters because it is encrypted using the SHA256 hashing algorithm [27]. Only a particular voter will have knowledge of his transaction id in the blockchain network [20].

- **Resist DDoS attacks**: To effectively perform DDoS (Distributed Denial of Service) on a distributed network the intruder must DDoS each and every node in the blockchain to down the distributed blockchain network which seems impossible for some aspects. The E-voting system would be promptly found if that would happen. Every node is created with a Byzantine adaptation to an internal failure algorithm, which helps to find failed nodes in the blockchain network [9].

- **Authentication vulnerability**: During the election process each individual voter is distinguished and confirmed by the E-voting system by introducing a UIDAI Aadhar ID from an authorized election commission of India. Without supervision, an individual voter could vote in favor of a candidate multiple times. But for each election, there will be a single node that will be generated by a consensus algorithm where the individual voter will be able to vote only once and after the vote cast is recorded in the blockchain then it is impossible to revert the transaction or do it again.

- **Sybil attack [23**]: This attack is also known as an attack on centralized systems, where an individual intruder makes a lot of nodes while trying to disturb network activity by capturing or hijacking messages. Since the E-voting system is running in a private blockchain for ECI (Election Commission of India) no individual person has the entrance to do any malicious attacks. Indeed, even the smart contract that is utilized in our E- voting system is Sybil attacks resistant.

- **Voter privacy**: Each vote recorded in the blockchain is purely anonymous and each casted vote has a SHA256 hash [27] allocated to each voter's identity so only voters will have knowledge of his digital hash of identity no other person can identify the individual voter in the blockchain. To fulfill the protection of every voter, no individual vote ought to be detectable back to the voter.

Conclusion

In this paper, we discuss the basic requirements of information security, and compared the advantages of decentralized E-voting systems with the traditional E-voting system. We also discussed the demand for blockchain technology in the elections without the need of a trusted third party. We discussed the global picture of the online voting system tried and utilized by the different nations across the globe and broadly discussed the authentication of the voter based on the UIDAI Aadhar ID issued by the government of India. Here we also mentioned the role of the ECI (Election Commission of India) to authenticate the voter, register the voters and finally display the result of the election from the blockchain technology. We also mentioned the analogy of cryptocurrency for the E-voting system that how we can use the cryptocurrency wallet as a ballot for the election. This E-voting system provides greater benefits in terms of the traditional E-voting system considering the security attacks, privacy, transparency, and authenticity and voter anonymity compared to the traditional E-voting system.

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EDFA Gain Performance Analysis at 10 Gb/sec in Optical Communication System

Ms. Divyangna Gandhi
Assistant Professor
IITE, IU, Ahmedabad, India
divya.gandhi123@gmail.com

Dr (Mrs) Shilpi Gupta
Associate Professor
ECED, SVNIT, Surat, India
shilpig1980@gmail.com

Abstract: Performance analysis of erbium doped fiber amplifier at 10 Gb/sec in optical transmission system has been reported in this paper. EDFA performance depends on different parameters such as doping concentration of Er3+ iron, length of the fiber, pump power, pump wavelength and input signal power. As per the results obtained by using OptiSystem 13 simulation tool, 36db maximum gain is reported at 1532nm with 100mW pump power. Comparatively flat gain is obtained from 1540 to 1560nm after that, rapidly the gain starts to decrease. Noise figure of EDFA is achieved between 3.3 to 4.6 dB. Finally gain and noise figure has been analyzed for different parameters like input signal power, pump power and EDFA length.

Keywords: Erbium doped fiber amplifier (EDFA), Gain, Noise figure (NF).

1. Introduction

The backbone for high-speed data transmission at a reasonable cost is provided by optical fibre. Currently, optical fibre can handle data rates of up to several Gbps. But the generation of today demands an even faster data rate. Network engineers were therefore pushed to discover solutions to deal with the existing demand for data rate and applications [1]. Again, optical fibre is the engineer's choice. Although the signal travels via the optical fibre, there is attenuation loss because of the fibber's imperfections and a number of other factors. The transmission distance is constrained by this loss in addition to the optical power loss brought on by scattering and absorption [2]. Consequently, optical amplifiers are employed in long-distance communication to minimise data transmission losses minimise data transmission losses. Several amplifiers have been introduced like SOA, EDFA and Raman amplifiers. Among these all optical amplifiers, EDFA is the most promising key component in WDM light wave system. It has become integral part of every WDM and DWDM system due to their compatibility with optical fiber, high gain, low cross talk, polarization insensitive and low noise figure. It has well-known lasing species characteristics by strong fluorescent at 1550nm wavelength provides minimum silica attenuation. Additionally, it enables signal amplification regardless of the modulation style or data rate which is the biggest advantage of EDFA.

The performance of wavelength division multiplexing (WDM) and dense wavelength division multiplexing (DWDM) system utilising EDFA significantly depends on noise and gain performance. [3-5].
This paper's objective is to offer an analysis of EDFA's performance with considering some parameters like gain, signal power of input, power of pump, length of the fiber, noise figure and power of output.
There are four sections in this paper. System model has been explained in section2. Section 3 contained simulation results and finally conclusion has been provided in section 4.

2 System Model

The 980 nm pump signal and the input signal that needs to be amplified are multiplexed together in EDFA using a WDM coupler. Amplification occurs as a result of the input signal photon's stimulated emission [6, 7, 8]. It is possible to illustrate the two- or three-level erbium iron model, which is distinguished by its emission and absorption cross sections. Different expressions are used to define the EDFA's gain and noise characterization.
The system model of EDFA performance is displayed in Figure 2.1.
Practical basic configuration of EDFA consists of CW laser, pump laser, erbium doped fiber and WDM coupler. Gain of EDFA is also depends on pump power and fiber length.

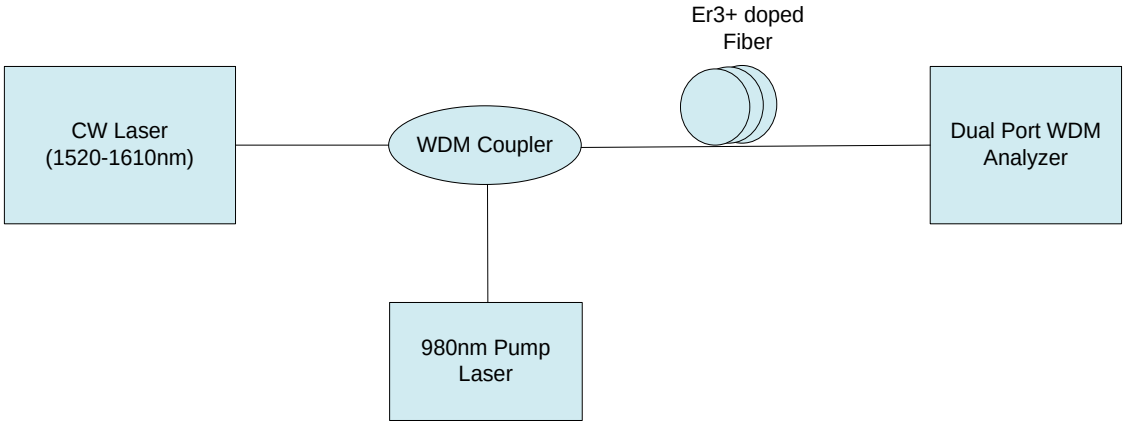


Figure 2.1. System modal of EDFA

Following equation shows the EDFA maximum gain of a three level laser having length L.

$$G_{max} = \exp(\rho\sigma_e L)$$

σ_e is a cross section of signal emission where ρ is the rare-earth element concentration. Maximum EDFA gain is given by the minimum of the two gain expression.

$$G \leq min\left\{\exp(\rho\sigma_e L), 1 + \frac{\lambda_p}{\lambda_s}\frac{P_{pin}}{P_{sin}}\right\}$$

Since $G = \frac{P_{sout}}{P_{sin}} = \exp(\rho\sigma_e L)$, maximum

EDFA output power is given by the [9].

$$P_{sout} \leq min\left\{P_{sin}\exp(\rho\,\sigma_e L), P_{sin} + \frac{\lambda_p}{\lambda_s}P_{pin}\right\}$$

3. Simulation results An EDFA has been modelled using OptiSystem 13, which has a facility to vary and simulate different parameters of a system. Gain, noise figure, input power, pump power, signal wavelength, and pump wavelength are the main factors considered while assessing the EDFA's performance study.

3.1 Gain and noise figure analysis of the EDFA

Table 3.1. General simulation parameter

Parameters	**Value**
Input signal Power	-20dbm
Pump wavelength	980 nm
Pump Power	100mW
EDFA length	7m

Table 3.2.EDFA parameter

Parameters	**Value**
Life time of Er metastable	10ms
Radius of core	2.2µm
Radius of Er doping	2.2µm
Er ion density	10e+025 m^{-3}
Numerical aperture	0.24

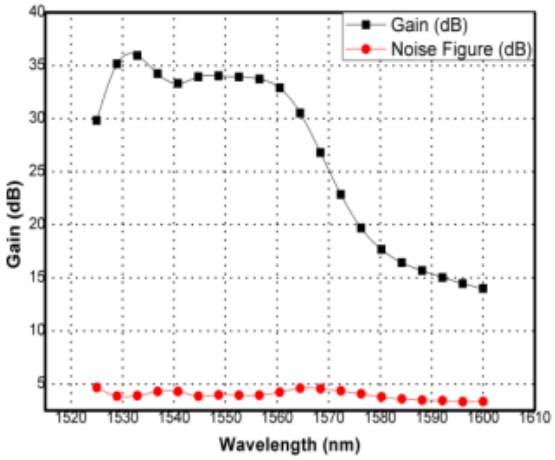


Figure 3.1.Gain and NF Vs Wavelength

From the figure 3.1, it can be observed that the gain of EDFA is not constant over the full wavelength range. (C band 1530nm-1565nm and L band1565nm-1610nm). Also there is a peak of 36db at 1532nm and comparatively flat gain from 1540 to

1560nm. After 1560nm, gain rapidly start to decrease. Noise figure of the EDFA which is depicted in figure 3.1 concludes that the value of EDFA noise figure is varies between 3 to 5db during the range of 1530nm to 1580nm wavelength.

3.2 Gain and input signal power analysis of the EDFA

Figure 3.2 represents the outcome of the different input signal power and gain of EDFA with considering input signal wavelength 1550nm.

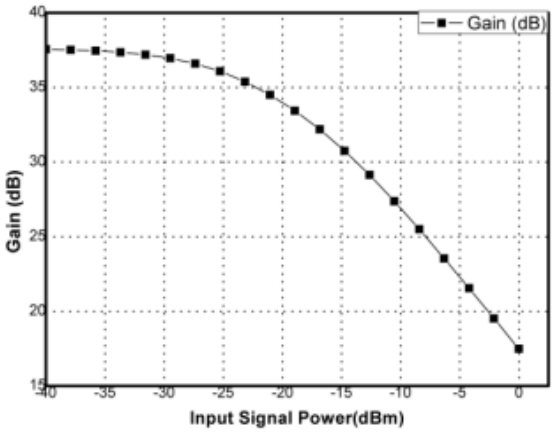


Figure 3.2. Input signal power Vs gain

It's interesting to see that when input signal power and gain are compared, it gives noticeable reduction in gain performance as shown in figure 3.2. It means at low input power the gain is high as the power starts to increase the gain of EDFA gradually drops. Hence there is no further amplification after 0dB.
Also it can be concluded that the performance of amplifier is good at low input signal power. Therefore, there should be an optimum value of input signal power for a given pump power which can be calculated by gain equation.

3.3 Analysis of gain for different pump power

To observe the effect of various values of pump power on gain, simulation has been done for 5mW to 80mW pump power.

3.3.1 Gain Vs Wavelength

Gain spectrum must be desired for long distance transmission. Nevertheless, the population level varies for different energies in Er+3 irons, so the gain depends on both the pump power and wavelength.

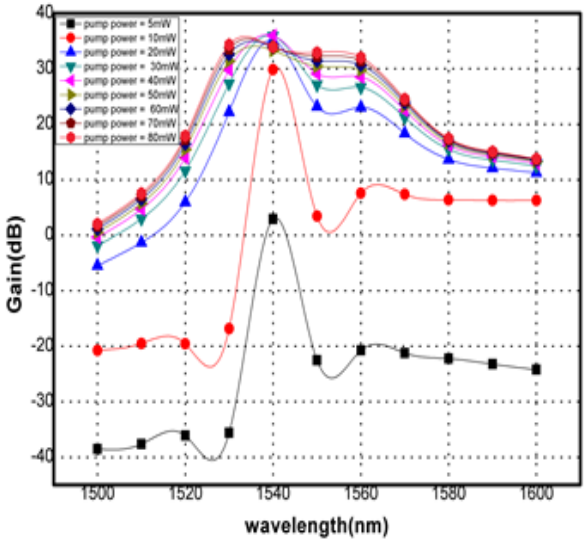


Figure 3.3: EDFA gain with wavelength at a different pump power

According to the figure 3.3 it is clearly observed that as the pump power increases the gain of EDFA is also increases.

Also it is noticeable from figure 3.3, initially at low pump power the gain variation between 5mW and 10 mW is approximately 27db at 1540nm. But after 10mw pump power, the overall gain variation throughout the C band is hardly 0.5 to 2db. It indicates that the gain of EDFA improves significantly with pump power but becomes lesser beyond 10 mw.

3.3.2 Gain Vs EDFA length

Length is also a responsible parameter for EDFA gain. Effect of gain with length for different pump power having 1550nm input signal wavelength and -20dbm signal input power is shown in figure 3.4.

Initially the gain of EDFA is increasing up to certain length of fiber but after reaching a particular maximum value the gain starts to drop because of insufficient population inversion. Hence there should be some optimum length which provides maximum gain.
In figure 3.4 simulations has been made for 1mW to 10mW pump power and it is clearly noticeable that longer erbium-doped fibre can produce higher gain if the pumping is adequate. .

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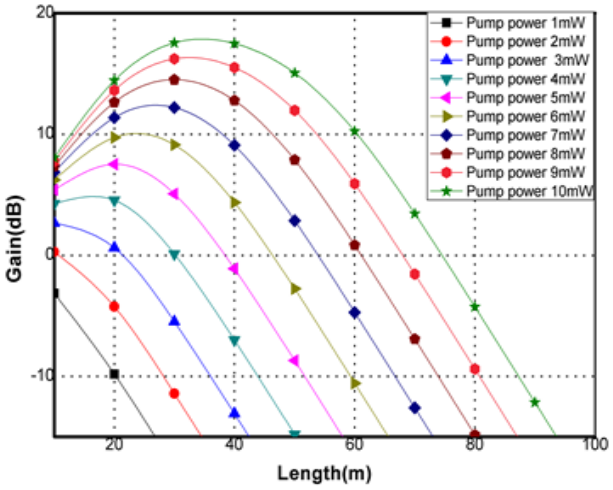


Figure 3.4. EDFA gain Vs length at a different pump power

3.3.3 Gain Vs Pump power

In this simulation part comparison has been made for various pump power values and length of amplifier with considering input signal wavelength 1550nm and input signal power -20dbm.

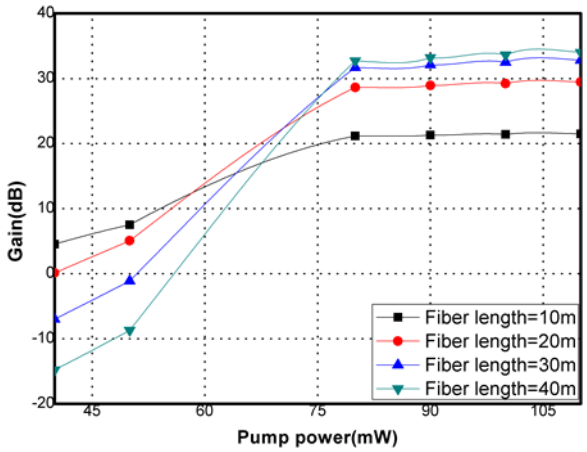


Figure 3.5. EDFA gain Vs Pump Power

It can be concluded from the results shown in figure 3.5, up to a particular fibre length, the gain of EDFA rises with increasing pump power and then goes to saturation.

3.3.4 Noise Figure Vs Length

Noise figure is also a function of amplifier length and pump power as shown in figure 3.6.Generally the performance of amplifier in terms of SNR will be degrade as the distance is increase and SNR degradation is calculated by the amplifier noise figure.

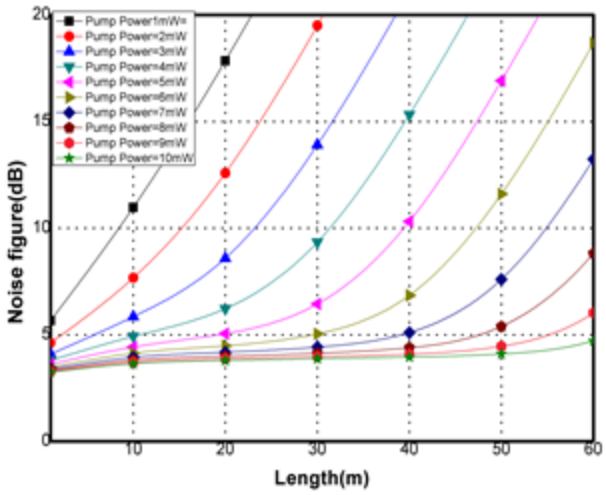


Figure 3.6: Noise Figure Vs length

Simulation result taken for the different value of pump power from 1mW to 10mW as shown in figure 3.6. It represents better the noise figure at larger power of pump and degrade the noise figure at lower pump power due to sharp pump depletion. At the value of 3mW pump power the noise figure increases very rapidly but as the pump power is going to increase from 3mW to 10mW the noise figure gradually become a constant up to several value of amplifier length and then again start to increase.

4. Conclusion

Performance analysis of EDFA has been conducted for a variety of parameters in this paper. It can be observed that, over the whole wavelength range EDFA gain is mainly nonuniform.. EDFA noise figure is varies between 3 to 5db during the range of 1530nm to 1580nm wavelength. As per the obtained results, it has been concluded that gain and NF are dependent on pump power, input signal power and EDFA length.

By optimizing above mentioned EDFA parameters one can offer better operating performance in terms of gain and NF which ultimately helps to increase the data transmission rate. Also EDFA gain can be flattened by optimizing the Er+3 doping concentration or with gain flattening filter, long period gratings and fiber Bragg gratings. A further potential device to offer a flattened and widened gain is the hybrid amplifier.

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A review on seismic isolation with innovative SMAs for smart bridge structures

N.Meenalochani
Dept of civil engineering,
Indus institute of Technology
Indus University
Ahmedabad, India
meenalochani.22.rs@indusuni.ac.in

ANKIT SODHA
Asst.Professor ,
Dept of civil engineering,
Indus institute of Technology
Indus University
Ahmedabad, India
ankitsodha.cvl@indusuni.ac.in

PAYAl MEHTA
Asst.Professor ,
Dept of civil engineering,
Indus institute of Technology
Indus University
Ahmedabad, India
payalmehta.cvl@indusuni.ac.in

***Abstract*— Shape Memory alloys is new age material, also termed as intelligent materials, gained its importance in recent years. The unique property of SMA is that it can remember its original shape and get back to its undeformed shape even after undergoing large deformations, through heating or stress reversal. Due to its unique property, SMA is been widely used in many fields like engineering, aerospace, biomedical and robotics. As there is a thirst for sustainable approach in every sector, these SMAs can cater to replace the inadequacies of conventional materials and thereby taking construction sector to highest echelon, if used with appropriate knowledge.**

Substantial quantity of research is been conducted for the best suitable SMA in various fields according to suitability. When it comes to civil engineering applications, SMAs are being used in steel as well as concrete structures, as Steel SMA fiber reinforced concrete, in vibration isolation systems, damping, in Beam column connections, frequency controller, pre-stressing strands, hybrid steel-SMA rebar and bracing system. This paper mainly focuses on the application of various types of SMAs such as Ni-ti, Iron based SMA and its potential scope in seismic resistance of structures. A detailed review of the same is necessary to take this intelligent material to the next level and this paper helps in bringing a fair knowledge about application of SMA dampers as base isolation systems in buildings and bridges .The various applications of SMAs in different structures for mitigating the hazards due to earthquakes are reviewed and presented here for the future applications and this can also help in finding the future scope in this area for researchers and students.

Keywords— Shape Memory Alloys (SMA), Damping, Seismic Isolation

I INTRODUCTION

In the new technological era, a robust transformation is utmost necessary in the market for the growth of construction sector, especially when latest technologies like AI and ML have taken its boom in the country's economy and education sector. Especially when it comes to infrastructure projects which are the pillars of nation's fiscal growth, the use of innovative technologies is bolstering the construction industry with various advancements from construction materials to equipments, and methodology.

Sustainability being the most sort topic in recent days, buildings and bridges are adopting various innovative approaches to make the structure sustainable. One such approach to achieve sustainable goals is to adopt smart materials in engineering and construction industry. Few of the new age smart materials are MR fluids, Shape memory alloys, and piezoelectric materials and so on. These materials possess one or more of the properties like self healing, self centering, self sensing and self altering dynamic characters. These special properties make them unique from the conventional materials and gained importance in modern days. These smart materials proves to improve the performance of the structure in many ways, by providing better strength, improved safety, better seismic resistance, cost effectiveness and many more to add on.

According to [Dolce 1994], one of the effective techniques for passive protection against vibration due to earthquakes for new structures and also for retrofitting of already existing structures can be carried out with the help of special devices. Hence Shape memory alloy's applications find its approach not only in seismic design of new structures, but also can be extended to strengthen against seismic forces of the existing structures as well as retrofitting, and rehabilitation of structures subjected to severe earthquakes.

1.1 Shape Memory Alloys

1.1.1. Properties of SMA

Shape Memory Alloys are the intelligent materials which has the potential to recover its predefined shape even after experiencing a very large strain. This is mainly due to the unique characteristics termed as shape memory effects and the super elasticity (pseudo elasticity) of SMA.[1] This is the reason why these materials are gaining its application in the field of construction mainly in buildings and bridges. The property of the material to exhibit shape memory effect only upon heating is said to be one-way memory effect, while on both heating as well as cooling is termed as two way memory effect, refer "Fig 1".

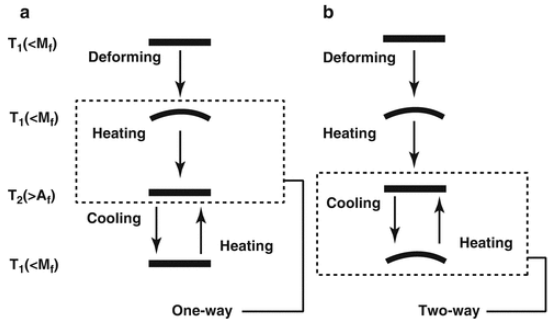


Fig 1: One-Way and Two-Way Shape Memory Effect, Src : Google Images

Before entering to the application of SMA it is essential to understand the basic characteristics and properties. General physical properties of Iron based as well as steel type SMAs are listed below in Table 1.[13]

Table 1: Physical properties of SMAs and structural steel [13]

Property	Units	Value				
		Fe-SMA	NiTinol (Martensite)	NiTinol (Austenite)	Q235	SUS304
Density	g/cm^3	7.2–7.5	6.45–6.5		7.86	7.93
Young's modulus	GPa	170	28–41	83	201	193
Electrical resistivity	μΩ-cm	100–130	76–80	82–100	29.3	73
Specific Heat Capacity	J/kg·°C	540	836.8	836.8	745	500
Thermal conductivity	W/(m·°C)	8.4	8.6–10	18	61.1	16.3
Thermal expansion coefficient	($\times 10^{-6}$) °C^{-1}	16.5	6.6	11	12.6	17.2
Melting point	°C	1320–1350	1240–1310		1468	1398–1454
Strain recovery limit	%	2	10		-	-
Poisson's ratio	-	0.359	0.33		0.294	0.25

1.1.2.Phase transformation of SMA

The two unique properties the SMA are super elasticicty /pesedoelasticity and shape memeory effect (SME).SMAs even though possessing same chemical composition exhibits more than one crystal structure. SMAs are characterized by 4 different transformation temperatures in the stress free state namely Austenite start(As) and finish (Af) and Martensite start(Ms), and Martensite finish(Mf), The low temperature phase is the martensite , and high temperature phase is termed as Austenite. "When there is low temperature, SMAs exist in the martensite phase, and when heated,there happens a transformation to austenite phase and there is crystalline change also."[4] "When the temperature (T) is less than Mf ,SMA exists in fully martensite state and SMA will be in fully austenite state when the temperature (T) is greater than Af. "During the course of phase change from either of the phases, both martensite phase and austenite phases together exists".[4].The same is illustrated via " Fig 2".

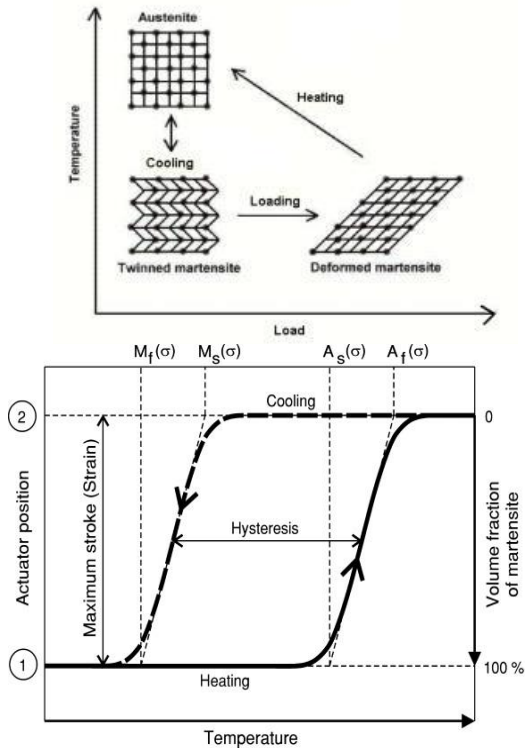
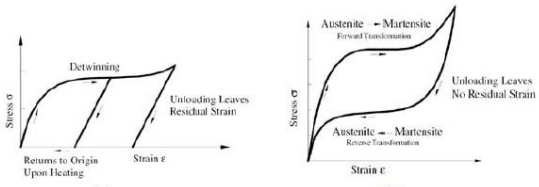


Fig 2 Source :Narendra Mali, Archana Mali,IJARSET, Vol. 4, Issue 8 , August 2017, ISSN: 2350-0328



idealized stress-strain curve for shape memory effect (a) and for superelastic effect (b) [from (Desroches and Smith 2003)].

Fig 3

1.1.3.Types of SMA

Many types of alloys exhibit the shape-memory effect. The transformation temperature of SMA can be controlled or adjusted by changing the alloying constituents. Some common types of alloys include the following: Cu-Al-Ni, Copper-Zinc, Iron-Pt, Iron Managnese Silicon and, Ni-Fe-Ga , Ni-Ti approx. 55–60 wt% Ni and so on. Till now around 30 different types of shape memory alloys have been discovered, but the most suitable SMAs for the structural applications are the copper-zinc-aluminium-nickel, Cu-Al-Ni and nickel-titanium (Ni-Ti) alloys.[3] and also nitinol is the most extensively used material in structural applications. The main advantage of SMAs is that it has better corrosion resistance and process of deformation and shape recovery can be repeated multiple times..

2 APPLICATIONS OF SMA

Substantial research is been conducted in past 1 decade to find the potential application of SMAs in new structures as well as in retrofitting and rehabilitation of old structures. The same includes SMA based Actuators, SMA bases Dampers, SMA based isolation devices SMA in beam column Joints, SMA in Column Anchorage, SMA wires in prestressing in bridges, and so on.

2.1 SMA based Reinforcements in bridge piers and Beam column Joint

SMAs are used as rebars in beam –column joints and also in the bridge piers, especially in the plastic hinge location to minimize the large deformations especially when the structure is subjected to rigorous earthquakes.

According to [6] , Wang(2006) conducted a shake table test, where as he designed and constructed a spiral RC column of two quarter scale model as a representative of RC bridge piers refer "Fig 4a".The RC detail of bridge pier is shown in "fig 4b", where as plastic hinge region is provided with SMA rebars and is connected to the steel reinforcement with the help of mechanical couplers. From the observations,(Wand 2004) it is clear that "SMA-RC columns showed better performance in limiting relative column top displacement and also residual displacements. Also they could withstand larger amplitude of earthquake when compared to conventional RC column".

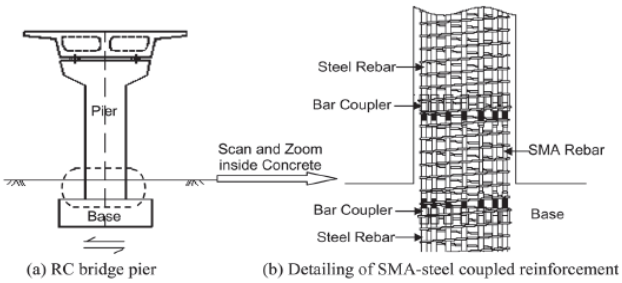


Fig. 4 RC bridge pier reinforced with coupled SMA-steel rebar(Source:Wang 2004)

2.2 SMA in repair and Rehabilitation of heritage structures

Shape-memory alloys also finds its application in repair and strengthen architectural heritage structures. According to [6] "The bell tower of a church at Trignano in Italy (San Giorgio church) "Fig 5" was heavily damage due to an earthquake in 1996. The restoration of the church is done by using SMA devices, which was connected with steel bars in series inside the bell tower. Thus it helped in restraining the lateral movement during the earthquake"[6]



Figure 5. San Giorgio church and its bell tower, Trignano

2.3 SMA in repair and Rehabilitation of highway bridges

A highway bridge in Michigan was the first concrete structure to be first field implemented using SME for post tensioning. There was very poor shear resistance and due to which the bridge suffered severe cracks. According to [8] ,"the strengthening of bridge girder was done by using iron–manganese– silicon–chromium SMA rods. 10.4mm dia SMA rods were mounted crossing the cracks at either of the web faces as shown in "Fig 6" . According to (Soroushian et al., 2001),A 1000A current to achieve 300°C, was used to heat each rod and thus resulted in minimizing crack width to about 40 %"

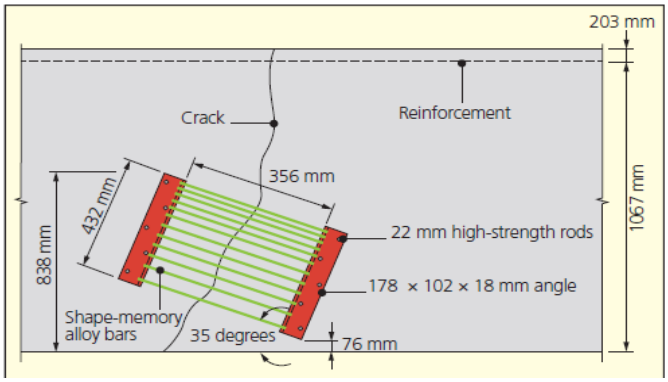


Figure 6. SMA bars at either side of crack connected by angles (Soroushian *et al., 2001)*

3 SMA DAMPERS IN SEISMIC ISOLATION

Nowadays structural control devices are gaining it's consigning in the research and development especially for bridges. These have the potential to reduce the intension of wind and seismic forces. These are effective mechanisms there by no need for increasing the structural capacity of the structure to resist the seismic forces. These control systems are basically divided to active, passive, hybrid and semi active .These passive control devices are either embedded or attached in the structure and are designed in such a way that they improve structural stiffness and structural damping and the control forces are developed opposite to the motion of the structure. SMA has great potential to be used as active as well as passive energy dissipation tools in the field of construction.

Damping can be defined as a process by which the structural vibrations or excitations can be controlled , by dissipation of energies.It is also defined as the process of converting strain and kinetic energy to thermal energy.Damping is an important phenomena in the seismic isolation of structures which finds its potential applications as passive structural control.This is gaining its importance in recent days as it can improve the efficiency of structure without increasing the structural capacity, where by provides economical design solution against seismic forces. According to [11], Among the two mechanisms of SMA, the shape memory effect and pseudo elasticity, the studies proves that the metallic alloys exhibiting the martensitic phase transition has a desired damping capacity" [11].

3.1 Fe-based SMA dampers

Steel is used as the the conventional metal dampers, but SMA based dampers made of alloys which have better capability in seismic resistance. Fe based SMA lso shows better corrosion resistance and cost effective when compared to Ni-ti based SMA which are often meant to be costlier. Some of the notable applications in Fe-based SMAs are undertaken in recent decade and are reviewed here.

With reference to [13], Iron based SMA (Fe-15Mn-4Si-10Cr-8Ni) was developed by a Japanese industry [13]. This Fe based buckling restrained shear dampers (BRS, see Figure 7a) and buckling-restrained braces (BRB, see Figure 7b) were used in the JP Tower Nagoya and The Aichi International Convention & Exhibition Center, Tokoname, respectively [14].The results from this concluded that these Iron based SMA seismic dampers prove to exhibit longer fatigue life ,nearly about 10 times when compared with the traditional steel dampers. Also loading tests with random seismic wave inputs were performed and results proved that these smart seismic dampers shows stable behavior of energy absorption under broad range of deformation angles, thus reflects reliable performance during seismic sequences [14].

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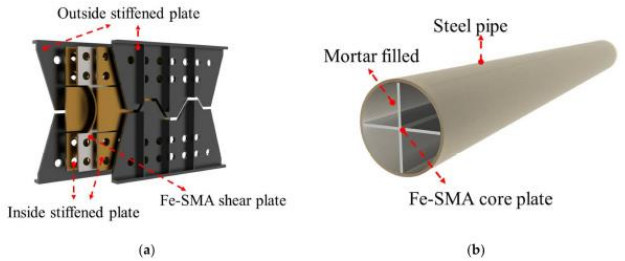


Figure 7. Fe-SMA-based (**a**) BRS; and (**b**) BRB developed by a Japanese industry–academic–government joint research group.(souce 13)

A series of tests were conducted by Zhe-Xi Zhang 1, Jie Zhang, and co-authors as per [13],on Iron based SMA U-shaped dampers as per "Fig 8a" The test results notified that the LCF life of Fe-SMA dampers 5-7 times that of their other steel counterpart. Figure 8b shows the representative hysteric curve of Fe-SMA damper, where full and stable hysteresis curves are observed.

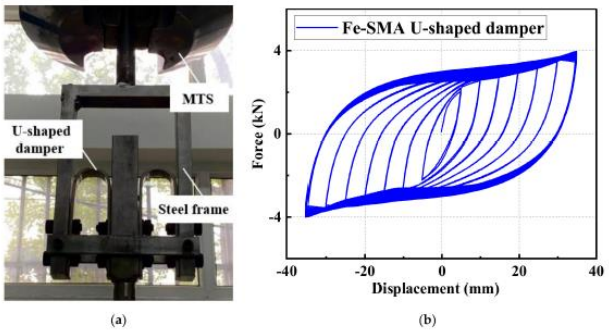


Figure 8. (a) Test set-up and (b) Hysteric response of U-shaped Fe-SMA dampers

3.2 SRB based isolation system for Bridges

A study was made by Ozbulut and Hurlebaus (2011) and as per the [12, 16],the authors and coauthors articulated the efficacy of SMA-rubber-based (SRB) isolation systems for bridge protctection against near-field earthquake, as shown in Figure 9. According to [12,16] "the authors and co-authors considered some of the parameters like transformation displacement, strength, temperature, and pre-strain level of alloys to investigate the sensitivity of the seismic response of the bridge and the lateral stiffness of the rubber bearings." The results were compared from their system proposed with the results of the (S-FBI) SMA friction base isolator. "It was found that both had similar peak deck drift .But the peak deck acceleration and peak base shear values in the S-FBI were smaller."[12, 16]. The energy dissipation in the S-FBI system is through friction and SMA device acts as a re-centering device. It was then concluded by the authors, that the SFBI shows better desirable properties when compared to SRB isolation system".[12,16]

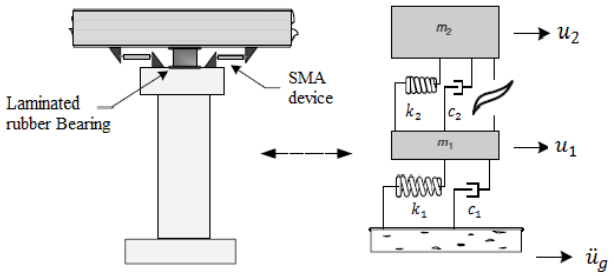


Fig. 9. SMA/rubber isolation system in a bridge model (Source:Ozbulut and Hurlebaus, 2011).

An innovative base isolation device was introduced by Casciati et al. (2007) [17]. "The set up comprises of two disks, a vertical cylinder with an upper enlargement sustained by three horizontal cantilevers, and three inclined SMA bars."[17]. The prototype of the base isolation device was built and tested using shake table shown in "fig 10".
These bars basically have four functions: (i) Energy dissipation (ii) Distinguish large displacements ,(iii) providing stiffness against low intensity excitations; and (iv) re-centering of the device;. When the system is exposed to cyclic loading, it is noted that the super-elastic behavior of the SMA give rise to wider load displacement loops, where a quantum of energy dissipation is noted. Also when there is a decay in the excitation intensity the loops become smaller which resulted in the re-centering of the device.[17]

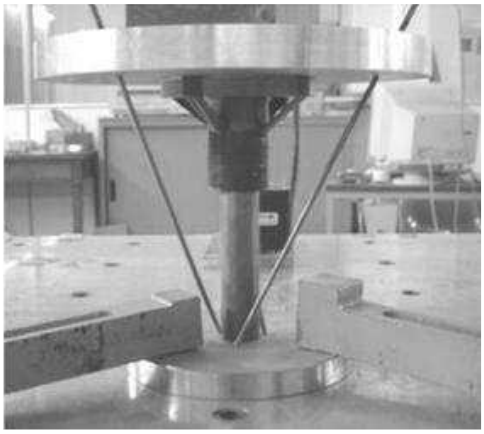


Fig. 10. Prototype of base isolator (Casciati et al., 2007).

IV LIMITATIONS AND CHALLENGES

In spite of having a great potential for the utilization of various SMAs in day-to-day construction, Shape memory alloys are meant for its high cost which is one of the major barrier in implementing this intelligent material without hesitation in construction. Since the structures are huge and so the huge force encountered by structures, a large amount of material requirement is utmost necessary for practical applications. There is only handful of manufacturers available and this new technology is still in research phase with very limited application in real time projects. Even though software's like ANSYS support FEA of SMA based devices, proper design standards are not available for the implications of SMA based structures, which is a constraint to evaluate their performance theoretically by design standards. Large diameter bars of Ni-ti alloys faces extreme difficulty in machining process using conventional equipments. Even though development of Iron and Cu based SMAs prove to be less costly and also show good bond strength than Ni-ti based, the shape recovery of Fe, Cu based SMAs is still poor. These challenges are to be overcome by undergoing advanced research so that this novel material can do wonders in future generation construction industry.

V CONCLUSIONS

This review gives some of the notable uses of SMA in base isolation and seismic resistance of structures. From the review, it is clear that the SMAs are capable new generation alloy which can be incorporated in varieties of civil engineering structures like bridges, beam columns, retrofitting ,and in steel structures. Based on the various analytical and experimental studies made till now in Ni-ti alloys and Fe-based alloys, these materials can be used in passive seismic control as dampers and base isolators because of its unique property of super elasticity/(pseudo) elasticity as well as SME. Now it is the responsibility of the upcoming generation of engineers as well as researchers to advance this intelligent material in various building and infrastructure projects, to take the construction industry to next level.

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Sonic Boom Noise Reduction through Low Boom Flying Demonstrator (LBFD)

Amol Kumar Singh
Mechanical engineering
Indus Universirty
India
amolsingh14@yahoo.in

Dr. Ishbir Singh
Professor, Mechanical Engineering Department
Indus Institute of Technologyand Engineering,
IndusUniversity, Ahmedabad
ishbir@rediffmail.com

Abstract

Turboprop aircraft is a type of an aircraft having propeller attached with the engine. So many modern technologies which are used on aircraft such as glass cockpit, acoustic panel for reducing sound from an engine. Many improvements in technology, for example, in terms of fuel usage, upkeep, and performance. This type of an aircraft producing thrust by propeller They typically have noisier cabins, and because of the tonality present, there is an elevated amount of vibration discomfort. linear comfort model is allowing for the improvement of aero plane cabins, the prediction of general discomfort using measurements of turboprop noise and vibration. In turboprop aircraft noise level generally occurs between 10 to 30 decibel Gretter than the commercial aircraft. Turboprop cabin noise may be reduced through active structural acoustic control.

To enable commercial supersonic flying over land, the Low Boom flying Demonstrator (LBFD) project will show a sonic boom with significantly less noise.

Keywords— Aircraft, Reduce, noise, Turboprop, Vibration, LBFD

1. Introduction

The noise of turboprop aircraft is different than the jet noise. Basically, noise is caused by the periodic rotation of engine parts, Now a day there are so many technologies used in aviation to makes easy and comfort for passengers. When engine of aircraft is started once than there is so many noises come from this section which feel discomfort for the passengers as well as cabin crew. The noise and vibration that passengers in aircraft will experience will be different from what is experienced in existing aircraft due to changes in aircraft design. Fuel efficiency in turboprop engine is more efficient than the other engine but produce so many noises as well as vibration. There are so many things are used before LBFD to reduce the vibration as well as noise. Reduction of noise as well as vibration is must for passenger comfort. Increase the level of noise and vibration affects the passenger discomfort. Before low boom flight demonstrator, the linear comfort model was used. In linear comfort model where the predication of measurements of turboprop noise and vibration occurs. Human responses depend upon the combination of noise and vibration takes place. Human response is additive either increase in noise or vibration. If there is only changes in one modality than the responses is synergistic means i.e. non linearly. Increases one mode which reduces the sensitivity to the other stimuli called antagonistic. The majority of optimisation research used to reduce aeroplane noise or vibration uses nonlinear programming or traditional optimum control methods.

The study of this research paper shows how to reduced the level of noise which come from sonic boom through the low boom flight demonstrator on fighter aircraft fitted with turboprop or different engine. The LBFD [17] aircraft is envisioned as a subscale research aircraft that, while in supersonic cruise (Mach 1.4), emits a shaped sonic boom signature with a loudness level of little more than 75 PLdB. LBFD have effectiveness of the accuracy of acoustic propagation codes.



Fig 1-Low Boom Flight Demonstrator Concept
Source-NASA

II.DESIGN

For determine the effect of sonic boom first we work on design and how it actually works. Because sonic boom creates noise for an aircraft and which adversely affect the comfort of pilot. For this NASA and Japan Aerospace Exploration Agency worked together and developed a technique which reduces as well as lower the sonic boom noise. [17]The technology which are used is and under construction is X-59 Quiet Supersonic Technology. Through this we can easily lower the level of noise. A shaped sonic boom, commonly referred to as a low-boom or sonic thump, measuring 75 dB on the Stevens Perceived Level (PL) scale, is what this aircraft is intended to create. During the NASA Quiet Supersonic Flights 2018 (QSF18) test, the X-59 sonic boom travelled through 22 atmospheric profiles that weather balloons measured. Show that the noise from sonic booms can be decreased to a level that the people who live near future supersonic flight paths will find tolerable.

Requirement C608.1		Name
MR-1	Traceability of booms	
MR-2	Formatted Signature	74.3 PLdB,
MR-3	Variability of Boom	0-80 PLdB
MR-4	Cruise Deviations	74.5 PLdB,

Source-Lockheed Martin

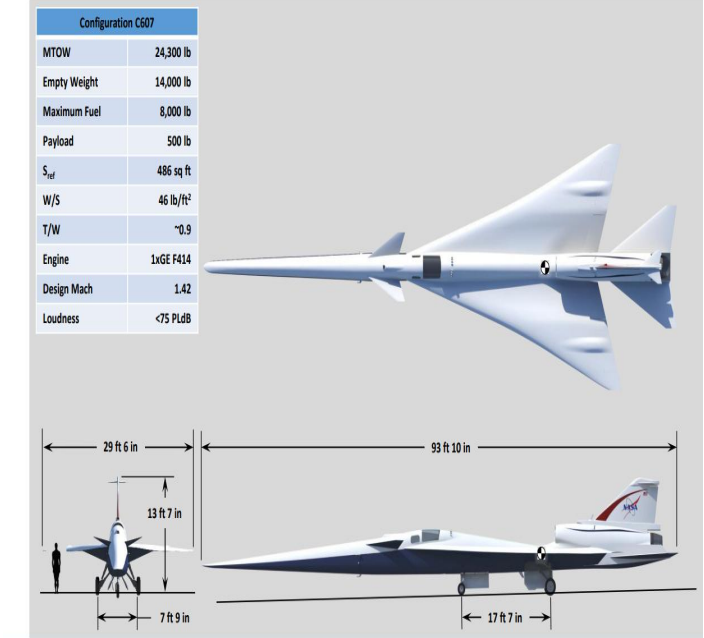


Fig-2.CONFIGURATION
Source- Lockheed Martin

III. Design Analysis

The nose up trim is provided by a fixed canard. In order to lessen the forward shock, it has an enlarged nose with area contouring.

This design having the external vision system for the visibility. This system implemented with the T-38 canopy system and seat for escape systems.

This system or design having F 414 GE 400 Engine. It has T tail to minimize the tailor aft shock.

IV. Testing and Results

[18]C608.1, 15% scale (about 14' long), test details

100% leakage, bullet-faired nacelle

NASA Langley 14x22 test section, 14.5' x 21.75' x 50' wind tunnel

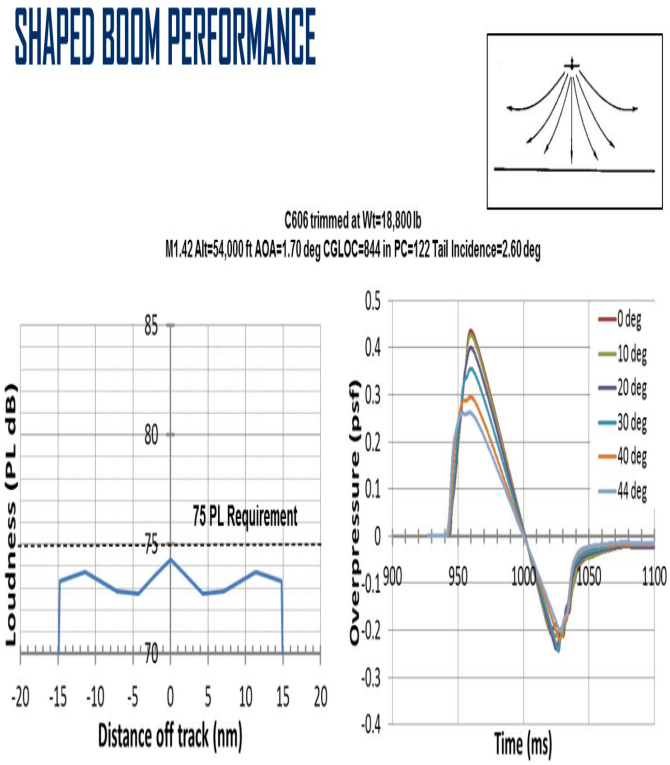


Fig -3 Source-Lockheed Martin

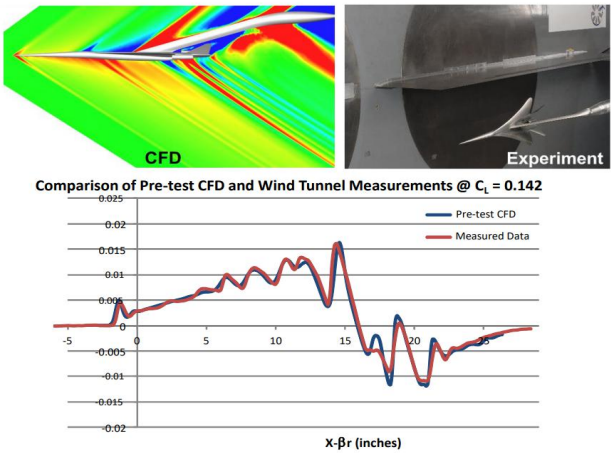


Fig-4 Source- Lockheed Martin

V. Research and Future Plans

Aerodynamic drag is being greatly reduced because to improvements in high-speed computer tools by employing the enhanced ability to analyses complex flows and aircraft layouts. Fuel burn, NOx, and jet noise are all being improved by engine makers. As technology advance, compromises on environmental design goals may become viable and interdependent. The capabilities required for civil supersonic operations are already provided by avionics and cockpit systems. These systems are still being improved through additional work. Civil supersonic operations may be divided into two basic phases: supersonic operations over water and then supersonic operations over land. Enabling supersonic technologies are convergent to provide practical and effective aircraft configurations.

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IoT Based Monitoring and Control of AC Motor

Hinal Shah
Department of Electrical Engineering
Indus University
Ahmedabad, India
hinalshah.el@indusuni.ac.in
ORCID 0000-0001-6667-2510

Maahi Vora
Department of Electrical Engineering
Indus University
Ahmedabad,India
voramaahi.20.el@iite.indusuni.ac.in

Abstract—**The most prominent driving machinery is found in vital devices like electricity motors, generators, and turbines. An electrical motor failure in industry can result in a productivity stop, which could result in enormous economic losses.The objective of the proposed research work is to develop and build an IoT-integrated monitoring and control system for AC motors. Many electrical, mechanical, chemical manufacturing industries and the pharma, agriculture, and transport sectors use induction motors for processing and manufacturing purposes. The primary goal of this research is to leverage the Internet of Things for online monitoring of motor parameters like current, voltage, temperature, speed, etc. In the event of an abnormality, an operator can take the appropriate procedures to avoid a total breakdown. The suggested work can assist industry people with online monitoring of motors, and future work can be extended to include fault identification and categorization to improve system reliability.**

Keywords— Internet of Things, Sensors, Induction Motor, Node MCU, Web server.

I. INTRODUCTION

In the era of smarter and faster technology, the majority of industries are functioning based on automation from remote locations. Almost every manufacturing and production industry uses induction motors [1]. To prevent the malfunction of the system and manufacturing process, it is required to access and control the induction motor parameters like full load current, voltage, vibration, temperature of the environment, winding temperature, and many more. The internet of things is used here to access data from a web server.

This assessment included numerous already existing tracking devices for electrical machines. It was noti ced that an IoT-based technology is being implemented. A current sensor was applied in system to check power consumption [2]. Various electrical machines and power system component data are monitor and controlled using IoT devices such as wind turbine monitoring as given in article[3], research article [4] indicates fault diagnosis in induction motor, article [5] shows reliability monitoring, etc. IoT devices are not only used at large scale monitoring and controlling purpose but also used for small and medium scale application like submersible pump parameters monitoring[6]. It is also applicable for health monitoring [7] system, agriculture sector, smart grid, smart cities, home automation and many more.This paper has divided in a different section. Section II is indicated the proposed system working. Section III has represented development tools and software programming for local area network. Section IV has discussed results of the proposed system. Section V has indicated future scope and conclusion.

II. PROPOSED SYSTEM

Proposed system is devided in hardware and software model. IoT system is a technology that enables communication between devices and the cloud as well as between the devices directly. IoT is also called overall network of linked devices. There are different level of IoT communication. In proposed system local area network (if device is sharing same network then only communicate) is used.

A. Block Diagram

Figure 1 is represented block diagram of the system. Induction motor connected to temperature, voltage, current and humidity sensors. These sensors analog values are converted to digital data using ADS1115. ADS1115 has 16 resolution. Digital data has transmitted to Node MCU ESP8266. Node MCU convert data in appropriate format and transmit data to local host wireless. At receiver side data has been received web browser. If any abnormalities has been detected on subscribed data then user can actuate trip command to relay. Relay signal will disconnect the motor from supply.

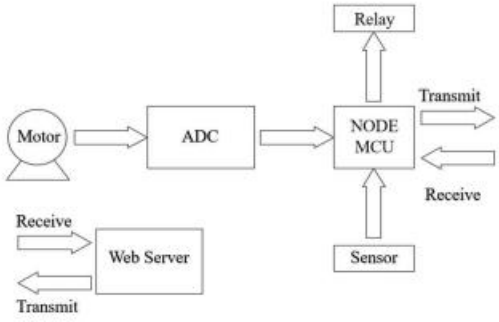


Fig. 1. Block Diagram of the system

B. Schematic Diagram

Figure 2 shows the circuit diagram of proposed system. Voltage, current, temperature and humidity sensors were

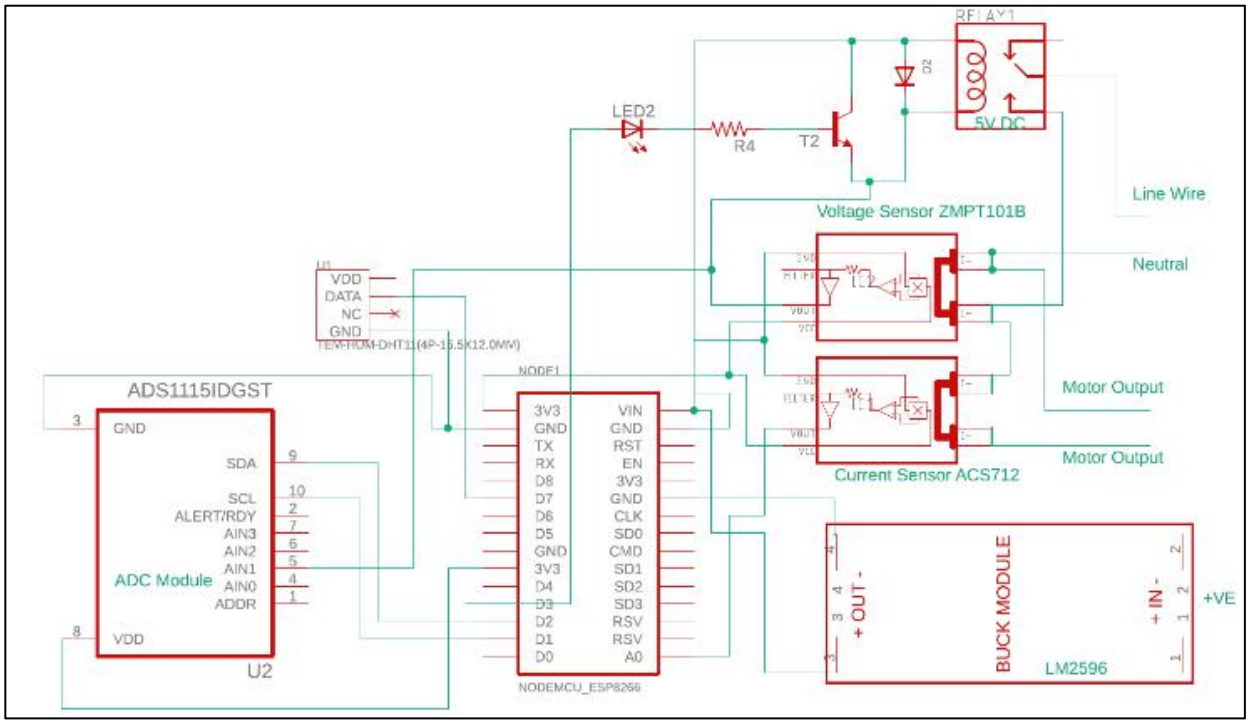


Fig. 2. Circuit Diagram of the system

taking input from the motor and output of the sensors are connected to ESP8266 micro controller. The operating voltage of ESP8266 is 3.3 volts. Both hosting an application and outsourcing all Wi-Fi networking tasks to another application processor are both options available to this module. It is also a self-contained open source software and hardware development environment designed around an affordable system with an integrated TCP/IP protocol stack that can allow any micro controller access to a Wi-Fi network.

TABLE I. HARDWARE MODEL SPECIFICATION

Sr. No	Component	Specification
1	Squirrel Cage Induction Motor	1Hp; Full load current 4.9Amp; 2.2kWatt class B insulation, 130▫c
2	ESP8266 Node MCU (WiFi module)	802.11 b/g/n, Wi-Fi Direct (P2P), soft-AP, 4MB Flash Memory. Integrated low power 32-bit CPU, SDIO, SPI, UART.
3	Relay	1 Channel 5V DC relay Maximum load current: 10A/250V AC, 10A/30V DC. Maximum switch voltage: 250V AC, 30V DC.
4	ADS1115 (Analog to Digital Converter)	16-bit, I²C compatible, analog-to - digital converters
5	ACS712 (Current Sensor)	66 to 185 mV/A output sensitivity Output voltage proportional to AC or DC currents.
6	ZMPT101BAC (Voltage Sensor)	Rated Input / Output Current 2mA, Linear range - 0~1000V 0~10mA, Linearity - 0.1%
7	DHT11 (Temperature Sensor)	Temperature Range - 0°C to 50°C, Humidity Range - 20% to 90% Resolution - 16-bit, Accuracy - ±1°C.

A popular transducer for humidity and temperature is the DHT11. A specific negative temperature coefficient for temperature readings and output 8 bit data serially for temperature and humidity readings.The current sensor utilized in this research work offers a precise solution for AC and DC detection while also being cost-effective. Its output sensitivity spans from 66 to 185 mV/A. A voltage-sensing circuit takes the voltage's reading and generates an output volt that satisfies the demands of the Wi-Fi board. Table I has indicated hardware model specification used in the given system.

III. SOFTWARE SETUP AND DEVELOPMENT TOOLS

A. Software coding

Figure 3 is indicated flow chart of the ESP8266 working. Configure all the sensors as input and actuator as output. Set the baud rate of serial communication (UART peripheral) 9600. To begin Wi-Fi communication set SSID and Password. Select station as Wi-Fi mode. Connect server and update all sensor data to local host. If any abnormalities has detected then send signal to node MCU to shutdown motor using relay.

B. Software Development tools

To develop this system the following development tools are used Visual c, Angular online platform for mobile or desktop application purpose, NodeJs for backend, ExpressJs for API creation and Mongo DB for data storage purpose.

- The front end is built with Angular, a platform and framework for developing a web app implementation that loads only one web document and then updates the body content of that single document. HTML, Typescript, and SCSS are the three languages used in this application. The "localhost" display is referred to

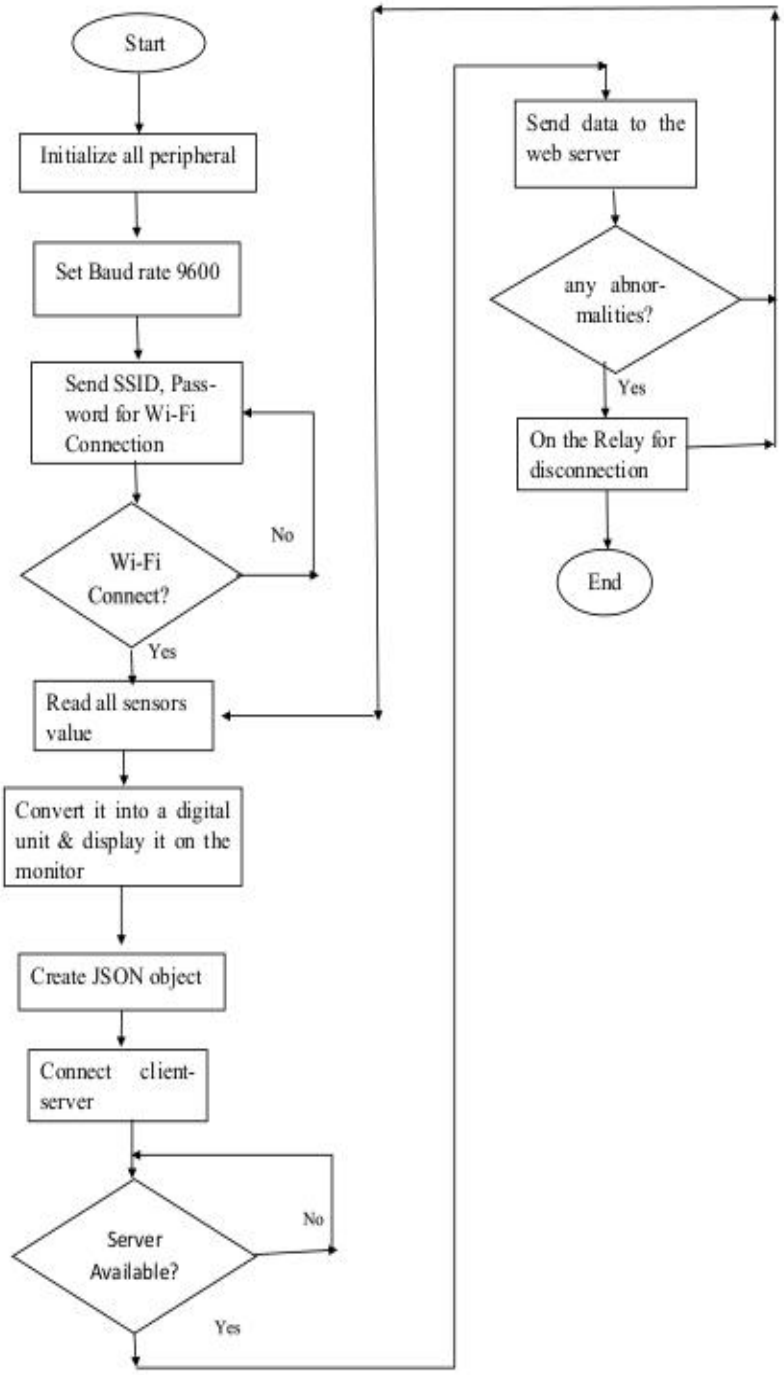


Fig. 3. Flow chart of the Node MCU working

as the front end, from which the selected sensors can be viewed on any device connected to the same Wi-Fi network.

- The back end is the portion of a computer application that enables its operation but cannot be viewed by the user. The majority of data and operational syntax are saved and accessed in the computer system's back end. NodeJS was applied to put up the back end in this app. NodeJS is a cross-platform and open-source. The back end is linked to the database, and only the back end has access to it.
- API Creation is an abbreviation for "Application Programming Interface." API creation is the process of developing and publishing APIs in order to make them available to potential customers. Allowing client applications to connect to other applications is a vital step. The API is used to send and receive information/data. ExpessJs provides web application framework that offers a variety of functionality for developing web and mobile applications. It can be used to create a single-page, multi page, or hybrid web application.

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- A structured set of data stored in a computer, particularly one that can be accessed in multiple ways. This program's database is built on MongoDB. The database and the back end are linked. In terms of data flow, the Node MCU will make a request to the server and then wait for a response from the server. The server answer will include information on whether Node MCU needs to trip the relay or not.

IV. RESULT

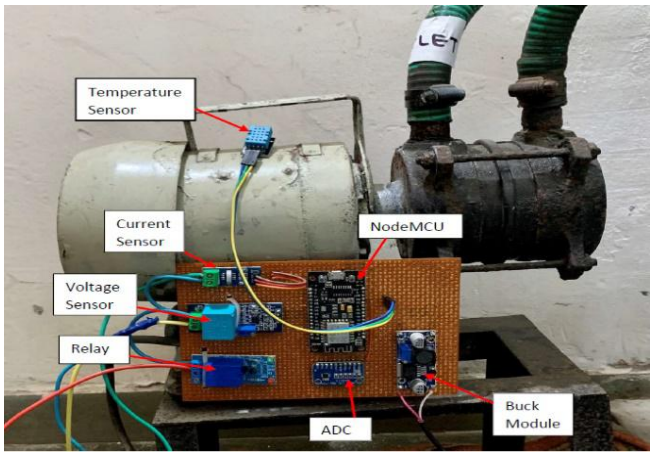


Fig. 4. Hardware setup snapshot

Hardware working setup snapshot of proposed system is given in Figure 4. It also indicate all the sensor interfacing with NODE MCU and motor. Figure 5 and Figure 6 are re-presented screenshot of the dashboard to display data at local server. All information is transmitted to the Things Speak IoT platform, where users may monitor the values using widgets.

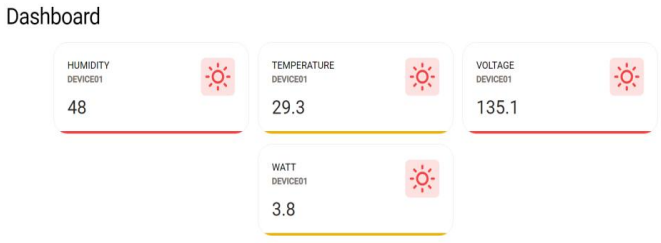


Fig. 5. Dashboard at local host server without load

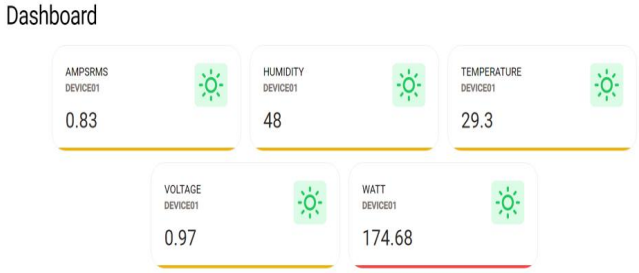


Fig. 6. Dashboard at local host server with load

The parameters can also be observed on serial monitor screen. Humidity, temperature, voltage and current value are displayed on dashboard as well as on serial monitor screen as shown in figure 5, 6 and 7. Continuously any abnormal data are detected user can send trip signal to relay to disconnect supply from motor.



Fig. 7. Serial terminal screenshot

V. CONCLUSION AND FUTURE SCOPE

A single-phase induction motor has been monitored in real time in this paper. Using framework, all the key parameters may be shown. The user can observe any discrepancies in parameters and take the appropriate action to improve the motor's longevity. In the future, such technologies could be utilized to capture data while also preventing substantial damage to the apparatus or operator.

IoT is used in a application at local network. If devices are in same premises and same network then only data can be subscribed or published. While IoT higher level application is selected then data stored at cloud using global network. In a global network devices are located at any place and with any network connection can be communicated with each other that is the future goal of research work.

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Overwhelming study on computer integrated seed spraying machine

Yash Prahladbhai Patel
Dept. of Mechanical Engineering
Indus Institute of Technology and Engineering
Ahemdabad, India
yash.ppatel.19.me@iite.indusuni.ac.in

Dr. Mitesh J Mungla
Dept. of Mechanical Engineering
Indus Institute of Technology and Engineering
Ahemdabad, India
miteshmungla.me@indusuni.ac.in

Prof.Jignesh Patel
Dept. of Mechanical Engineering
Indus Institute of Technology and Engineering
Ahemdabad, India
jigneshpatel.me@indusuni.ac.in

Abstract—Food is the basic requirement for the living any animal which is achieved by the farming. We already know that farming is hard working process as well as number of workers are gone away from the agricultural field. In this condition, we should require suitable technology that helps to increasing production of food sowing. We should have made automatic techniques that work without worker. In this technique, seed throwing by help of high-speed motor and all data can send by the computer interface to the motor. All motor is chosen according to the different work. computer integrated seed spraying machine may increase rate of production as well as cost of food in agricultural sector. In this paper, we will check result compare with existing techniques. Also, Working, arrangement, components of computer integrated seed spraying machine discuss in this paper.

Keywords: Seed throwing, High-speed Motor, computer interface.

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I. INTRODUCTION

India is developing country in which number of people move to the technology for increasing GDP in different ways. Where, most of farmers are believe that other field have more growth than the agricultural field and also believe that farming has way for more expensive and less money earning rate. For the solution we use perfect technology that expenditure is to be reduce. For this, we make technology that reduce human efforts as well as saving time. I have like to explained about computer integrated seed spraying machine that is help to remove barriers from the life of farmers with help of full fill, the requirement of natural food and use less investing
money. Computer integrated seed spraying machine give signal that
can help in seed throw over all working place. This innovation is helps to increase rate of food production. That is reduce requirement of food as well as cost of food. More detail of computer integrated seed spraying machine being show in upcoming paragraphs.

II. PROPOSED WORK

This machine has very less cost. This is operated by help of programming of some motors. Servo Motor or Brushless dc motor is giving velocity and angles. With help of motor, seed obtained velocity according to the rpm of the motor and radius of seed in arm. And throw at require angle. For the stopping angle, we use separate mechanism. Throwing seed follow path as projectile curve. Which give range of the particle. Some mechanisms, such as robotic arm, is give different angles. With help of robotic arm, we throw seed at different angles. Seed meter is also helpful during seed pouring in machine.

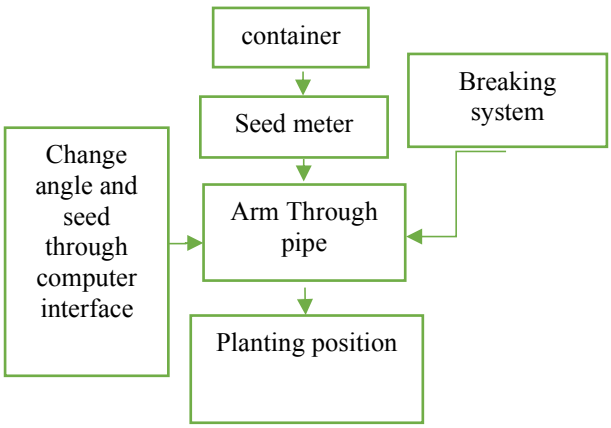


Fig 1: Process for the seed spraying

III. Factor affecting during process

Some defects are place during seed throwing that shown below:

- Coefficient of friction between plate and seed
- Air friction during moving seed to the planting position
- Incompressibility of seed
- Some manufacturing defect of components of computer integrated seed spraying machine by worker.
- Variation of flow of current

These factors may affect during seed travelling.

IV. Layout of computer integrated seed spraying machine

Computer integrated seed spraying machine have so many components that is shown below according to different works:

1) Seed obtained velocity from the Brushless DC motor

- 24V BLDC Motor
- Arm

24V brushless motor is give high RPM. According to the V= $\omega \cdot r$, Velocity of the seed is decided by the speed of BLDC motor and distance between axis of rotation and arm length.

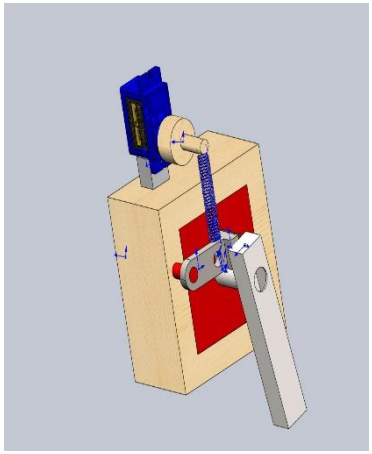


Fig 2: SOLIDWORKS design of computer integrated seed spraying machine

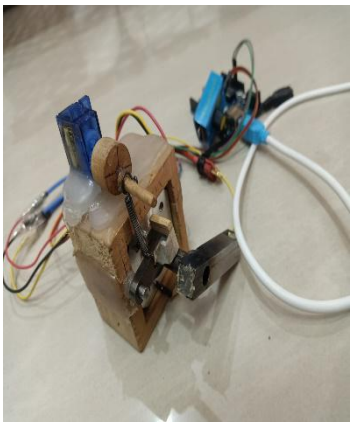


Fig 3: Computer integrated seed spraying machine in actual life

2) For the braking system

- cover of shaft (with special design)
- Servomotor
- Spring
- Braking block
- Rod

In this braking system, it has suitable to attach physical contact over the frictional contact that is helps to stop shaft of BLDC motor. In this system, we are using four bar mechanism, component of four bar mechanism is spring, Rod, Braking block, Etc. This mechanism is run by the servomotor which is control by signal from Arduino.

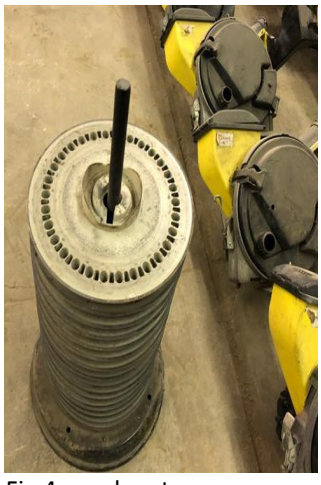


Fig 4: seed meter

3) For the seed travelling container to the arm

- Container
- Servomotor
- Plate (Circle in shape)

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In this mechanism, bottom part of container attach plate which is rotate by the Arduino signal. Through the signal, motor is rotate that is helps to putting into pipe. Pipe is seed put in the Arm that attach to the brushless dc motor.

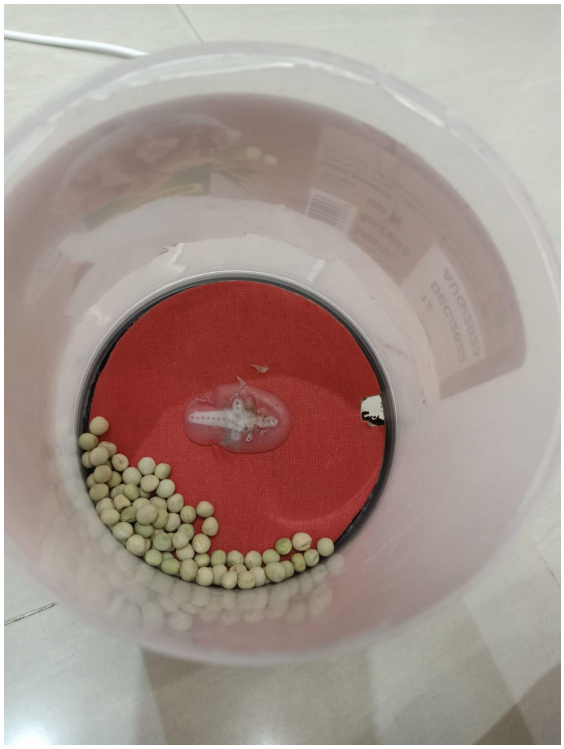


Fig 5: Homemade seed meter

Note: Electronic device is not part of device but it is help for run some device.

V. HEPING IN PROGRAMMING

For the programming of motors of computer integrated seed spraying machine mathematic is required that shows in below:

1. Length of planting position is already coded with help of programming.
2. Angle is fixed by the manufacturing (Here, it is $45°$).
3. We can make program of rpm according to the,

$$v_0 = \sqrt{\frac{R \cdot g}{\sin 2\theta}} \quad \text{... (1)}$$

Machine efficiency can use as better results.

4. Breaking system have one servomotor, that can change angle according to the time.
5. Seed meter is used for entering seed in arm and it have one servomotor that can change angle according to the time.
6. We can implement programming in robotic arm.

VI. HOW TO CALCULATE RANGE FOR THIS MODEL

For the calculate range we are take parameter that shows below:

Arm stop with $-45°$
Max. speed of motor=1000 rpm
Therefore, angular velocity=104.67 rad/s

Length of arm=0.05 m
Therefore, max. velocity of arm=5.2335 m/s
According to the formula (1),
Max. Range=2.79 m

Note: It is just theoretical calculation; machine efficiency also effects the range.

VII. PATH OF SEED

Seed is stored in container after that seed I moving to the plate of container and after seed is go to arm throughout pipe. Seed is obtained velocity and different angle from them. When braking system run then seed is throw in environment. Seed is following path as projectile according to angle and velocity. Which give range of seed.

VIII. RESULTS

SR.NO.	Speed of BLDC Motor (RPM)	ANGLE (degree)	RANGE (cm)
1	443	$45°$	53
2	497	$45°$	65
3	565	$45°$	82

Table 1: Result where input in rpm and output in cm

IX. TOTAL EXPENDITURE

Component/Processes	Quantity	Cost (INR)
24V DC Motor	1	5594.69/-
Servomotor 9g	2	200/-
Spring	1	5/-
Wood	1(raw material)	150/-
MS	1(raw material)	300/-
Manufacturing cost (wood + metal)	3 + 4=7	1300+2300=3600/-
Electronic device such as wire, ESC, Driver, Arduino	1 for all	1500/-
Total Cost	-	11349.69

Table 2: Total cost of computer integrated seed spraying machine

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X. COMPARISION TO THE OTHER TECHNIQUES

By hand	By Tractor	By Drone	By CISSM
Time consuming	Faster than hand	Less time consumption	Very less time consumption
Worker required	Worker required	Skill worker required	Worker not requires always
Food is required for energy	Run by petrol	Electric cost required	Electric cost required
Not usable in night	usable in night by usable light source	Not usable in night	usable in night
Maintenance cost high	Maintenance cost high	Maintenance cost less	Very Less maintenance cost
No setup cost	Very high setup cost	Very high setup cost	Less setup cost

Table 3: Comparison with existing techniques

XI. ADVANTAGES OF MACHINE

Following are the advantages of manual seed planter machine are:

- Increased speed of seed planting
- Seed planting accuracy with in short time
- Less maintaining cost
- Less amount to setup cost
- Automation build that reduced manpower
- One design is satisfied with different type of shapes and mass.
- One design can satisfy with different farm or agricultural places. (Acceptation programming)
- Design same for the different mass and size of seed.

XII. CONCLUSION

According to the result, it can be proposed to have low cost computer integrated seed spraying machine which utilises automatic technique to reduce human efforts as well consumption of electricity. It also increases productivity as well.

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IOT based *Smart Wheelchair for Physically Disabled People*

Ayush Jain
Electronics and communication Dept.
Indus University.Ahmedabad, India
ayushjain.19.ec@iite.indusuni.ac.in

Prof.Miloni Ganatra
Electronics and communication Dept.
Indus University.Ahmedabad, India
miloniganatra.ec@iite.indusuni.ac.in

***Abstract*—In today's world, Elderly and physically challenged folks rely on other people. But in today's quick-paced world, where everyone is extremely busy, there aren't many individuals around to properly care for these folks. They locate the autonomous wheelchairs for these people with disabilities so they may travel easily. Designing and creating a smart wheelchair that uses a gesture control system is the planned Endeavour. People who are unable to walk due to a physical condition, an injury, or impairment use wheelchairs. This study proposes a hand-gesture controlled user interface model and highlights usability, application, and technological developments. We describe a very practical and comprehensive method for real-time obstacle identification, fall detection, and hand gesture-based data glove technique that operates the wheelchair using hand movements and an accelerometer sensor. This paper will examine recent research on smart wheelchair systems. It seeks to assess the most recent technological advancements and talk about potential new avenues for our ongoing research effort.**

Keywords—Challenges, Hand-gesture, real-time, obstacle, fall-detection, accelerometer.

I. Introduction

Malaysia's population of people with disabilities was estimated by the Asia-Pacific Development Centre on Disability (APCD) to be 197,520 cases. The CDC guessed that over 53 million Americans are living with a disability. They number around two million and rely on wheelchairs for mobility and daily duties. In most situations, wheelchairs, whether manual or electric, are satisfactory. However, using wheelchairs independently might be challenging or impossible in severe circumstances. People with vision issues, spinal cord injuries (SCI) kind of disabilities are examples of these cases. Therefore, wheelchair users depend on family members, nurses, or other caretakers to assist them with the wheelchair. Some businesses manufacture a variety of so-called "smart wheelchairs" to lessen the misery and dependency of such users. A smart wheelchair is a specially customized motorized wheelchair that comes with different sensors and a control system. Smart wheelchairs are made to help their users in a variety of ways. Its goal is to lessen or do away with the wheelchair user's complete responsibility. Additionally, they are made for different user types based on their circumstances and limitations. The higher cost of the Smart wheelchairs in comparison to manual or basic electrical driven wheelchairs is one disadvantage. This essay examines contemporary smart wheelchair technologies. Finally, we examine new potential directions for our continuing research Endeavour.

The major goal of this effort is to support or assist physically disabled individuals who are unable to leave their current locations without assistance from others. A wheelchair comprises a Micro-electromechanical systems accelerometer sensor as a sensing component and motors to navigate and control the wheelchair's movement. The MDDS30 motor driver controls the motors. The wheelchair may be quickly moved in four directions by tilting the accelerometer sensor with hand motion.

II. Literature Review

According to Simpson's 2005 review study, there are numerous ways to create a smart wheelchair. Early intelligent wheelchairs were mobile robots with seats. Currently, the majority of smart wheelchairs being developed are based on commercially available motorized wheelchairs. Few "add-on" smart wheelchairs that can be connected to and disconnected from the base motorized wheelchair exist. The common objectives of all of these designs are to make it simpler to utilize the chairs, avoid crashes, and prolong the trip. This section evaluates current smart wheelchair technologies based on three characteristics:

a. Interface between people and machines.
b. The tools and techniques for navigation.
c. Other intelligent systems.

A. Interface between people and machines.

The primary goal of the wheelchair user interface is to make it easier, safer, and more robust for the user to manage the wheelchair's mobility. Special instruments may be required when the patient has a severe condition, such as those who have SCI. Furthermore, smart wheelchairs could include extra features and technologies that require more sophisticated interfaces. When it comes to mobility control, the joystick is the most widely used steering control interface for electric powered wheelchairs. Typically, a stick on a dock is used to

operate the joystick. Various wheelchairs employ different styles of joysticks. One approach to guide the wheelchair is to move the head and/or chin. Some wheelchairs also utilize tongues. These PCBs are connected to a third PCB that houses a microcontroller, a radio chip, and a battery. When a person touches a sensor with a ferromagnetic tongue piercing, the sensor coils' inductance changes. Yet another helpful gadget is sip-and-puff. It employs air pressure to deliver signals to the wheelchair by "sipping" (inhaling) or "puffing" (exhaling) on a straw, tube, or wand. Other intelligent wheelchairs employ artificial intelligence methods such as those that track the direction of the user's eyes and/or face. Such systems keep tabs on the direction a person is looking or turning their head. The "Rob Chair" project for assisted navigation makes use of a vocal Human Machine Interface (HMI) and a user-friendly Graphical User Interface (GUI) that doubles as a simulator. The architecture of the system is based on behavior-based control.

B. The tools and techniques for navigation.

The term "smart wheelchair" refers to a customized motorized wheelchair with seats, as was previously stated in this essay. Several initiatives are looking into the best ways for a smart wheelchair to assist its user, according to a poll conducted in 2010. According to how much assistance is provided, there are three different sorts of navigational procedures. The three main types of control are shared control, partially autonomous control, and fully autonomous control. As a result of automatic navigation, autonomous and semi-autonomous systems allow the user to occasionally issue commands while also allowing them to unwind thereafter. Because they may direct the motion and map out the path, users with shared control have more independence. Only emergency or corrective actions, such as collision avoidance, obstruction avoidance, and wall following, are offered by the smart chair. Systems with adaptive shared control are one intriguing concept. In these systems, the more independent work the user can complete, the less help the shared control system needs to provide. In order to assess if the required operation can be carried out safely, data can be gathered. The system then chooses whether to assist the user or let them operate the wheelchair themselves. It is obvious that the machine help increases because the terms “autonomous control” and "semi-autonomous control" are used. Therefore, wheelchairs are increasingly involved in route planning as well as collision avoidance, obstacle avoidance, and wall following. Users must issue commands to semi-autonomous devices that provide a short-term local destination. The wheelchair then begins to move until a navigation system external flag indicates that the directive was carried out. Semi Autonomous systems could be helpful for situations like users who are blind. They support their independence and movement, similar to the "Help Star" system. The "Help Star" feature can be used when a user encounters an unexpected situation. Cameras are a significant add-on thanks to algorithms for pattern recognition and computer vision. Stereoscopic cameras, for instance, are used by T. H. Nguyen et al. Images are recorded left and right from the wheelchair's mounted cameras. Using the Sum of Absolute Differences (SAD) correlation approach, the ideal disparity is calculated. This discrepancy is used to build the map, which will be used to implement an efficient obstacle avoidance method for this system.

C. Other intelligent systems.

According to the requirements of each individual user, the add-on unit concept offers flexibility in sensor, interface, and input device configurations. It enables the system to be adjusted in response to environmental changes or developments in the patient's condition. Children in particular find it satisfying because of how rapidly their bodies develop.

Patient monitoring systems could be one of the most significant add-ons. The Bluetooth communication protocol is then used to transfer the information to an Android tablet computer for processing. It is important to note that not every one of the 5 smart wheelchairs identified during the previous search corresponds to the meaning of the term used in this research. Most of them can be folded easily, can climb stairs, can stand up, and have other comparable features, which is why the manufacturers refer to them as smart. We discovered that the only company offering truly smart wheelchairs is Smile Smart Technology Ltd. in the United Kingdom. This is due to the fact that numerous studies have not yet fully confirmed the technology's robustness and safety. The decision to use or not use dependable autonomous wheelchair technology, on the other hand, depends on the degree of the handicap, the person's attitude towards their situation as a whole, and the cost of the technology. In other words, the most crucial aspects of commercializing smart technologies are affordability, usability, and personalization.

III. Technology

We used Micro-electromechanical systems accelerometer-based hand gesture technology in this work. An accelerometer detects the acceleration (change in speed) of the object it is attached to. The ability of the accelerometer to swiftly detect a broad range of motion makes it a particularly significant sensor in the field of sensors. An electromechanical instrument known as an accelerometer measures acceleration forces in three directions.

The entire apparatus is transportable and may be used anyplace using wireless technology. A microcontroller is employed in this system and is programmed using embedded C instructions. This microcontroller can simply communicate with our designed transmitter and receiver modules. The Micro-electromechanical systems sensor detects tilt and transmits this data to the microcontroller, which in turn directs the movements (left, right, forward, and backward).

Two DC motors are interfaced with the controller using a motor driver, which drives the motor to regulate the wheelchair's direction. MPU6050 will also be used for wheelchair fall detection. If the user is blind, an ultrasonic sensor will be used to identify obstacles. An extremely

sensitive accelerometer sensor tracks hand motion to control the devices wirelessly.

250W 24V 2650RPM DC motor for an e-bike comes with a 4-bolt mounting bracket (threaded M6) and an 11-tooth, #25 chain sprockets on the base. Due to the fact that it is a DC motor, its speed can be adjusted and it can rotate in either a clockwise or anticlockwise direction by simply switching the battery's polarity.

Additionally, the Micro-electromechanical systems 3 axis gyroscope was used in this instance to detect wheelchair falls. The accelerometer offers data on the angular parameter, such as the three-axis data, while the gyroscope is utilized to detect orientation. We will contrast the amplitude of the acceleration with the threshold value in order to identify the fall. The gadget will notify the individual in question through SMS if the fall is detected. Here, a microcontroller and Wi-Fi module called NodeMCU are used to connect to IFTTT and deliver SMS messages.

In the event that the user is blind, an ultrasonic sensor will be used to detect any obstacles in front of the wheelchair and, via a buzzer, will enable the user to understand the front path.

Because we move the hand using an accelerometer sensor to control the wheelchair in this project, we had to employ a hand gesture detection system. One simple method for developing a practical and highly adaptable interface between machines and their users is hand gesture recognition. One of the finest ways to enable the operation of sophisticated devices with simple hand gestures is hand gesture technology.

IV. Methodology

The atmega16 microcontroller interface is based on the hand gesture in the design for the real-time embedded system that has been proposed. We employed an accelerometer sensor for the hand gesture control, which uses hand motion to control the direction of the wheelchair. With the use of a wheelchair that is readily controlled by hand gestures, persons who are reliant on others are independent to move from one location to another. The motor driver module was utilized to operate the dc motor. These essential construction elements include the accelerometer module, microcontroller module, transmitter, receiver, ultrasonic sensor, gyroscope, and NodeMCU. The hand gesture sensor accelerometer, which is attached to the person's hand, provides the signal, which is transmitted by the transmitter module. The receiver module receives the signal, which is transmitted by the transmitter, and acts in accordance with the instructions provided by the signal through the microcontroller.

Gesture of hand	**Motor 1**	**Motor 2**	**Motion**
Stable	0	0	Rest
Upward	1	1	Moves in Forward dir.
Downward	1	1	Moves in backward dir.
Left	1	0	Moves in leftward dir.
Right	0	1	Moves in right dir.

Below are two separate block diagrams for the system in question.

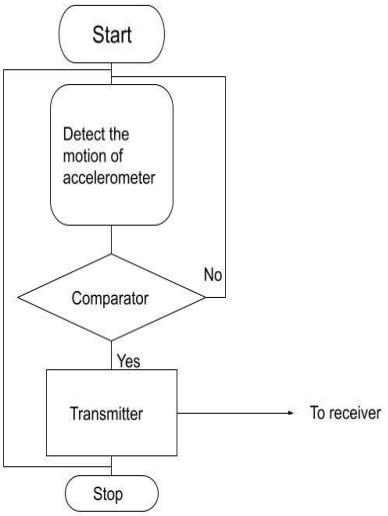


Figure1: Transmitter side

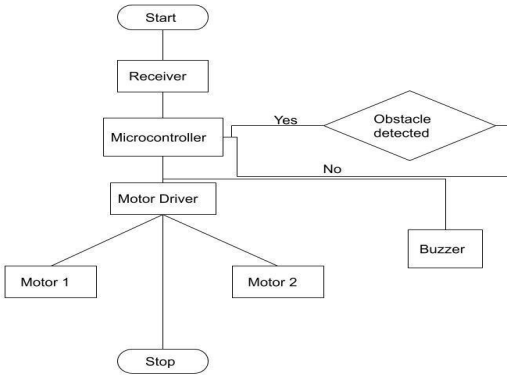


Figure2 : Receiver side

V. Proposed Design

The design of the suggested system can be broken down into two parts. First, the design of gesture recognition incorporates gesture technology. The second step is to implement the hardware, which requires assembling various sensor types and hardware control devices. The system has two Arduino microcontrollers: an Arduino nano and an Arduino Uno. An Arduino nano serves as the transmitting device, doing gesture recognition and sending orders to the Arduino uno. In this instance, motor navigation is made possible by integrating the Nano and motor driver with the aid of Arduino. Arduino gets instructions via serial communication based on input gestures from the main processing unit. Then, specific PWM impulses are directed at the motor drivers. Our system is built for obstacle detection using five Ultrasonic sensors, fall detection using an accelerometer, and emergency SMS alert feature in addition to wheelchair navigation commands.

VI. Limitations

There are a number of restrictions on the use of smart wheelchairs, despite the fact that they have the potential to enhance the quality of life for those with mobility problems. Some of these restrictions include:
Cost: Because of the cutting-edge technology and components utilized in their construction, smart wheelchairs can be pricey. As a result, many users who rely on government or insurance support may not be able to buy them.
Reliability: Smart wheelchairs can be sophisticated mach. that depend on a variety of hardware and software elements, including sensors and motors. Because of their sophistication, they are more likely to fail or break down, which is troublesome for users who depend on them for daily mobility.
Accessibility: While smart wheelchairs are made to increase user accessibility, there may be restrictions on their use in particular settings. The technology, for instance, might not work with specific building layouts or designs, which could restrict its functionality.
Training: To ensure safe and efficient use, smart wheelchairs may require specialized training for both users and carers. Some users may find it difficult to access the right training resources as a result, which can be a barrier.
Privacy and security issues may arise because smart wheelchairs may gather personal information and interact with external systems. The protection of user data and preventing unauthorized access to the system are crucial considerations for developers.

VII. Future Research and Development

Future study in the area of intelligent wheelchairs has several potential directions. Among them are:

Navigational improvement: Researchers can concentrate on creating more sophisticated wheelchair navigation systems. In order to improve the wheelchair's ability to maneuver in challenging surroundings, this may entail the use of sensors and machine learning algorithms.

Utilizing assistive technology in combination:There is a lot of potential for combining smart wheelchairs with other assistive technologies, including speech recognition, environmental control, and home automation systems. The users may be able to better manage their environment and live more independently as a result.

Creation of custom smart wheelchair systems: Researchers can work on creating custom smart wheelchair systems that are suited to the unique requirements of each user. This may entail using machine learning algorithms to alter the wheelchair's functionality based on the user's preferences and behavior.

Examining the user experience: To find out where the technology needs to be enhanced, researchers can investigate the user experience of people who use smart wheelchairs. In order to comprehend the difficulties faced by users and how intelligent wheelchair technology may be made more user-friendly, this may entail conducting user surveys, focus groups, and interviews.

Creation of ecosystems for smart wheelchairs:To create a smooth user experience, researchers might concentrate on creating smart wheelchair ecosystems that combine diverse technologies such as smart homes, healthcare systems, and transportation services. This may entail working together with business partners to create integrated solutions that satisfy user needs.

Conclusion

The ideal sensor to utilize for hand gesture-based device implementation is an accelerometer. It is extremely sensitive and a significant sensor in the sensor world since it can swiftly detect a range of motion. As a result of its small size, low supply voltage requirement, low cost, and high sensitivity, the sensor we utilized in this research allowed us to more easily implement the smart wheel chair direction control concept. For someone who needs someone else to move around, this design is incredibly helpful.

This gadget requires very little electricity to function correctly and is simple to use. By moving it in the same direction as the wheelchair, we can likewise control the speed of the wheelchair.

Here, a blind person's obstacle detection is done using an ultrasonic sensor. It is a device that uses ultrasonic sound waves to gauge a distance to an item. It transmits and receives ultrasonic pulses through the transducer in order to learn about an object's vicinity.

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Driving Towards Sustainability: The Flex Fuel Engine Solution

Dr. Suketu Y. Jani
Automobile Engineering Department,
Indus Institute of Engineering & Technology (IITE),
Indus University, Ahmedabad
suketujani.am@indusuni.ac.in

Jaypalsinh Rana
Mechanical Engineering Department ,
Indus Institute of Engineering & Technology (IITE),
Indus University, Ahmedabad
jaypalsinhrana.me@indusuni.ac.in

***Abstract*—Flex fuel engines are vehicles that can run on different types of fuels, such as gasoline, ethanol, or a mixture of both. These engines have become increasingly popular in recent years, as consumers and governments look for ways to reduce dependence on fossil fuels and promote more sustainable energy sources. The technology behind flex fuel engines is relatively simple. The engine is designed to run on a range of fuels, from pure gasoline to pure ethanol, with different levels of blending in between. The fuel system of the vehicle is equipped with sensors that detect the type of fuel being used and adjust the engine's performance accordingly. One of the main advantages of flex fuel engines is their versatility. They can be used in a wide range of vehicles, from small passenger cars to large trucks and buses. They also offer consumers greater choice in terms of the type of fuel they use, which can help reduce costs and improve fuel efficiency. Another advantage of flex fuel engines is their environmental benefits. Ethanol is a renewable energy source that produces lower greenhouse gas emissions than traditional gasoline. By using ethanol or a blend of ethanol and gasoline, flex fuel engines can help reduce carbon emissions and promote more sustainable energy use.**

In addition, flex fuel engines can help reduce dependence on foreign oil and promote energy independence. By using domestically produced ethanol, countries can reduce their reliance on imported oil and increase their energy security. However, there are also some challenges associated with flex fuel engines. One of the main challenges is the availability of ethanol fuel. While ethanol is widely used in some countries, such as Brazil, it is less common in others. This can limit the availability of flex fuel vehicles and make it more difficult for consumers to find fuel. Another challenge is the cost of producing ethanol. While ethanol is a renewable energy source, it can be more expensive to produce than traditional gasoline. This can make ethanol fuel more expensive for consumers, which can limit its use and adoption. Despite these challenges, flex fuel engines are a promising technology that offers many benefits. As more countries and consumers look for ways to reduce their reliance on fossil fuels and promote sustainable energy sources, flex fuel engines are likely to become increasingly popular in the years ahead.

Keywords—Flex Fuel, Engine

I. INTRODUCTION:

Flex fuel engines are designed to operate on a range of fuels, including gasoline, ethanol, and a mixture of both. This literature review aims to explore the current state of knowledge on flex fuel engines, including their history, benefits, challenges, and future prospects.

A structured literature review was conducted using electronic databases including Science Direct, Google Scholar, and Web of Science. The search terms used were "flex fuel engine," "ethanol fuel," "gasoline fuel," "engine performance," "emissions," "fuel efficiency," "energy security," and "costs." The inclusion criteria were articles published between 2010 and 2023, in English language, and related to the topics mentioned above. The exclusion criteria were articles that did not meet the inclusion criteria, duplicates, and articles published before 2010.

The literature review found that flex fuel engines have several advantages, including increased fuel efficiency, reduced emissions, and improved energy security. The following are the key findings from the literature review:

1. Engine performance: Several studies have shown that flex fuel engines perform well with both ethanol and gasoline fuels. A study conducted by Hosseini et al. (2019) found that a flex fuel engine achieved similar torque and power output with both gasoline and ethanol fuels. Similarly, a study conducted by Hussain et al. (2017) found that the use of ethanol fuel in a flex fuel engine improved its performance and reduced emissions.
2. Emissions: The use of ethanol fuel in flex fuel engines has been found to reduce emissions of carbon dioxide, nitrogen oxides, and particulate matter. A study conducted by Garcia et al. (2017) found that the use of ethanol fuel in flex fuel engines reduced carbon dioxide emissions by up to 90% compared to traditional gasoline engines. Similarly, a study conducted by Wang et al. (2018) found that the use of ethanol fuel in flex fuel engines reduced nitrogen oxide emissions by up to 60%.
3. Fuel efficiency: Flex fuel engines have been found to achieve similar or better fuel efficiency compared to traditional gasoline engines. A study conducted by Halder et al. (2015) found that a flex fuel engine achieved similar fuel efficiency with both ethanol and gasoline fuels. Similarly, a study conducted by Rezvani et al. (2016) found that the use of ethanol fuel in a flex fuel engine improved its fuel efficiency.
4. Energy security: The use of domestic ethanol fuel in flex fuel engines can help reduce dependence on imported oil and increase energy security. A study conducted by Koehne et al. (2018) found that the use of domestic ethanol fuel in flex fuel engines reduced dependence on imported oil and improved energy security.

5. Costs: The cost of producing ethanol fuel can be higher than traditional gasoline, which can make it more expensive for consumers. However, several studies have found that the use of ethanol fuel in flex fuel engines can still be cost-effective. A study conducted by Bambrook et al. (2019) found that the use of ethanol fuel in flex fuel engines can reduce fuel costs by up to 25%.

II. HISTORY:

The concept of flex fuel engines dates back to the 1980s, when researchers began exploring the use of ethanol as a fuel source for vehicles. In 1994, Brazil became the first country to introduce flex fuel vehicles on a large scale, with the launch of the Fiat Uno Mille Electronic Flex. Since then, the technology has spread to other countries, including the United States, Canada, and Europe.

III. BENEFITS:

Flex fuel engines offer a range of benefits, including reduced dependence on fossil fuels, increased energy security, and improved environmental performance. Ethanol is a renewable energy source that produces lower greenhouse gas emissions than traditional gasoline, making it a more sustainable fuel option. Flex fuel vehicles also offer consumers greater choice in terms of the type of fuel they use, which can help reduce costs and improve fuel efficiency.

IV. CHALLENGES:

One of the main challenges associated with flex fuel engines is the availability of ethanol fuel. While ethanol is widely used in some countries, it is less common in others, which can limit the availability of flex fuel vehicles and make it more difficult for consumers to find fuel. Another challenge is the cost of producing ethanol, which can be more expensive than traditional gasoline, making ethanol fuel more expensive for consumers.

V. FUTURE PROSPECTS:

Despite these challenges, the future prospects for flex fuel engines are promising. With increasing concerns about climate change and the need to reduce dependence on fossil fuels, flex fuel vehicles are likely to become more popular in the years ahead. Governments and policymakers can play a key role in promoting the adoption of flex fuel vehicles by supporting the production and distribution of ethanol fuel, providing incentives for consumers to purchase flex fuel vehicles, and investing in research and development to improve the technology.

VI. CONCLUSION:

Flex fuel engines offer a range of benefits, including reduced dependence on fossil fuels, increased energy security, and improved environmental performance. However, the availability and cost of ethanol fuel remain major challenges. Governments and policymakers can play a key role in promoting the adoption of flex fuel vehicles by supporting the production and distribution of ethanol fuel, providing incentives for consumers to purchase flex fuel vehicles, and investing in research and development to improve the technology.

The literature review has found that flex fuel engines have several advantages, including improved engine performance, reduced emissions, increased fuel efficiency, improved energy security, and potential cost savings. However, the availability and cost of ethanol fuel remain key challenges to the widespread adoption of flex fuel engines. Further research is needed to address these challenges and improve the viability of flex fuel engines as a sustainable energy source.

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Improving Telemedicine through Machine Learning Approach

***Hiral Choksi*[1]**
Department of Computer Engineering,
Indus Institute of Technology ,
Ahmedabad, Gujarat,India
choksihiral.20.it@iite.indusuni.ac.in

***Vikash Maheshwari*[2]**
Department of Computer Engineering,
Indus Institute of Technology ,
Ahmedabad, Gujarat, India
maheshwarivikash.20.it@iite.indusuni.ac.in

***Dr. Pooja Shah*[3]**
Department of Computer Engineering,
Indus Institute of Technology ,
Ahmedabad, Gujarat, India
poojashah.ce@indusuni.ac.in

***Abstract*— The need to increase the diagnostic precision and effectiveness of telemedicine is expanding as it continues to gain popularity. In this aspect, machine learning approaches demonstrate significant potential. In this study, we want to assess how well machine learning algorithms for telemedicine can improve diagnostic precision and efficacy. We will employ a sizable data set of telemedicine consultations and a variety of machine learning techniques, such as convolutional neural networks and decision trees, to do this. Also, we will assess how well these algorithms perform in terms of diagnostic effectiveness and efficiency, as well as any potential effects on patient outcomes and healthcare expenses. Our findings will provide light on the potential of machine learning to enhance the effectiveness and quality of telemedicine.**

***Keywords*— Machine learning, diagnostic precision, efficacy, convolutional neural networks, decision trees Introduction (Heading 1)**

I. INTRODUCTION

Particularly during the ongoing COVID-19 pandemic, telemedicine has become a crucial component of healthcare delivery. Telemedicine has become a potential strategy for providing healthcare remotely in recent years, especially in impoverished or rural areas where access to medical institutions may be constrained. Many advantages of telemedicine include better patient access, lower healthcare expenses, and more productivity. Yet, one of the difficulties with telemedicine is the efficiency and accuracy of diagnoses, which can be hampered by the absence of face-to-face communication between patients and medical professionals.

As seen in Fig. 1[2], telemedicine is frequently a component of a wider investment by healthcare organisations in information technology or the provision of clinical care.

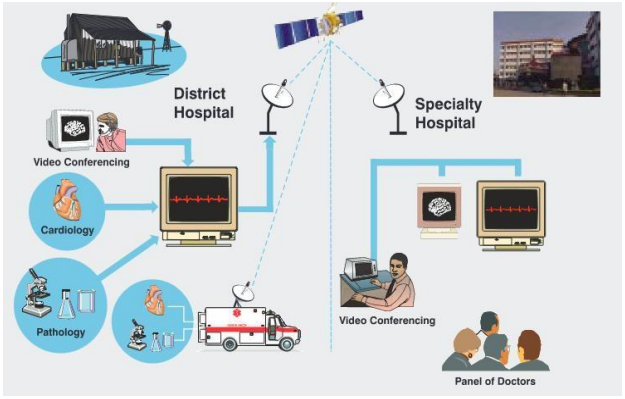


Fig -1 Telemedicine in IT

Telemedicine can offer the following services:
-Services for primary care and specialist referral

-Monitoring of Remote Patients

-Information about consumer medical and health issues

-Telemedicince Gives Chronic Patients with Less Mobility More Power

-The Power of Telemedicine in Medical education Benefits of Telemedicine

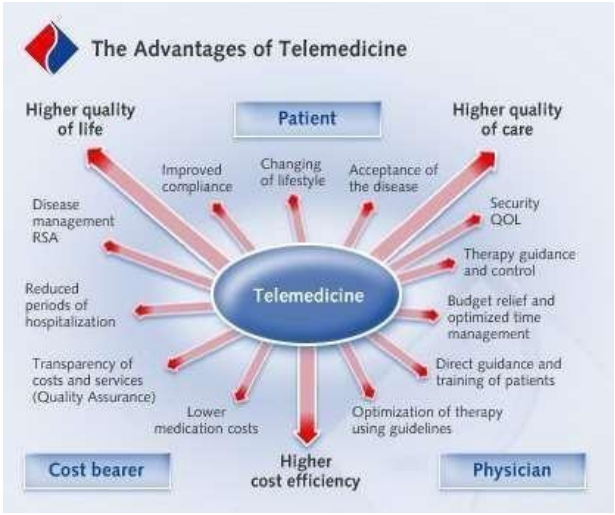
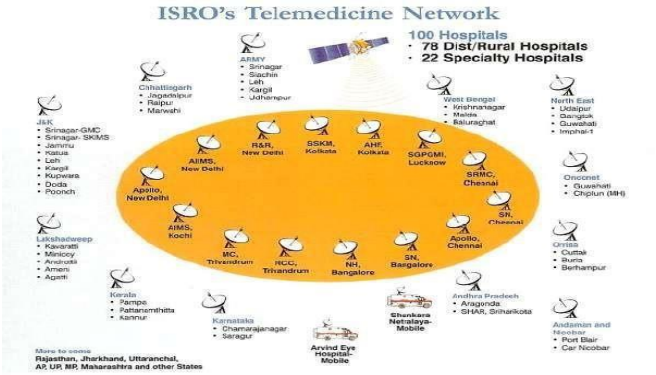


FIG -2 BENEFITS OF TELEMEDICINE

By offering automatic and precise diagnoses of medical disorders using patient data, machine learning (ML) algorithms have the ability to overcome this challenge.

We specifically apply convolutional neural network (CNN)models to a dataset for recognizing ocular diseases, and we contrast the outcomes with conventional telemedicine methods. Our research indicates that ML algorithms have the potential to fundamentally alter how healthcare is provided remotely by considerably increasing the precision and efficacy of telemedicine diagnosis.Relationship-based care is made possible by telemedicine. Doctors can keep up a dialogue with a patient much more effectively and efficiently than they could if they only used traditional interactions. When patients need help, they can receive it more quickly and easily. This is the most compelling justification for the potential growth in telemedicine. See Fig. 3[2].



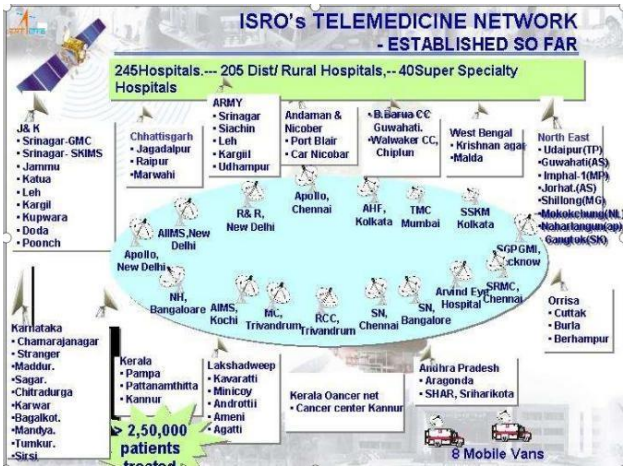


Fig - 3 ISRO`s Telemedicine Network[2]

A branch of artificial intelligence called machine learning (ML) gives computers the ability to learn from data and get better at a task without having to be explicitly programmed. In order to uncover patterns that can aid in the diagnosis of diseases, forecast the outcomes of treatment, and personalise treatment regimens, ML algorithms have been extensively employed in the healthcare industry to analyse vast volumes of medical data, including electronic health records, medical imaging, and genomics data [4]. ML has been used for a variety of healthcare tasks, including disease prediction, clinical decision support, natural language processing, and image analysis[5].

AREAS OF APPLICATION FOR TELEMEDICINE

Home-based patient healthcare, emergency services, or information services are the main applications for telemedicine. By exchanging clinical data with a healthcare provider, teleconsultations entail the use of telemedicinetools to obtain a second opinion.

Almost all medical specialties use telemedicine, but the most popular services involve the use of telemedicine resources for: transmitting or exchanging diagnostic x-ray or other images (teleradiology); managing records and electronic clinical histories (telepathology); assisting dermatology through videoconferences or image transmission (teledermatology); and assisting psychiatric patients through chats and videoconferences. To support and monitor surgical procedures as well as to execute remote surgery (telesurgery), telemedicine resources are combined with resources from virtual reality, robots, and artificial intelligence.

II. LITERATURE REVIEW

Several studies have investigated the use of ML in telemedicine to improve the accuracy and efficiency of healthcare delivery. Oztekin et al. [6] used a deep learning algorithm to diagnose diabetic retinopathy in telemedicine images accurately. Schlegel et al. [7] showed that an ML algorithm could accurately diagnose skin cancer in telemedicine images with a sensitivity of 97% and a specificity of 83%. Liu et al. [8] developed an ML-based triage system that could quickly and accurately identify patients who needed urgent care in a telemedicine setting. Althubaiti et al.

[9] used ML to develop a predictive model that could identify patients who were at high risk of developing pressure ulcers in a telemedicine environment.

Despite the promising results of these studies, there are still challenges to the widespread adoption of ML in telemedicine. One of the key challenges is the potential for bias and unfairness in ML algorithms, which can lead to disparities in healthcare outcomes [10]. Therefore, it is crucial to develop strategies to mitigate potential biases and ensure fairness and equity in healthcare delivery for ML algorithms in telemedicine.

Gaps in the Literature and Research Questions

Although there is growing evidence of the potential of ML in telemedicine, there are still gaps in the literature that need to be addressed. First, there is a need to investigate the impact of ML on patient outcomes in telemedicine, such as healthcare costs, clinical outcomes, and patient satisfaction. Second, there is a need to develop strategies to mitigate potential biases and ensure fairness and equity in healthcare delivery for ML algorithms in telemedicine. Third, there is a need to investigate the feasibility and scalability of ML- based telemedicine systems in real-world healthcare settings.

Finally, there is a need to develop guidelines and standards for the ethical use of ML in telemedicine to ensure patient safety and privacy.[11]

The factors that contribute to telemedicine competitiveness, particularly those related to the tool's introduction strategy, include an analysis of the socioeconomic context, user needs, cultural aspects, and the sustainability of the technological and innovation system associated with telemedicine in a specific area of the health care system.

CONTEXTUAL INVESTIGATION

A telemedicine program's aims and requirements must be understood in the context of social/cultural, social/health, and resource realities in order for it to be implemented successfully. To better understand the most crucial requirements, conditions, and resources for integrating the telemedicine service into the pertinent scenario (taking into account infrastructure, funding, human and organisational resources, standards, legality, ethics, and information privacy), a comprehensive analysis is needed.

IDENTIFYING NEEDS

A systematic method addresses the differences between present and expected results in evaluating unmet needs. This analysis will optimise resources and boost chances of success by avoiding the natural temptation to implement the first plausible answer (which almost always results in failure).

This examination evaluates features of health requirements as well as the characteristics of conventional services that address those needs. This evaluation can be scaled up or down to accommodate projects of any size, timeline, or budget. As a general rule, determining the size and scope of the needs assessment requires determining what type of information to collect for decision-makers, as well as establishing a plan for collecting it.

Once it is clear what information is required and how it should be structured, the data collection process, which consists of three basic stages, begins.

1. Identify the required information, as well as the sourcesand how to acquire it.
2. Next, examine the data to see if it fulfils your expectations.
3. Finally, consider whether or not to include such information in the needs analysis.

These phases are not strictly in chronological order, but they are required to ensure that the final needs analysis contains accurate information. This logical approach should undoubtedly be included in any information-based decision-making process.

Despite this wide range of diversity, three types of queries can be identified at this point of deployment. Concerns about final users

Among the relevant questions are those about patients as programme participants. This would entail inquiring as to what specific health concerns the telemedicine programme could address, as well as the prevalence of this health problem and/or the geographic region of action. What are the patients' health requirements? What are the most common health conditions that require hospitalization? Which of these requirements may a telemedicine service meet? What are the most commonly seen diagnoses? Is it possible to perform these diagnoses remotely (through ICTs)? Is it possible to treat these diseases remotely using information and communication technologies? Are patients prepared and willing to be treated via telemedicine? Is there a genuine need for telemedicine? Is there a genuine need for telemedicine?

Concerns about service delivery

A thorough assessment of needs should take into account difficulties of service delivery. If they are not taken into account from the start, the workflow may be badly impacted, and anxiety may occur in teams in charge of implementation. What disorders demand more time and/or experience to treat effectively? What more services do other health care providers in your area provide? Is your medical facility prepared and willing address (for example, training opportunities, network collaboration with specialized providers, such as Communities of Practice)? What level of training could the hospital provide?

Concerns about organizational issues

We emphasise the need of identifying the telemedicine program's aims and needs within the framework of social/health, social/cultural, and resource realities once more. Is the organisation allocating resources to do a needs assessment? What are the best specialised services for the telemedicine service? What technologies are available for telemedicine services? What legal and reimbursement requirements are available to implement a telemedicine service at the local and regional levels? Is the telemedicine programme in line with the organization's purpose or strategic plan? Is the tertiary health facility associated to the telemedicine service capable of properly treating certain diagnoses? What telemedicine services might be better suited to the existing offerings?

Resources for information

The availability or viability of data gathering sources is determined in the second step of defining needs. As a result, the types of inquiries may be limited. These data can come from two sources: (secondary) data collected by others and (primary) data that can be gathered informally.

The benefits and drawbacks of each are obvious: while secondary data is easier, faster, and less expensive to gather, it may have been collected for a different reason and hence would not provide the exact information required. With primary data, however, the exact opposite occurs.

As a result, identifying the appropriate combination of information sources will be case-specific, taking into account the constraints of the context.

III. PROBLEM STATEMENT

Simply said, medical practitioners are overworked in modern times. First of all, both nurses and doctors are in great demand. Additionally, doctors simply do not have enough time to spend with their patients. They are unable to gather sufficient patient histories, which are important for accurate diagnosis and therapy. Additionally, medical professionals are unable to devote the necessary amount of their spare time to staying current with medical research. A primary care physician would need to spend 29 hours per weekday reviewing all pertinent and recent literature, according to one study3. Due in part to this, patients experience 10-15% erroneous diagnosis and receive subpar treatments.[12]

Finding a physician in their area who can offer the best care for their particular ailment might be challenging from the patient's perspective. Finding a doctor in a rural area can be very difficult for people. Furthermore, due to the high maintenance costs of these facilities, many patients might find the cost of in-person doctor visits to be prohibitive.

It would be necessary to change one's way of thinking from experience- or rule-based care guidelines to evidence- or probability-based care in order to apply machine-based diagnostics or treatment recommendations. Additionally, a significant overhaul of how EHR systems are currently put into practice would be necessary.

IV. SOLUTION

At the moment, the telemedicine sector mostly consists of instruments for patient-doctor contact. However, as the industry develops, the use of AI and machine learning is continually growing. Chatbots, diagnostics, and therapy advice are the main use cases. Additionally, some businesses use machine learning algorithms to schedule virtual appointments and even pair patients with physicians who have treated patients with similar symptoms most successfully. Let's examine these technologies in more detail and consider potential applications while keeping in mind that many of the models utilized in practise are confidential and cloaked in secrecy.

CHATBOTS

Generally speaking, chatbots are well-suited for substituting or assisting people in data collection, reminders, and motivational messaging. They can also give patients a sense of security when a doctor cannot be reached right away. The simplest and most popular chatbots are rule- based, which means that the user's possible responses are predefined. Such chatbots can be effective when given thoroughly thought-out guidelines, but they lack the organic feel of a discussion.

Natural language processing (NLP) is a technique used by the most advanced chatbots to interpret input and generate responses. As seen in the scenario next, the bot must evaluate each message received in order to ascertain the sender's intention and the object being discussed. The algorithm will perform the relevant query, take the appropriate action, and convert the pertinent information into a convincing response.

DIAGNOSTICS

Several mHealth applications use chatbots to gather data on a patient's medical history, way of life, and symptoms in order to make potential diagnoses. Although the specifics of how each diagnostic app uses machine learning techniques are unknown, a straightforward application would probably include the following steps:

- Utilise a large dataset of patients' symptoms and verifiedor informed diagnoses from doctors.
- To develop a model for prognostication
- Create potential diagnoses for the patient of interest usingthe model.

Currently, radiology, pathology, ophthalmology, and dermatology are the medical specialties that use diagnostics in telemedicine the most frequently. Contrary to the patient history and symptom example, where a number of machine learning algorithms could be used, convolutional neural networks (CNNs) are the standard algorithm for image analysis. CNNs can, however, be used to complete a wide range of potential jobs that fall under the category of computer vision. Included in them are object detection, which counts or identifies instances of objects, picture segmentation, which divides an image, and basic categorization of the entire image.

The application of computer vision issues to telemedicine is widespread. A programme for routinely screening diabetics for diabetic retinopathy, a condition that can result in blindness, was put into place in England. Patients no longer need to visit an ophthalmologist more frequently than low- risk patients thanks to remote imaging.[14]Computer vision models were also trained to recognise melanoma, and it has been demonstrated that they outperform dermatologists in this task[15].

TREATMENT RECOMMENDATIONS

Perhaps a more challenging issue than assessing treatment effectiveness is evaluating the accuracy of diagnoses. Because of this, and given how crucial it is to employ the best medicines the first time, AI-based therapy recommendations have the potential to significantly For numerous reasons, RL cannot be employed in its conventional form. It would be exceedingly immoral to train RL models online and potentially make bad decisions that affect real patients. We must also take into account the fact that health care is based only on a person's partial observable health (non-stationary) and that treatment objectives change over time. Both of these circumstances call for unique treatment in an RL model[16]. Having said that, there are a few well-known RL applications in the medical field that take considerable care to address these modelling and ethical issues. By calculating the dosage of vasopressors and the volume of IV fluid to provide, one group has employed deep RL to reduce organ failure in sepsis patients.In a simulation scenario, RL has also been utilised for clinical trial dosing, and experiments have been conducted with limiting the number of possible dose cycles to fall within medically acceptable ranges[17].

CASE STUDY:

For the question of whether patients had time to consult with their doctors, both groups reported similar findings. The FTF participants showed a higher level of agreement (92%) than the telemedicine group (82%), when asked if their doctors were paying attention. The groups' outcomes were comparable in terms of having enough clinic time, physician support for patients, and general satisfactionas shown in Table1[18].

enhance healthcare quality. One of the best-known and most well-established examples of this, notably for advice on cancer therapy, is IBM Watson Health.

Reinforcement learning (RL), a sort of machine learning that learns from experience and aims to generate judgments that optimize a given reward function, is used in some of the most cutting-edge research in this field. The objective of employing RL for therapeutic decisions is to create a plan of care for patients that would be substantially comparable to that of an experienced doctor.

Item	FTF		Telemedicine	
Able to talk	Strongly Agree	93%	Strongly Agree	91%
	Agree	7%	Agree	9%
Physician listened	Strongly Agree	92%	Strongly Agree	82%
	Agree	8%	Agree	18%
Had enough time	Strongly Agree	93%	Strongly Agree	91%
	Agree	7%	Agree	9%
Physician gave support and encouragement	Strongly Agree	90%	Strongly Agree	91%
	Agree	10%	Agree	9%
Able to communicate comfortably	Strongly Agree	90%	Strongly Agree	94%
	Agree	10%	Agree	6%
Overall satisfaction	Strongly Agree	89%	Strongly Agree	90%
	Agree	3%	Agree	5%

TABLE -1 COMPARISON OF TELEMEDICINE AND FACE-TO-FACE(FTF) CLINIC RESULTS

Ensure the long-term viability of the telemedicine service
Due to restricted resources, it is logical to believe that not all solutions are viable. At this phase in the process, needs have been recognised, and it is clear how much the current and future settings can withstand internal and external influences. With these conditions in mind, a range of remedies to the observed health problems can be considered; these may or may not function at one or more levels of practise or process, and they may or may not answer to more than one need. However, not all solutions are optimal for specific settings, culturally sensitive, or environmentally viable.The analysis should take into account potential costs and the proportion of the population that would be impacted, the complexity of implementation, the infrastructure that is already in place and is required, funding, human and organisational resources, the ability of professionals to implement it, legal considerations, industry standards, and ethical and privacy concerns. The options that are provided can be organised using these features. When there is insufficient information to determine objective priorities, a more individualised approach should be taken.

The distinction between "what would be good to have versus what might be nice to have" can now be made for each prospective solution[19]. These novel approaches merely represent a different way of doing things rather than required complex technology solutions.

This is unquestionably a crucial phase in creating the strategy for telemedicine service implementation, as it establishes the direction for resource allocation and looks for political will to build ICT infrastructure. The advisory team for the telemedicine project should be formed at this point by a large group of local stakeholders (at the institutional, regional, and national levels), including governments, representatives of the public and private sectors, and scientific experts (who may later join the local work group). The group should be made aware of every piece of information obtained and examined in the preceding actions. Its main responsibility is to assess identified and prioritised demands while taking the situation into account and coming up with creative solutions.

When evaluating implementation, it's important to comprehend the aspects of telemedicine that are directly related to various aspects of an organization. Work teams, training, organizational structure, compensation and incentives, and relationships with direct external agents are a few examples of these. Specific tasks are assigned, carried out, and coordinated by an organization, which is defined as a consciously coordinated social unit. Depending on the organization's physical form, social relationships, technological capabilities, and organizational culture, several definitions and techniques are used to describe the parts that make up the organization. As a result, an organization's structure dictates how tasks are distributed, information systems, and means for interaction and coordination. The organization and its function may also be influenced by additional factors relating to the social and cultural setting. Organizations can be classified as network organizations, matrix organizations, or profit-centered organizations. Aspects relating to the organization are made more difficult by the complexity of health care systems and, in particular, their processes. The goals of an organization are typically long-term commitments that coexist with other goals. Organizational elements involved in establishing a telemedicine service

Process:

Establish efficient communication channels, ensure clear, recognizable, and proactive leadership, and establish all requirements and specifications from the outset.

- Establish precise goals while outlining roles and duties;
- Set reasonable goals and take care not to underestimate theproject's complexity;
- Establish time constraints that are reasonable and give the programme credibility; • Specify how the telemedicine programme influences the healthcare system;
- Examine both internal and external influences on the organisation;
- Be mindful of all technological challenges, making sure that the technology being used is practical and user-friendly; Establishing goals for health policies that cover data protection, security, and other ethical and legal considerations. Making sure that developers and users of telemedicine programmes are aware of privacy concerns.
- Verify that technology has room for growth.

STRUCTURE:

Health professionals who will later use the new telemedicine service should be involved. Telemedicine projects should be strategically aligned between various participants. Defined roles will be impacted, responsibilities will be redistributed, and new professional profiles will be created. Individuals' level of competency in computing environments and/or the necessary skills to develop the programme safely should be improved. Incentives should be established to overcome resistance and fear. Training options should be established.

Budget:

•Establish collaboration with other organisations participating directly or indirectly in the project (healthcare, businesses in the technological and service sectors, administration) outside of the customer-provider relationship. Create and implement a business plan that includes implementation costs (initial funding and sustainability of the project).

• Gather the resources required for implementation and longevity. The plan should take into account the changesthat must be made, the demand for human and technological resources, the need to spread the new service, as well as the required time and finance.

Management and control

Establishing strong procedures for continual review; establishing efficient governance systems; and monitoring user needs while monitoring service operation are all important.

Organizational culture

Keep in mind existing views on telemedicine: ascertain cultural disposition towards telemedicine as a regular component of clinical practise, and ascertain prior experiences with health care models designed to incorporate technology; • Create an emotional bond and a sense of belonging to the project; • Strategically align all the participants;

• Take into account the different interests, worries, and priorities of health professionals who must implement telemedicine compared to those who are promoting the technology; • Work on the resistance to change: a certain level of initial uncertainty occurs when professionals must change routines with which they feel comfortable for new and unfamiliar ones;

V. IMPLEMENTATION

This study represents a pioneering effort aimed at enhancing telemedicine using advanced machine learning methods through the analysis of two distinct datasets. As part of our investigation into optimizing clinical decision- making underpinned by big data analytics and predictive modeling processes, we utilized the Hospital Mortality Prediction dataset comprising over 58K anonymized hospital admissions coupled with more than three dozen different features correlated with clinica outcomes such as demographic information, laboratory results & medication utilization trends. By leveraging Naive Bayes Machine Learning algorithms we were able accurately to predict in-hospital mortality with an impressive accuracy rate of 87.209%. This models performance underscores its potential as an effective tool for predicting patient outcomes and identifying high-risk patients to facilitate proactive interventions for unfavorable outcomes.

Using advanced machine learning techniques such as K Nearest Neighbors (KNN) we examined data retrieved from eight parameters including age, BMI, and blood pressure among others collected from a sample size comprising 768 individuals belonging to Pima Indian population suffering from diabetes or at higher risks associated with it. The precision rate achieved through our model stood at a remarkable percentage of about 79.870% underlining the efficacy of our approach to identify patients prone to diabetes and create tailored treatment plans for managing their condition.

Our research involved utilizing the Naive Bayes machine learning algorithm with a diabetes dataset and achieving an accuracy rate of 71%. While not as impressive as the KNN model's result our findings showcase the vast potential of applying machine learning techniques to enhance medical diagnosis and decision-making processes significantly. With predictions made by such algorithms readily available to healthcare providers remote patient monitoring becomes more efficient than ever before. However, there remains much work ahead before we can confidently integrate these predictive models into clinical workflows without any reliability issues and ensure that they are correctly utilized.

VI. CONCLUSION

There is still a lot of reticence to implement telemedicine solutions more generally, despite the possibility that telemedicine plus AI could improve patient outcomes. One reason is that many people would never give up the personalized care that may be obtained via in-person doctor visits. Patients and medical professionals will both have legitimate reservations about relying on AI for diagnosis and treatment. There are still unanswered questions regarding how liability would alter if machines were used tohelp make healthcare choices.[13].

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