

# INTERNATIONAL CONFERENCE ON ADVANCES IN BUSINESS MANAGEMENT AND INTELLIGENCE SYSTEM-22



**INTERNATIONAL CONFERENCE ON ADVANCES IN BUSINESS  
MANAGEMENT AND INTELLIGENCE SYSTEM-22**

**Archers & Elevators Publishing House**

**Bangalore - 560 090 India**

**ARCHERS & ELEVATORS PUBLISHING HOUSE**

**No.54, MM Layout,**

**Hesaragatta Main Road,**

**Bangalore -560090**

**Mob: + 91 9164362263**

**E-mail: archerselevators@gmail.com**

**Website: www.aeph.in**

***International Conference on Advances in Business Management and Intelligence System-22***

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First Edition 2022

**ISBN: 978-93-94958-30-2**

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**PRINTED IN INDIA**

A & E printers, Bangalore-90.

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# **FACTORS AFFECTING POST-DISASTER RECOVERY OF THE TOURISM INDUSTRY IN INDIA: A CONCEPTUAL MODEL**

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## **Abstract**

The tourism sector plays a prominent role in the country's social, economic, and cultural development. However, disasters such as floods and earthquakes have adversely impacted the tourism industry. In response to natural disasters, many stakeholders, including public and private organizations, local communities, peoples, and Government, support the tourism industry's post-disaster recovery. Nevertheless, there is a lack of systematic research focused on the factors that influence the post-disaster recovery of the tourism industry. Therefore, to fill the research gap, the study aims to present a conceptual model depicting the relationship among the factors influencing the post-disaster recovery of a country's tourism industry. The present study undertakes a comprehensive and rigorous review of contemporary literature allied with a discussion with the practitioners and academicians involved within this field of study. The conceptual model comprises seven constructs that offer future research opportunities within the dynamic and contextually driven field. The constructs are destination differentiation, social media utilization, coordination efforts of stakeholders in the tourism industry, promotional discounts, role of media, and government support on the post-disaster recovery of the tourism industry. The study provides the basis for empirical research, including empirical validation of the developed model. The outcome of this study will encourage further research in this largely neglected field. Practitioners can also benefit from the conceptual model and foster post-disaster recovery of the tourism industry. To the best of our knowledge, the study is one of the first to propose a conceptual model for the previously under-researched area of post-disaster recovery of the tourism industry.

**Keywords:** Strategy; Tourism industry; Disaster; Performance; Conceptual model.

**Paper type:** Conceptual paper

## **1. Introduction**

Tourism refers to "activities of persons traveling to and staying in places outside their usual environment for not more than one year for leisure, business, and other purposes"[1]. Globally, the tourism sector has emerged as a significant industry that has influenced the country's economic growth and generates employment opportunities[2], [3]. The tourism sector has immense social, economic, and cultural benefits. It is a source of foreign exchange earnings, infrastructure development, restoration of culture, and environmental preservation. It is also responsible for increasing people's living standards and promoting harmony in many countries.

The tourism industry is amongst the most critical sectors in developing nations such as India [4]. The Indian tourism industry has shown phenomenal growth in recent years and is recognized for the lavish treatment of tourists [5]. The Indian slogan 'Athithi devo bhava' means that visitors are like God, despite their country (Ministry of Tourism (MoT), 2011). The incredible natural beauty and cultural heritage, varied lifestyles, foggy hill stations, serene backwaters, monuments, pilgrimage sites, visitor-friendly traditions, and colorful fairs and festivals hold an abiding attraction for tourists. India's "Make in India" initiative includes tourism critical components. Tourism is a significant economic multiplier. It is becoming increasingly crucial as India strives to grow rapidly and create jobs. The tourism sector encourages the development of facilities such as hotels, resorts, and restaurants and improves the transportation infrastructure (airports, roads, shipping, and railways) and healthcare facilities. However, globally, the tourism sector is vulnerable to many forms of crisis and disaster[6], [7].

Disasters such as earthquakes, floods, volcanic eruptions, avalanches have severely affected many tourist destinations[7]–[13]. Besides the enormous loss of precious life and infrastructure, these disasters have inspired lingering fear and have raised concerns about the places' safety. This resulted in decreasing tourist arrivals worldwide[14], [15].



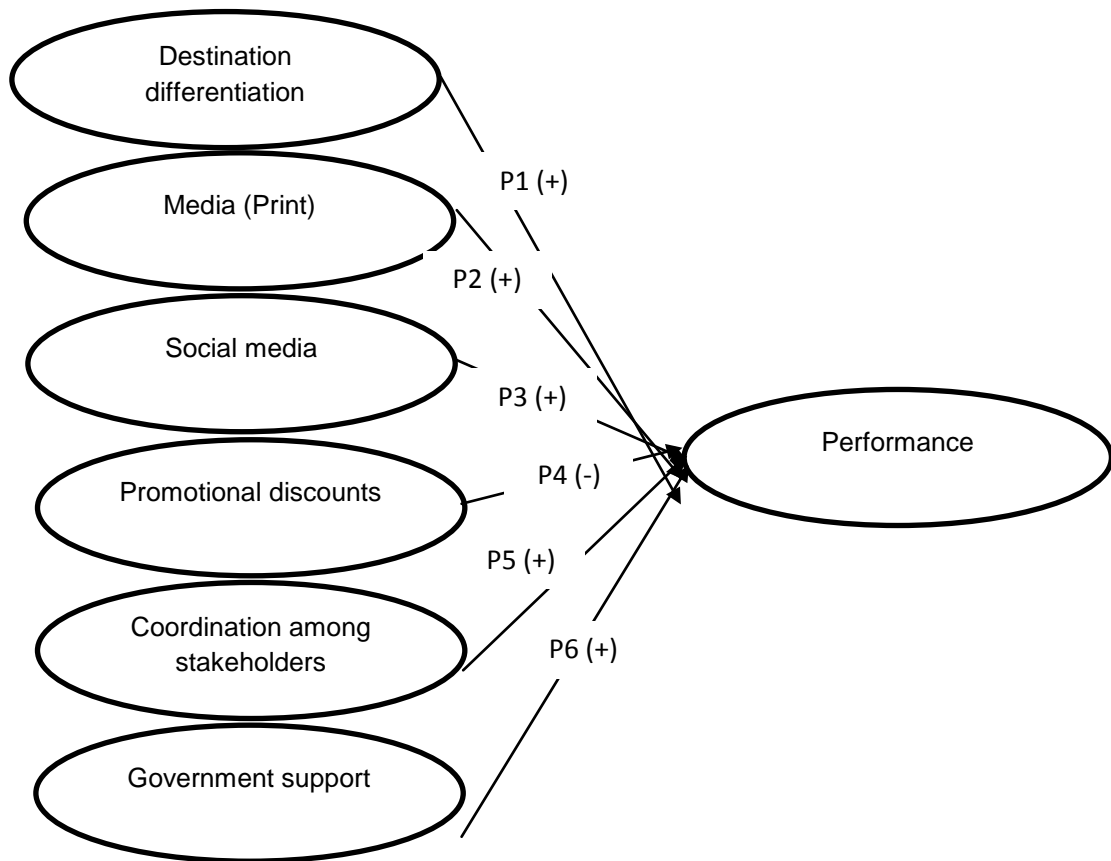
A disaster can cause a substantial fall in employment in the short run. Tourism agencies in these destinations must act quickly to minimize any negative impact on their country's tourism industry. In response to natural disasters, many organizations assisted the post-disaster recovery of the tourism industry (e.g. [16]). While highlighting the merits of an investment in disaster risk reduction, researchers recognize the tourism sector's resilience in terms of both supply and demand [17]–[19]. Resilience is known as "ability to absorb shocks, to avoid crossing a threshold into an alternate and possibly irreversible new state and to regenerate after disturbance"[16]. It further "encapsulates a paradigm shift that accommodates the analysis and facilitation of growth"[20]. The resilient community provides supports to cooperate more effectively. The efficiency of the tourist destination's resilience is enhanced when all stakeholders, including the Government of the country, the private sector, the media, and other organizations, work in a coordinated manner[9].

The adverse effect of the disaster on a tourism destination is both abrupt and possibly long-lasting. These events affect emerging economies prone to disaster, such as India, Nepal, etc. For example, after the disaster in Uttarakhand, India, on June 14, 2013, many tourists abandoned their plans in the Uttarakhand and nearby areas[21]. There was a sharp decrease of 85 percent in tourist numbers, resulting in around 1,800,000 unemployed in Uttarakhand and neighboring areas for around six months. Hotels in Nainital and Mussoorie generally see 100 percent occupancy during some times of the year. However, rates dropped to less than 20 percent after the disaster (ASSOCHAM, 2013). According to the PHD Chamber of Commerce of India (PHDCCI), the estimated loss to the economy is about Rs.12,000 crores. The occurrence of a disaster affects the domestic tourism countries and adversely affects the tourism sector of neighboring countries. For example, the tourism sector of the Maldives was adversely affected by the political unrest in Sri Lanka, as the Maldives is often considered an add-on destination to Sri Lanka.

Due to the importance of the tourism industry in the economic development of a country, several disaster management frameworks were developed for the tourism industry (e.g., [22]). There is, however, a dearth of studies focusing on the interrelationship between the factors influencing the post-disaster recovery of the tourism industry. Consequently, the current study presents a conceptual model depicting the relationship between the factors influencing the post-disaster recovery of the tourism industry.

## **2. Conceptual model development**

The literature supports the need to develop a conceptual model describing the relationship between the factors affecting the post-disaster recovery of the tourism industry. The proposed conceptual model in Figure 1 consists of seven constructs that are dynamic and contextually driven: destination differentiation, social media utilization, coordination efforts for linking the stakeholders of the tourism industry, promotional discounts, role of media, and government support for the post-disaster recovery of the tourism industry.



**Figure 1: Conceptual Model**

### ***Destination differentiation***

The primary intention of tourists who visit any place is to experience tangible and intangible features. Tangible features include geographical features such as beaches, deserts, mountains, or historical sites, while intangible features include traditional culture, history, etc.[23]. Before visiting a particular site, a tourist will have pre-existing impressions about that place. This positive perception in the mind of a traveler will influence the final decision to visit a destination[24]. Thus, destination differentiation, i.e., creating a distinct image in the minds of leisure travelers, plays a critical role in improving the tourism inflow[25]. The contemporary literature on the tourism industry asserts the positive relation of destination differentiation on the inflow of travelers within the industry.

Similarly, after a disaster, a destination's competitiveness is vital for rebuilding the tourism inflow in a particular area. After the disaster, stakeholders in the tourism industry are expected to highlight the uniqueness of a region, such as geographic features and historical importance, instead of luxury facilities available at that site. Destination differentiation would affect media reporting after a disaster. Thus, this leads to the proposition:

**P1: Destination differentiation positively influences the post-disaster recovery of the tourism industry.**

### ***Media***

Media is the most critical communication method, i.e., spreading the message to a wider audience. For this paper, media refers to television, radio, and newspapers. The media can play a vital role in disseminating information and knowledge in pre-and post-disaster phases. The media can develop or create a positive public opinion with ease about the safety of a particular destination after a disaster[26]. This will further trigger positive associations with the destination and distinguish it from other places. Thus, media significantly affects the relationship between destination differentiation and post-disaster recovery of the tourism industry. Media reporting is vital for tourism as it will affect the ultimate decision of visitors to travel to a particular destination. For example, media reporting highlights people's interest in the destination. Ideally, decisions to visit a particular destination are being made by those who have never visited a particular destination in the past. They are unaware of the extent of a disaster and the area affected. Those media reporters, such as newspaper journalists, should understand the importance of reporting and report only factual information. For instance, they can identify those areas particularly affected and highlight the safety and facilities of nearby areas. They can also cover the positive stories about particular destinations even after a disaster in a nearby location. This leads to these propositions:

**P2: The media reporting (print) positively influences the post-disaster recovery of the tourism industry.**

### ***Social media***

Social media is defined as "a group of internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user-generated content." Social media includes social networking sites such as Facebook, LinkedIn, Twitter, blogs, consumer review sites, internet forums, etc. Existing research highlights the importance of social media such as tourism websites in improving the tourism industry's performance [27]. These are recognized to advertise the uniqueness of a destination, such as local cultures and cuisines (du Rand et al., 2003). Social media is widely acknowledged for its importance in sharing experiences about a particular destination. Similarly, social media also supports the development of travel plans [28], [29].

The role of media is widely acknowledged in the post-disaster recovery in the tourism sector [30]. In the aftermath of a disaster, the utilization of social media such as Facebook, Twitter, etc., could be vital in promoting safety in a particular place. Showing photographs and videos about the current situation in a disaster-affected area, posting stories about having fun, promoting the safety of hotels and attractions operating as usual in unaffected areas can all play a vital role in the post-disaster recovery of the tourism industry. In this way, social media can promote the post-disaster recovery of the tourism industry. Thus, this leads to the following proposition:

**P3: The degree of social media use positively influence post disaster recovery of the tourism industry.**

### ***Promotional discounts***

Amongst the most frequent search, keywords on the internet are 'free', 'discount', and 'price' [31]. Existing research reports the importance of promotional discounts in improving the tourism industry's performance. However, promotional discounts will not support the process of post-disaster recovery of a tourism destination. Tourists cannot be motivated to visit a crisis-hit destination by providing additional discounts. This may devalue the image of a destination in customers' minds [32]–[34]. Once conditions come back to normality, it is difficult to improve the perceived value of the destination; customers actively seek discounts to visit a particular destination. Offering discounts post-disaster may be misconstrued by potential visitors. This leads to the following proposition:

**P4: The promotional discounts negatively influence the post-disaster recovery of the tourism industry.**

### ***Coordination efforts for linking the stakeholders of a tourism industry***

Zahra et al. [35] pointed out that coordination involves "formal and informal efforts to resolve disputes, disagreements, or conflicts about the nature and scope of capabilities to be built and how to obtain needed resources [36]." Coordination refers to working jointly compared to working in isolation to improve the industry's performance [37]. Resources are limited in terms of manpower, capital, etc., to improve the post-disaster recovery of the tourism industry. This triggers the need for stakeholders to coordinate with each other as strategic planning is vital to revamp the tourism sector after a disaster. For example, coordination among the stakeholders will support training and personnel development and improve the tourism industry's performance in times of disaster. This leads to the following proposition:

**P5: The degree of coordination among stakeholders positively influence the post disaster recovery of the tourism industry.**

### ***Government support***

The Government's role in developing and promoting tourism is vital, involving policies and political philosophies. Over the years, promoting and nurturing the tourism industry has been the foremost economic priority of the Government [38]–[40]. Tourism policy is a tool for both national and local governments to develop specific areas, technologies, products, and services to create jobs, generate wealth, and promote development [41]. An investment in tourism is not simply for constructing buildings and infrastructure but to improve people's skills and living conditions. The Government can frame policy and guidelines for the promotion of ecotourism. Besides direct support, indirect support can be provided, such as extending the accessibility of tourism destinations through tourist-oriented macroeconomic infrastructure, raising input on environmental protection and restoration, and extending support through marketing. These measures can all be provided by the Government. Also, the organizations' indirect support is of paramount importance for improving the performance [42], [43].

Governments also have a role in improving transportation and communication infrastructures, reducing corruption, and fostering peace and stability, which contribute to a destination that travelers are more likely to want to visit. The Government can develop a comprehensive plan in coordination with stakeholders of the tourism industry to support the post-disaster recovery of the tourism industry. The Government can provide subsidies to tourism stakeholders immediately after the disaster. However, the utilization of social media could negatively affect the post-disaster recovery of the tourism industry if not utilized properly. For example, rumors about a particular destination may compound the adverse effect on their tourism industry. Media-led stories may increase public anxiety if reported negatively. Therefore, social media utilization should abide by the rules and guidelines set by the Government. This leads to our following proposition:

**P6: Government support positively influence the post-disaster recovery of the tourism industry.**

### **Discussion and implications**

Disasters, either man-made or natural, cause social unrest and economic pressures. Due to globalization, the effects of these disasters affect the host country and many other countries. To bring the life of the affected peoples back to normality, the tourism industry can play a vital role. Yet, existing literature lacks a conceptual model depicting the factors affecting the post-disaster recovery strategy of the tourism industry. This study attempts to fill the knowledge gap by incorporating the views of practitioners and academicians views within this field to propose a conceptual model. Also, the study reviews the roles of destination differentiation, social media utilization, coordination efforts for linking stakeholders, promotional discounts, the role of media and government support in post-disaster recovery of the tourism industry. Finally, the current study formulates a conceptual model with propositions to answer the research question.

The propositions were supported by the arguments on how these factors may influence the post-disaster recovery of the tourism industry. Proposition 1 suggests the positive influence of destination differentiation on the post-disaster recovery of the tourism industry. Natural disasters are significant life events [44] that interrupt the inertia that guides human behavior [45]. The desire to provide some support to disaster-affected peoples leads to the areas being visited with actual media reporting about the place's safety from the site. Similarly, propositions 2 and 2a suggest the direct and moderating impact on the tourism industry through destination differentiation. Tourists generally avoid trips to those locations where they are concerned; they will be unsafe or avoid being a target. Because most travel decisions are made by people who have never seen the place first-hand, the tourism sector heavily relies on media reportage. The media's responsibility is to be truthful and factual in their presentation of a particular destination's attractions, activities, facilities, and accommodations.

Proposition 3 suggests the positive influence of social media on the recovery of the post-disaster tourism industry. The realities of a post-disaster situation at a particular site could enhance the tourism flow. As the importance of social media utilization is widely acknowledged in the tourism industry, this is meaningful in the post-disaster tourism industry recovery. Media can play an active role in promoting the tourism industry after the disaster by creating blogs, sharing situation updates about various tourist places, and creating awareness and positive images about the safeness of the place. Proposition 4 suggests the negative effect of promotional discounts on the post-disaster recovery of the tourism industry. However, in stable environments, research suggest that both domestic and international visitors make repeated trips when offered discounts. Thus, in stable environments, promotional discounts positively affect the tourism industry.

Proposition 5 suggests the positive effect of coordination on the post-disaster recovery of the tourism industry. However, achieving coordination among the many stakeholders of the tourism industry is challenging due to the difference in priorities of these stakeholders. For example, the Government is interested in long-term solutions while tourism agents are more interested in short-term plans as their livelihoods depend on tourism only. Those industries, such as tourism, those address the immediate needs of the community. And the needs of the individual and his community override the barriers to coordination, at least temporarily, until the situation returns to normal; even this will open a path for long-term collaboration among the stakeholders. The realities of a post-disaster setting for people are characterized by a potential decrease in access to credit, increased labor costs, and constantly changing regulations [46]–[48]. The Government should also look into the aspect of illegal mining as it is a severe threat to the environment. It has been shown that the impact of floods is also increased due to illegal mining and illegal construction. Therefore, decision-makers should consider these aspects while making policy. They will ensure that formal rules and regulations are followed strictly. The Government can enforce the rules and guidelines to be followed by the media while reporting on stories about the disaster.

This indicates the importance of the role of the Government in rebuilding the tourism industry after the disaster, as depicted in propositions 6a, 6b, 6c, 6d, and 6e.

## **Conclusion**

The immediate post-disaster recovery of the tourism industry is vital for the economy. Stakeholders must work collaboratively to achieve this common goal under the direction of the Government of the country. Similarly, these stakeholders can utilize social media and work with national media to create destination differentiation and highlight the safeness of the place. This present study discusses the development of a conceptual model that integrates the factors in improving the post-disaster recovery of the tourism industry. This study has extended the body of knowledge in these ways.

First, the study proposes that if a resilient community tries to act collectively in a more collaborative manner, then the efficiency of the tourist destination's resilience is enhanced; this happens when all the actors, including Government, the private sector, the media, and other agencies work in a coordinated manner to devise and execute a recovery plan [9]. Second, the study proposes that promotional discounts may negatively affect the post-disaster recovery of the tourism industry. Third, attraction to a destination can be developed by efficient marketing practices, including better utilization of social media to highlight the safeness of the place. Fourthly, the role of the Government is crucial and is the most important factor in enhancing the performance of the tourism industry. The Government can enhance the coordination among stakeholders. It can also harness social media by creating blogs, sharing situation updates about various tourist places, and creating awareness and a positive image about the safeness of a place in the minds of tourists. Government support is also essential for devising an official tourism disaster management plan; machinery for its successful implementation must be provided.

## **Limitation and scope for future work**

The present study is expected to serve as a roadmap for further studies in the domain of tourism after the disaster has struck. However, there are certain limitations of this study that need to be acknowledged at this stage. First, the study results are based on a single case of a disaster; hence results cannot be generalized. Therefore, more research is required on other types of disasters occurred in different countries. Second, there are likely to be differences within and between government and commercial organizations that are not apparent in the results. This study provides the foundation for additional research in the tourist business, be it theory development or theory testing. Future research is expected to elucidate the linkages between tourism, disasters, and recovery. Future research is also needed in developing a separate disaster recovery plan for various sectors such as tourism and real estate. Resources and machinery need to be provided to promote ecotourism to preserve and sustain the diversity of India's natural and cultural environments.

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# IMPACT OF AI ON VARIOUS STAKEHOLDERS IN EDUCATION

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**Abstract:** Artificial Intelligence is changing the way most of the businesses are operating today. Growth of AI has spurred funding in this sector for the start-ups resulting in \$1108 million in 2021 for AI start-ups. Ed tech industry is the third most funded sector. This is bound to revolutionise the education system soon. This review paper has attempted to highlight the role of AI in education. It has studied various papers relating to the role of AI, problems and benefits of AI and has classified the impact of AI on various stakeholders primarily on teachers, students, and the Educational Institutions.

**Key Words:** AI in Education, AI for students, AI for teachers, AI and NEP,

## I. Introduction

Today Artificial Intelligence has become a part of our everyday life. Most of the businesses are adopting AI in one form or the other to improve their customer experience. Education Industry is also not left behind. (Branson et al., 2019).

In India during the year 2021 Indian start-ups in the AI domain received a funding of \$1,108 million. The funding was \$836.3 in the year 2020. This results in growth of 32.5 percent from the previous year. (Rahul Bhorayal, 2022). Out of these the edtech startups have received a funding of \$4.7 billion funding in 2021. Ed tech startups were the third most funded sector in 2021. (team Inc42, 2022). The edutech sector is bound to grow soon in India. It is forecasted to grow to \$11.6 billion by 2026. This shows that the growth is permanent and is not temporary. (Sajal Singh, 2022)

## II Theoretical Background:

### A) Artificial Intelligence

Artificial intelligence (AI) is the ability of a computer, or a robot controlled by a computer to do tasks that are usually done by humans because they require human intelligence and discernment. (Copeland, 2021). As a term AI is very difficult to be defined as it is interdisciplinary and continuously evolving field of study. (Chen et al., 2020) For a common man, AI is intelligent computer that can automate tasks traditionally done by humans. Thus, Artificial intelligence (AI) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.

### B) Education System

In the ancient times, India followed the gurukul system of education where the student was given personalised education in terms of skills, values, morals, knowledge etc. by the Guru. There was an emotional relationship between the Guru and his disciple, and the Guru will impart training based on the student's requirements and ability. The introduction of formal education system by the British, emphasised on standardisation of education and thus was born our current education system. With Artificial Intelligence in Education there is a ray of hope that again we may be able to get the benefit of personalised education. This will help in bringing out the best from everyone based on his or her capability.

## III Artificial Intelligence and New Education Policy:

The New Education Policy (NEP) 2020 has highlighted the importance and role of Artificial Intelligence in education at all levels in the future. To prepare the students for the AI economy, the NEP has emphasised on imparting the necessary technical and digital skills at all levels of education. At the school level to give the exposure to digital literacy, coding and computational thinking new subjects like Artificial Intelligence and Design Thinking are introduced. At the college level, to prepare the students for industry ready professionals, courses in Artificial Intelligence, Machine Learning, Big Data Analysis, 3-D machining are offered. All universities will be offering doctoral and master's program in areas of Machine Learning. In addition to introduction of various courses for careers in AI, colleges may also offer vocational courses or training in low expertise tasks to support the AI value chain. (Samiksha Mehra, 2020)

## IV Literature Review:

The education system needs to implement the latest technology like Artificial Intelligence in order for it to be in line with the latest developments in the world. (Chatterjee & Bhattacharjee, 2020). Intelligent Tutor Systems (ITS) have been used to teach popular subjects like science, mathematics and other languages etc (Ocaña-Fernández et al., 2019)



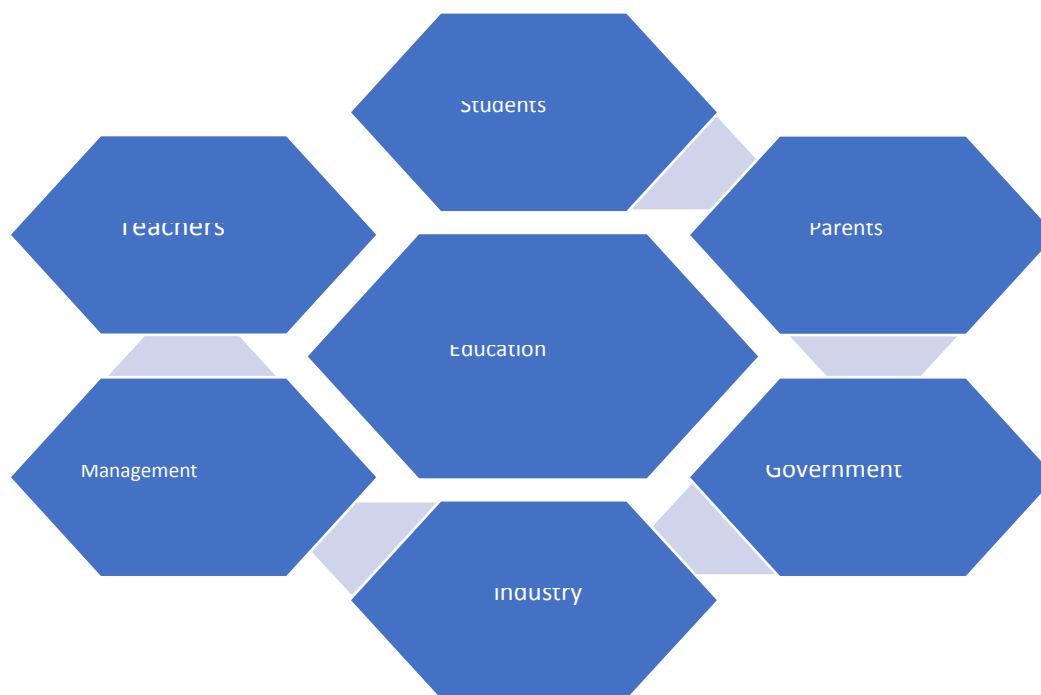
Artificial intelligence in education is used at different levels. There are basically 3 layers or levels of AI as applied in education. The first level or the basic level is the conversational Interfacing which allows just surface level interactions with students like sending emails or messages to students. The next level is contextual interfacing which is a blend of conversational interface with some traditional graphic user interfaces. The next level is integrating the contextual interface with unstated needs of the user and helps in predicting their behavior.(Branson et al., 2019)

AI usage has been undergoing paradigm shift in education. This has been classified into three paradigms: AI directed, AI Supported and AI Empowered. In AI directed stage the learner is a mere recipient whereas in AI supported the learner's role is enhanced to a collaborator and in AI empowered, the learner as the leader.(Ouyang & Jiao, 2021)

Artificial Intelligence can be applied in varied aspects of teaching learning processes and improving the competencies of the teachers. According to Klutka et al, the goals of AI in education are to increase outcome, access and retention, and lower time and cost. (Bates et al., 2020). In the educational set up teaching learning processes, Artificial Intelligence can help in better achieving the educational goals.(Fahimirad, 2018). Application of Artificial Intelligence are finding their way into education field in various forms like chatbots, engagement platforms, automated assessment systems, self-directed learning and sentiment analysis etc.(Sharma, 2021)

## V Impact of Artificial Intelligence on various stakeholders

Education system comprises of the formal educational institutions. There are various stakeholders of educational institutions. Primarily students, teachers, Management (administrators), Policy makers or Government, Parents, and Industry which employs the students. Among these stakeholders, the role of teachers, students and Management is most important when it comes to implementation of AI in education. Hence the study is focused on the impact of Artificial Intelligence on these stakeholders.



**Fig 1: Stakeholders in Education**

### A) Impact of AI on Teachers.

The impact of Artificial Intelligence is felt on the most important stakeholder in education which is the teacher. They are the epicenter of this as they impact the teaching learning process with their pedagogy. (Chaudhry & Kazim, 2021). AI will be augmenting the teachers and not replacing them. Many fear that in future, AI will replace human teachers but that is not true. AI can augment the teachers and not replace them.(Holmes et al., 2019; Popenici & Kerr, 2017)

**1) Task Automation leading to reduced workload:** AI helps in reducing the day-to-day administrative burden by automating the routine tasks like attendance handling and inventory management. This not only makes the tasks done faster and also error free, but it also spares more time for the teachers to prepare for their classes and upgrade their skills.(Popenici & Kerr, 2017; Sharma, 2021)

Biometric authentication records help in attendance monitoring at the institute level and also at the national level to keep track of the youth and adult participation in education, gender diversity etc. (Roy, 2020)

**2) Continuous upgradation of skills:** The biggest challenge that any faculty will face with experience is to keep themselves constantly updated with the latest in their domain area. AI will assist and help the faculty to overcome this challenge by feeding them with the required knowledge from time to time and sharing with them the latest happenings in their domain area. (Woolf et al., 2013)

**3) Assessment:** AI has changed the assessment style where it can consider not only the responses to the quizzes and tests but can also include all forms of student engagements like resource content revised, interaction with peers, teachers and all kinds of student work assigned and completed. (Cope et al., 2021) The assessments are currently standardized have the drawback of their inability to consider the complete range of students' abilities and provide their holistic assessment. This can be overcome easily with AI based assessments that can consider each asset and strength of the student while assessing them. (Chaudhry & Kazim, 2021) AI can help the faculty to predict the students' requirement for additional support and attention (Fahimirad, 2018)

**4) Identify slow learners:** Through data mining and interaction data, AI can help the teachers in identifying the slow learners and the kind of difficulties that the students face. This helps them to prepare adequate support material or alter their teaching styles for such learners and assist them in better understanding of the concepts taking into account their individual strengths and weaknesses. (Woolf et al., 2013)

**5) Facilitate personalized coaching:** Using AI can assist the instructors to identify the slow learners, and this will help them to personalize their course material for such learners. If the student is found to be weak in certain areas, AI will identify that and bring it to the notice of the instructor who can take appropriate action at the right time to assist such slow learners with additional guidance. (Fahimirad, 2018) IBM's Watson classroom helps the teachers in gaining insights about the learning styles, attitude and preferences of each student which helps in personalized coaching (Tuomi, 2018)

**6) Identify Course material gaps:** It also enables the faculty to identify the areas in their course material that needs to be improved by identifying the gaps in their material which might have led to confusion in the students' comprehension of the topic. (Fahimirad, 2018)

**7) Develop courses:** AI helps in tailoring the classes according to the students' profile and can also assist the faculty in homework. Some of the AI tools that facilitate the education system are automatic grading, additional support from AI tutors, constructive feedback to the teachers and learners, alter the role of teachers etc. (Fahimirad, 2018)

**8) Sentiment Analysis:** AI can assist the teachers in making a behaviour analysis of all students in the classrooms in real time. This may not be possible without the AI assistance.

## **B) Impact of AI on Students.**

Students are also one of the major stakeholders in the education system. They are directly impacted as AI will change the way they learn and are taught. It will result in supporting them by enhancing and providing them additional tools and facilities to understand the topic. The students derive the following benefits through AI applications in education.

**1) Mentors for every learner:** AI can provide individualized and personalized mentoring for each student based on his or her need, style of learning, and abilities. (Woolf et al., 2013).

**2) Personalized Learning:** AI has brought a few powerful apps for the students to learn a new language or topic. Most popular of these is the Duolingo app that helps one to learn an additional language at one's own pace. Through the automatic speech recognition (ASR) and NeuroLinguistic Programming (NLP) techniques, it helps in learning the accent correctly. (Ocaña-Fernández et al., 2019; Sharma, 2021). Student's learning is impacted by their contextual background in terms of their social background, economic wellbeing, prior knowledge of the topic and emotional state. Artificial Intelligence can provide the teachers data on the student context by which the teacher may be able to assist the student in learning through understand their context. (Chaudhry & Kazim, 2021)

**3) Continuous upgradation of skills:** AI helps the students to continuously keep themselves updated with the latest developments in their field of interest and thus will keep them upskilled (Woolf et al., 2013)

**4) Global Classroom:** Students have access to courses offered across the globe through various online education models and this gives them the benefit of learning from different experts in different parts of the world. It enables them to explore the knowledge from different cultural perspective(Woolf et al., 2013)

**5) Improve Writing skills:** AI powered writing assistant Grammarly is a great application that assists the students in finding grammar mistakes in their writing and helps in correcting the same. (Sharma, 2021)

**6) Overcome disability:** The interaction of human with Artificial Intelligence is a good support or collaboration that will help the students assist them in overcoming their disability and motivate them to be more engaged in learning effectively. Some students find it difficult to attend to regular classroom studies due to health issues or geographic locational issues. AI gives them the opportunity to learn.(Sousa et al., 2021)

**7) Better learning capability:** Research has shown that the students' learning capability has increased to a large extent with the introduction of web based education.(Malik et al., 2019)

**8) Learning Outcome:** AI can help in achieving better learning outcomes through learning more. It gives one to one tutoring (Luckin et al., 2016)

**9) Collaborative Learning:** AI facilitates collaborative learning among the students (Luckin et al., 2016)

**10) AI supports students with special needs:** Interacting and collaborating with digital objects and virtual characters can help the students with autism to explore and improve their social skills. AI techniques may be also used to diagnose dyslexia, dyscalculia, spelling difficulty etc. among the students. (*TRUSTWORTHY AI IN EDUCATION: PROMISES AND CHALLENGES*, 2020).

### **C) Impact of AI on Institutions**

Just as AI has had an impact on the teachers and students. It also has an impact on the management of schools or universities in running their administration. The management impact is discussed here:

**1) Class Timetabling:** AI helps in preparing the class timetable automatically taking into consideration the faculty availability and ensuring that there is no clash in the timings.

**2) Staff Scheduling:** Many of the facilities in the educational system work for extended hours which needs that the staff work in shifts. Scheduling this is possible through AI

**3) Facilities Management:** The schools and Universities have various facilities like labs, conference halls, auditorium etc that are shared. AI can assist in managing such facilities

**4) Finances:** Every new technology brings in its own challenges of pricing and updation. The management needs to spend money on AI implementation which may involve a huge investment initially which may be recovered through cost savings and productivity increase.

**5) Predict Dropouts:** AI applications can help the institutions in predicting the student dropouts (Kasinathan, 2020) Such prediction models of AI are intended to develop early warning systems to identify the likelihood of any student dropping out of the course. (Zawacki-Richter et al., 2019)

**6) Safety and security:** AI is driven by data and the data about students most of whom are minors and not capable of understanding and protecting their privacy. Thus, the management or the institutions should ensure that the data is secure and used ethically.(Kasinathan, 2020)

**7) Chatbots:** Conversation assistants assist the institutions to handle the routine queries of their customers. Chatbots are programmed to handle the FAQs.

**8) Smart Infrastructure:** AI tools like IOT and sensors can help the institutions in managing their institutional property smartly with security, lighting, or air conditioning.

## VI Conclusion:

AI has immense potential in the field of education. AI can enable teaching and learning in a more productive and interactive ways. It will have a far-reaching effect with rural India getting connected & being drawn into mainstream of education as well. To utilize its full potential, it must be executed on a national level. With a population of around 600 million young people AI in education will enable us to achieve our 2030 goals which are aligned with the UN Sustainable Development Goals. Artificial Intelligence will play a crucial role in India becoming a \$5trillion economy. Implementation of AI tools in education has seen an aggressive growth with the Pandemic closing schools in many parts of the country for over 2 years now. The future will see a blended mode of human and AI centered approach in education.

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# **EFFECT OF APPLICATION OF ARTIFICIAL INTELLIGENCE ON PERFORMANCE OF BANKS**

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### **ABSTRACT**

Artificial Intelligence(AI) is a modern technology which have been the leading edge in the technology revolution across the globe. It was growing at an unprecedented pace due to the greater acceptances of technological innovations. AI is transforming financial service sector globally. Banks and financial service companies are quickly adopting Artificial Intelligence to redefine its business operations. Artificial Intelligence is leading its way in banking industry with reduction in operational cost, improves the efficiency and thus enhance the customer expectations. This study investigates the application of AI in banking industry in India. The main purpose of the study is to analyse the effect of AI on performance of Indian banking industry. The research design is exploratory and descriptive in nature. A survey method is employed to collect the data from the employees of different banks in India which adopted Artificial intelligence. The main idea behind the survey method is to collect data relating to the perception of banking employees on application of AI in the banking sector and its effects on the performance. AI technologies have been employed in different fields of banking such as core banking, customer support, operational performance, and analytics. Adaption of AI has a multiplier influence on growth and the development of banks in India.

**Keywords:** Artificial Intelligence, Banking Industry, Impact, Performance.

### **INTRODUCTION**

Artificial Intelligence (AI) is a vast ranging area of Computer Science interested with developing intelligent machines efficient of completing tasks that usually requires human intellect. Artificial Intelligence permits the machines to study from the experiences, familiarize with the new inputs and execute human assignments. Every industry has a high demand for Artificial Intelligence used for automation, learning, risk reduction, legal assistance, and research. AI operates through a combination of large volume of information with fast, reiterative processing and intelligent algorithm which enables the software to be able to learn automatically from the patterns and features in the data. AI is a comprehensive field of study which includes multiple theories, methods, and technologies. AI is likely to have a disturbing impact on most of the industries. Business organizations and Governments worldwide are investing billions of dollars to finance research and pilot programs of applications of AI in addressing the real-world issues that today's technology is incapable of tackling. The adoption of AI and its implementation has grown due to the Covid -19 pandemic.

Digital disruptions are redefining the entire business functions. Every business is trying to identify the different opportunities and implementing various approaches to generate a value in a technology driven world. Artificial Intelligence has facilitates the banking firm to manage their business operations more effectively. AI enables the banks to manage record high speed data to receive valuable insights (Raghav Bharadwaj, 2019). The emphasis of AI implementation is confined to enhancing the effectiveness of operations or the effectiveness of the operations. Exploiting technology with AI offers the benefits of digitalization to the banks and assist them to face the competition generated by FinTech. According to research conducted by the National Business Research Institute and Narrative Science, 32% of the financial service providers are already implementing AI enabled technologies like predictive analytics, Voice Recognition.[1]

## **REVIEW OF LITERATURE**

Kishore Meghani (2020) states that the usage of Artificial Intelligence and Block Chain in Banks helps to reduce the dependency on the human elements in operations and help to fulfil the customer demand more easily and quickly.

Dr. Navleen Kaur and Supriya Lamba Sahdev (2020) explained in their study that banks are applying AI to enhance the customer experience by empowering frictionless and fraud less banking operations.

Dr. Anil B Malali and Dr.S Gopalakrishnan (2020) indicates in their study that the implementation of AI in banking sector result in small losses and provide superior transaction with the highest customer satisfaction.

O Kaya and J Schilbach (2019) states that usage of Artificial Intelligence increases the labour productivity and reduce the cost in banking sector. They also mentioned that the implementation of AI technologies helps the banks to remain competitive.

Meha Agarwal. (2019) in her article states that the banks are vigorously accepting new-era technologies for an increase in the prospectus and to assist new-age clients. Banks are future proofing their products and services through Artificial intelligence and machine learning.

BSFI (2019) indicates that the banks are competing with each other to introduce AI enabled tools in their banking operations to attain goals related to digital transformation for the future.

Sophia (2018) states that adaptation of innovation in technology in banking sector enhance the profitability of the banks and can offer harmonized and upgraded financial services to the clients.

Jewandah S (2018) states that banks are gradually implementing Artificial intelligence which helps them to eliminate human error and to cut down the costs. Application of AI in banking operations enhances the customer services in the long run.

## **ARTIFICIAL INTELLIGENCE IN BANKING**

The strategic implementation of AI in banking and finance can create significant gains. Banks will be able to achieve a substantial rise in the number of interactions or dealings with the same number of workforces through the usage of AI enabled techniques. With rising customer's expectations and with an objective of providing improved customer experience, banks are employing AI in banking operations. AI has the capability to detect fraud, mitigate uncertain risks and help to manage compliance with regulatory requirements. The future of Artificial Intelligence in the banking sector might deploy the humanoid robot to steer the customers through the banking process (Django Stars, 2019). AI is the future of banking as it gives the strength of advanced data analytics to prevent fraudulent transactions and enhance compliance. AI technologies in banking achieve anti money laundering activities fast and manage large number of information which leads to greater quality of services to a broader client base. All these converts into improved revenue, lower cost and thereby enhance profit. Following are the some of the benefits of AI in banking sector. (Ashish Anantharaman, 2019)

### **1. Enhanced Customer Experience**

AI builds a superior understanding of customers and their financial behaviour based on their past interactions. This allows the banks to customize financial services products by combining customized attributes to offer meaningful customer engagement and create a solid association with its clients.

### **2. Reduced Operational Costs and Risks**

The banking industry is pretty much digital in operation, but it remains strewn with a human based operations that sometimes are paperwork heavy. Banks are facing considerable operational cost and risk problems due to possible human errors in those human based operations. AI enabled techniques in banking operation minimise the human errors and increases the efficiency in operations.

### **3. Improved Fraud Detection and Regulatory Compliance**

AI facilitates to obtain an improved perception of customer behaviour and hence improves in fraud detection. AI facilitates the banks to use AI virtual assistance that regularly check the bank data in accordance with the regulatory compliance. They examine all the transactions, check customer behaviour and audit.

#### 4. Cybersecurity

AI can greatly improve the effectiveness of cybersecurity systems by mobilizing data from previous interactions and studying the patterns and indicators which prevent the attacks. AI can also examine the inside risks and recommend remedial actions developing in the prevention of data theft.

#### 5. Effective Decision Making

AI techniques in banking offers optimal solutions based on accessible real-time data. These systems retain a database of specialist data which helps the banks in strategic decision-making.

#### OBJECTIVES

- To study the different areas of application of Artificial Intelligence in Indian Banking Industry.
- To analyse the effect of application of Artificial Intelligence on the performance of Indian banking industry.

#### METHODOLOGY

We have used both primary and secondary source of information to analyse the impact of AI in banking industry in India. Primary information is collected through a survey method and the population of the study consists of employees of different banks in India. A simple random sampling method is used to select the respondents from the population. Secondary data was collected through authentic secondary data sources i.e., from articles of research journals and prominent sites relevant to the study. A regression model is used to test the hypothesis to find out the effect of application of Artificial Intelligence on performance of banks.

The research hypotheses developed for the study is as follows.

Hypothesis 1

H<sub>0</sub>: Artificial Intelligence does not minimise the human errors

Hypothesis 2

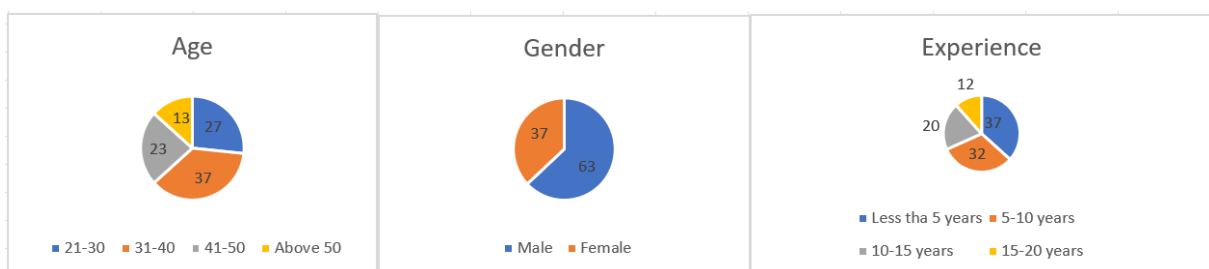
H<sub>0</sub>: Artificial Intelligence does not helps in fraud detection.

Hypothesis 3

H<sub>0</sub>: Artificial Intelligence does not helps in reducing cost of services.

#### RESULTS AND DISCUSSION

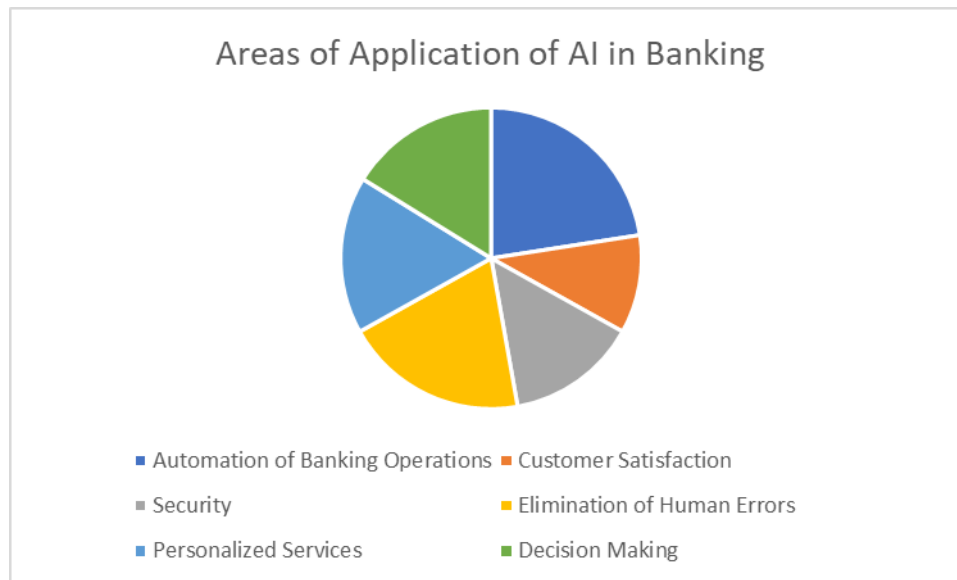
The study focuses on the objective of how the application of AI on the performance of banks. Here the factors considered for the evaluation of performance is non-financial factors like customer engagement, reduction in cost of services, risk management, fraud detection, security. A descriptive analysis is used to study the demographics of the respondents and the fundamental background required for the study.



**Fig:1 shows the demographic profile of the respondents.**

From the above figure it is observed that 37% of the respondents are in an age group of 31-40 years and 27% are from 21-30 years. And the least percentage is from the age group of above 50 years. As per the data collected, 63% of the respondents are male employees and 37% are female employees from different banks in India. It is observed that the maximum respondents have been working in the industry for a period of less than 5 years, 32% are having experience of 5-10 years and 12% of the respondents are with an experience of 15-20 years.





**Fig: 2 shows the areas of application of AI in banking sector.**

It is observed from the above chart that all the respondents know about the different fields of AI application in banking industry. Majority of those surveyed have confirmed that the adoption of AI is done mainly in the automation processes. The respondents were also mentioned the areas like personalised services, reduction in human errors, etc. Most of the secondary research suggested the same results application of AI in banking sector is mainly for enhancing the performance through the automation of banking operations, which helps to reduce the human errors and provide the personalised services to its customers.

It was identified that Artificial Intelligence is applied in banking industry in the areas of fraud detection, risk management, asset management, reduction in cost of services and minimising human errors. This research focusses on the extent of artificial intelligence affects the banking efficiency using non-monetary parameters like fraud detection, reduction in human errors, risk management, asset management, minimising cost of services.

### Hypothesis 1

H<sub>0</sub>: Artificial Intelligence does not minimise the human errors

**Table 1: Model Summary**

<i>Regression Statistics</i>	
Multiple R	0.623
R <sup>2</sup>	0.388
Adjusted R <sup>2</sup>	0.378
Standard Error	0.670
Observations	60

**Table 2: ANOVA under Regression**

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	16.550	16.550	36.848	.000
Residual	58	26.050	0.449		
Total	59	42.6			

The calculated value for Coefficient of determination for hypothesis 1 is 0.388 which shows that 38.8% of the variation in eliminating human errors is described by Artificial Intelligence. The regression coefficient explains that there is a positive relationship between AI and elimination of human errors in this study. In the above calculation, the F-statistic is 36.848 and the P-value is 0.000 that proves that a major influence of artificial intelligence on eliminating human errors. The positive regression coefficient denotes that Artificial Intelligence helps to eliminating human errors in banking operations. Since the P-value is less than significance level of 5%, it is evident that null hypothesis (H<sub>0</sub>) will be rejected. It concludes that Artificial Intelligence helps in eliminating human errors and thus enhance operational efficiency.

## Hypothesis 2

H<sub>0</sub>: Artificial Intelligence does not helps in fraud detection.

**Table 3: Model Summary**

<i>Regression Statistics</i>	
Multiple R	0.990
R <sup>2</sup>	0.981
Adjusted R <sup>2</sup>	0.981
Standard Error	0.129
Observations	60

**Table 4: ANOVA under Regression**

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	53.419	53.419	3161.487	.000
Residual	58	0.980	0.016		
Total	59	54.4			

The Coefficient of determination for the hypothesis 2 is 0.981. It indicates out of 100% influence on fraud detection Artificial intelligence accounts for 98.1%. The regression coefficient of hypothesis 2, fraud detection concerning AI is with a standard error of 0.129, F-stat. of 3161.487 and p-value 0.000 respectively. The calculation of regression coefficient indicates that there is a positive relationship between Artificial intelligence and fraud detection. Since the p-value is less than significance level of 0.05, it is suggested to reject the null hypothesis(H<sub>0</sub>). Thus, the study concludes that adoption of AI in banking operations helps to prevent fraudulent transactions and thus shows an increased performance.

## Hypothesis 3

H<sub>0</sub>: Artificial Intelligence does not helps in reducing cost of services.

**Table 5: Model Summary**

<i>Regression Statistics</i>	
Multiple R	0.864
R <sup>2</sup>	0.747
Adjusted R <sup>2</sup>	0.743
Standard Error	0.403
Observations	60

**Table 6: ANOVA under Regression**

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	27.824	27.824	171.199	.000
Residual	58	9.426	0.163		
Total	59	37.25			

The Coefficient of determination i.e., R<sup>2</sup> is 0.747 of hypothesis 3 revealed 74.7 % of the total variation in minimising cost of services is justified by AI. This means that out of its 100% influence on the reduction in cost of services , artificial-intelligence meant for 74.7%. The F-statistic is 171.199 and the P-value is 0.000 that proves the considerable effect of artificial intelligence on reduction in cost of services of banking operation. Hence, the regression analysis signifies a rejection of the null hypothesis (H<sub>0</sub>). This suggests that Artificial Intelligence assist to minimise the cost of services in banking operations, interpreting to the approval of an Alternative Hypothesis (H<sub>1</sub>)

## CONCLUSIONS

The study is conducted to identify what extent artificial intelligence impact on banking operations. It is observed from the study that AI helps the banks to detect fraud, eliminate human errors and minimise the cost of services. AI represents the potential future of banking since it creates strength of enhanced data analytics in order to fight with fraudulent operations and enhance efficiency. AI must be implemented in doing banking processes to improve efficiency and assist in achievement of corporate goals, especially in the non-monetary parameters.

Banks and other Financial service firms in India must insist on the adoption and implementation of AI, as it creates more value, the effectiveness and efficiency to the business. However, companies should be strategic, and goal focused when they implement AI, to get better from its use at their respective companies.

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# **“EXPLORING THE EFFECTIVENESS OF CONSUMER BEHAVIOR TOWARDS USAGE OF DIGITAL MARKETING TOOLS: APPLICATION OF PRINCIPAL COMPONENT ANALYSIS”**

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## **Abstract**

The unprecedented crisis of existing pandemic situation momentarily across the Globe have triggered the necessity of a rational consumer to be a techno savvy in burgeoning new era of Marketing Analytics. The wide-ranging use of internet and social media have swiftly changed the landscape of consumer behavior and the conduits in which companies perform their businesses. Due to the extensive use of the digital tools by the consumers nowadays, marketers are prone to use digital marketing platforms. These include Google Ads, Electronic Word of Mouth, Email and SMS Marketing, web advertisements to conduct internet marketing by fostering better-quality brand awareness and augmented sales revenue. This article brings together the shared insights from sample cohort study of technically knowledgeable respondents working in high tech industries (n=52) in the millennials age group of 23-38 years on issues relating to pros and cons about usage of digital marketing tools from consumer’s perspective.

Statistical Modelling techniques such as Inferential Statistical analytics and Factor Analysis has been conducted on respondent responses to experientially investigate the magnitude of variance and other reliable parameters through primary and secondary data collection for the time period of 2021. The study deployed orthogonal rotation method of varimax with Kaiser Normalization for each response variables to empirically test the relationship among the variables. The results presented in this paper reflects consumers’ behaviour in one of the most dynamic marketing sectors, and provide greater insight in the specific digital channel of marketing communication.

**Keywords:** Digital Marketing, Consumer, Statistical Modelling

## **1.0 Introduction**

The coronavirus pandemic gleamed panic-shopping for in many nations everywhere in the global both in in-individual stores together with supermarkets and pharmacies as well as in ecommerce stores. According to recent statistics for covid era 2021, 80 percent of digital consumers across the globe shop online by productively exploiting varied digital communication technologies such as Internet, Social Media platforms, Websites, Mobile Apps and other location-based services – all affecting consumers practices. Owing to devastating experiences of Covid Variants in India from January 2020 to contemporary year 2022 anomalies, it is very interesting to note that 93 percent of consumers have imbibed digital technological innovations and ubiquitous marketing tools. (Statista,2022) Various Business companies at Global level are concerned about the increasing consumer interactions with innumerable digital marketing tools. The average share of consumer option of marketability of products through digitalization in their purchasing portfolio before and during the pandemic has been recorded.

The foremost objective of this study is to identify consumer’s perception about utilization of Digital Marketing Tools in their day-to-day marketing activities.

- To focus on the experiential digital marketing practices of consumers
- To identify the best combination of digital tools that emphasize profound effect on consumers.

## **2.0 Conceptual and Theoretical Framework**

Digital advertising is one sort of advertising being extensively used to promote products or services and to reach clients the usage of digital channels. (Dr. Manas Khatri,2021) Digital advertising, digital marketing, e-marketing and Internet marketing are all comparable phrases which, honestly put, refer to advertising and marketing on-line whether or not thru websites, on-line advertisements, decide-in emails, interactive kiosks, interactive TV or mobiles. (Dr. Manas Khatri,2021) The marketplace is getting larger and higher, with virtual markets imparting clients infinite new alternatives for buying. Customers proportion their goals, attitudes, and ideals through many avenues and mediums, because the want for superb client experience grows across all virtual systems. (Fazla rabby, 2021) the position digital marketing plays on customer behaviour via three dimensions: (1) cellular apps, (2) social media platforms, and (three) electronic phrase-of-mouth. (Mahmoud Alghizzawi, 2019)

India has 280 million Facebook users that makes it the pinnacle United States of America having the largest Facebook target audience, India is 2d highest based on Instagram audience. These analytics have modified the way entrepreneurs make digital advertising and marketing strategies and layout enterprise portfolio in accordance with the goods and services to be had within the marketplace. (Dr. Manas Khatri,2021) The number one advantages of social media marketing is decreasing expenses and improving the attain. The charge of a social media platform is generally decrease than different marketing systems together with face-to-face sales or sales with an assist of middlemen or distributors. Added to this, social media advertising lets in companies to attain customers that won't be on hand due to temporal and locational boundaries of current distribution channels. Generally, most important benefit of social media is that it is able to permit groups to growth attain and decrease costs. (Afrina Yasmin et al, 2015) The function of synthetic intelligence inside the virtual advertising can't be omitted. It covers everything from search engine optimization, to chatbots for purchaser interplay and assistance, it's far an essential device for organizations these days. (Dr. Manas Khatri,2021) The preference of customers is stimulated by way of the interaction and relation with the agency. Artificial intelligence is changing the sector of digital advertising and marketing and presenting huge benefits. AI agents provide happy client offerings that's absolutely important to have true patron relation. Human agents may also get disillusioned sometimes so they may not reply to clients in a very good mood, but AI agents don't accomplish that that's one of the advantages of the use of AI. Machine studying is likewise used alongside AI for facts processing and provide efficient digital advertising and marketing. Chatbots help use NLP to provide clean interplay with the customers which satisfies patron needs. NLP also enables the corporations to perceive that if they are using key phrases successfully of their marketing content that the customers are simply seeking out. (Dr. Manas Khatri,2021) Business Intelligence immediately or in a roundabout way have profound influence on patron choice making. (Perini PraveenaSri, 2021) cellular advertising gear affect clients' decision-making in a different way and their impact varies in step with the customer type. It suggests that loyalty has a direct impact on mobile marketing effectiveness, because the decision-making method of loyal clients is extra tormented by cell advertising and marketing tools than the non-unswerving customers. (Athanasios Patsiotis et al, 2021)

### 3.0 Methodology of the Study

For the cause of this study, we have selected 52 IT Professional personnel randomly as clients that are the use of digital advertising machine to purchase their commodities. Additionally, we've got elicited the differential evaluations of the consumers on the effectiveness of digital advertising. Collected records and records has been organized, defined and analysed with the aid of using exclusive statistical gear and techniques. This examines shows effects each in descriptive and analytical manner.

### 4.0 Empirical Results and Discussion

#### 4.1 Inferential Statistical Applications

To show the magnitude of digital interactions of the consumers at the Global Level in Precrisis and during Covid-19 crisis, hypothesis testing was utilized and assessed whether the data was generalizable to the broader population. For this purpose, a record of Consumers interaction in 4 randomly selected months of different time periods of 2017, 2018, 2019 & 2020 were taken in to consideration.

**Table: 1 Digital Consumer Interactions: Global Scenario**

Months	June (2017)	May (2018)	December (2019)	July (2020)
Avg share of Consumers digital interaction Global scenario	20	20	36	58
Asia – pacific	22	19	32	53
Europe	18	19	32	55
North America	25	25	41	65

The study uses  $\alpha = 0.05$  to determine whether the data fits a uniform distribution. The various procedural steps of hypothesis testing can be executed as follows.

#### Step1: - Set null & alternative hypothesis

Ho: Average share of consumer digital interactions in pre-crisis & during covid – 19 crisis are uniformly distributed over the different months of varied years.

Ha: Average share of consumer digital interactions are uniformly distributed over different months of varied years.

**Step2: - Calculate the appropriate statistical test**

$$X^2 = \sum (f_0 - f_e)^2 / f_e$$

With degrees of freedom = K-1-c

**Step 3: - Calibrate the level of significance Alpha that has been specified as 0.05.**

**Step4: - Lay down the decision rule for a assumed level of significance 0.05 protocols for acceptance or refutation of null hypothesis are stated below.**

If  $X^2_{cal} > X^2_{critical}$  cast-off the null hypothesis, otherwise do not reject it

The critical  $X^2$  value is  $X^2_{0.05,3} = 7.81$  where  $df = n-1 = 4-1 = 3$ .

In a chi-square take a look at, as noticed effects (or) results deviate further from predicted (or) forecasted outcomes, the chi-Square cost increases. Hence, that is very clear that a incredibly big value is representative of the outcomes being no longer a result of random factors.

**Step5: - Collect the pattern records. The pattern records are given.**

**Step6: - Analyse the data**

Expected frequencies, can be computed through dividing total discovered frequencies by means of variety of months. In this situation, anticipated frequency =  $\sum f_0 / 4 = 126 / 4 = 31.5$

Computation of Expected Frequencies and Chi-Square Statistic

**Table 2: Global Level Inferences**

Months	Global f0	Global fe	(fa-fe)2/fe		
June 2017	20	33.5	-13.5	182.25	5.4403
May2018	20	33.5	-13.5	182.25	5.4403
December 2019	36	33.5	2.5	6.25	0.18657
July 2020	58	33.5	24.5	600.25	17.9179
	134			971	28.9851
	33.5				0.02985

**Table 3: AsiaPacific**

Months	Global f0	Global fe	(fa-fe)2/fe		
June 2017	22	31.5	-9.5	90.25	2.86508
May 2018	19	31.5	-12.5	156.25	4.96032
December 2019	32	31.5	0.5	0.25	0.00794
July 2020	53	31.5	21.5	462.25	14.6746
	126			709	22.5079
	31.5				0.03175

**Table 4: Europe**

Months	Global f0	Global fe	(fa-fe)2/fe		
June 2017	18	31	-13	169	5.45161
May 2018	19	31	-12	144	4.64516
December 2019	32	31	1	1	0.03226
July 2020	55	31	24	576	18.5806
	124			890	28.7097
	31				0.03226

**Table 5: North America**

Months	Global f0	Global fe	(fa-fe) <sup>2</sup> /fe		
June 2017	25	39	-14	196	5.02564
May 2018	25	39	-14	196	5.02564
December 2019	41	39	2	4	0.10256
July 2020	65	39	26	676	17.33333
	156				0.02564
	39				

**Step7:-**Arrive at a statistical conclusion and business implications (or) Inferences.

At 95% confidence level, the critical value obtained from the table is  $X^2_{0.05, 3} = 7.81$  and the  $X^2$  values at Global level, Asia – pacific, Europe and North America had a calculation of 0.029, 0.032, 0.032 & 0.025 which are less than the tabular value and falls in the acceptance region.

Hence null hypothesis is accepted and alternative hypothesis is denied.

**4.2 Factor Analysis** In this case study, we made an effort to explore the underlying factors from a set of variables by performing factor analysis by using Business Analytics Software Tool R. The underlying factors are a linear combination of variables. The sixteen variables are as follows.

1. I think that most of the consumers during pandemic Covid Era prefer social media platforms for their product purchases?
2. How do you rate the intensity of offline purchases from the start of Covid variant crisis to till date?
3. How frequently do you see digital advertisements on your social media
4. I spend maximum hours of time for getting effective awareness about consumer purchases by utilizing YouTube
5. I spend maximum hours of time for getting effective awareness about selective purchases by utilizing Instagram
6. I spend maximum hours of time for getting effective awareness about selective purchases by utilizing Facebook
7. I spend maximum hours of time for getting effective awareness about selective purchases by utilizing Twitter
8. I prefer mostly omnichannel as a part of my product purchases
9. I feel consumers find latest trends more on online through variety of products?
10. My preferred website provides good recommendation for the product (e.g. quality awareness)?
11. I am possessed with the advantage of comparing the prices of several products online by browsing through varied social media platforms?
12. I think shopping preferences through online is convenient even at remote distances and conserves time?
13. I find during Pandemic Covid era, Artificial Intelligence Chatbots are remarkably effective in handling customer queries through customized solutions
14. I feel that as India's digital economy grows, so does the digital advertising, which is contributing to an increase in the threat of advertisement fraud
15. I think it is becoming progressively widespread by Marketing Brands to utilize Augmented Reality (AR) for marketing to permit consumers to try products before they buy them, with augmented shopping experiences and appropriate decision making
16. I think usage of digital tools for marketing makes consumers to become techno savvy and self-reliant?

#### **Input Data**

We recorded the responses of 52 individuals for sixteen statements on a Likert scale of one-five, wherein 1 is Strongly Disagree and 5 is Strongly Agree.

**Table 6: Application of Principal Component Analysis**

Communalities		
Variables	Initial	Extraction
Var_1	1.000	0.28
2	1.000	0.57
3	1.000	0.43
4	1.000	0.56
5	1.000	0.36
6	1.000	0.54
7	1.000	0.42
8	1.000	0.32
9	1.000	0.65
10	1.000	0.33
11	1.000	0.36
12	1.000	0.56
13	1.000	0.60
14	1.000	0.65
15	1.000	0.72
16	1.000	0.44

Extraction Method: Principal Component Analysis



**Component Matrix**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Q1	0.52	-0.05	-0.02	-0.48	-0.15	0.36	-0.24	0.36	-0.04	0.01	0.32	-0.19	0.00	-0.10	-0.02	0.03
Q2	0.05	0.61	0.45	0.24	0.46	0.17	-0.14	0.06	0.06	0.04	-0.05	0.00	-0.23	-0.17	0.00	0.13
Q3	0.61	-0.02	0.24	0.08	-0.12	0.34	-0.46	-0.17	-0.24	-0.03	-0.30	-0.13	0.01	0.15	-0.02	-0.07
Q4	0.42	0.61	0.09	-0.25	0.17	-0.41	-0.11	0.15	0.10	-0.04	-0.10	-0.08	0.27	0.06	0.19	0.05
Q5	0.53	0.23	0.15	-0.42	-0.22	0.29	0.26	-0.38	-0.07	0.08	-0.05	0.22	0.09	-0.21	0.07	-0.01
Q6	0.47	0.56	0.05	0.40	0.16	0.09	0.19	-0.11	-0.13	0.24	0.32	-0.02	0.05	0.16	-0.01	-0.13
Q7	0.44	0.48	-0.01	0.23	-0.49	0.03	0.28	-0.07	0.26	-0.25	-0.04	-0.15	0.01	0.03	-0.18	0.10
Q8	0.56	-0.10	-0.02	0.39	-0.02	0.01	0.25	0.40	-0.43	-0.28	-0.05	0.14	0.02	-0.08	0.06	-0.01
Q9	0.58	-0.52	0.21	0.02	0.01	-0.30	0.06	-0.35	-0.20	0.00	0.17	-0.09	-0.08	0.08	0.08	0.21
Q10	0.52	-0.20	0.11	0.33	-0.52	-0.19	-0.07	0.20	0.24	0.33	-0.06	0.00	-0.13	-0.08	0.15	-0.05
Q11	0.51	-0.32	-0.03	-0.24	0.41	0.06	0.51	0.04	0.10	0.04	-0.18	-0.27	-0.10	-0.02	0.02	-0.10
Q12	0.61	-0.39	0.20	0.25	0.24	-0.28	-0.24	-0.14	0.17	-0.11	0.08	0.01	0.18	-0.22	-0.16	-0.10
Q13	0.58	-0.02	-0.51	0.07	0.19	0.21	-0.17	-0.15	0.32	-0.29	0.09	0.14	-0.14	0.08	0.16	-0.08
Q14	-0.02	-0.44	0.67	0.03	0.08	0.34	0.15	0.19	0.29	-0.02	0.03	0.16	0.14	0.18	0.01	0.05
Q15	0.60	-0.14	-0.59	0.11	0.20	0.15	-0.03	0.12	0.02	0.32	-0.13	0.10	0.13	0.02	-0.13	0.16
Q16	0.63	0.17	0.15	-0.49	0.00	-0.38	-0.04	0.15	-0.02	0.00	-0.02	0.24	-0.21	0.14	-0.17	-0.05

**Total Variance Explained**

Component	Initial Eigen Values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.16	26	26	4.16	26	26	3.35	21	21
2	2.15	13	39	2.15	13	39	2.60	16	37
3	1.47	9	49	1.47	9	49	1.84	11	49
4	1.39	9	57						
5	1.18	7	65						
6	1.06	7	71						
7	0.93	6	77						
8	0.79	5	82						
9	0.66	4	86						
10	0.52	3	89						
11	0.42	3	92						
12	0.35	2	94						
13	0.30	2	96						
14	0.26	2	98						
15	0.21	1	99						
16	0.15	1	100						

**Rotated Component Matrix**

	Component		
	1	2	3
Var_1	0.44	0.21	0.21
Var_2	-0.16	0.64	-0.37
Var_3	0.56	0.33	0.00
Var_4	0.03	0.74	0.10
Var_5	0.34	0.49	0.07
Var_6	0.08	0.71	0.15
Var_7	0.09	0.61	0.19
Var_8	0.49	0.19	0.22
Var_9	0.80	-0.10	-0.01
Var_10	0.55	0.11	0.09
Var_11	0.57	-0.02	0.20
Var_12	0.75	0.02	0.02
Var_13	0.32	0.15	0.69
Var_14	0.42	-0.23	-0.65
Var_15	0.38	0.04	0.76
Var_16	0.45	0.48	0.10

Extraction Method: Principal Component Analysis  
 Rotation Method: Varimax with Kaiser Normalization

## **Experiential Results:**

The output of factor evaluation is expected by way of acting Principal Component Analysis and specifying the rotation. There are two stages in issue analysis, namely

### **1. Factor Extraction Process**

In this case, the study extracted three factors with a cumulative amount of variance explained of 49 percent. Henceforth the study has reduced the number of variables from 16 to 3 underlying factors.

### **2. Rotation of Principal Components**

The study has used the orthogonal rotation method of the varimax for our analysis. By utilizing a minimum cut-off of 0.7 in the Rotated, Factor Matrix, the research paper arrived at the following factors

#### **a. Factor 1: Convenience of Purchasing Online and Cost Effectiveness of Products**

The research exhibits those variables 9,12 and 11 have a high loading of 0.80,0.75 and 0.57 respectively indicating that Factor 1 is a combination of these variables and can be congregated with the name Convenience of Purchasing Online and Cost Effectiveness of Products.

#### **b. Factor 2: Digital Marketing Services**

The research paper reconnoiters those variables 4, 6 and 2 have a maximum loading of 0.74,0.71 and 0.64 respectively demonstrating that Factor 2 is a culmination of these variables and can be clustered with the name Digital Marketing Services.

#### **c. Factor 3: Relevance of Artificial Intelligence Chatbots and Augmented Reality in Digital Marketing**

The study provides that variables 15,13 and 8 are possessed with a greater loading of 0.76,0.69 and 0.22 respectively exhibiting that the factor 3 is an amalgamation of these variables and can be assembled with the name Relevance of Artificial Intelligence Chatbots and Augmented Reality in Digital Marketing.

## **5.0 Concluding Remarks**

Digital Marketing Tools has ended up as an essential part of technique for lots Business organizations. Nowadays, even for small organization owner there's a totally cheap and inexperienced way to marketplace his/her products or services. Digital marketing and advertising haven't any limitations. Company can use any gadgets collectively with smartphones, pills, laptops, televisions, corporation consoles, digital billboards, and media which embody social media, search engine optimization, You Tubes, motion pix, content cloth, electronic mail and lot more to promote business corporation itself and its products and services. Digital advertising and advertising can be successful greater if it considers consumer needs as a top priority. Just like "Rome became not built in an afternoon," so, virtual marketing results acquired additionally come without attempt, without trial (and mistakes). The watchwords "trial, take a look at out and development" should be at the coronary heart of all digital advertising and advertising and marketing responsibilities. Companies have to create progressive customer reviews and specific strategies for media to pick out the notable direction for riding up digital advertising and marketing and advertising performance.

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# **IMPACT OF 360- DEGREE FEEDBACK ON EMPLOYEE PERFORMANCE EVALUATION**

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## **Abstract**

The 360- degree feedback is an effective tool for the evaluation of performance of an employee. As per the 360-degree appraisal, the feedback is to be collected of an employee through colleagues, subordinates, supervisor and self-evaluation. This will have a clear idea about the employee and the organization performance and growth. Once the feedback is collected, the feedback will be shared to the employee providing them a clear suggestion to improve in order accomplish the organizational goals and effectiveness as well as to improve themselves. Keeping this view in mind the researcher tries to explore the impact of 360-degree feedback on employee performance evaluation and also tries to find out the methods for gathering the feedback of an employee in an organization.

**Keywords:** Employee, Feedback, Performance Evaluation

## **Introduction**

The various elements of an organization are employee, employer, customer, services which works for the common goals and objectives of the organization. These different elements should work hand in hand and all need to be synchronized and directed towards the common objective. In the VUCA world as competition increases in the business scenario the employee need to be rated and evaluated based on their performance. The performance appraisal is one of the important measure to measure how an employee and organization performs. Without assessing the employee performance superior cannot generalize how an employee and organization contribute to the organizational needs and objectives. Feedback can be one of the tools where it reflects the productivity of an employee as the feedback arrived from the different people in the organization. Since many years the 360- degree feedback is being considered as the attractive measure to identify the employee performance (CIPD, 2003; Ward, 2004). The 360-degree feedback appraisal has been used by many organization and they found it would be the best evaluation process and the popularity of this system has been continuously increasing (Waldman and Atwater, 1998).

## **Conceptual Framework**

### **360- Degree Feedback**

The 360-degree feedback is an employee performance evaluation where in the different stakeholders of an organization evaluates the individual employee performance (Ward, 2003). The different stakeholders comprise manager/supervisor, colleagues/peers, subordinates, proctors, customers (Mount, Judge, Scullen, Sytsma, Hezlett, 1998). According to the manager outlook 360-degree is a complete assessment of an employee to improve the organizational effectiveness. As per manager viewpoint the 360 degree feedback is something is being used in order to develop and complete the assignment more efficiently and effectively ((Hazucha, Hezlett, & Schneider, 1993). The feedback is very much essential in every organization to foresee the growth of the organization by the contribution of individual employees (Maurer 2002).

According to the perceptions of Lepsinger and Lucia define (1997) 360 degree feedback process describes collecting the feedback from various fellow mates like boss, reports, peer members, internal and external members and suppliers.

There are two ways we could implement the 360 degree feedback which consists of development and appraising the performance management (Atwater et al., 2007; Atwater and Waldman, 1998; Ward, 2004; Tyson and Ward, 2004). It was proved from the various studies that most of the feedback appraisal has been conducted to develop the individual performance and the organization development emphasis (Fletcher 2001).

Moreover there was a debate that multi rating feedback analysis has been given the best result when it comes to development when compared to performance (Atwater 2007).

There are other research discussion resulted that 360 degree performance really worked for performance evaluation (Ward, 2004; Lepsinger and Lucia, 1997; Gallagher, 2008; Dowling et al., 2008; Carter et al., 2005).

### **Process of 360 degree feedback**

The USA military (1940s) have used the 360 degree feedback very initially, then organization were using the 30 degree feedback in order analyze the performance of the individuals. Through the different related studies the following 360 degree feedback model has been adopted (Kutcher, Donovan, & Lorenzet, 2009; Waldman, Atwater, & Antonioni, 1998). It is a complete corporate process which consists of planning; meetings with employees, feedback tool designing, development of reports, results delivery review the feedback learning follow up.



### **360 Degree Feedback**

The main project superior collects the feedback from the employees and then he will evaluate the feedback and that will be communicated to the individual. If any deficiency found in the feedback that will be intimated to the respective employee and suggesting him to overcome those deficiencies. As superior is considered as well experienced and skilled personality, he could provide the best feedback and suggestions to the employees. But somewhere down the line the personal bias would be the major drawback in the existing process.

Meanwhile, employees could provide the feedback pertaining to his/her merits and drawbacks. But it will be always purely to the safer or positive side of the employees (Wlmer 2006). Collecting the feedback from peers is always best feedback to be considered. Feedback is always kept confidential in order to avoid the grievances.

### **Methods for collecting the feedback**

#### **Questionnaires**

One of the best possible ways of collecting the feedback is questionnaire. The questionnaire has be prepared in align with measurable aspects of work of an employee by Likert scales (Dewing et al., 2004). The paper based feedback assessment is entirely different from online feedback assessment and the result might vary among these two assessments (Kurtzberg et al., 2005).

During the process of filling the questionnaire, the rater would select the best option according to his/her perception to describe the employees (Lepsinger and Lucia 1997). Paper based questionnaire could be scannable or non scannable. Time can be saved in the scannable questionnaire and non scannable questionnaires are economical (Ward 2004).

### **Structured Interviews**

The suitable ways to collect the feedback through interview are telephonic interview, group interview and face to face interview. The best way to gather the feedback through interview is face to face interview and least would be the group interviews (Lepsinger and Lucia 1997) . The manager to be trained first to interview the employees. The questions are mainly focused on open ended questions. It is very much seen that one to one interview might be time consuming than normal questionnaire (Ang and Cummings 1994)

### **Unstructured interviews and Emails**

Unstructured interviews are possible only if the raters of the feedback are skilled and trained in order to get the effective results. It has been recommended that if the raters are not trained or skilled on the unstructured interview, there would be possible that information might go wrong (Ward 2004). The raters providing the feedback through an email are being considered to be informal way of collecting the feedback.

### **The Purpose of 360 Degree Feedback**

The self-development, training, team building, performance appraisal, strategic development remuneration has been considered as the main reasons having 360 degree feedback appraisal (Carter 2005). According to study of Lepsinger and Lucia (1997) multi source feedback would help the raters to identify the individual assessment, business strategy, cultural change and group effectiveness. The multi-rater feedback act as an team- building and management, succession development, communication enhancement, the values of the organization, process of decision making, rewarding and annual performance ( Rao and Colleagues).

### **Strengths and Weaknesses of 360 Degree Feedback**

#### **Strengths**

The contact between the supervisors and the employees will strengthen because the multi-rater feedback approach (Gallagher 2008). The employees feel proud in the multi-source feedback system as they are evaluating their bosses (Alimo – Metcalfe, 2003). It gives power and right to speak when they have to rate their bosses. It is always reliable to consider from different sources which gives the level of their performances.

#### **Weaknesses**

The cost involved in the multi-rater feedback approach is much costlier when compared to all other feedback system (Rohan-Jones, 2004; Ward, 2004; Nickols, 2007). Multi rater feedback approach may create a inconsistencies as it considers feedback from different raters (Levy and Albright 1995). According to the free choice system the employees are allowed to choose their raters who are close to them and the rating might be inappropriate.

#### **Conclusion**

Each and every employee is big asset to their organization and which contributes the growth and profits of the organization. The development of the employees shall directly link to the growth and success of the organization. The 360 degree feedback system provides an opportunity to the employees to understand their strengths and remedy to improve any areas of development. This approach provides clear picture about the employee's performance, behavior and contribution to the success of the organizational goals. The usage of 360 degree feedback system is limited in the some of the organization. However, it would be beneficial to the organization and to the employees for the growth and success. Therefore its application facilitates in sustainable development of employee and organization.

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## **IMPACT OF ARTIFICIAL INTELLIGENCE IN RECRUITMENT PROCESS**

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### **ABSTRACT**

Today organizations are growing global and therefore to remain competitive and strategic in their approach adapting innovative technologies in all aspects of their business operations is a must. The most sought-after technologies in today's time are Artificial Intelligence (AI), Machine Learning (ML), Cloud computing, Blockchain Technology, IoT. Many business enterprises prefer using AI based software tools to re-define their business operations. The uses of AI are immense, it is used for saves-in-time, reduction of operational cost, increasing efficiency, growing revenue, error-free decision making and improving client & end-customer experience among other reasons. With increasing no. of company requirements and availability of growing workforce there is a challenge that every HR manager face in hiring the right candidates with the right set of KSAOs that is demanded by the job positions created in the enterprise. Earlier recruitment process had to be carried out in a very deliberate manner which was time-consuming and costly but today with the usage of AI recruiters are very easily able to streamline the hiring process with less human intervention. The objectives of our study are to identify the usage of AI in the talent acquisition process and to identify the challenges faced by recruiters while using the AI tools. Our study is conceptual in nature. The adaption of AI in the hiring process is required to address the arduous efforts of recruiters and indicate the challenges faced by them while using such software tools.

**Keywords:** Artificial Intelligence, Recruitment, Efficiency, Challenges.

### **Introduction**

Artificial Intelligence(AI) is a modern technology which have been the leading edge in the technology revolution across the globe. It was growing at an unprecedented pace due to the greater acceptances of technological innovations. Artificial Intelligence enables the machines to learn from the experiences, adapt to the new inputs and execute human assignments. Every industry has a high demand for Artificial Intelligence used for automation, learning, risk reduction, legal assistance, and research (Erixon, 2018). AI operates through a combination of large volume of data with fast, reiterative processing and intelligent algorithm which enables the software to be able to learn automatically from the patterns and features in the data (Tecuci, 2012; Kaplan, 2016). AI is the technology that enables one to perform responsibilities those are generally undertaken by people like for instance decision-making, visual and voice recognition, and translation (Tecuci, 2012). AI offers multiple benefits to Recruiters, for instance, using an AI powered Applicant Tracking System is used to scan and read through several CVs by looking out for related keywords or phrases, this provides efficiency at work and enables the recruiters to quickly get at the desired candidates (Galanaki, Lazazzara & Parry, 2019).

The usage of AI to quickly scan through CVs frequently leads to censure from job applicants. Though critics contend that technology decreases the chances of candidates getting recognized effectively due to its keyword search method of identifying the desired candidates but the truth is that with limited supply of jobs in organizations and thousands of applicants applying for these jobs AI becomes the best alternative to choose from relative to the traditional method of recruiters personally reading and evaluating every single CV (Tecuci (2012). AI also improves candidates experience at organization not making them wait to hear back from the recruiter after applying. AI tools are used in other areas other than screening including pre-selection, on-boarding, answering candidate questions, setting up interviews among others (O'Donovan, 2019)



## Literature Review

- Fraij & László (2021) in their paper focus about convention and advantages of AI, its influence on screening, hiring managers prejudice and the best hire candidate decision. AI boosts the quality and the time taken in the staffing processes.
- Komal Rai & Roshni Singh (2021) conclude in their paper how HR and TA leaders can improve their plan by ensuring that their tools are best used to empower recruiters with technology. The computerization of routine and monotonous hiring tasks such as screening and higher intelligence-based hiring tasks such as candidate interaction are empowered by AI making recruiters become shrewder and successful in enabling the recruitment process.
- Kshetri, N. (2021) states that companies can enhance their recruitment and selection process effectiveness with the implementation of AI in HRM and obtain access to an improved recruitment pool.
- Rahul Chopal & Dr Usha Garg (2021) have described the role and merits of using AI in the hiring process. They have emphasized on how Machine learning and automatic data analytics have played vital role in the rise of AI part in recruitment which has reformed the complete system into automatic technology-based operation.
- Tanvi Sharma & Dr. Garima Malikthey (2020) indicate in their paper that AI-based HR tools have strong possibility to increase employee efficiency in the recruitment process thereby helping HR professionals become well-informed advisors that lift employee performance. AI in HR can help analyze, predict, spot and become more influential and proficient resources.
- Vedapradha, R., Hariharan, R. and Shivakami, R (2019) declares that Artificial intelligence has become a benefit to recruiters in automating recurring tasks, administrative functions. They mentioned that recruitment and variables that contribute performance have greater association if artificial intelligence is implemented.
- Geetha R (2018) in their paper promulgate the importance and uses of AI. They drove the focus on highlighting how AI enables hiring personnel bring into line the unstructured applicant biodata, bring profiles into a structured format, classify and match skill sets required for the job.
- Bhanu Sree Reddy D (2018) states that AI technology has remarkable effect on recruitment process as it permits the recruiter to support9 all unstructured candidate bio data, construct profile into uniformity, recognizes and match skill sets essential for the industry
- Dimple Agarwal, Josh Bersin, Gaurav Lahiri, Jeff Schwartz (2018) declares that AI functions simplify the recruitment process in human resource management.

## Objectives of the Study

- To study the benefits of Artificial Intelligence in recruitment process.
- To identify the impact of AI on hiring process.

## Methodology

This is a conceptual paper built based on reviews from literature. The review of literature helps to understand the concepts of AI and its effective implementation in recruitment process. The study is based on secondary information which is collected from research papers, reports, articles, books, and different websites. A descriptive type of research is carried out to have a better understanding application of AI in recruitment process.

## Artificial Intelligence in Recruitment

Recruiters are aware that excellence in hiring is one of the Key Performance Indicators used to measure success of recruitment, as it measures the efficacy of the hiring process by sourcing for productive candidates (Griepentrog, Harold, Holtz, Klimoski & Marsh, 2012). Luckily, staffing firms can depend upon Artificial Intelligence to improve the metrics, as technology allows them to precisely match candidates with open positions based on formerly managed data. In other words, the AI can scrutinize an applicant's knowledge, skills, and abilities and contrast it to the job necessities in order to define how suitable the contenders actually are (Upadhyay and Khandelwal 2018).

Conventional HR techniques had recruiting professionals manually screen resumes to assess candidates those who were better suited for the positions. Apparently, this took excessive while, resulted in extensive use of resources. A well driven AI recruitment solution can systematize the monotonous tasks of assessing resumes and shortlisting the best applicants (Hmoud, B., & Laszlo, V. 2019). It has an enormous influence on the amount of time it takes to recruit someone for an open position as it progresses the entire process. This, in turn will have an impact on the cost of the entire hiring process.

A true diversity and inclusion initiative will have to deal with the intrinsic prejudices of the talent acquisition processes that may have trickled down from the cultural stereotypes and systemic factors. Fortunately, AI is the solution to it.

Artificial Intelligence depends upon data for the hiring process therefore it is indispensable to build them from cut to ensure a dependable depiction of the population. This process may lead to a diverse base of data that avoids taking gender, ethnicity, sexual orientation, appearance, or any of those biases into consideration. The present epidemic has thoroughly redesigned the whole world and its most notable effects on business has been the immense adoption of the remote work model (Hemalatha, A., Kumari, P. B., Nawaz, N., & Gajenderan, V. 2021). Left without any choice, several companies have adopted WFH policies to keep going during the lockdowns and stay -home orders. Therefore, with restrictions and various SOPs at work it is most likely that organizations will garner the usage of new technologies that support their operations. Hence in this context AI tools have proved to be a boon in the HR sector.

## **Impact of Artificial Intelligence in Recruitment Process**

### ***1. Saves recruiters time through automation***

Recruitment is known to be very time consuming because of the real fact that it takes a lot of time to choose the right candidate due to the elaborate process of screening candidate applications and shortlisting them based on their ability, this process was manually undertaken in the past till the time AI was introduced (Dessler, 2020). But today with the application of AI process is getting easier and it has become a seamless approach for recruiters as recruiters do not have to spend more time doing repetitive, time-consuming task such as screening of resumes, shortlisting of candidates for interviews and conducting assessments (Vijay Sundaram 2018) . AI powered technologies are designed in such a way that it doesn't just adapt itself to the workflow of the process, but it also integrates the current recruiting task without disrupting the workflow (F. Gementi, 2018).

### ***2. Improves quality candidate search***

Quality of hire is on the key metrics used to assess the success rate of the recruitment process. AI-based technologies have made the jobs of the recruiters simplified and meaningful (Alistair Cox, 2018). The promise of AI for improving quality of hire lies in its ability to use data to standardize the matching between candidates' experience, knowledge, and skills and the requirements of the job. Early adopters of this technology will witness benefits like decreased attrition rate, higher productivity and more happy employees (F. Gementi, 2018).

### ***3. AI Chatbots***

Recruitment integrated chatbots act as AI-powered assistants that give the experience and feel of interaction with a human being (Bringsjord, S. & Schimanski, B. 2003). It is considered to provide real time interaction as candidates can ask questions based on their job requirements and preferences and receive automated responses in the form of feedback, answers to the candidate's questions, any updates etc. Chatbots are therefore intended to enhance the candidate experience with the company (Kok, J.N., Boers, E.J., Kusters, W.A., Van der Putten, P. and Poel, M., 2009).

### ***4. Balanced decision making***

Making a hiring decision should depend on the recruiters and interviewers unbiased opinions, but most conventional organizations face challenges during examination of an applicant's potential and competency. The discrepancy and similarity of opinions regarding candidate essentially affects their judgement (Alexandra Levit 2017). But AI as a software is not influenced by prejudice or discrimination and therefore is less prone for making errors. It treats every candidate purely based on what value the candidate can deliver to the company without fully depending only on their interpersonal skills (Kaur, P., 2015).

### ***5. Changing Recruiters role***

AI will change the recruiter's role through automated intelligence which will allow the recruiters to become more proactive in their hiring function (Blacksmith, N., & Poepelman, T., 2014). It helps determine the candidate's job fit and company culture fit and improve their relationships with their managers and management leaders as now they can sound more confident to committing to the KPIs set (Dickson and Nusair 2010)

## **Challenges of Implementing AI in Recruitment**

Companies started executing AI in their recruiting process in recent years. Many instances it has helped the companies save the time and enhance efficiency (Zang & Ye, 2015). AI has totally modified the hiring process and helps reduce time in organizational job. But there are several potential challenges during the application AI (Muthukumar, C.K., 2014).

AI needs to have a heap of data so that they can monitor resumes as human. It discovers through examining repetitive previous activities. Risk exists here as it is going to adopt biases against these patterns if it is not updated correctly. Usage of algorithms to excavate an applicant's social networking information can lift privacy issues and increased the potential for discrimination.

AI largely depends on specific keywords scanning through the pile of applicants (Paul Attfield 2018). This could become a gap for applicants with knowledge of how the system is in AI have been programmed (Mansfield, Wooster, & Marion, 2016). This creates an issue of reliability and accuracy in hiring process. The capacity to shift to new innovative technology in businesses reveals that that how they can accomplish their market effectiveness (Martincevic & Kozina, 2018). The greatest challenge for AI enabled HR processes are programmed and training biases. AI based staffing involves unconscious discrimination during the hiring practice by companies (Stuart & Norvig, 2016). Artificial Intelligence based HR practices are highly involved with technology and support best talent hunt. But still some activities have to be conducted by humans like negotiations, appraisal of cultural fit and building rapport with team (Upadhyay & Khandelwal, 2018). Another challenge for AI is the language biases and cultural understanding by machines.

## Conclusion

Artificial intelligence is a technology that can operate rapidly as equals to human brains. AI assists in incorporating human abilities and machine learning abilities while taking decisions. It earns awareness and significance in automating hiring process when compared with traditional recruitment methods. Artificial intelligence enabled tools which used in HRM practices has enormous influence on recruitment process as it facilitates the HR managers to line up with all candidates' profile, Identify and match with the skills needed and to get the right fit. AI enabled tools which are used in HRM have great capability to enhance the performance of the company as well as employees. AI based technologies can expand recruiter's role by permitting them to go up in recruitment value chain. Companies can adopt AI integrated applications in their processes to enhance the employee productivity and organizational effectiveness.

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# **DEVELOPING ORGANISATIONAL HIRING INTERVENTIONS: HARNESSING BUSINESS OPPORTUNITIES THROUGH CANDIDATE EXPERIENCE**

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## **ABSTRACT**

Recruitment is a crucial aspect of Human Resource Management and it is clearly evident that it has an impact on the bottom line of any organization. Recruitment refers to a host of actions and tasks undertaken by organizations to identify appropriate employees with the prime objective of improvising organizational performance (1). In this light, it is imperative to evaluate the recruitment process in organizations and identify appropriate solutions to improvise the same.

Recruitment being of significant importance for both individuals and organizations alike makes it an exciting topic for research. Various studies in the past have examined recruitment from a micro perspective i.e. at an individual's point of view .However limited studies have been done at a macro perspective i.e. recruitment at an organization level (2) . To get a more all-inclusive understanding of the recruitment process, micro and macro perspectives to the research must complement each other.

Therefore, these subtle issues need to be comprehended correctly so that they have the right impact on organizations in the long run. The study has been carried out considering that prospective employees of a company are also its potential customers. The results are based the questionnaires that were sent out to over 3000 IT professionals in Bangalore. The study has been limited to IT professionals in Bangalore to get a focused analysis. However, the results are expected to be applicable to other industry verticals as well.

The study revealed that many IT professionals are not contented with the way in which organizations manage the entire interview process. It was also found that most professionals were not satisfied with the various aspects of the recruitment process as essential aspects which tend to have serious implications on the organization in term of its brand image, the talent pool, employee satisfaction and HR policies are ignored.

**Key Words:** Recruitment Process, Employee Satisfaction, HR Policies, applicant reactions, Candidate experience Organizational Culture, IT sector.

## **INTRODUCTION**

The recruitment process of an organization reflects the HR policies and the work culture of a company (3). It also speaks a lot about the brand of the company.A perfect recruitment process would always be appreciated by any jobseeker whether or not he/she actually gets the job in the company Recruitment should be taken as a process where applicants move through various stages from making decisions (e.g. whether to apply, whether to persist, whether to accept an offer) at various points along the way. Thus, understanding the total effect of recruitment is a matter of assessing the cumulative influence of varied recruitment activities. Recruitment process should be considered as an opportunity to showcase the organizational excellence to the external world(4).Any prospective employee for an organization is also its “potential customer”, if such a perspective is developed by the recruiters, it can lead to major improvements in the whole experience of recruitment. Each phase in the recruitment process- the pre-selection, during selection and post selection is an experience for the job seeker. But it is generally found that most of the organizations lack proper recruitment processes in these phases. Organizations treat an accepted candidate differently from a rejected one. While this seems to be a minor issue in the short term, it could lead to “negative word of mouth” publicity and can potentially damage the organization in the long run. This paper seeks insights into the recruitment process in organizations and identifying appropriate solutions to improvise the overall candidate experience.

## **PROBLEM STATEMENT**

Longstanding studies suggest that applicants frequently withdraw from hiring process following initial interviews, and unfavourable perception about the candidate selection process candidates may limit the offer acceptance (5) Moreover, negative candidate experiences to a selection procedure are likely to discourage other prospective applicants from interviewing with the organization. Also, if an applicant's perception towards the recruitment practice is unfair , it may dissuade the applicant from performing well in the interview process.

For most applicants, the behavioral outcomes from the first interview shape the candidate's decision to continue in further recruitment processes, implying the importance of each interview in the entire process from the organization perspective.

In this context, the paper aims at critically evaluating the current existing recruitment practices followed by IT companies in Bangalore. IT professionals from various age groups have been surveyed to identify major gaps in the recruitment process. The paper intends to throw light on such gaps and open up scope for improvement which would benefit both the organizations and the employees.

## **THEORETICAL BACKGROUND**

Candidate Experience can be understood as the sum total of all interactions that a candidate has with an organization during the recruitment process, beginning from initial discovery up to final hire or rejection.

With the emergence of Strategic Human Resource Management (SHRM), much research has been done which demonstrates the existence of relationships between human resource practices and organization-level outcomes(6). From a recruitment perspective, it has been observed that the influence of recruitment process on any actor (applicants, organization, and outsiders) will be reflected in the assessment of firm performance or its bottom-line.

Literature mentions five important dimensions of recruitment: Players, activities, outcomes, context and phases.

**Players** – organizations engaged in recruitment, applicants, recruitment agencies, headhunters and media. Research has focused more from the applicant's point of view rather than from organization's point of view. But understanding an organizational environment in which recruitment takes place is very critical and the objective of this paper.

**Activities** – The specific tasks, procedures and actions undertaken for recruitment process including the definition of target population, medium used, delivery of message, selection and rolling out the offer to mention a few. Actions taken during this stage of recruitment have direct consequence on post-hire outcomes like performance and turnover. Choice of medium and message delivery should focus on providing accurate information to applicants (like salary, location and diversity policies), greater role clarity and more realistic expectations thereby leading to improved attitudes, enhanced performance and increased longevity. Sometimes there is a mismatch between pre-recruitment information and the actual hiring process. (7) found that applicants emphasized more on the attributes for which they seek specific information rather than vague information (e.g. exact salary Vs competitive salary) was provided. (8) found a strong positive correlation between amount of information provided and probability of responding to the advertisement. Belt and Paollilo (9) found that more targeted advertisements also generate the right respondents and "weed out" unqualified ones. Discrimination also exists in the hiring process depending upon the source through which the applicant applied. For example, a referral applicant is treated better than one coming through job advertisement.

**Outcomes** – Organisation need to understand that recruitment can influence post hire attitudes and behaviors of the recruits as well(10). In addition, it can also have an impact on the attitudes and behaviors of existing employees, potential applicants and other stakeholders due to spillover effects. From a broader perspective, it can also influence higher level organizational outcomes such as the triple bottom line, which includes the social responsibility aspect of organizations.

**Interview process:** (11) found that recruiters' performance and information with respect to compensation, job and growth were positively relationship with overall response to interview process and offer acceptance. The other outcome can also happen when applicants report their interview experience to potential customers, investors or potential applicants, and that can affect the brand image of any company. (12) found that there is minimal training given to recruiters in an organization, the complexities of agency theory also apply to the process. For example: a recruiter might misunderstand or disagree with the organization's desired recruitment process leading to inconsistencies. Alternatively, they might be motivated to hire people from their alma mater or through any other relation. They may also take recruitment process as an enjoyable break from normal work routine without really putting serious efforts. This is further aggravated by the fact that, recruiters are generally not evaluated or given any feedback on different parameters after a recruitment process. (12)found that few companies tracked recruitment results and those recruiters, site visit hosts, agencies or others behave in matter consistent with the organization's goals and intentions.

(13) found that the site visit experiences which include experiences such as the company employees they meet during the visit, applicants 'treatment', scheduling, transport, venue information, etc have an influence in the final acceptance of offer by applicants.

(14) Studied the impact of delays among the various phases of recruitment process. They found that large time lags led to applicant dropouts either due to alternative job offer or due to declined interests. Also it was found that lengthy delays influenced their willingness to accept a position with the company in some cases(12).

One of the significant decisions that organizations must take about their recruitment practices is regarding the accuracy of information they provide to applicants. Accurate information can reduce employee turnover as realistic information would bring commitment and meet the expectation of the applicant (15). Though (16) and (15) had a different viewpoint saying the on-job experience would overwhelm the pre-job interview experience.

## **SURVEY METHODOLOGY**

The survey used simple random sampling where an online questionnaire was sent to IT professionals in Bangalore. The random samples were obtained from various reputed recruitment agencies. To conduct a focused analysis, the survey was limited to IT companies in Bangalore

The online questionnaire has been mailed to reach a random and large sample. The survey was sent out via email to 3000 IT professionals. Few respondents did not complete the survey because they found it a demanding task; few others found it unsafe to share information. Finally 500 of these returned surveys were found to be fully complete and valid. The analysis discussed in this paper is based on these completely filled and valid survey responses.

A pretest of the questionnaire was done involving 15 respondents. The questionnaire was divided in different sections, viz. Demographics, Pre-Selection, During Selection, and Post-Selection. There were 25 questions in total. SPSS (Statistical Package for Social Sciences) and MS Excel were used to analyze the data. The study evaluates the recruitment practices in IT companies in general and does not target any particular organization.

## **RESULTS**

A careful analysis of the results of the survey revealed several interesting insights about various issues related to the various interview stages in the recruitment process of the IT industry. These aspects are discussed in the following sections.

### **Pre-interview stage**

Analysis of the responses of the pre-interview stage of the survey indicates that, by and large, the processes being followed are perceived to be satisfactory. However, it can be observed that a significant percentage (34%) of respondents feel that the specific job details were not communicated properly before the interview stage. One of the possible reasons for this could be that during phases of heavy recruitment, it may not be entirely feasible for companies to provide specific job requirement details in advance and hence the details provided could end up being generic in nature. Specific job details and role mapping could be done in a detailed manner during the interview phase or after selection and training.

A very high percentage (38%) of the respondents indicated that due consideration for convenience was not accorded to them during the pre-interview stage i.e., in scheduling the interview at a convenient time. While this could be due to constraints related to scheduling of recruitments from the companies, these issues must be given due importance as they could be potential reasons of losing worthy candidates. It can be observed that there is an apparent trend of increased attention and care as the process moves from the pre-interview stage towards the interview stage. This is evident, for instance, from the relatively higher degree of satisfaction (78%-80%) of the respondents regarding the handling of the telephonic interview process in terms of its scheduling and punctuality

A similar trend is also evident from the relatively low percentage of respondents (less than 25%) indicating issues over conduct of the written test in terms of unfair practices being followed and improper examination conditions provided. However, the incidents of such issues increase slightly for outsourced written test processes compared to written tests conducted by the company.

The survey indicates that, broadly, the application process is fairly convenient with about 78.2% indicating that the process was not cumbersome. It is interesting to note that communication through internet and print media is found to be most convenient with 26% and 23% of the respondents indicating cumbersomeness in the survey.

## **Interview Stage**

The survey indicates that a high percentage (80%) of the respondents indicates that the questions asked in the interview were fairly relevant. It can be inferred that, while outsourcing the interview process did not have a significant impact on the duration of the interviews, there was a significant difference in the relevance of the questions asked in an outsourced interview, with a mere 14% indicating the relevance as compared to 44% for interviews conducted by the company.

Slightly lesser opportunity to ask questions was provided in the case of outsourced interviews. Furthermore, there was higher indication that there was lack of clarity on part of the interviewer about the skills required in the case of outsourced interviews (57%) as compared to interviews conducted by the company (40%).

The survey indicated that 9% of the respondents experienced some form of gender bias during the interview. The survey, however, indicated that the respondents were given adequate opportunity to ask questions & their questions were satisfactorily answered .

While there is high satisfaction level with the overall interview process (93%), there are certain issues which must be looked into. A case in point is the opportunity being provided to the candidates to provide feedback about the entire process. Providing such an opportunity could facilitate an immediate feedback about the entire process. Providing such an opportunity could facilitate an immediate feedback of the recruitment process and thereby providing an opportunity to improve the process from the feedback. In addition, it must also be noted that about 57% of the respondents indicate that the specific details of compensation were not provided during the entire process.

A significantly high percentage (45%) of respondents who were rejected indicate that there was no communication from the company about the rejection. The issue must be carefully considered by companies and care must be taken to improve the brand image of the company as a preferred recruiter. This process also significantly helps in essential feedback being provided to the candidate. The survey indicated that, upon no communication being received from the company, 52% of the employees had in fact tried to contact the company. Among these, 50% received either no response after repeated attempts or an impolite response from the company. These issues must be carefully noticed by companies and improved accordingly as it may negatively impact its image among prospective employees. As high as 86% of the rejected candidates indicate that there was no feedback provided by the company or the HR during the entire process.

## **RESEARCH FINDINGS, IMPLICATIONS AND DISCUSSION**

The purpose of this study was to investigate the recruitment process in finer detail. The results from the survey have given insight into the various issues often neglected during the recruitment process. The organizations should hence look into such seemingly petty issues and understand the strategic importance of such issues. The recruitment and talent acquisition team of any organization should be trained to look into such simple yet important aspects during the recruitment process. The problems highlighted in the paper are mainly due to implementation loopholes, negligence and improperly designed policies. A disciplined and well designed recruitment process can easily overcome most of the issues outlined in this paper without incurring any extra overheads on budget. The benefits, though intangible, of imbibing such practices would strongly strengthen candidate experience and the culture of any organization.

It is not uncommon in the industry that despite an outstanding track record and excellent credentials, a candidate doesn't experience a 'disconnect' with the company and either works uninterestingly or leaves the company. This entire process can be cost intensive both for the candidate and the company.

Time and again employers seem to believe they know what traits are required in a candidate; however they don't put much effort to find out what competencies are exactly required for a particular job to achieve a fit. Employers who establish a solid pre-recruitment foundation use a proper and well thought approach to recruiting to get the right fit for the company. This includes a formal review of the role responsibility, reporting relationships, environmental aspects, compensation and growth opportunities, as soon as there is a position open for recruitment. This makes it mandatory for the third party who is recruiting on behalf of someone, to prepare a job description and other required information to hire the right candidate.

One of the key observation from the survey is that the intangible requirements like behavior and personality traits are as important as tangible elements like education and experience. The compatibility of the person to the job becomes clear with tangible criteria too. Also intangibles help to evaluate an entry level application as he doesn't have any experience to justify his fit.



However, it is mandated that proper care should be taken while judging a candidate on intangibles as the evaluation can become subjective. There is a need for right mix of tangible elements during applicant's evaluation.

Another important area of improvement is the disclosure of salary, benefits and growth opportunities. Companies either don't discuss compensation during interviews and if they do, such discussions happen only at the final HR interview when the company has already decided to hire the applicant. Rather than revealing in final interview, it could be disclosed during the interview process because salary and benefit disclosure during interview can be a good selling point for a company, especially for hard to fill vacancies. Similarly, the normal growth trajectory should be discussed during interview to avoid any misunderstandings later.

Recruiter's training is mandatory to make the entire recruitment process effective. Training on different dimensions like organizational goals, behavioral aspects, compensation, interview structure etc should be taken for recruiters. According to a study by Stevens, trained recruiters asked better and relevant questions compared to an untrained recruiter.

Organizations should understand the importance of each contact point and interviews in the entire recruitment process. Applicants form impressions from each preceding interview which drives their interest for the next interview.

Organizations should also focus on the site visit experiences of applicants which can have a profound impact on the final acceptance of offer. Proper information about interview venue and schedule, transport, food arrangement and people meeting the applicant should be provided to applicant in advance.

Unnecessary time lags and delays during the various phases of the interview may lead to loss of potential good applicant. This might also affect the brand image of the organization making it imperative to bring discipline in the recruitment process.

The guidelines offered in this paper are meant to encourage conscious thought about the importance of studying recruitment processes from the perspective of both the individual and the organization. Organizations should understand the strategic importance of different phases in recruitment process and how each one can have an impact, direct or indirect, on the performance of the firm. Organizations should continuously evaluate their recruitment processes and improvise to maintain a competitive edge in long term.

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# **ARTIFICIAL INTELLIGENCE AND SMART ANALYTICS: LEVERAGING TECHNOLOGY FOR EFFECTIVE GLOBAL MARKETING THE DIGITAL WAY**

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**Abstract**— The Digital medium and social media marketing have transformed the way business's function. They allow for the faster execution of the marketing strategy and provide brands the ability to connect with audiences around the world more engagingly. While it holds true that with the global digital revolution, consumers spend most of their time on the internet browsing through different sites and engaging on various digital and social platforms, their online presence does not guarantee the success of marketing campaigns run digitally. Marketing globally with digital marketing requires more than just an app or a website, it mandates understanding and acknowledging the existence of dramatic differences in digital understanding, approaches, and regulations. To crack success globally necessitates a marketing strategy that accounts for cultural differences, is grounded on a local over global approach, stems from the overall business strategy, and is backed by a solid product or service. However, achieving this depth of knowledge and information for understanding what is working and what is not for a population in billions spread across the globe is humanly impossible. Appreciatively technology and Smart Analytics in particular have made achieving this momentous task possible. Gone are the days of the spray and pray approach of marketing, technology today offers critical information required to drive effective marketing campaigns. Marketers with access to real-time consumer data can tweak and improvise campaigns to drive conversions. This paper explores the important aspects that are key to implementing effective global marketing campaigns digitally and the role of technology Smart Analytics, Artificial intelligence, Machine learning, Virtual reality and Augmented reality is revolutionizing the way to market in this digital era.

**Key Words:** *Social Media Marketing, Digital Marketing, Smart Analytics, Artificial Intelligence, Virtual Reality, Augmented reality.*

## **Introduction:**

Affordable Internet services and the availability of smartphones has swept the world with a digital revolution where people spend most of their time on the internet[1]. This has created a huge opportunity for marketers to reach their customers most discreetly. As the reach of the internet is global, so is the reach of marketers today. Communicating with and influencing a global audience has never been this easy prior. Businesses globally resort to Digital marketing to connect with their customers online through various digital platforms accessed from different digital devices[2]. However, being able to reach and being able to convert are two entirely different things. Often, using digital marketing is considered to be a success mantra that guarantees results. Digital marketing like traditional marketing requires as much analysis, thinking, and understanding or even more than the traditional mode of marketing. A well-researched, well-thought digital marketing campaign can create a huge positive impact while a poor one can backfire adversely. While Digital marketing enables a global reach, it does not guarantee business results unless it is implemented appropriately basis a solid marketing strategy and is supported with continuous improvement with the help of vital consumer behavior data. However, technology today provides the marketing function the edge and the power to create and implement unique campaigns, enriching experiences, designed based on detailed customer behavior and are thus most likely to fetch business results[3]. The function of marketing uses technology today at every footstep; hence it is important to understand the role of technology and revisit the fundamentals of marketing to strike a fine balance that is critical to creating effective global digital marketing campaigns that sell.

## **The new fundamentals for marketing successfully in the digital age**

Digital marketing is an integral part of the larger marketing function. Marketing thrives when it seeks input from the overall business strategy that defines the purpose of the existence of a business and the products or services it thus plans to offer to its customers. Placing customers, their needs, and desires as the principal focal point is fundamental to the inception of any marketing strategy, conventional or digital [1]. While all the principles of marketing, research, and analysis that are applied to the traditional mode of marketing apply to digital marketing as much their meanings and implications have certainly evolved. Customers today seek a journey that is seamless and rewarding and translates into an enjoyable experience worth remembering. When customers interact with a brand, what they want is the ability to get something done, immediately.

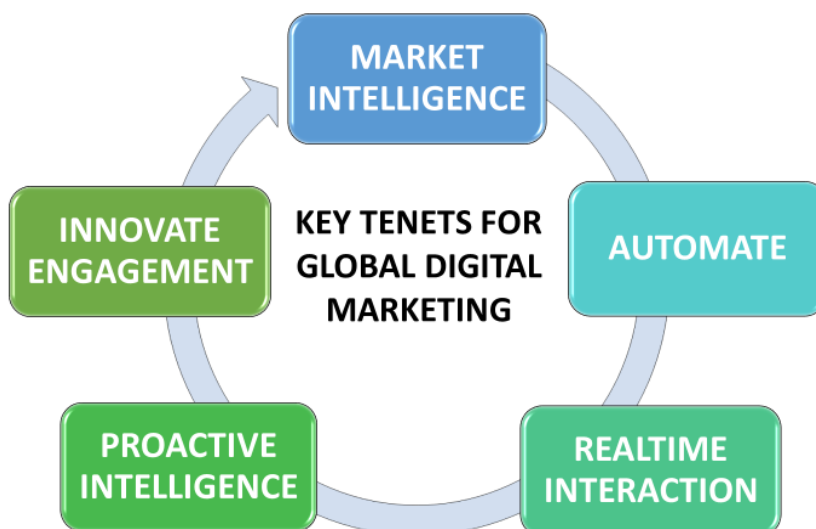
Digital marketing requires shaping a journey and understanding how to design an experience that carries the customer through to make a conversion. While traditional marketing is focused on driving the sale of a product, digital marketer requires to understand and think through how journeys can deliver experiences and design and implement them accordingly. The understanding of the product offering, a sharp idea about the market size and target audience, a deep understanding of the digital ecosystem in terms of compliance and regulatory terms, and the cost of implementing digital operations are fundamentals of marketing that should be in place before a business decides to market its product or service through digital marketing. Below is a proposed landscape mapping framework that is vital to have in place before initiating any marketing endeavor through digital media.



**Fig I: Landscape Mapping for digital Marketing**

Mapping the landscape for digital marketing is fundamental to gaining clarity around the effectiveness of digital as a medium for reaching the target market and mitigating any risks. Also, a knowledge of the digital ecosystem and the digital capabilities of the target audience makes it easy to map and create digital customer journeys for a fulfilling experience.

The key to delivering these experiences however is through using technology for seamless execution. For any business or brand that wishes to market its product or services online, it is imperative to ensure that a robust digital ecosystem is in place before it sets foot into the market by ensuring the below key aspects[4]:



**Fig II: Key tenets for Global Digital Marketing**

**Market Intelligence:** Data is the starting point and the most important input for any strategy or plan. Market intelligence refers to all the information about a market that a business needs to target and should encompass all the relevant information about competitors, trends, and customers, which should be congregated, monitored, and analyzed, to begin with, and decide upon a strategy.

**Real-time Automation:** For companies that wish to have a successful digital presence, it is necessary to not venture into the market without real-time automation. Customers today look for instant access to products or services without a long waiting time. By understanding and mapping a customer journey, automation should be able to help and guide the customer through this journey across all the touchpoints from the beginning to the end[5].

**Real-time Interactions:** Marketers today need to ensure that their company has interfaces that fit across the range of digital devices such as Laptop, Tablets and Smartphones that their customers possess, allow uninterrupted interactions with them, are intelligent enough to understand what the customers are doing on their digital device at any given point of time and take advantage of this information to help push them further into the marketing funnel.

**Proactive Intelligence:** With systems that are smart and have Artificial Intelligence capabilities marketers should be able to take advantage of the information that the company knows about a customer, and use that to target them at the right time with something relevant, to personalize information and content for them, and to optimize the content and offering over time[6].

**Engagement Innovation:** As a business gains access to all of the customer information from the multiple interactions, the digital marketer's endeavor should be to change the nature of the engagement and innovate and come up with new things and new capabilities that will drive people to interact even more with businesses and give them more information to keep the cycle of growth running.

However, if a business is thinking about going to market with new kinds of offerings, they need to build clarity and understanding of whether they have all the underpinnings that the new offering talks about backing it up for effective delivery. This demands an understanding of the IT architecture that the company employs for driving its business. In the digital age, the marketers need to manage the customer journey just the way a product needs to be managed, where somebody is on top of it, putting together all the different pieces across functions, driving continuous improvement, and thinking about innovation. This might seem like a momentous task however with technology understanding the pulse of the global population and hence delivering effective digital campaigns that can be tracked, measured, and improvised to deliver better business results is very much possible.

### **Smart Analytics: The driving force behind successful digital marketing**

Successful businesses cannot be built on guesswork, they flourish when supported with data-driven decisions. It's quite evident that driving successful marketing campaigns on digital platforms requires access to as much consumer behaviour information as possible to target and serve as precisely as possible. However, when we talk about a global population gathering this information for billions of people might seem like an unachievable task.

This is where technology comes to the rescue. Analytics in particular provides businesses the capability to capture voluminous consumer data and convert it into meaningful information in real-time. Analytics offers matrices, reports, and dashboards that provide visibility to what is working and what is not[7]. Without analytics, a business is flying blind. The judicious use of this information can help propel business growth by driving continuous improvement and enhancing customer experiences.

Implementing and using digital analytics is fairly simple and does not require much technical expertise. By attaching small tracking code to each page of a website, anonymous data about the user's activity on the website such as the URLs of the pages visited, the time spent on each page, the content that attracted their attention, if conversion happened at the end or not can be easily captured. Also, information about the type of browser, language setting of the browser, the Operating system of the device used, the location, age, and gender of the user gets captured as well. The traffic source that directed the user whether it be a search, an email, or an advertisement also gets collected for each user visit. In a nutshell, analytics collects all the information about a user that provides critical insights into their behaviour and can be used to offer better products, services, and experiences to them. The beauty of analytics is its ability to provide features that enable collation and representation of data in various forms that can be read and used to mine critical consumer information.

Some key features that are extremely beneficial from a marketing perspective are:

**Views:** A reporting view in analytics is where reports and analysis tools can be accessed. Views can be customized based on the data required for convenience, data security, and data accuracy. Creating data subsets such as data for a particular region, creating restricted access, and filtering data such as spam, or internal traffic for data accuracy are features that are easy to implement.

**Filters:** Applying filters in a view allows inclusion-exclusion and modification of the collected data. With filters internal traffic can be excluded, domain referrals can be filtered out, data can be narrowed down based on geography, continent, language, or any attribute. Filters can be searched and replaced, long URLs or codes can be replaced with smaller codes, and product codes with product names for better understanding and visibility.

**Goals:** Setting up goals is like setting up a new lens on the data that can depict what are the traffic sources, regions, devices, that are delivering conversions and not just collating the number of visits and pages viewed. To measure whether the app or site where repeat or new customers interact with the business, fulfills the objective of conversion, goals can be set up accordingly with analytics. Goals can be set to identify the source of traffic such as website, app, email newsletter, etc that leads to maximum conversions, identify subsets of users such as gender, age, ethnicity that drives conversions while also being able to track the precise pathway followed by most users before completing a goal. Individual marketing campaigns and conversions resulting from them can also be tracked thus identifying how successful a marketing effort has been. Besides, goals can also be set to identify, no of new accounts created, newsletter signups, eBooks downloads, online payment completion, and any other relevant objective that needs to be measured and reported for driving business growth.

**Tools for Data Analysis:** Data is meaningless if it cannot be converted to information to drive improvements. With data analytics tools marketers can set the range for a period that needs to be analysed such as hourly daily weekly and so on, compare ranges to see the business changes, compare subsets of data in a report by adding segments, derive various visual representations of data such as graphs, charts, histograms or any other that makes it easy to understand and act promptly.

### **Optimizing Marketing effort with Analytics**

The various analytical tools and reports capture vital information that if used thoughtfully can help drive critical improvements to optimize the marketing effort.

**Audience Data:** Data about audiences provides insight into the characteristics of the users and can be utilized by marketers for the following purpose:

**Build a Persona of Buyer:** Using Audience data, one can build a buyer persona by gaining an understanding of the age, gender, location, and interests of the most valuable users, and target them in future acquisition campaigns, tailor one's site content, and messaging to address their needs.

**Develop new markets:** Data about audiences can also be used to develop new markets that have a good amount of traffic originating from and thereby take business decisions such as whether to set up offices or improve Shipping Options to these locations and so on.

**Identify technical issues:** Furthermore, audience data can be used to fix technical issues that block sales, by identifying high bounce rates that may indicate device or browser incompatibility.

**Plan for the future:** Also, by identifying the most preferred mode for accessing the information on digital devices and narrowing it down to the most preferred device configuration such as Apple, Android, or Windows one can plan for an app, or a site accordingly to cater to the needs-based on the mode of access [1].

**Benchmark reports:** Audience reports can be benchmarked to identify how marketing channels; their location and devices are performing as compared to the competition.

**User Acquisition data:** With the help of user acquisition data, it's easy to identify how users are acquired i.e., through an app or a website, and thereby be used to accomplish the below-mentioned interventions.

**Compare channel performance:** Optimise marketing effort by comparing the performance of different channels of marketing and compare how well each channel drives conversions and allocate resources accordingly to what is working to maximize results

**Identify traffic sources:** Identifying traffic sources delivering high conversion even with low to medium amounts of traffic and invest in growing them.

**Invest in sources:** Identify traffic sources that are delivering or outperforming in terms of traffic and sales and capitalize by focusing on them.

**Understand social media traffic:** Acquisition data can also help track the return on social media traffic, identify best performing social media platforms like Youtube, LinkedIn, Instagram or, and identify website owners that refer the maximum traffic to a business and build relationships with them while seeking out for similar sites to grow traffic in future.

**Understand channel performance:** Acquisition report can help identify the efficiency of each channel is it, organic search through search engines, paid search from AdWords, direct visitors from URL, a referral from an affiliate, or social visitors originating from a social network. This information can then be applied to steer the marketing efforts to the channel that fetches the maximum conversion along with ones that show future potential for growth.

**Data on your fingertips with Dashboards:** Dashboards provide an overview of all the information that one requires in real-time on their fingertips and they are easy to create, customize and share. With Dashboards, many metrics can be monitored at once to check the health of the accounts at a glance. It also unbaes establishing correlations between different reports. Besides Dashboards can be created for different roles or metrics, such as site performance or commerce, or visitors.

In a nutshell, analytics allows marketers to measure and report every dimension of their digital presence and this information is the driving force behind creating and implementing digital marketing campaigns that taste success globally by ensuring conversions for the business. However, this is not the end of the road for a marketer today, technology has more to offer.

### **Artificial Intelligence (AI) Empowering Marketers to serve better and Drive Conversions**

While analytics collects, measures, and reports all the vital information relevant for understanding the performance of a business in a digital world, AI empowers marketers to predict, project, and take better decisions. AI-powered digital tools use state-of-the-art AI algorithms to enable marketers to take decisions that make a real impact and show immediate results[8].

Today marketing leaders across the globe leverage AI-powered tools for digital marketing to produce real business impact.

**Optimize advertising effort:** AI can determine the best audience for specific advertisements and thereby help marketers target the precise users that are most likely to convert. Both Google and Facebook deploy AI to serve targeted advertisements to audiences that have a higher tendency of conversion.

**Serve better search results:** In most cases, a digital journey begins with a search, and if the right content is served when a search is initiated, the chances of conversion improve. AI can enable search tools to provide better search results based on search analysis and Key words.AI has proven to be extremely effective in cognitive search and helped improve content and e-commerce search.

**Manage content effectively:** AI today is being used for curating content and also personalizing it. AI can learn from historical data and consumer behaviour and hence deliver appropriate and personalized experiences to users. With AI and Machine learning, marketers can deliver personalized journeys that have been especially curated.

**Automation:** AI-enabled marketing automation tools can learn from historical data, identify patterns of consumer behaviour that produce desired business outcomes. Marketers can leverage this information to automate the delivery of relevant content, at the right place, through the most effective channel at the right time to drive highly engaging experiences for customers.

**Better Customer Service:** Chatbots with AI capabilities are of great help to address user inquiries, queries, complaints and provide round-the-clock support. They can assist users while saving effort, time, and cost for the business while enhancing the total customer experience.

In Short with the help of AI marketers can predict the future, incentivize a purchase by quoting the most likely acceptable price, present users with search results that are most likely to yield conversions, recommend products through web campaigns that can prompt an engagement[9].

In today's day and age, technology empowers marketers by providing them access to the most covert behaviour patterns that consumer themselves are not aware of, that help them target with precision and ensure commercial success. Information from analytics and AI is being used by businesses globally to target and engage customers by crafting experiences that encourage conversions and another set of technology genius augmented reality and virtual reality[10] have totally transformed the way advertisements are served in this digital age for an audience that is most accessible in the virtual world.

## **Augmented reality and virtual reality for marketing in a virtual world**

Today's customers are well informed, tech-savvy, and expect the best from brands and therefore marketers need to keep pace with new advances in the world of technology to meet customer expectations and deliver the best possible experiences[11]. Virtual Reality (VR) and Augmented Reality are technologies that have empowered marketers serve mind-blowing experiences to global audiences virtually.

**Virtual Reality** is a kind of interactive software used to create real-like experiences by immersing users in a 3D environment usually with the help of special lenses and headset to simulate a real experience. A 360-degree experience is simulated for viewers which they find thrilling and captivating. Marketing using Virtual reality allows businesses to fill the gap between experience and action[12]. VR offers a digital experience in place of a physical one to promote products and services. In 2017 Adidas launched a VR campaign to market TERREX, its line of accessories and outdoor apparel where viewers were able to follow mountain climbers Delaney Miller and Ben Rueck on their adventurous trek and climb along with them. Through this ad, Adidas introduced its viewers to an activity that is otherwise not very popular and instil an interest in mountain climbing which would eventually make their product line more appealing to the users[13].

Virtual Reality is also used to draw customer attention towards future developments and to create their interest in upcoming products and services while taking important feedback for the same. In 2017 Volvo the Swedish luxury automobile manufacturer introduced a VR ad where customers could test drive Volvo cars through VR simulation. Not only did this help revive Volvo's brand image, but it also helped place the Car company on the map for something innovative while creating a new association between adventure and Volvo in viewer's heads, which was a novel perception of the brand [14]. With VR marketers are changing the dynamics between brands and consumers. VR advertisements and experiences are very popular with customers, people seek such experiences, and hence using VR works as a crowd puller where consumers come to the brand and not vice versa. While VR is gaining popularity with marketers who sit on large budgets, it is not very affordable and has a few limitations. VR is a form of fictional reality that is completely virtual and requires a headset and a system to control the users, Augmented reality on the other hand is a technology that has become hugely popular in the marketing circle, as with AR users can control their presence in the real world, it is accessible from smartphones and can enhance both the virtual and real-world experience[15].

**Augmented Reality** is a technology that provides a composite view by superimposing an image generated by the computer on the real-world view of the user[16]. Augmented Reality serves as an effective tool for enhancing brand value and driving sales through mobile devices. Brands today use AR to allow customers to try products before purchasing them. Augmented shopping experiences are rapidly gaining popularity and companies across different industries and sectors are adopting AR to deliver realistic and fulfilling experiences to their customers. Lens kart an Indian optical eyewear retail chain offers an AR-enabled website and app that supports the '3D Try On' feature whereby allowing access to the smartphone camera, a customer can experience what would the frame looks like on their face. It also records the customer's face from various angles and provides different views of the glasses from different angles. Product experience is delivered conveniently at the comfort of one's home, features that are highly desirable for any customer especially in today's scenario [1].

Makeup genius is an AR and AI-enabled app by L'Oreal where a customer can take a picture of their face and based on 61, different characteristics of how their face looks it scores them for what's the right kind of makeup, and also suggest makeup for different kinds of situations like day or night and occasions like casual or formal. The app also suggests the right makeup recipe put together to get that look and shows what will be the final look that appears on the customer's face using that recipe. It then goes a step further to generate a shopping list for the customer to be able to buy it. Based on the purchase AI algorithms derive an understanding of the customer's like and dislike and use that information to constantly update their algorithms over time. This app empowers female customers alters the whole flow of the decision journey of what makeup to buy[17]. From testing eye gear to makeup to clothes to test driving a new car, AR is surely the next big trend that marketers wish to cash upon[18].



## Moving beyond marketing mix to Project Mix

Marketing today has moved beyond just creating a message for the brand and establishing a connection with the audience, it is now about the journey that a brand can provide somebody in buying and using a product or a service. This experience and journey is the new product that customers seek and brands need to sell. Marketers are the custodians of this journey, they need to manage this journey just like any product by putting together all the different pieces across functions, driving continuous improvement, and thinking about innovation.

Creating extraordinary journeys and experiences that customers wish to embark upon requires marketers to think through by putting themselves in the customer's shoes [19]. Crafting these journeys requires access to Data, ethnographic research, talking to real people, tracking people and their online activities to map the end-to-end journeys and the real goals that customers wish to achieve through them. Also, it's vital to Identify value points, battlegrounds, pain points leading to frustration, touchpoints where value addition can be incorporated into the journeys to distinguish one's brand from competitors and for weaving this all together to provide exceptional experiences.

A marketer's understanding of the underlying IT architecture is paramount to pull this off. Cross-functional collaboration with technology and IT experts and Knowledge of the IT architecture are imperative to identify what is in the realm of the possible, what are the possibilities of delivering experiences, changing things, and how[20]. The knowledge of the backend is important to pull off a clean and seamless frontend in the form of apps and websites that are the interface with the real world. Understanding the flow of data, the complexities of the IT infrastructure are skills that a marketer should possess to succeed in this ever-evolving world of digital marketing to be able to address and exceeded the expectations of the multifaceted global population.

## Conclusion

Curating and delivering exceptional journeys requires putting together, technology, people, different functions beyond marketing and orchestrating them to generate a melody in the form of an unforgettable customer experience that draws new customers and brings the old ones back repeatedly. Delivering journeys demands an organizational shift that organizes more against journeys by setting up cross-functional teams to initiate acquisition through activation or relationship deepening, or service problem, all the way to advocacy or creating new journeys with marketing experts owning leading and driving them. The current generation of marketers is required to operate a notch higher than the marketing mix, they need to understand the project mix from the lens of bringing together the market intelligence, automation, interaction the predictive intelligence and innovation, to drive breakthrough improvements in the journeys that customers experience.

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# **INVESTIGATION OF AWARENESS AND FACTORS INFLUENCING IN THE PURCHASE OF ELECTRIC TWO-WHEELERS INCLUDING THE ROLE OF GOVERNMENT**

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## **ABSTRACT:**

Two-wheeler comprises of 80.8% of the total automobile sales in Indian Market. Out of these more than 99 percent are conventional petrol vehicles and hardly 1 percent are electric vehicles. Indian market is mostly led by the middle class who depend on two wheelers for their transportation needs due to the poor public transport services across India. Government plays an important role in encouraging electric vehicles through subsidies and incentives. An empirical study was conducted to study the awareness of various brands of electric two wheelers and factors influencing and the purchase of electric two wheelers and the factors that discouraged the purchase. The study has also listed the role of the Government in influencing the purchase of electric vehicles.

## **KEY WORDS:**

Electric two-wheelers, Environment, Consumer Awareness, Government Initiatives, FAME 2 Policy

## **I Introduction:**

Indian automobile market is the 5<sup>th</sup> largest in the world. Two wheelers comprise of 80.8% of the total share of the automobile market in India. 88% of these two wheelers are below 150cc. Transportation especially public transport is still a challenge in most parts of India and hence this

has led to the lower and middle class to depend on their own two wheelers. According to the report of Society of Manufacturers of Electric Vehicles (SMEV), the sales of electric two

wheelers have increased by 132 percent in India in 2021.

The FAME 2 policy (Faster Adoption and Manufacturing of (hybrid &) Electric Vehicles) of Government of India which is involved in subsidising the making and buying of electric vehicles is one of the major factors leading to the growth of the Electric Vehicles in India. The other factor leading to the shift towards E vehicles is the increasing environmental concerns and the need to sustainable living.

To examine the underlying factors that has led to the shift towards electric vehicles, an attempt is made to conduct an empirical study.

## **II Literature Review:**

Sudharshan jayasingh (2021) in his study titled “Factor Influencing Consumer’s Purchases Intention Towards Electric Two Wheelers” has found that the demand for Electric vehicles has increased significantly but yet it is only a meagre 1 percent of the total sale of vehicles.

V. VijaiKrishan in his study “Evaluating the Factors Influencing Purchase Intention of Electric Vehicles in Households Owning Conventional Vehicles” studied that in view of mitigating the threat of climate change due to emissions from transportation sector and to reduce the dependency on foreign countries for oil, many countries have started to develop policies for promoting sustainable and innovative transport technologies.

Sarthak Das (2020) “Customer Perception and Awareness Towards Electric Two-Wheelers: An Analysis in Pune city” swotted that in present era global warming is a big concern where world is working towards finding ways to be environmentally friendly. So, this analysis shows that more and awareness program are required for customers on electric vehicles. Now a days the customers are becoming more eco-friendly. So, it is the right time for the two wheelers industry to manufacture a more and more electric vehicle and to boost their sales by spreading the awareness across India.

Mr. Omkar Tupe, Prof. Shwetha Kishore “Consumer Perception of Electric Vehicles in India” has found that the environmental pollution and concern for the same has prompted the Government to consider the promotion of lectric vehicles. To fight the pollution levels the GOI is offering subsidies to both the manufacturers of electric vehicles and to consumers.

Ankita Nagpal “Consumers Perception towards Electric Vehicles in India” study reviewed that Purchase of electric vehicles effects on oil and gas market and it also increases the demand of electricity based on consumer behavior. The research was supported on the basis of the Perceived Conduct theory.

Kenneth Labeau (2013) “Consumer Attitude towards Battery Electric Vehicles: A large- scale survey” reviewed that now a days Electric Vehicles receiving a lot of attention but still their market is not straight forward. So here the survey results shows that the EV will provide more km at low cost and the survey says that the adults are purchasing more EV and they are lagging in the charging infrastructure installation and they are working on it and the government is also providing subsidies for the EV manufacturers.

Krushnakant Babhale, Saurabh Maurya “Consumer Attitude towards Adaption of Electric Vehicle” The study of the adoption of electric vehicles shows that one of the prominent factors affecting the adaption of electric vehicles is the availability of charging station in the countries where the penetration of EV is at medium level. So, the analysis says that people are ready to adopt electric vehicles but right now due to the unavailability of proper infrastructure people may not buy it right now.

Lingzhi Jin, Peter Slowik (2017) “Consumer Awareness and outreach activites of EV” reviewed that the actions like consumer campaign, non-financial incentives and high model availability by the government at national and local level conducted a review on EV configuration, battery sources, emerging trends and technological development in the EV market.

Fan Chao Liao (2017) “Consumer Preferences for Electric Vehicles” reviewed that widespread adoption of EVs may contribute to reducing the environmental pollution. Though the government is offering promotional schemes and incentives, the penetration of electric vehicles is still very low.

Dr. Harish Kumar S. Purohit (2021) “Electric Vehicles and Attitude of Metropolitan Consumer” research was primarily on Metropolitan consumer's attitude towards electric vehicles and understanding the impact of factors. He focused mainly on Mumbai city, which says that the speedway was reduced to 50% during the past decade.

Mohammed M in his study titled “Study on Electric vehicles in India opportunities and Challenges” research study suggested that IC engines should be replaced with electric ones which will help in fighting the environmental concerns.

Akshat Bansal, Akriti Agarwal “Comparison of Electric and Conventional Vehicles in Indian Market” study reviewed that 83 Indian firms are working towards Electric Vehicle, it can be clearly seen that the electric vehicle industry in India is in it initial phase. In addition, there is a great pressure on these firm to increase the efficiency and effectiveness. A large number of electric vehicles are being used by the Indian Government in Public Transportation.

Philippe Lebeau(2015) “Conventional or Electric Vehicles” rewied that Freight transport has major impact on urban movement. Researcher explored the possible integration of electric vehicles in last mile and they presented a fleet size and mix vehicle routing problem with time windows for EVs.

Troy R. Hawkins, Ola Moa Gausen(2019) “Environmental Impacts of Hybrid and Electric Vehicles” in this research they discussed about providing consensus around a transparent inventory for production of electric vehicles, appropriate electricity grid mix assumptions, the implications of EV adoption on the existing grid, and means of comparing vehicle on the basis of common driving and charging patterns.

### **III Methodology:**

The study is based on an empirical survey using a descriptive research design where a total of 112 respondents were surveyed to study their awareness of Electric Two-wheeler brands in India and to learn the source of awareness. It also examines the factors that encourage and discourage in buying electric two wheelers. Data is collected from both secondary sources and primary sources. The secondary data on government’s role in subsidising the electric two wheelers was taken and a questionnaire was developed to collect primary data from the respondents.

The objectives of the study were:

- To Study the awareness of electric two wheelers among the respondents
- To examine the factors influencing the consumers to buy electric two wheelers
- To identify the factors discouraging the consumers from buying electric two wheelers
- Role of Government in encouraging electric vehicles

#### IV Results and Discussion

A survey of 112 respondents was undertaken. The demographic profile of the respondents are given here.

**Table 1: Gender of the respondents**

Gender	Frequency	Percent
Male	53	47.3
Female	59	52.7
Total	112	100

**Table 2: Age of the respondents**

Age	Frequency	Percent
Less than 25	86	76.8
Between 25 - 35	24	21.4
Between 36-45	2	1.8
Total	112	100.0

**Table 3: Occupation of the respondents**

Occupation	Frequency	Percentage
Student	47	42.0
Home Maker	6	5.4
Self Employed / Business	14	12.5
Working/Service	45	40.2
Total	112	100.0

**Table 4: Annual Family Income of the respondents**

Annual Family Income	Frequency	Percent
Less than 5 lakhs	78	69.6
5L to 10 L	20	17.9
10L-20L	13	11.6
Above 20L	1	.9
Total	112	100.0

**Table 5: The engine capacity of the vehicle driven by the respondents**

Vehicle Engine Capacity	Frequency	Percent
Less than 100CC	27	24.1
100CC - 200CC	68	60.7
200CC - 400CC	15	13.4
Above 400CC	2	1.8
Total	112	100.0

**Table 6: Awareness about the Electric Two wheelers among the respondents**

S No	Brand Name	Awareness frequency	Awareness percentage
1	TVS IQube E	45	40.2
2	Ather 450 X	39	34.8
3	Hero Electric Optima	34	30.4
4	Revolt RV 400	17	15.2
5	OLA S1	44	39.3
6	Bounce Infinity E1	46	41.1
7	Simple Energy 1	15	13.4
8	Bajaj Chetak	36	32.1

Awareness is highest for Bounce Infinity E1 closely followed by TVS IQube E and OLA S1 whereas it is lowest for Simple Energy 1 and Revolt RV 400.

Table 7: Source of Awareness

S No	Source of Awareness	Awareness frequency	Awareness percentage
1	Newspaper	31	27.7
2	Magazine	7	6.3
3	Television	33	29.5
4	Social Media	78	69.6
5	Advertisements	40	35.7
6	Word of Mouth	43	38.4
7	Website	15	13.4
8	Automobile Exhibition	12	10.7

Social media is the source that has created the most awareness among all the respondents followed by word of mouth and advertisements. Thus, it can be suggested to use social media in its promotion strategy to create awareness and influence the customers.

**Table 8: Factors influencing the respondents to buy Electric two wheelers**

S No	Factors	Frequency	Percentage
1	Price	33	29.5
2	Convenience	38	33.9
3	Less noise pollution	45	40.2
4	Less air pollution	63	56.3
5	New Trend	24	21.4
6	Reference	5	4.5
7	Test drive	9	8
8	Low running cost	37	33
9	Low Maintenance	44	39.3
10	Government subsidy	21	18.8

Less Air Pollution and Noise Pollution seems to be the most important factor influencing the respondents to buy an electric two-wheeler which shows environmental concern is the most important factor followed by low maintenance, convenience, and low running cost.

**Table 9: Factors discouraging the respondents to buy Electric two wheelers**

S No	Factors	Frequency	Percentage
1	Limited Availability of charging stations	83	74.1
2	Long Charging Time	48	42.9
3	High Price	36	32.1
4	Lack of trust to new technology	15	13.4
5	Inconvenient for driving longer distances	53	47.3

Availability of charging stations is the most discouraging factor for the respondents to buy electric two wheelers followed by long charging time and inconvenience in driving long distances.

**Table 10: Attitude towards Electric Two wheelers**

S No	Statement	SD	D	N	A	SA	WS
1	Electric two-wheeler will replace conventional two-wheeler	8	12	35	38	19	48
2	Electric two wheelers are the need of the day	10	6	18	49	29	81
3	We need to make electric two-wheeler mandatory in cities	9	14	30	36	23	50
4	Electric two wheelers are meant for single Riders	23	32	24	25	8	-37
5	I prefer driving electric two wheelers	7	4	40	43	18	61
6	Government is doing enough to encourage electric two wheelers	10	24	34	34	10	10
7	Government should focus on public charging Stations	9	4	23	39	37	91
8	Public charging stations will boost sales	9	6	26	40	31	78
9	I would recommend to buy electric two Wheelers	9	2	35	42	24	70
10	My next two-wheeler would be an electric two-wheeler	9	9	41	34	19	45
11	Electric two wheelers are not designed for Cities	33	30	30	14	5	-72
12	Electric two wheelers are not suitable for riding doubles	28	32	31	17	4	-63
13	I will prefer to replace my vehicle with electric one next time	9	14	39	33	17	35

Based on the responses to the above statements and the weighted score, it can be said that the respondents are having positive attitude and preference towards electric two wheelers and be inclined to purchase the same in near future. They are also of the opinion that in the current scenario, electric two wheelers are the need of the day and feel that they are designed for cities and should be made mandatory in cities. However, they feel that government should focus on public charging stations though it is doing enough to encourage electric two wheelers.

### Role of Government

Transportation uses up 18 percent of energy consumption in India. During the COP 21 summit at Paris, India has committed to reduce the carbon emission by 33-35% by 2030 from 2005 levels. Electric mobility will provide a solution to meet this target emission. Government of India has taken multiple initiatives to accelerate the adoption of Electric vehicles. Under the Phase II of the FAME scheme, an amount of Rs 10,000 crore has been put aside for electric vehicles. Out of this 86 percent has been set aside for incentivising the demand for the electric vehicles. Government of Karnataka has the intention to make Bangalore the electric vehicle capital of India.

It is offering incentives and subsidies to electric vehicles and its component manufacturing enterprises in the form of investment promotion subsidy, exemption of stamp duty, concessional registration charges, reimbursement of land conversion fee, subsidy for setting up effluent treatment plant, Exemption from tax on electricity tariff, etc.

### **Highlights of budget 2022-2023**

In the recent budget presented by our finance minister Electric Vehicle promotion as a means of transportation in India has been given due attention. To further the penetration of Electric vehicles and promote them as a means for public transport, the creation of special mobility zones was highlighted. Like Europe and China, India too is set to promote EVs and to help in its adoption, will increase the usage of EVs in its public transport system apart from incentivising them under the FAME II policy. Cheaper financing and easier credit availability will be made for building up EV infrastructure in the country.

It was also proposed to reduce the customs duty on Nickel and other chemicals that are key in manufacturing of lithium – ore batteries that are used in Electric vehicles. This will help in reducing the overall production cost. Overall, the budget has been positive towards promoting green mobility and increasing the penetration of electric vehicles in the market.

### **V Findings:**

The study has found:

- Bounce Infinity E1 has the highest awareness among the existing electric vehicles in the market closely followed by TVS IQube E and Ola S1 whereas Simple Energy 1 and Revolt RV 400 has the lowest awareness
- Social Media followed by word of mouth and advertisements are the major source of creating awareness among the respondents
- Among the factors influencing the respondents to buy electric two wheelers, environmental concern followed by Economy of operations was the most influencing.
- Availability of charging stations and long charging time was discouraging the respondents to buy the electric two-wheeler
- Attitude of respondents is positive towards electric two wheelers and they have the intention to purchase the same soon
- Though the government is doing enough to encourage electric two wheelers, the respondents are of the opinion that the government should focus on public charging stations that will encourage sales

### **VI Conclusion:**

Based on the survey and the secondary data study, it can be concluded that future is bright for electric two wheelers in India. People seem to have a positive attitude and are willing to replace their conventional two wheelers with electric ones. Environmental concern is the major reason to prefer these vehicles and the non-availability of sufficient charging stations is the major reason discouraging the respondents to prefer them. Hence government can focus on public charging stations to encourage the sales of these vehicles in India apart from continuing to incentivise and subsidize them.

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## **THE KMV MODEL IN ESTIMATING CREDIT RISK: A HISTORICAL PERSPECTIVE**

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### **ABSTRACT**

Moody's KMV is one of the most important industry models for assessing the risk due to default, which arises when a lender fails to receive the principal and the interest, that is owed by a counterparty. The model has been developed based on the structural approach, wherein the probability of default (PD) of a firm is derived from its capital structure. The model defines a fundamental term called Expected Default Frequency (EDF), which is a prescient indicator of an incoming financial collapse and is most appropriate to companies' whose stocks are publicly traded, wherein the value of equity ascertained by the stock exchange. The market information embodied in the stock price as well as the information contained in the balance sheet, is put together and interpreted into a potential risk of default. The KMV approach, before calculating the default probability, applies a preliminary step to compute a measure called the distance to default ( $dd$ ), which has a strong correspondence to the Probability of Default (PD). KMV's  $dd$  computation is a modified version of the Merton's Concept of PD, wherein, the default risk of a firm is worked out by modeling the equity of a firm as an option 'call' option on its assets. The Merton's concept also helps comprehend how competent a firm is at discharging its financial burdens and paying off its debt, by evaluating the probability that it might go into default. This method factors in the basic concepts of the Black Scholes Option Pricing Model (BSM), which again acknowledges several inputs to price an option contract. These inputs and the math forms the basic building block of the method used to compute the distance to default of the KMV. The paper discusses the assumptions and the math behind the BSM which has paved way to the computation PD in the Merton's model which further facilitated the computation of  $dd$  in the KMV model. Following the acquisition of KMV by the Moody's Corporation, the model was further modified and improved, which has dramatically transformed the way in which credit risk is measured. This conceptual paper examines and traces the history and the progression of the core idea behind the KMV approach towards modeling credit risk.

**Keywords -Black Scholes Merton Framework, Merton Model, KMV Approach, Credit Risk**

### **INTRODUCTION**

In the year 1973, Black and Scholes recommended that the equity of a firm can be reckoned as an option 'call'. This proposition made the first move to build a methodical contexture that objectively assesses the credit risk of a firm. Subsequently, the idea was further enhanced by Merton (1974), Black and Cox (1976) and others after them, and has evolved into what is called the Merton Model. Thus, the classic Merton model benefits from Black and Scholes Option Pricing Model to value corporate liabilities. Oldrich Vasicek, Stephen Kealhofer and John McQuown furthered the Black Scholes Merton framework to contrive a VK model of default probability and established the KMV corporation in 1989. The acquisition of the KMV by the Moody's, later in 2002, augmented the product offerings of the Moody's Credit Risk Modeling Analytics. The Moody's analytics proficiently engineered the advanced implementation of modern financial theory and various statistical concepts, to competently address the credit risk, by superstructuring the footprints of Kealhofer, McQuown and Vasicek (KMV). Moody's KMV (MKMV) combines asset volatility along with asset market value and the default point to quantify the 'Distance To Default' ( $dd$ ) parameter which is then decoded into a credit risk term called 'Expected Default Frequency' (EDF). The expected default frequency is the probability of default for a predefined risk horizon of 1 year or more. MKMV's credit measures of the expected default frequency can be examined and evaluated with the help of the software called Credit Monitor™ (CM). CM software calculates the EDF probabilities, by permitting the user to opt for any term structure between 1 to 5.

### **LITERATURE SURVEY**

Manilo Del Giudice, Federica Evangelista and Matteo Palmaccio (2016) showcases a careful review of the the analytical contribution of the Black and Scholes model, and explains the performance as well as the opportunities imparted to its application. The study affirms that the method has been grabbed by decisors not only to price options but also in other areas. A.S. Shinde and K.C. Takale (2012) studies the Black Scholes equation and partial differential equation in an depth manner and concludes that that the equation is very much useful in financial engineering. Anubha Srivastava, Manjula Shastri (2020) studies if the Black Scholes option pricing model proves to be fair benchmark of option pricing and tests its relevance on 10 popular industry's stock listed in the NSE.

Norliza Muhammad Yusof and Maheran Mohd. Jaffar (2012) reviews the Merton model and the KMV Merton model to assess several firms' likelihood of default.

The paper tests the sample data from two firms in Malaysia for a year and justifies that when the market value of the companies' assets fall to zero or when the book value of the firm's liabilities equal zero, then the default probability turns out to be significantly less or more. The reliability of the NIG model is tested with the classic Merton Model for estimating probability of defaults. Cigdem Ozari (2017) estimates the probabilities of default using the Merton Model of select BIST100 Companies and the DD and the EDF. Of the firms are compared and their correlation with total debt is scrutinised. Amit Kulkarni, Alok Kumar Mishra and Jigisha Thakker (2018) projects the likelihoods of default of a few Indian firms in the Black Scholes Merton framework and compares with the default rate reported by CRISIL.

## OBJECTIVES OF THE STUDY

Through the methodical distention of the Black Scholes Option Pricing Framework, Merton pioneered a basis for investigating the credit risk of the firm by modeling the firm's equity as an option 'call' on the assets. The model which banks on the capital structure of the firm constructs a mechanism within which credit events are sparked off, by movement of the firm's asset value relative to some predefined boundary value. The limitations posed by the model were further refined by Moody's analytics as a part of KMV model and the term EDF i.e., Expected Default Frequency was trademarked for the probability of default. This conceptual paper

1. Discusses the assumptions and the math behind Black Scholes Merton's Option Pricing Framework and the intuition behind  $N(d_2)$ .
2. Explains how the aforementioned option pricing formula is used to model equity as a call option and thereby establish an equivalence between the  $N(d_2)$  and PD as proposed in the Merton's Model
3. Summarises how the preceding model was refined and shows the relationship between PD in the Merton's Model to distance to default and EDF in KMV.

## 1. BLACK SCHOLE MERTON OPTION PRICING FRAMEWORK and the INSIGHT BEHIND $N(d_2)$

The Black Scholes Merton Model is a largely accepted and standardised way of pricing options formulated by three renowned economists Fisher Black, Myron Scholes and Robert Merton. The Black Scholes formula assumes that markets follow the weak form of the Efficient Market Theory and the Random Walk Theory both of which leads to the No Riskless Arbitrage argument. The efficient market theory postulates that all the current market information is embedded in the stock price whereas the Random Walk theory states the stock prices follow a random path or a stochastic process - a series or a path of consecutive random steps with no knowledge of past events that help predict future events. Further, Black and Scholes applied Louis Bachelier's analysis on Geometric Brownian Motion to model the stock price movement, according to which, the motion of stock prices has two driving forces - a constant drift added by random shocks. The stock equation is given by

$$dS_t = \mu S_t dt + \sigma S_t dW_t$$

Where  $S_t$  is the stock price,  $W_t$  represents Standard Brownian motion,  $dS_t$  represents change in stock price,  $\mu$  the expected continuously compounded return on  $S_t$ . The first term in the equation is a continuous growth over a certain length of time also called the drift rate and is fixed. The second component is due to the effect that constant volatility, of individuals selling and buying stock over time, has on the drift rate. Thus, it is concluded that

Change in stock price = Fixed drift rate + Uncertainty caused by volatility

### 1.1 No Riskless Arbitrage Argument and Dynamic Hedge

Another key assumption of the Black Scholes formula is the No Riskless Arbitrage argument which means that no one can freely profit without taking a certain amount of risk. In other words, a situation cannot be set up where one could make more money than a 'riskless fixed income investment', without taking a risk. Otherwise one would be able to engage in riskless arbitrage by the simultaneous purchase and sale of the same asset and get a profit. By shorting a bond, one would be able to place two offsetting positions that combine and make a profit that exceeds the interest on the bond, without any risk of losing money. Such a position would pay a greater rate of return than the interest cost on the loan which would be the same as making free money.

To prove this, Black and Scholes, along with Merton, developed what is called a dynamic hedge --ie, take two opposite positions in the market in such a way that the positions are perfectly hedged. During the life of the option, as the stock prices increase or decrease, the hedge ratio continuously changes for which the size stock positions have to be increased or decreased in order to keep both positions balanced or hedged. If stocks have to be bought, it is done by shorting bonds at the risk free rate or if stock is to be sold, the money obtained is then used to cover the short on bonds.

This is known as dynamic rebalancing and in doing so all the risk of losing money is eliminated. But, if the investment portfolio does not increase at a riskless rate, there is an opportunity for arbitrage - if the total position increases more than the riskless rate, then one can make free money with no chance of loss. If the position increases at a rate lesser than the riskless rate, then by reversing the positions mentioned above one can keep dynamically rebalancing throughout the life of the option and still make free money without the risk of loss.

Thus, it is concluded that, if all risk had to be removed from markets, the total position has to increase at the same rate as a fixed riskless investment.- ie, the market has to drift with the risk free rate.

### 1.2 Driving Forces Of Price of an Asset

Bringing together the no riskless arbitrage argument and the concept of Brownian motion to movement of an asset price, it is concluded that the stock prices drift at a constant rate which is the risk free rate in addition to a risk factor which is due to the volatility caused by the random buying and selling of stocks by the people.

Change in stock price = Risk free rate (fixed overall drift rate) + Constant random volatility (random stochastic process)

The volatility changes the path of the price from a certain path of risk free rate to a random path. Also, volatility drags down risk free rate to a lower value. In other words, volatility of the periodic daily returns erodes or degrades the risk free rate. It turns out that drift rate is eroded by volatility at half the variance over time or  $(\rho - \sigma^2/2)$ .

Change in stock price =  $(\rho - \sigma^2/2) \tau$  (risk free rate less effect of constant random volatility has on this rate) +  $\sigma W_t$  (random stochastic factor)

Future Value of stock (with risk not added) =  $S e^{\rho \tau}$  Future Value of stock (with risk included) =  $S e^{(\rho - \sigma^2/2)\tau + \sigma W_t}$

### 1.3 Modeling Asset Price using Normal probability Distribution Curve

Furthermore, the Central Limit Theorem in Statistics states that if periodic daily returns of an asset is plotted, it would render a curve that is normally distributed over the entire life of an asset and it can be assumed that the daily rates of changes in the prices, in the future, will also be normally distributed. Thus, the future periodic daily rates of return graph will also be normally distributed. with the mean at  $\rho - \sigma^2/2$ , which is the same as the drift rate and the future standard deviation is the historical standard deviation of one year's worth of periodic daily returns and the total area under a normal distribution curve representing all possibility of the future rates of return would be.

Thus the asset price, with the drift rate with the risk included, can be modeled using a normal probability distribution, centered with a mean that equals the risk free rate minus half the variance over time. In asset modeling, the normally distributed curve corresponds to the entire probability of what values the future rate of return would take and can be used to determine the likelihood that the stock price will be above or below a specific amount at a particular time in the future. To gather the rate of growth that it would take for the stock price to be at the strike price when the option expires, the rate of growth from the stock price to the strike price  $(\ln(K/S))$  is calculated at the particular point and from it the mean of the probability curve is subtracted, and the result is divided by the standard deviation to get a standardised Z score.

$K/S = e^{\text{Rate of growth from the stock price to the strike price.}}$

$\ln(K/S) = \text{Rate of growth of the stock price to the strike price.}$

$Z \text{ score} = (\ln(K/S) - (\rho - \sigma^2/2) \tau) / \sigma$

## 1.4 Insight behind $\eta(d_2)$ and $\eta(d_1)$

The standardised Z score when plotted on the graph of the normal distribution, the area to the left represents the probability of the stock price being below the strike price on expiration [ $N(Z \text{ score})$ ] and the area to the right represents the probability of the stock price being above or at the strike price on expiration [ $N(-Z \text{ score})$ ]. This is  $N(-Z \text{ score})$  is denoted by  $\eta(d_2)$

$$d_2 = -Z \text{ score}$$

$$d_2 = -\left\{ \frac{\ln(K/S) - (\rho - \sigma^2/2)\tau}{\sigma\sqrt{\tau}} \right\}$$

$$d_1 = \left\{ \frac{\ln(S/K) + (\rho - \sigma^2/2)\tau}{\sigma\sqrt{\tau}} \right\}$$

$\eta(d_2)$  is the standard normal distribution value corresponding to  $d_2$  and it represents the probability that the S will be at or above K when the option expires. Similarly,  $\eta(d_1)$  is the future value of the stock price provided that S is above K at expiration.

## 1.5 Deriving the Option Pricing Formula

The current stock price is compounded at the risk free rate to get the future price. The strike price is then subtracted from the future stock price to get the option's future price and value. This intrinsic value is then discounted to present value and negative compounding removes the interest that could be earned from now until the option expires. Thus, in a risk free world, the price of an option is the option's intrinsic value at expiration discounted to the present value.

$$\text{Today's option price} = \text{future option price} * e^{-\rho\tau}$$

$$\text{Value of a call option (with no risk)} = C = \{S e^{\rho\tau} - K\} * e^{-\rho\tau}$$

$$C = S - K * e^{-\rho\tau}$$

Including the risk in pricing an option brings in the two expressions of probabilities  $\eta(d_1)$  and  $\eta(d_2)$  tells us whether the probability that the stock price will be at or above the strike price when the option expires and whether the option will be exercised or not.

$$\text{Value of a call option (with risk added)} = C = \{S \eta(d_1) e^{\rho\tau} - K \eta(d_2)\} * e^{-\rho\tau}$$

$$C = S \eta(d_1) - K * e^{-\rho\tau} \eta(d_2) \quad \text{Similarly, Value of a put option} \\ = P = K * e^{-\rho\tau} \eta(-d_2) - S \eta(-d_1)$$

This is the basic Black Scholes equation for pricing a European call option. Where  $d_1 = \left\{ \frac{\ln(S/K) + (\rho - \sigma^2/2)\tau}{\sigma\sqrt{\tau}} \right\}$

$$\text{and} \quad d_2 = \left\{ \frac{\ln(S/K) + (\rho - \sigma^2/2)\tau}{\sigma\sqrt{\tau}} \right\}$$

## 2. The MERTON MODEL: Measuring the PD

The Merton Model, developed by Robert Cox Merton, is the first structural model where insolvency is rendered using the microeconomic concepts of the capital structure of a firm. When the firm's cashflows are paid out, the debtors have a priority over the cash flows, until their debt to the firm is completely discharged and the remaining cash goes to the shareholders. Here, we assume the firm financed by two sources - equity (E) and debt (D). It is also assumed that equity does not give any returns (no dividend payments) and the debt comprises of only zero coupon bonds which matures at time T (due in a single payment). The value of the company at time T is

$$V_T = E_T + D_T$$

If the company does well and if it continues to be in business, then the value of debt at a time T ( $D_T$ ), is the debt at time 0 ( $D_0$ ) times the interest paid up to the future date and the value of equity at the future date ( $E_T$ ) is the value of the firm less the debt.

$$D_T = D_0 * (1 + i)^T \quad E_T = V_T - D_T$$

If the firm goes bankrupt and if, in case, it gets liquidated and the equity shareholders get nothing and if the value of assets are lesser than the initial debt acquired, the debt holders get to keep the amount realised on liquidation.

$$E = 0 \quad D_T = V_T$$

The equity and debt functions can be thus generalised as follows

$$D_T = \text{Min} [D_0 * (1 + i)^T, V_T] \quad E_T = \text{Max} [V_T - D_T, 0]$$

$$V_T = \text{Min} [D_0 * (1 + i)^T, V_T] + \text{Max} [V_T - D_T, 0]$$

## 2.1 Equity modeled as a Long Call and Debt like a Short Put

In this case equity of the firm is modeled as a long call - The original investment they put in the firm will be the premium for the call, the strike price being  $D_T$  and the spot price being the total value of firm  $V_T$ . The shareholders will be 'in the money' when the value of company is above the strike price of debt, at time T. This is analogous to the shareholders possessing the right to buy the firm from the debt holders by paying an amount of  $D_T$ . If the value of the firm is below the debt, the shareholders are 'out of the money', the company gets liquidated and the equity shareholders get nothing and they lose the original investment they had put into the firm (premium paid to the debtholders). Thus, equity holders can enact the option to 'buy' the firm away from the debtors at the strike price which happens to be the face value of the firm's debt at time T. This conveys that the cashflow to the lenders is consistent to that of a risk free asset minus the firm's credit risk.

The lenders have taken the risk to lend to the firm. Debt can be modeled as a 'short put' with a strike price of  $D_T$ . The Interest times Debt  $Debt_0$  is regarded as the premium given by the shareholders to the lenders for the short on the put option. In the event, if the value of the firm goes beneath the value debt at T, the put option would be 'in the money', then the lenders or put sellers are obliged to buy the firm at the strike price of  $D_T$ . They also receive a premium amounting to interest times debt.

Current market value of Equity =  $C$  (the premium for the long call option)  $Debt_T = K$  (the strike price for the long call option)

Value<sub>T</sub> =  $S_T$  (the stock price at T) Value<sub>0</sub> =  $S_0$  (the stock price at 0)

interest\* Debt<sub>0</sub> =  $P$  (the premium for the short put option) Interest rate = Risk free rate of return

## 2.2 Establishing an equivalence between PD and $\eta(d_2)$ .

The equations imply that the proceeds to the debtors is equivalent to that of a risk free asset minus the credit risk of the firm. The credit risk is characterized using the option 'put' and is valued utilizing the BSM option pricing formula. The probability of exercising the option is the probability of not defaulting. Thus the probability of default is one less the possibility of the option being exercised, given by,  $1 - \eta(d_2)$ .

The current equity price as an option 'call' is

$$E = C = \eta(d_1)V - \eta(d_2) D_T e^{-\rho T}$$

$$d_1 = (\ln(V/D_T) + (\rho - \sigma^2/2)T) / \sigma \sqrt{T}$$

$d_2 = d_1 - \sigma \sqrt{T} = (\ln(V/D_T) + (\rho - \sigma^2/2)T) / \sigma \sqrt{T}$  Where  $\sigma$  is the implied variance of asset values and the standard normal distribution of  $-d_2$  is defined as the probability of default in the Merton Model.

$$PD = \eta(-d_2) \text{ or } 1 - \eta(d_2)$$

$dd$  = value of  $d_2$  = asset value at which firm will default

The formula of  $d_2$  matches the math in the option pricing model and gives way to the distance to default in the KMV Model, in which the firm's asset value  $V$  is represented as a lognormal process (following geometric brownian motion), wherein the firm will default in value if the assets  $V$  drop below a particular boundary value  $X$ , the default could happen at the specified point of time T.

$$\sigma_E E_0 = \eta(d_1) \sigma_V V_0$$

From this equation, we can estimate the value of a firm (market value of assets) and its volatility from the equity value and volatility.

## 3. THE KMV APPROACH : calculating DD and EDF

Oldrich Vasicek and Stephen Kealhofer augmented the Black Scholes Merton Framework to build a perception of default probability known as the Vasicek Kealhofer model (VK model). The idea presumes equity as a perpetual call option on the firm's underlying assets and assigns five different kinds of liabilities- short term debt, long term debt, convertible debt

, preference and common shares. Also cash payouts in the form of coupons and dividends prevail, unlike the Merton model. Besides, the default can occur at or before horizon. Apart from these, the model tags along behind the same rationale as the structural method up until a specific juncture. It states that the firm will renege on its obligations, if the asset value declines below a particular level, which is termed as the default point ( $d$ ).

Moody's KMV integrates the market price of assets, asset volatility and default point to compute the distance to default which is then decoded to a credit measure called EDF. EDF is the probability that a given firm will fail to honor the payment obligations within 1 year. Moody's KMV also tries to vanquish many of the shortcomings of the Merton's model. The normal distribution which is used to calculate the PD of a counterparty in the Merton's model is substituted with another distribution which is analytically computed. This new distribution makes a provision for fatter tails to accommodate more extreme loss events and can be much more credible than the thin tails of a normal distribution. Also the distance to default ( $dd$ ) measure that is proposed, rationalizes the interdependence between the market measures and is used as an input to calculate the PD.

### 3.1. Steps to assess Credit Risk under the KMV

**a. Estimating The Market Value Of Assets and asset volatility :** The equity value of a firm as depicted by the stock price is steered by the following parameters : value of the firm's assets ( $V$ ), the volatility of the asset returns ( $\sigma_v$ ), the leverage ratio ( $L$ ), the average coupon on long term debt ( $C$ ) and the risk free rate ( $\rho$ ).

$$E \text{ (equity value)} = f(V, \sigma_v, L, C, \rho) \sigma_E \text{ (volatility of equity)} = g(V, \sigma_v, L, C, \rho)$$

Of the above, all the parameters are known, and so is the stock price. The only undisclosed values are the firm's asset value and its asset volatility. Given a knowledge of all the known variables, the KMV approach follows an iterative approach to find out the values of the unknown parameters.

**b. Estimating the 'Distance To Default' ( $dd$ ) :** The pivotal notion fundamental to the KMV approach is the understanding that a firm does not get into default the instant when the asset value falls below the face value of debt. Actually, the default can occur even when the value of the firm's assets degrades to a value in between the total of value of short term debt and the value of total debt. i.e., it is not possible for the value of debt to have fallen below the short term debt. This is due to the fact that the immediate cash requirements which are borne by short term debt, induces the default. The firm might have sufficient cash to keep servicing all the liabilities as they come due, in spite of the total liabilities being much above than the total assets. Hence the model places the default point ( $d$ ) somewhere between the total of short term debt and half of the value of the long term debt.

$$d = \text{short term debt} + \frac{1}{2} * \text{long term debt}$$

The next step is to calculate the distance to default and is given by

$$dd = (\text{Market value of assets} - \text{default point}) / (\text{Market value of assets} * \text{Asset volatility})$$

The larger the distance to default, the smaller the probability of default which means there is less chance to default.  $dd$  can also be expressed as a multiple of standard deviations of expected returns.

$$dd = \ln(V / d_T) + (\mu - (\sigma_v^2 / 2) T) / (\sigma_v T^{1/2}) \text{ Where } \mu \text{ is the mean of asset returns.}$$

**c. Determination of the EDF :** The final step is the assessment of the expected default frequencies which is done by mapping the distance to default values to probabilities of default based on a proprietary datalist.

### FINDINGS

The default barrier is the total debt in BSM whereas the default barrier is empirically determined in KMV. Default point replaces the face value of debt in the Merton Model.

1. Equity is viewed as an option 'call', on assets at the maturity of debt in BSM whereas in KMV, equity is a perpetual call option.
2. For private firms, the market value of equity is not available and hence some additional steps have to be followed preceding the estimation of  $dd$ .
3. EDF gauges are not credit scores but they are probabilities.
4. There exists a Gaussian relationship between PD and  $dd$ , in BSM whereas in KMV, the mapping of  $dd$  to EDF is empirically determined from calibration to historical data.
5. For assessing risk in a credit portfolio in KMV, a global factor model called the G-Corr Model is developed using asset correlations.

## CONCLUSION

The credit risk model developed by the KMV uses the information contained in the stock prices as well as the capital structure of the firm to estimate the firms' default probability. At the start, the model proposes that the firm will go into a state of default if the asset values decline beneath a given level marked by  $d$ , which again is a function of liabilities. The KMV model also incorporates the concepts from the options' pricing approach, in computing the firm's asset value and asset volatility, from the market value of equity and the debt structure. Using the above values a  $dd$  metric is constructed which denotes the number of standard deviations the firm's asset value is away from  $d$ . Lastly a mapping is done between the  $dd$  values and the actual default rates based on historical default experience and the resultant EDF is obtained. The model operates exceptionally well when implemented to companies, which trade publicly, where the market value of equity is insistent on the prices in stock market. The  $dd$  value substantiates the aspect of default risk and examines the firm's net worth to its volatility. The model has the adequacy to accommodate to the changes in credit cycle and expose the changes in the quality of credit. Also, the EDF gauges specify a cardinal ranking of credit quality rather than ordinal one.

The shortcomings of the model includes that it necessitates some subjective assessment of the input factors and the difficulty to build hypothetical EDF's, without assuming the normality of asset returns. However, the model is still popular and is recommended as a prominent credit risk model to be applied in the Indian banking sector as per the RBI's Guidance Note on Credit Risk Management 2001.

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# **IOT BASED PLANT MONITORING SYSTEM AND SMART IRRIGATION USING NEW FEATURES:**

## **A REVIEW**

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**Abstract** – Agriculture is important for the survival of humans and also helps in balancing the ecological cycle. Most of the farmers still use the traditional technique for agricultural purposes as they are quite unaware of the development in the modern technology that can benefit them. In this paper we have come up with an IOT based approach for smart agricultural device using Arduino microcontroller. With the help of this system, farmers can treat their crop fields in a cost-effective way, they can monitor the growth of the plant and automatically irrigate it by sensing various parameters such as, soil nutrient sensor, PH sensor, Smoke sensor, Moisture sensor, Temperature and humidity sensor. And another important feature of this project is that, in sloppy areas, the agricultural lands will be inclined and when the crops are irrigated the water will go stand in the bottom of the land and there will be unequal proportion of water supply to the crops in the entire field. Due to this crops might be affected. We have proposed a system where equal proportion of water can be supplied to the crops in inclined field by dividing the entire field and placing valves which controls the water flow in the division. All the data sensed by the sensors are sent to the microcontroller and the data is exchanged with the users with the help of GSM module. The data collected is stored in cloud for future references and is the one responsible for irrigating the field.

**Keywords** – *IOT, GSM module, Cloud, Sensors, Soil nutrient analysis, Sloppy areas*

### Introduction

Internet of things has become one of the booming technologies which has been recently used all over the world for different purposes. It is mainly being used in agricultural field for smart irrigation. As agriculture is the main source of income, around 50% of the country's population relies on agriculture and its activities. Around 16% of the country's GDP is contributed by Agricultural sectors. The wastage of agricultural needs (such as water and nutrients) will affect the future needs, therefore agricultural needs should be thoroughly analysed and managed. Agriculture requires a lot of water for irrigation, Water plays a vital role, it can either help grow your crops or even destroy them according to the amount of water supplied. By applying new farming methods helps the farmers increase their yield. To reduce the wastage of water during irrigation, several methods have been invented among which drip irrigation seems better than any other methods. In drip irrigation method, the water is supplied directly to the roots of the plant drop wise. One of the advantage of drip irrigation is that water wastage by evaporation and runoff can be minimized.

With the help of this system, farmers can treat their crop fields in a cost-effective way, they can monitor the growth of the plant and automatically irrigate it by sensing various parameters such as,

- **Soil nutrient sensor** – Soil requires proper nutrients which is most important for the growth of plants. This sensor(NPK Sensor) detects the contents of nitrogen, phosphorous & potassium in the soil as they heavily affect the fertility of the soil and yield of the crop.
- **PH sensor** – It determines the soil alkalinity and acidity.
- **Smoke sensor** – It senses for the smoke or fire indication around the field.
- **Soil moisture sensor** – It measures or estimates the amount of water in the soil and it accordingly irrigates the land automatically.

- **Temperature and humidity sensor** – These are the electronic devices that measures and reports the moisture and temperature of the environment.

In sloppy areas, the agricultural lands will be inclined and when the crops are irrigated the water will go stand in the bottom of the land and there will be unequal proportion of water supply to the crops in the entire field. We have proposed a system where equal proportion of water can be supplied to the crops in inclined field by dividing the entire field and placing valves which controls the water flow in the division. Initially the bottom valve (which has the most inclination) is open so that the water is supplied to the lower part of the field. Once a message is received, the flow of water is stopped by closing the valve. Later the second valve leading to a less inclined land will be opened using commands and water will be regulated according to the requirement. Similarly, this will be done to all the divisions in the field till the water requirement is satisfied.

The main aim of this paper is to utilize internet of things to accomplish the succeeding goals:

- To properly manage the wastage of water during irrigation by measuring various parameters such as soil moisture value, temperature, PH value of the soil, Nutrient analysis.
- To reduce the time intensive of irrigation the alternative and effective automations are introduced.
- To analyze nutrients of the crop, PH level of the soil so that proper nutrients can be supplied to the crop for increasing the crop yield.
- To find the efficient method for irrigating crops in unequal lands so that equal proportion of water can be supplied to entire field by installing valves.

Literature review

**Shwetha B. Saraf and Dhanush H. Gawali in [1] proposed “smart irrigation monitoring and controlling system using IOT” and says that, to meet the requirements of human demands improving farm yield is essential and suggested that advances tools and technologies can be utilised to improve the crop yield. The automated system for irrigation is presented in this paper which favors in reducing the usage of water for irrigation purpose. Soil moisture sensor is used for implementing this system. They have also used Wireless sensors which monitors the environmental conditions like temperature, water level, moisture of the soil and humidity. The data sensed are stored in the cloud server for managing the actions. IOT is the objects connected with each other to exchange and store data without human intervention. The plants water needs are monitored and controlled with the help of cloud-based monitoring system. To increase the productivity, sensors are helpful.**

Gaurav Patil in [2] proposed a “plant monitoring system based on IOT using Node MCU”, plant monitoring system provides a feedback to the farmer through a mobile phone. The farmer can monitor plant parameters based on IOT using different sensors. Node MCU is a open source platform. It offers complete and self-contained WIFI networking.

Soil moisture sensor is used to measure the content of moisture in the soil. The electronic board and the probe are the two pieces of the sensor which detects the moisture content. Depending on the moisture level, the sensor's voltage changes. The voltage decreases as the moisture level increases and vice versa. To measure the temperature and humidity DHT 11 is used in this system. The electrodes in DHT 11 measure the humidity. The resistance between these two electrodes changes as and when the humidity around it changes. Thermistor is used to measure the changes in the temperature. The sensor's resistance changes as the atmospheric temperature changes.

In [3] Smart ways of irrigation has been applied due to the scarcity of water in today's world. The project gives a description of smart irrigation using IOT.

The aim of this paper is to reduce the wastage of water and human interference in carrying out the irrigation.

In this paper, mesh topology is being used wherein the farm area has the sensor nodes and a stationary base station which collects and processes data from the sensor nodes.

The hardware components such as the photocell sensor, temperature sensor, soil moisture sensor, etc and the software components like the Android based application are together combined to form this system.

The Soil moisture sensor measures the amount of water contained in the soil. This information helps in maintaining the water level in the soil and allows water to be irrigated based on the soil's need for proper nourishment of plants.

The acidity and the alkalinity of the soil is checked by using pH sensor. This information will be constantly updated to the Android application in the mobile.

This is a simple process to use as the sensors will direct the user as to when the moisture content in the soil is low and the sprinkler needs to be turned on. We can overcome the cost barrier by using this system and therefore it is considered to be much useful in the irrigation process.

Pernapati kiranmai in [4], has proposed a cost effective smart irrigation system using Node MCU microcontroller. This model uses the different sensors which are connected to the Node MCU to check the level of water in the soil. These sensors continuously send data to the ESP8266 Node MCU in which the controller processes the data first and will then send it to the web server in the phone through MQTT. These sensors are connected to the Microcontroller as inputs. The values measured from the sensors are sent to the end user that being the phone. Based on the requirements of the data received, respective operations are performed..

This system reduces the amount of water wastage during irrigation by traditional methods as well as operates the system at less power due to Node MCU.

In [5] The food chain pyramid mainly depends on the plants as they are the primary producers. So it is very important to maintain the nutrients and the growth of plants.

This paper aims in demonstrating the automatic irrigation system using the IOT technology.

In this paper, it uses respective sensors for checking the moisture content, the temperature as well as humidity in the soil. The proper evaluated data from these sensors will then decide the amount of water required for irrigation in order to reduce over irrigation.

The hardware components like DHT11(which measures the temperature and humidity) , ESP8266 (which is a Wi-Fi model used to provide internet to the Microcontroller), Water pump, Arduino Uno etc and the software components like Android based application are together combined to form this system.

Agriculture consumes a lot of water for proper growth of plants. This design's prototype is used for irrigating the plants depending on the values measured by the sensors. This system is one of the most time efficient activity because it automates the process of irrigation by just switching the motor on/off. Online monitoring by farmers through an android based application makes it more efficient. This paper concludes that the development in automation using IOT has expanded considerably in the agricultural domain.

In [6] The farmers usually tend to use a lot of water for irrigating and due to which the electricity increases. This could cause soil damage. Smart system and automated irrigation system is created, used to control and observe irrigation. This paper aims at implementing the above proposed system by using WSN and water pumps. Water level sensors are connected to canals and flow sensors are connected to pump. The data is periodically sent from these sensors through a wireless gateway to the web server.

This paper gives a system that is used for automation by analysis of moisture of ground. It is used for regulation of water without any human interference.

In [7] soil management will also improve yield by various parameters of soil according to crops. Considering WSN to this system makes possible to measure various parameters of soil.

This model can be considered to get great yield in smaller grounds. The overuse of fertilizers is the cause of declining productivity. Arduino Uno can also be found on Atmel Atmega328, has clock speed of 16MHZ. Microcontroller has 6 input with analog to digital converter and 14 I/O ports.

Data analysis is done to get application rates of fertilizers. Excess use of fertilizers causes soil damage and even damage environment.

In [8] pH is main parameter for soil product, it should be addressed to improve system. pH is used to check hydronium ion, and which is used to check how much fertilizers need to be provided. Knowing pH has advantage for this system. Soil pH is taken as negative logarithm of  $h^+$  concentration of soil. The soil is "acidic" if the pH value measured is below 7, it is "alkaline" if pH value is above 7, the soil is "neutral" at pH 7. present while in alkaline soil P, Fe, Cu, Z and B are present.

## Methodology

The values from different sensors inserted in the field are collected and sent to a microcontroller (Arduino)

The data collected will be sent to the users phone through a GSM module.

Based on the data received, the user can either irrigate the field or check for the nutrients required for proper growth of the plants.

If the land is elevated i.e., if the land is not even, then the land is divided into subregions so that the irrigated water is distributed throughout the land without being clogged in one area.

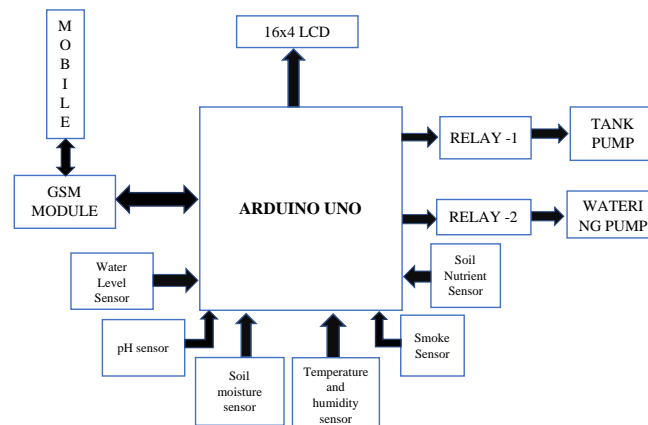


Figure 1: Block Diagram

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## A STUDY BASED ON SMART SHOPPING TROLLEY

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### Abstract

In today's world, people get too busy with their job and find less time for shopping. As we know during weekends shopping malls are much crowded and after shopping it's a tedious process to stand in a long queue and wait for billing to happen. The bar-code-based billing process fails to be on par with the speed of the billing process when it has many products to be scanned. Thus, it is time-consuming and inefficient. So, for this reason, people nowadays undergo online shopping which has got huge drawbacks like quality issues. To overcome this issue, there are many technologies used. RFID technology is one of them. Instead of scanning laser light reflections from printed barcode labels, an RFID scanner recognizes the location and identification of tagged things. It leverages low-power radio frequencies to collect and store data. In this survey, we examine the use of different techniques such as Wireless Sensor Network (WSN), Global System for Mobile communication (GSM), Microcontroller, etc...for the smart trolley. This concept "Smart Trolley" aids us to save time and brings the billing process to be on par with the busy days of the customer. This unique smart trolley system can be easily implemented and tested on a commercial scale and can be made used as a real-time scenario in the future.

**Key Words:** *Microcontroller, RFID, Wireless sensor network, GSM, Smart trolley*

### I. INTRODUCTION

For the majority of the two millennia, India had the world's largest economy from the first to the nineteenth century. India's economy is described as an emerging market economy with a middle income. It has the world's third-largest purchasing power parity economy and the sixth-largest nominal GDP (PPP). The Indian retail market is projected to be over US\$600 billion, making it one of the world's top five in terms of economic value. India is one of the world's fastest-growing retail markets, with a predicted value of \$1.3 trillion by 2020.

In 2018, India's e-commerce retail business was worth \$32.7 billion, and it's predicted to grow to \$71.9 billion by 2022. Developing new products is still a strategic decision for businesses looking to acquire a competitive edge today. Enterprises gradually realize that they may receive information, technology, and labor from outside to jointly develop products in order to succeed from innovation [2][3]. Users, on the other hand, no longer take products offered by the enterprise passively, but actively participate in product development and design, as well as other areas of product creation, in order to co-create value [4]. Customer participation can improve product performance, improve product innovation ability, and perfect products and services, in addition to strengthening the enterprise's competitive advantage and increasing the likelihood of innovation success [5].

The way people shop has changed dramatically. People are shifting away from local marketplaces and toward marts. The explanation is simple: people can acquire everything they need, from vegetables to cosmetics, under one roof.

Nowadays, shopping in a mall for a range of things necessitates the use of a trolley. Many supermarkets nowadays provide shopping conveniences, one of which is a shopping trolley. Customers use it to bring things to the cashier while shopping, and he is not supposed to leave the store. Every time a consumer pulls the trolley from rack to rack to gather products, he or she must also calculate the cost of those items and compare it to the amount of money in his pocket. Even if people now have electronic money, everyone will agree on one issue: standing in long lines for billing. In the end, customers must choose between their valuable time and the number of products they acquire. We can have a very good method of paying our bills in no time because we live in the twenty-first century with great technologies. Consider buying a significant number of products and be ready to pay bills as soon as you're done shopping. It will undoubtedly save us time. Customers, on the other hand, are frequently concerned about a variety of issues when visiting a mall. Most clients, for example, are concerned that the carrying amount will not be sufficient to cover the cost of purchasing things. As a result, clients using RFID smart trolleys will be able to avoid the challenges that customers in hypermarkets face.

In the introduction section, the problem of traditional shopping and billing scenario was reported. In section II motivation for a survey about smart trolleys is discussed. In section III problem statement is explained using a flowchart. In section IV we came across different literature surveys to know more about smart trolleys. In section V design analysis, a research study was done. Finally, this article concludes in section VI

## **II. MOTIVATION**

### **A. DESIGN OF THE SERVICE:**

It is critical to note that there is a dearth of understanding on how new services should be developed. As the global economy shifts from manufacturing to services, it's critical to comprehend and understand the new service design process.

In order to please customers, a service concept is a description of client needs and how those needs are met. The goal of development is to provide service prerequisites that customers find appealing. Many years ago, most investors concentrated their efforts on industrial research and design. As a result, production methods and processes were essentially optimized; items were created and produced, while service development and design were mostly overlooked. However, the scenario is rapidly changing, and then there's Service Design. Service Interfaces are typically created for intangible items that are helpful, profitable, and attractive to customers while being effective, efficient, and unique to the supplier. The most significant aspect of service design is that it visualizes and formulates solutions that aren't currently available by watching and analyzing client demands and transforming them into possible services or new services.

Sylvan Goldman, the owner of Standard Food Market in Oklahoma, was one of the first to introduce a shopping cart. Customers frequently complain to him about the trouble they have bringing groceries from his store. Goldman attempted to resolve the issue by experimenting with shopping baskets in his store. To make it easier for customers to transport groceries, he mounted the basket on a carriage with little wheels. To help and delight his customers, he commissioned an engineer to create a modern shopping trolley, which he patented [1]. Since then, the shopping cart has been mass-produced. Shopping trolleys come in a variety of designs and sizes at today's supermarkets.

Following Goldman, there has been a slew of research and products aimed at improving shopping carts.

### **B. THE REASON FOR USING A MICROCONTROLLER BASED SYSTEM:**

Microcontroller-based systems are less bulky and transferrable. It consumes less energy. As a result, the system becomes affordable. It takes up less room and is simple to install. User-Friendly And Cost-Effective: Because this system relies on a microcontroller, it consumes less energy and occupies less space, making it both user-friendly and cost-effective.

### **C. GENERIC APPROACHES (As of Now):**

The microcontroller-based design has risen to the top of the electronics trend list. This is a highly specialized field that allows thousands of transistors to be integrated onto a single silicon chip. Nowadays, shopping in a mall for a range of things necessitates the use of a trolley. Every time a consumer pulls the trolley from rack to rack to gather products, he or she must also calculate the cost of those items and compare it to the amount of money in his pocket. Following this approach, the customer must wait in line for billing. So, to avoid headaches such as dragging a trolley, sitting in a billing line, and planning a budget, "SMART TROLLEY" is a new concept that we are introducing. Only the RFID TAG of the product wrapper must be held in front of the RFID scanner by the consumer. Following that, product-related data will be displayed on the display. Customers can purchase a big number of products in a short amount of time and with minimal effort by using this trolley. A computer may be readily interfaced at the billing counter for verification and bill printing.

### **D. RADIO-FREQUENCY IDENTIFICATION (RFID):**

As defined in [1] Aboli. H and Poonam. T, RFID is a technique that employs radio waves to convey data from an electronic tag, termed an RFID tag or label, attached to an object, through a reader for the purpose of identifying and tracking the object (2015). When RFID technology is used with a trolley, it creates a powerful combination., it may detect the location of items or products, making it easier for customers to find what they're looking for. It can also help the company or the store identify commodities or products that are in short supply. It will be easy for the corporation to order goods or a new product, ensuring that it is always available.

As a result, interactions between the dealer and the supplier will be easier. This trolley is said to assist customers in determining the pricing of things and keeping track of their budget when shopping. Customers who wish to buy something in a mall should select things from the display rack and wait in line for payment. Customers must also wait in line at the cashier for an extended period of time to pay. This will be the hardest hit during the holiday season or if shopping centers continue to use traditional ways of adding the price of each item to the cash register by hand.

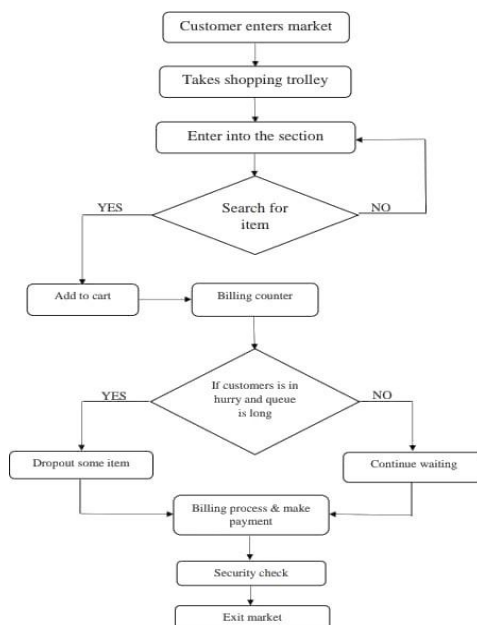
### III. STATEMENT OF THE PROBLEM

The marketing process, which promotes items to consumers and distributors, is an important aspect of supply chain management. Shopping refers to a gathering of individuals in one location for the purpose of purchasing goods. There are supermarkets or shopping malls that give a venue for people to shop where sellers promote their items to customers and customers buy products based on quality factors such as ingredients, expiration date, brand name, affordable price, and quantity. Traditional retailing is another term for this. Supermarkets are advantageous in terms of retail and urban development.

At the weekend, supermarkets are the most congested places. Making a list, whether on paper or on their phone, is one of the most basic tasks in shopping, as most customers have learned. They must spend a significant amount of time searching for products in the entire supermarket one by one, as well as time waiting in long lines to pay bills. Waiting in lines has a bad impact on people's moods and can lead to misunderstandings or confrontation, such as when someone cuts in line and stands in front of others. Traditional marketing encourages many local jobs, city life, and urban culture, thus this is not an ideal development. The store must also tailor its assortment to the desires of its customers.

As a result, online shopping attracts a big number of customers who purchase goods via the internet and browsers. In the interim, consumers can choose products based on prescribed criteria, ingredients, or instructions and obtain them from defined places. Furthermore, there is a higher risk of fraud, lack of inspection, the item may not work properly or be defective, not be the same product as the item pictured, transaction from stolen credit card, Phishing in which the customer believes they are purchasing a product from a reputable seller, disruption in the retail industry, and failure to provide pricing negotiation. Traditional shopping, rather than internet shopping, makes people feel more valuable, entertains them, allows them to enjoy themselves, and provides them with a high-quality product. Traditional shopping and supermarkets must reinvent themselves in these key scenarios if they are to thrive in the modern-day. Markets, also known as retail hubs or shopping malls, are sites where multiple small businesses come together to form a market.

The Smart Trolley proposal stood out among the team's many ideas because of how it might be turned into an exciting technology product that is convenient, easy to use, and efficient, as well as being an add-on service to the existing self-checkout system.



**Fig1: Flowchart depicting the present shopping issue**



## **1). Aim**

### **A. OBJECTIVES AND GOALS**

Concept generation and selection - The first step in the project is to find an idea that supports the project's established

To utilize the knowledge and abilities of innovation that are essential in entrepreneurship. This is to identify technology project ideas that will be assessed for their commercial viability.

## **2). Objectives**

### **Parameters.**

**Planning and preparation** - research and surveys aid in determining how to use tools, methods, and procedures to develop a technical concept that can be evaluated for commercial objectives.

**Requirement Analysis** - To examine the project's requirements, which include product idea development and selection, product definition and value proposition, market research and function of product concepts, and commercial viability strategy.

**Product Design and Architecture** - A technologically oriented create will be used to design the product's system architecture, based on the project requirements.

**Design Implementation** - To ensure that the product is implemented using the appropriate technology.

**Outcomes** - Develop a commercialization strategy in order to turn this initiative into a business plan. And it's simple to put into practice in real-life circumstances to help with the shopping process by automating the shopping cart.

## **IV. LITERATURE SURVEY**

This document contains in-depth information about RFID technology. RFID is a flexible and user-friendly technology that is employed in IoT and embedded devices. To identify products, radiofrequency identification (RFID) tags are routinely employed. Tags and readers are the two components of an RFID system. The reader sends out radio waves and receives a signal from the RFID tag. This technique was recognized in the 1970s, but it has only recently become increasingly significant. RFID scanning distance can be easily adjusted as per needs.

The RFID tags are scanned using a variety of ways. Some use the ATMEGA 32 microcontroller, the Em18 module, and the RC522, which is one of the finest. We can use the Xampp server, ZigBee module, USB wire, Mobile app, or GSM module to generate the bill and transmit it to the cashier, just as we can use the Xampp server, ZigBee module, USB wire, Mobile app, or GSM module to scan.

This all about combining multiple technologies such as Arduino Uno, RFID, and an Android mobile application, the intended system design for the automation of the purchasing process. Electronic components and software components are the two primary types. In the field of electronic components, the Arduino Uno serves as an intermediate microcontroller that controls RFID technology and facilitates communication between RFID technology and software components such as an Android mobile application through a Wi-Fi module.

In [8] there is a deep study of components used for smart trolleys such as LCD, LCD stands for liquid crystal display, and it is a type of display that looks like a flat panel. An LCD is installed on the cart to display the product information as they are added or deleted, as well as the updated bill details. The commands to the LCD are delivered through the code developed to show the required content.

EM18 RFID reader, 125KHz tags are read with an EM-18 RFID reader. It uses a minimal amount of electricity and can read up to 10cm away. It comes in a tiny package and is simple to operate. The communication formats UART and Wiegand26 are available. It can communicate directly with microcontrollers through UART and with a PC via RS232.

The HC-12 communication module is utilized to establish wireless connectivity between the trolley and the shopping mall's central PC. This module is commonly used to send and receive digital data. It communicates in half-duplex mode. It has 100 channels with a frequency band of 433.4-473.0MHz. It has a range of up to 1.8 kilometres.



It provides information about MIFARE tags, MIFARE, a well-known NXP brand for a wide range of contactless IC components that allow read/write distances of up to 10cm, is more proven and dependable than any other interface technology on the market. The frequency of operation for these tags is 13.56MHz. Backward compatibility within the MIFARE product family provides a seamless transition to higher security and functionality levels. MIFARE Ultralight, MIFARE Classic, MIFARE Plus, MIFARE DESFire, and Smart MX are the most popular products.

MIFARE tag's disadvantages are, less supplier experience, backward compatibility issues, less choice of readers, change or migrate all applications, and need to make multiple changes in a short period of time.

This reports that the Smart Trolley will obviously necessitate a very good and adaptable design that will entice the client to utilize the product. Essentially, the trolley is and will continue to be a vital element of the consumers' shopping experience, and companies that utilize them must guarantee that the design meets the needs of the customers.

The Smart Trolley should be easy to maneuver; each Smart Trolley should be equipped with a security tracking device to prevent individuals from taking it outside of the retailer's premises, and it should only be used for card payments.

It should be equipped with a barcode scanner and a screen device (shopping tablet) to display all scanned products and prices, as well as a "help" button that may be tapped for any type of assistance. A shopping tablet should be user-friendly, with a touch screen that is simple to operate.

The method through which client software communicates with a database server is known as a database connection. The database connection is used by the program to send requests to and receive responses from the database server. The database stores information that the client program may access gives a solution for Why is RFID used? RFID tags are classified into two types: passive and active. Passive tags have no battery life, but Active tags do. RFID deployment of mobile technologies and automated recognition make smart cart technologies more accessible. RFID, in conjunction with wireless networks, makes the traditional retail process faster, more transparent, and efficient.

Since the introduction of wireless technology, electronic commerce has evolved to the point where it can give ease, comfort, and efficiency in daily life. The primary goal of this is to create a centralized and automated billing system that makes use of RFID and ZigBee connectivity.

The Bayesian Network A Bayesian network, Bayes network, belief network, Bayes (ian) model, or probabilistic directed acyclic graphical model is a type of Bayesian network. According to this statistical model, a set of random variables and their conditional relationships are represented by a directed acyclic graph (DAG). DAGs are formal Bayesian networks in which the nodes represent random variables in the Bayesian sense. They might be observable quantities, unidentified factors, or speculations. Edges show conditional dependencies, whereas nodes that are not linked represent variables that are conditionally independent of each other. A probability function associated with each node accepts a specific set of values for the node's parent variables as input and returns the probability distribution of the variable represented by the node. gives the feasibility study as the first step that must be taken before starting a business. This research also serves as the foundation for business choices, ensuring that no one party is affected. The feasibility assessment also includes commercial, technological, financial, legal, and risk identification aspects. One of the primary factors for determining feasibility is the marketing component.

Market analysts all think that the conventional trolley market is growing at a rapid pace. Whereas overall trolley sales climbed by USD 250 million in 2013, sales increased by USD 900 million in 2016. This increase is also expected to be as much as 1.86 percent in 2020, implying that total trolley sales in 2021 might reach up to USD 1 billion globally.

As a consequence of this study, it is possible to infer that a potential market has been waiting for this Smart Trolley technology to replace the function of the traditional trolley.

In general, the differences between Smart Trolleys with embedded motor thrusters and Smart Trolleys with detachable motor thrusters are negligible. Whereas the traditional trolley market is still in demand, there are several prospects provided by various technologies that provide convenience to all buyers. The sole distinction is in the degree of flexibility in its functional purpose. The Smart Cart with replaceable motor thrusters has a greater propensity to provide flexibility and more options for consumers who can push the trolley on their own or who require more thrusters.

## V. SMART TROLLEY DESIGN ANALYSIS

The components of the Smart Trolley design are as follows. Each component was assigned to a different team member who was responsible for researching and submitting the design requirements.

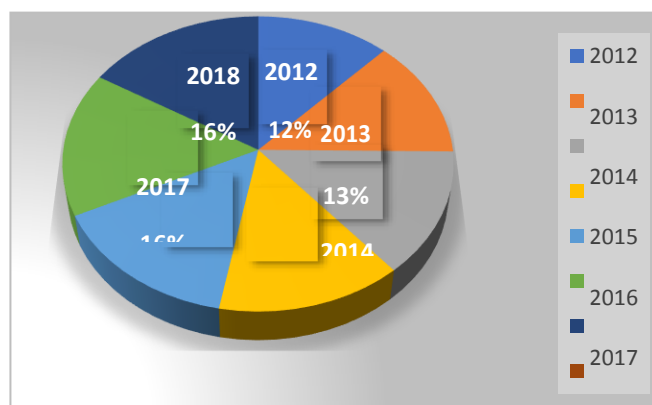
1. User interface and design of the Smart Trolley
2. Access to the store's database
3. Wireless Internet access
4. Establish a network
5. Scanning product
6. Power
7. Payment mechanisms and receipt creation

## A. RESEARCH STUDY

**TABLE I**  
**COMPARISON OF PRESENT AND RECOMMENDED SYSTEM**

Sl. no	Functionality	RFID System	Zigbee	Barcode System	Recommendation System
1	Based on Arduino	Yes	Yes	No	Yes
2	RFID Sensors	Yes	Yes	No	Yes
3	Bluetooth	No	No	No	Yes
4	IOT based Wire-less Communication	Yes	Yes	No	Yes
5	Barcode Scanner	No	No	Yes	No
6	Android based Mobile display	Yes	No	No	Yes
7	Location based searching module	No	No	No	Yes
8	Automation of bill generation	No	Yes	No	Yes
9	Shopping list management	No	Yes	No	Yes

In 2018, India's eight biggest metropolitan cities had a total of 253 shopping malls. From 188 malls in 2012, this was a steady year-over-year rise. Around a hundred malls are projected to be constructed by 2022. The development of the middle class is reflected in the number of shopping malls.



**Fig2: From 2012 to 2018, the total number of shopping malls in India increased, with an estimate for 2022.**

## **B. RESULT**

The retail component demonstrated by market researchers all indicates that the traditional trolley market is always growing, with total trolley sales increasing by \$250 million in 2013 and \$900 million in 2016. According to another article, several types of creative features found on a trolley to assist its user in shopping can boost trolley sales even more. The trolley has gone through a lot of evolution. Caper Inc, Focal System, Walmart APOLLO, and even Microsoft Corp. are among the companies that have improved its trolley.. This means that more trollies have been purchased by an existing mall or a newly opened mall for the convenience of the people, i.e longer queues.

To increase customer convenience and to reduce long and boring queues for the billing process, the concept of a smart trolley will be helpful.

## **VI CONCLUSION & FUTURE SCOPE**

The Smart Trolley was developed to be a mobile self-service system that will allow users to check out and transact from their local retail store. It is fully synchronized with the store's existing system. With this smart trolley, they will know the exact amount to pay. Each product in the store will have an RFID tag. The customer will be given a special RFID card that will allow them to access the trolley. The security tag is present in almost every item for theft protection. The name of the product, quantity, and price of each product will be displayed. This makes shopping convenient. A database is managed and presented on the cashier side, where the total amount and the number of products are shown for each customer. Obviously, RFID surpasses barcodes in their accuracy, quick response, and durability. This concept eliminates standing in a queue, saves the customer time, and facilitates the shopkeeper's process. This reduces one-third of the overall investment of the shopkeeper for the billing department.

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# WEATHER DATA CAPTURING FOR RAIN AND FLOOD DETECTION USING IOT

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**Abstract:** Heavy rainfall can cause floods in different regions according to a geographical area. Over the past few years, we can observe the occurrence of floods. Technological advances in recent years have made it possible for solutions to these natural disasters, one of which is the "internet of things". This device monitors rainfall and flooding. This tool is designed and controlled by Arduino Uno Microcontrollers which is integrated with rain sensor, ultrasonic sensor, float sensor, DHT11 for temperature and humidity sensors to monitor the weather, and a Wifi module for communication purposes and Arduino is mainly used to control functions of different sensors and components. The real-time data from Arduino uno is sent to "Thing speak" which is a cloud platform used for accessing data. The data is accessed by a flood detection device which is compared with safe default values. The system gives warnings when the data exceeds a safe threshold value, this is communicated to people by the "IFTTT" platform by means of SMS, and due to the android application, it's user-friendly and helps to receive information in one touch. This model is extensively used to alert people and warn humans earlier than the flood to arrive in order that essential protection precautions may be taken and to minimize harm from herbal screw ups.

**Keywords—** *Arduino uno Microcontroller, Ultrasonic sensor, Humidity Sensor, Rain Sensor, Temperature monitoring Sensor, THINGSPEAK, IFTTT.*

## I. INTRODUCTION

"Weather Data Capturing, Rain and Flood Detection using IoT" is a clever program that constantly monitors various aspects of the environment to predict flooding, and alert, to minimize damage caused by flooding. Natural disasters such as floods can be catastrophic, resulting in things effects and loss of life. To eliminate or minimize the effects of floods, the system uses various natural features to detect floods. The system has a Wifi connection, so the taken data can be easily accessed anywhere using Internet of Things. The flood monitoring system looks at various aspects of the environment, including humidity, temperature, water level and flow rate. Collecting biological data, The system contains various sensors that collect data for each parameter. For changes in humidity and temperature the system has a DHT11 Digital Temperature Humidity Sensor sensor. It is an advanced sensor module that contains moisture-resistant and temperature-sensitive components. The water level remains below the level of the floating sensor, which works by opening and closing the circuits (dry contacts) as water levels rise and fall. It usually rests in a closed area, which means the circuit is incomplete and there is no electricity passing through the wires yet. If the water level drops below a pre-determined point, the circuit automatically shuts off and transmits electricity to the completed circuit to start the alarm. The flow sensor in the system keeps an eye on the water flow. Extreme levels of flood danger were announced in at least two places. Understandably, flood hazards will not decrease in the future and as climate change begins, flooding will threaten many regions of the world. In order to minimize the damage caused by floods, disaster management information systems should be implemented in high-risk areas. This program will be able to reduce flood damage.

## II. LITERATURE SURVEY

Girija C et al. built a Internet of Things (IOT) based Weather Monitoring System. In this program we have seen the sensitivity of different sensors and the monitoring of weather conditions in a particular area and make the information visible anywhere in the world. The technology for this is the Internet of Things. The system is responsible for monitoring and controlling environmental conditions such as temperature, humidity and CO level of sensors and sending information to a web page.

Gopinath N, Vinodh S proposed a Weather Prediction using Machine Learning and IOT. Here, there are two settings: single, measuring weather parameters such as temperature, humidity using sensors and Arduino and setting, to display current values (status) and rainfall based IoT. We have seen weather forecasts and forecasts are made based on old data collected and compared to current values. Here the proposed setup will compare the forecast value with real-time data, as well as data-based rainfall prediction.

A F Pauzi and M Z Hasan developed an IoT Based Weather Reporting System. In this project we have seen the Internet of Things (IoT) platform using THINGSPEAK. should be able to show the parameters of the weather and the information will be visible. The Internet of Things (IoT) platform using THINGSPEAK should be able to display weather parameters and information will be visible. All data collected will also be saved in google sheet format with the IFTT tool for easy data analysis.

This app will monitor climate change occurring in the environment and provide users with the fastest way to access information anywhere.

Wen-Tsai Sung et al. proposed a project Early Warning of Impending Flash Flood Based on A IoT. The proposed system based on A IoT generation presents real-time flood inspection so that power can screen mountain dwellers and provide early warning. The study makes a speciality of a flood monitoring machine as a precautionary degree to efficaciously screen mountain slopes which are prone to flooding at the same time as taking into account price, performance, and protection measures.

The proposed system layout contains sensor integration into a small controller, and the connection among sending and sending records to a cloud computing thru the net. All sensor study in every installation are display in the application, and warn are sent via SMS via the application.

N. V. S. Sunny Varma et al. built a project on Internet of Things Based Smart Flood Monitoring & detecting system. we've got were given located records from this proposed device. the proposed layout of this device uses the net of factors to display those conditions close to the dam with the help of MEMS. stage sensor, temperature and humidity. With the assist of these sensors and a microcontroller, data is processed on a internet website. From the internet website online on-line, the information is scanned into net pages and notified close by villages and settlements.

Elmeen Daud et al. Developed the Advanced Flood Detection System with IoT. We detected a connection between the sensor and the small controller. This advanced flood detector contains a sensor module, microprocessor, and outlet module. Exit module is installed inside residential houses. It consists of an ultrasonic sensor to detect liquid levels and IOT features and the data is directed to a microprocessor. The microprocessor will collect the data, process it and the selected output will be sent to the output module. A distinguishing feature of some flood finders is the use of IoT systems. Exit module contains alerts that are an application warning from the IoT feature. Users will first receive a warning from the app in the event of a water level rise, or notice given to a nearby IoT dam.

Anita M et al. Built a IOT Based Weather Monitoring and Reporting System we observed, IoT venture primarily based on IoT weather monitoring and Reporting gadget used to get live climate Reporting. it's going to monitor temperature, humidity, humidity and rainfall. suppose scientists / biologists want to reveal adjustments in a particular vicinity consisting of a volcano or rain woodland. And those humans come from everywhere in the international.

Neha Suresh et al. developed a IOT Project called Early flood monitoring system using IOT applications. We have identified the ultrasonic sensors that create the flood-sensing devices that receive the ultrasonic water level sensors that we need to construct the flood-sensing devices that can detect water levels. This system is integrated with a microcontroller board that will help send data each time the water reaches a threshold value. Data stored in the cloud will help send it to users. User can get real-time information on monitoring flooded roads with android app.

S. M. Shirsath et al. proposed a IoT Based Smart Environmental Monitoring Using Wireless Sensor Network. The main purpose of the proposed system is to provide environmental terms for remote internet access. The system represents environmental and ambient parameter monitoring using Internet-connected low-power sensors, which transmit their measurements to a central server. Arduino uno is a small computer with popular features such as low cost, flexibility, fully customizable and customizable small Linux board embedded PC and capabilities for its use as a wireless sensor node. From the base station this facts is uploaded every seconds to the cloud (net) for further evaluation. If a drought scenario is diagnosed thru the tracking device then a notification message is sent to the customer through textual content message or electronic mail.

Mohamad Syafiq et al. developed a Flood warning and monitoring system utilizing internet of things technology. we've acquired data for this proposed software program , This paper develops real-time flood tracking and early warning system using a wi-fi sensor node in a flood-prone area. A wireless sensor node can assist patients by obtaining degrees of water and rainfall at the same time and providing early warning of floods or heavy rainfall. The sensor node consists of ultrasonic sensors and a rainsensor operated with the help of a microcontroller gadget method..

### **III. PROBLEM STATEMENT**

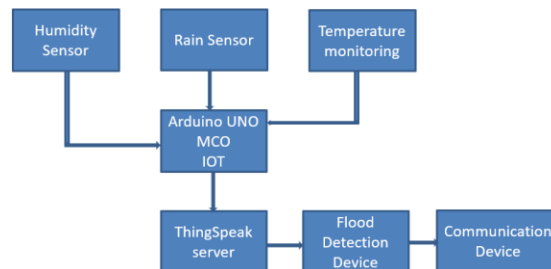
People's lives were lost because of the floods. Floods can occur at any time during the four seasons and anywhere in the world. Estimates of Flood Recurrence Caused by Recent Disasters. Recent findings regarding flood disasters encourage us to find the best solution to natural disasters. The flood information system is therefore being proposed as a measure to reduce the risk of flood damage to life and property. This program will be a great opportunity to make the work more efficient and synchronized.

Over the past decade, there are many types of programs that have been developed to prevent this problem from happening again. Therefore, a new system needs to be developed and operated from any time and place in order to solve this problem effectively using the best technology currently used in the world, and the system should be simple and practical. This program can inform people before there is a huge benefit to people who can protect their lives and their property.

#### IV. METHODOLOGY

IOT pre-flood monitoring device and Arduino warning system is a proposed solution to this problem. Our project contains various sensors, microcontroller, cloud, Wifi module and communication device. We use DHT11 sensor which is a temperature and humidity sensor, ultra-sonic sensor, float sensor and rain sensor to detect rain. With the DHT11 sensor the temperature will be expressed through Celsius, the humidity will be expressed in percentages. To get remote weather data we use a humidity sensor. so the DHT11 sensor detects its ambient temperature and humidity and sends information to a small control device. In our challenge we also use two sensors to gain two distinctive parameters. another ultrasonic sensor used to stumble on river water degree and flow sensor that acts as a switch when the water stage hits the glide sensor sends a stunning signal. The smaller controller we use is Arduino UNO, Arduino UNO is a cheap, bendy, and clean-to-use, smooth-to-use opensource microcontroller. All sensors are linked to this microcontroller board with a Wifi module. The Wifi module we use is the ESP8266 Wifi SoC module which itself has an incorporated TCP / IP protocol which can provide get admission to to your WiFi community. This version has a small Arduino UNO board with tje DHT 11 sensor, ultrasonic sensor, drift sensor, rain sensor. based totally on the information furnished by those sensors we can also determine whether or not a flood will arise or not. We join them to the cloud, the cloud we use is THINGSPEAK from where we connect this to the cellular app and we are able to see the output in this app first, the sensors linked to the Arduino UNO gets moisture, temperature, water degree and flow level. Our microcontroller will acquire all of these facts and upload them to the THINGSPEAK cloud we created before the use of the Wifi module and from these our statistics could be restored to the cellular utility the usage of the IFTTTnet server.

#### V. BLOCK DIAGRAM



The maximum fundamental step in constructing a tracking machine is to extract a blockchain gadget in which all extra moves are done. The Block diagram is accompanied with the aid of the layout of the circuit diagram in which all of the components namely, one-of-a-kind sensors, wireless module etc. mounted on microcontroller and breadboard. The maximum primary step in constructing a monitoring gadget is to extract a blockchain gadget in which all additional actions are carried out. The temperature sensor with DHT11 might be used which is the quality model for dimension. In this Temperature it is going to be displayed in Celsius. Humidity (H) will be indicated with the aid of percent. This Sensor reads 20% - eighty% with an accuracy of 5% and 40

- 80-diploma Celsius with  $\pm$ zero.five accurate, can pass down or up. (DHT eleven) Environmental sensors Temperature and Temperature sensors also transmit records to the Arduino microcontroller tool. Arduino UNO also uploads this records to recorded parameters in the THINGSPEAK cloud using the ESP8266 Wifi module. The person is the use of this THINGSPEAK server and it acts because the end of the complete machine. To gain remote weather records the usage of humidity sensor, rain temperature sensor, uv sensor that gives modern-day weather statistics and this facts is stored and monitored through Arduino UNO MCU IOT and then transmits the received information to the speech server. on this undertaking we use sensors to discover distinctive limits. One accelerated sensor is worn to determine the aqua diploma of the river and the possibility is a aqua go together with the glide sensor used to decide the go together with the glide fee of a river. through sending SMS to neighbor hood humans to document the scenario all through floods the use of the IFTTT internet server. To screen the information of these two limits we use an outside internet server referred to as THINGSPEAK. THINGSPEAKS is an unlocked supply internet of things software and API to examine and write facts from items. makes use of HTTP connection to talk. At THINGSPEAK we use graphs and numerical indicators to screen online information updates.

THINGSPEAK has many advantages along with activating a selected hyperlink whilst positive situations are met. IFTTT stands for if this is going past that. It approach that in the event of a cause a sure action should be achieved. IFTTT is a loose internet-primarily based applet constructing provider. In this assignment we're bring an applet containing apps, one webhook and the alternative message . To assemble this applet, it contains 7one of a kind step and we want one useful cellular phone with an agile sim.

After completing the 07 steps we can locate the Uniform Resource Locator used to release the Short Message Service applet. in this IFTTT we cannot fantastic deliver SMS but moreover push Gmail alerting , fb alerting and so forth IFTTT turn out to be very easy to apply. It best carry the HTTPS protocol, so in case you need to set up a connection the various we need net net page certificates which consist of fingerprints. It makes our undertaking hard, so we set the URL used to launch SMS.

## **VI. SYSTEM HARDWARE REQUIREMENT**

### **A. HARDWARE COMPONENTS**

Arduino UNO: Arduino Uno is a microcontroller board superior with the useful aid of Arduino. it absolutely is an opensource digital a party line mainly based on the AVR microcontroller Atmega328. The state-of-the-art ArduinoUno model came with a USB port connector, 6 analog I/P pins, 14 digital I / O holes used for connection and external power circuits. In 14 I / O holes, 6 pins can be applied for PWM output. It allows designers to manipulate and enjoy outside electric powered objects inside the actual global. This board comes with all the skills wished for the controller and can be without delay associated with a laptop with a universal serial bus cable used to alternate code to the regulator using the IDE software program, this is notably stepped forward for Arduino improving. making plans languages along with C and C ++ are utilized in IDE. without USB, the battery or AC to DC adopter can be powered on board. Arduino Uno has the most splendid variations that encompass the Atmega328 8-bit AVR Atmega microcontroller wherein the RAM memory is 32KB.

DHT11 (temperature and humidity sensor): This DHT11 Temperature and Humidity Sensor contains digital sign output. mixed with excessive typical overall overall performance 8-bit microcontroller. Its era guarantees immoderate reliability and brilliant extended- term balance. It has splendid exceptional, brief response, functionality to combat distractions and excessive performance. every of the DHT11 sensors consists of the most accurate size of the humidity measuring bower. The size coefficients are saved inside the One-time password tool memory, the inner sensors gain alerts in the device, we ought to call the ones size coefficients. The serial interface of a unmarried cellphone is blanketed to make it quicker and less complicated. Small length, low electricity, signal transmission distance of up to 20 meters, bearing in thoughts an expansion of programs and even the most annoying ones. Product is a four-line unmarried-pin PIN package deal deal deal. For easy communication, specific applications may be furnished in keeping with the need of the clients.

wireless Module (ESP8266): The ESP8266 WiFi Module is a self contained SoC with integrated TCP / IP protocol which could provide get right of entry to to your WiFi network (or the tool can function an get entry to factor). One beneficial function of Uno WiFi is guide for OTA applications (over the air), which may be the transfer of Arduino graphics or WiFi firmware. Ultrasonic Sensor: drift and Ultrasonic Sensor is used to suggest water first-rate and amount of water Rain sensor: The rain sensor module is a easy device for detecting rain. it can be used as a switch whilst a raindrop falls on a raincoat and measures the depth of rainfall. Analog output is used to stumble on rainfall values. connected to a 5V electricity supply, the LED will switch on if the enter board has no voltage drop, and the DO output is excessive. If you drop a small quantity of water, the DO output is low, the jump wires the transfer indicator will open. easy the water droplets, and when restored to its authentic nation, they emit a high awareness. A rain sensor or rain transfer is a versatile device brought about with the aid of rain.

### **B. SOFTWARE REQUIRED**

Arduino IDE: Open-supply Arduino software application software software (IDE) help it clean to set in put down code and downold it to the beam.

THINGSPEAK: The THINGSPEAK server is an opensource database and net gadgets API that permits you to acquire, keep, analyze, visualize, and procedure records from sensors.

IFTTT: IFTTT short for "If This Is What It Is," a program forum that briefly describes how the service works with IFTTT, you can connect all your "services" together so that activities can be started automatically and completed. There are many ways you can connect with all your resources - and the resulting combinations are called "Applets".

## VII. EXPECTED OUTCOMES

The statistics from diverse sensors along with humidity sensor , rain sensor and temperature sensor are controlled and accessed by Arduino Uno and the data from that is sent to flood detection device where the information obtained is as compared with secure threshold values . Then the end result are represented in shape integer values and despatched to communicate device thru IFTTT utility through sms layout

### Ex :1

Humidity : 30%.

Temperature: 33 .33 °c. Water degree: 20CFS. Rain level : 600mm.

The message received is No trouble everything seems safe.

### Ex :2

Humidity : 40%.

Temperature: 19.3 °c. Water degree: 637CFS. Rain stage : 1035mm.

The message acquired is situations is not regular evacuation protocols ought to be accompanied.

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## TWO LAYER SECURITY SYSTEM FOR IOT BASED SMARTOFFICE

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**Abstract-** In the last few years, the researchers have proposed various works for monitoring applications using IoT. The Internet of Things is the network of devices or objects that are embedded with sensors, actuators etc. for the purpose of connecting, transferring data with other systems over the internet. The usage of internet has increased by connecting the objects to make places more comfortable, safe and secure. The system presented here is a Two Layer Security System for IoT based Smart Office, which addresses the security aspects in smart homes, offices, buildings etc. The first layer refers to when an object or threat approaching the lock, it senses and captures an image of it and sends the data to the user. The second layer refers to the reverse lock system that comes into operation when it has to be automatically locked after it is opened. The user can use a mobile or laptop to operate it using a web browser or a cloud application like Blynk. The system uses a camera module, ultrasonic sensor and a solenoid lock. The survey also discusses the related work done previously regarding surveillance systems and IoT.

**Keywords-** Internet of Things, Arduino Mega, Sensors, Reverse Lock, Surveillance systems.

### I. INTRODUCTION

All the existing security systems are old fashioned methods of accessing the system with either a key or some RFID chips. The “Two Layer Security System for IoT based Smart Office” is an intelligent system that lets you see a visitor or an object while your main office or home is locked. If you are in the middle of a meeting in a conference room and there is some visitor or a threat approaching your door or any lock, this system will alert you and send a notification to your mobile or laptop with a photo. Only if you approve, you either use the mobile or laptop to unlock the system using a cloud application or a web browser with the control operations. Alternatively, if you have an intercom facility, you can talk to the visitor when he or she wants to access the system, after your visitor is identified, you may open the lock by controlling the tab on the mobile. The interfacing circuitry of the smart office security system is made using the Arduino Mega module. This is used for handling the major operations such as controlling and developing. The Arduino Camera Module is used to click the picture of the visitor or the object that is near the lock. The lock here used is a solenoid lock which is very efficient to use consuming less power. It is connected to an external power supply. The object movement is sensed by a sensor such as ultrasonic sensor. It also helps in measuring the distance. To start with, you should have an Arduino IDE with all the libraries installed. This is implemented so as to reduce the security concerns that exist in our society and contribute towards it to provide a better solution.

### II. LITERATURE REVIEW

Gurusha Lulla, Abhinav Kumar, Govind Pule and Gopal Deshmukh introduced an “IoT based Smart Security and Surveillance System”. In this we observed many security aspects that are covered such as face recognition, camera surveillance etc. the system is implemented by using Arduino. ultrasonic sensors and camera module. This system provides flexible and a reliable security, which can be used in many areas such as offices, homes etc.

Piyush Kumar Singh Saxena, Utkarsh Dubey, Aakansha Raj, Biswa Mohan Sahoo and Vimal Bibhu built a “Smart Security System using IoT”. In this system we observed implementation of different kinds of technologies such as edge analytics and cloud analytics. The technology behind this is IoT. The system uses Raspberri Pi with PID sensor associated with it. This system deals with smart security which sends signals to the Raspberri pi board when someone approaches within the range by clicking pictures with a camera associated with it. After this, for additional security, a ring will be initiated.

Rui Yu, Xiaohua Zhang and Minyuan Zhang built a “Smart Home Security Analysis based on the Internet of Things”. In this system, we observed the different technologies used related to security. This project discusses a smart security analysis system that can effectively detect and defend against the attacks that smart buildings suffer. Firmware security is used in this system and therefore can solve the problems between smart home network security and device performance.

Abhay Kumar Ray and Ashish Bagwari built an “IoT based Smart Home: Security Aspects and Security Architecture”. We observed in this project the cloud and firewall technologies being used. The firewall system is in between the internet and the fog layer to protect an unauthorized access. The system uses analysis engine that monitors the device communication and transmission of data. This is a smart home architecture which can ensure the consumer trust and help implement these technologies in smart homes and smart offices.

Shahrouz Sotoudeh, Sattar Hashemi and Hossein Gharee Garakani built a “Security Framework for IoT based Smart Home”. In this, we observed the framework for security levels and implementation of designs. This paper provides the protocols using IoT, different technologies, procedures and software to provide security in homes. This paper was introduced to improve architecture for all the security requirements.

Malti Bansal, Navodit Adarsh, Nitin Kumar and Monika Meena built a “24/7 Smart IoT based Integrated Home Security System” in which we observed the different sensors and modules used to keep a track on the property of the owner and keep the home safe from threats. The system detects any kind of breakouts in the house and informs the user via SMS. The system uses camera for recording, capturing the images and storing the data in the cloud. This system is designed using Raspberri Pi, GSM, Humidity, Fingerprint and Motion Sensor and a Piezo buzzer.

Ravi Kishore Kodali, Sasweth C Rajanarayanan, Avnesh Koganti and Lakshmi Bopanna built a “IoT based Security System” in which we have observed that it mainly aims to reduce the false alarm rate. This security system uses a PIR sensor which will help in notifying the owner and reducing the false alarm rate. The mode of operation is handled using ESP8266 microcontroller. It also uses MAC addressing and the data will be accessed through SQL database.

Kushank Sehgal and Richa Singh built a “IoT based Smart Wireless Home Security Systems”. In this paper we observed that it basically uses IoT technology and Cloud Services. This paper mainly focuses on developing and improving quality of Home Automation systems. This system uses SMS and GPS location technology for tracking purpose. All the operations are controlled by Arduino Mega ADK using Cloud system with internet support.

Suraj Pawar, Vipul Kithani, Sagar Ahuja and Sunita Sahu built a “Smart Home Security using IoT and Face Recognition” system. In this we observed the various sensing units such as PIR sensors, Ultrasonic Sensors used with a Raspberri Pi module. A web camera is used to capture an image of the visitor at the door if a motion is detected. The real-time face recognition is done using Local Binary Pattern. If someone tries to break the door, the alarm will be raised and SMS and Email will be sent to the user containing the image of the intruder. The owner can keep track of the activity using web browser or android application using the internet service.

Pranav Kumar Madupu and Karthikeyan B built a “Automatic Service Request System for Security in Smart Home Using IoT” system. In this paper we have observed an implementation of the Raspberri Pi integrated Automatic Service Request system which is associated with web browser or cloud application using wireless network. This system is also used for monitoring the home by using different sensors. The sensor data is processed by Raspberri Pi and if any abnormality is found, it sends a request automatically to the concerned user.

### **III. PROBLEM STATEMENT**

Internet of Things explains the thought of remotely connecting live objects through the web or cloud application. When it comes to our lifestyle, this idea is often adapted to form a smarter, safer and secure system. This project’s main objective is an office or a home security system which will alert the user or the owner in case of any threat with the help of internet connectivity. To tackle various problems related to home, office or locker security, we propose this system in order to get a solution and prevent any kind of threat to the owner’s valuables. In the past, various systems related to security have been introduced to overcome the problems, therefore a new invention of a new system needs to be introduced with new trending technologies which can be more safe and secure. This idea is implemented to control, monitor the locking system and protect the things behind the lock. This whole system is handled and is based on the IoT technology.

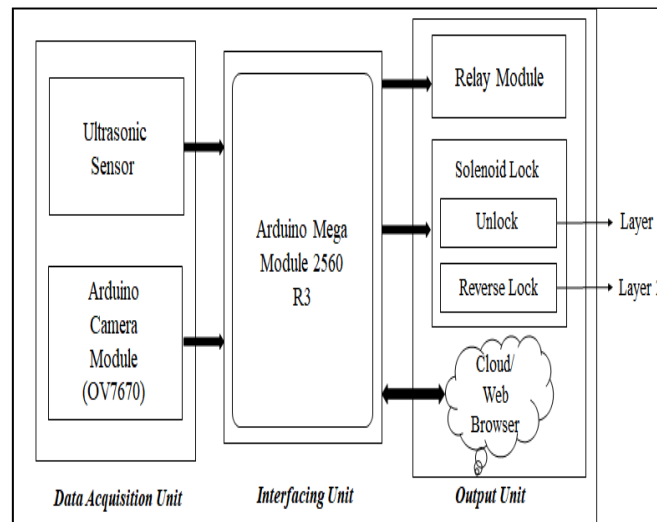
### **IV. METHODOLOGY**

A Two Layer Security System for IoT based Smart Office using Arduino Mega is implemented here and is thus a proposed solution to these problems discussed earlier. Our project mainly contains sensors, an Arduino controller, a camera, a cloud application or a web browser using internet connection. Earlier, according to different surveys, many researches have been done which have different technologies like surveillance, tracking, alarm, door bells etc. being used with various methods. There are many previous projects which are related to smart security using IoT, but this paper proposes a new system called Reverse Lock system.

This is a new system proposed in order to trap a thief or an invader who approaches to break the lock.

If the lock is broken or damaged, this idea will trap the thief inside by locking it back again. Our project uses Arduino Mega Module which is a microcontroller device that helps in monitoring and controlling the operation. We also use Ultrasonic Sensor which will sense any kind of movement or detect the range of an object approaching the lock. The lock here used is a Solenoid Lock which is a compatible device that consumes less power and is easy to operate. To capture the image or any object that comes near the lock, we use an Arduino Camera Module. All these devices are connected to the main board. Based on the data provided by the Arduino board, we may use the lock as per our convenience. The software part is implemented using Arduino IDE. We then connect the system to a cloud application like Blynk etc. or a web browser to check the status. The whole system is connected to an internet or to a WiFi.

## V. BLOCK DIAGRAM



The most basic step for any development of a monitoring system is to infer a block diagram for the system on which all the further is to be performed. The block diagram is followed by the construction of the circuit diagram in which all the components like sensors, modules, etc. are mounted over the controller and the breadboard. The Ultrasonic Sensor and the Arduino Camera Module will be used which will be the best for sensing and capturing the images. This complete part comprises to a Data Acquisition Unit. The sensor senses the object, the camera module captures the images and the data is sent to the microcontroller board. The next part is called as the Interfacing Unit where all the data is mounted over the Arduino Mega board and the information is sent to the cloud server application. The last part i.e. the Output Unit where the data is being sent to the cloud and stored. The cloud app consists of different tabs like controlling, readings, images etc. The Relay Module is used for switching operations that are to be carried out for lock operations. The Solenoid Lock is controlled using the microcontroller with the help of internet and cloud application.

## SYSTEM ARCHITECTURE

### A. HARDWARE REQUIREMENTS

**Arduino Mega 2560 R3** – It is an open source microcontroller board that is based on the ATmega2560. It has 54 input & output pins of which 14 can be used as PWM outputs, 16 analog inputs, 4 UARTs, 16MHz crystal oscillator, a USB connection and a reset button. The growth environment of this board executes the processing language. This board mainly contains everything which is required for supporting the microcontroller.

**Arduino Camera OV7670** – It is a low cost 0.3 mega pixel color camera module. It can output 640\*480 VGA resolution image at 30FPS. The OV7670 camera provides full frame window 8-bit images in wide range. The OV7670 image sensor is controlled using the Serial Camera Control Bus which is maximum clock frequency of 400KHz.

**Ultrasonic Sensor HC-SR04** – the Ultrasonic Sensor is basically distance sensor which can give the range of objects up to 13 feet. It is also used to detect any object with additional advantage of measuring the range of the object. This is a low power, inexpensive, easy to interface and is among easily available devices. It has four pins namely: Echo, Trigger, VCC and Ground (common GND).

## **B. SOFTWARE REQUIREMENTS**

Arduino IDE

Cloud Application/ Web Server (Blynk)

## **VII. CONCLUSION**

To conclude, during our course of initial research, we have come across importance of security systems, security threats etc. We do believe that traditional locks were, are and always will be a way of accessing the systems. But our effort is to help and make the current systems more secure and easily accessible so that a better system can be implemented in most places. We have proposed this design implementation and hope to contribute in the field of IoT and security and help in reducing the problems related to it.

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# SMART CABLE BREAKAGE DETECTION SYSTEM USING IOT

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**Abstract**– This paper is aimed to study a system that can find the precise location of fault in the underground cable from source station using a microcontroller system and display the result in human readable format using IOT technology. The studied system uses the concept of Ohm's law. When a Direct Current voltage is applied to the resistor circuit which represents the cable, then the voltage across series resistor alters based on the distance of fault occurred in the cable. This voltage is fed to an Analog to Digital Converter (ADC) and microcontroller uses the converted digital data to make the required calculation for fault detection and once the calculation is done, the fault distance and the phase of the fault cable is displayed on the LCD screen and also IOT is used to transfer this data over a network and to display it in an App with the help of ESP-8266 wireless module.

**Keywords**– *IOT, Analog to Digital Converter (ADC), Liquid Crystal Display (LCD), Microcontroller, Current Sensing Circuit*

## I. INTRODUCTION

Underground cables are ideal for congested area like cities and factories. These cables are commonly used for the purpose of electricity and telecommunication due to lesser transmission losses and as they are less affected by extreme weather conditions compared to overhead cables.

However, it requires a bigger construction budget as it needs to be buried underground to ensure that it is protected and won't cause harm to anyone.

One of the major limitations of the underground cables is the fault detection. Since the cables are laid under the surface, the visual method of inspection won't work effectively. Most faults occur due to underground conditions, rodents and other causes like mechanical injury during transportation, laying process or due to various stresses like overloading/overvoltage events encountered by the cable during its working life. To overcome this problem a system needs to be developed that can find the distance of fault in the cable for all three phases from base station in kilometer (Km) and display the fault distance and particular fault phase in LCD screen and android app.

## II. LITERATURE REVIEW

Laxmi Goswami, Manish Kumar Kaushik, Rishi Sikka, Vinay Anand, Kanta Prasad Sharma, Madhav Singh Solanki [3], In this paper the author has developed a IOT based cable fault detection using Node MCU and Google database. They have applied the Murray loop test to spot the fault. Murray loop method, generally used to find the fault location in an underground cable by making one Wheatstone Bridge in it and by comparing the resistance.

Here an ESP-8266 Wi-Fi module with the help of Google database is connected with transformer to underground cable system. Node MCU takes the signal status of transformer. If connection is being received by Wi-Fi module it means that the line is safe and the status is saved in the database. If the connection is not received by the Wi-Fi module, it refers that a fault has occurred in that particular line and notified in Google database with fault distance.

Sathana.B, Jaissandiya.R, Divyadarshni.S, Poonguzhali.E, the work presented in [4] proposed "Underground Cable Fault Detection Using Internet of Things". In this paper two methods are proposed to detect and locate the breakage in underground cables. One of the methods is Blavier Test and other is ohm's law. Blavier test is used to find the earth fault location in an underground cable. When a ground fault occur in a cable and there are no other cables without a fault, later Blavier hypothesis can be applied to find the fault in the same cable. Where as in Ohm's law method, in case there is a short circuit, the voltage across the resistors changes accordingly with the change in resistance along with distance.

Kunal Hasija, Shelly Vadhera, Abhishek Kumar, Anurag Kishore [10], from this paper, we identify the faults in underground cables by using three steps as follows:

**Step 1:** This includes creation of transmission model and fault model in MATLAB/Simulink.

**Step 2:** In this step, fourier analysis along with Simulink with the help of Artificial Neural Networks (ANN) to find the type of fault occurred.

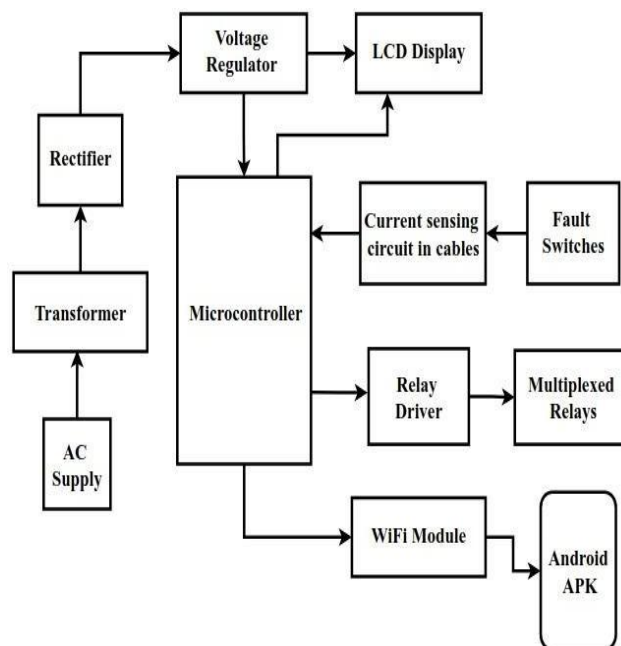
**Step 3:** After the detection of fault with the help of ANN, a software named OrCAD is used to find the fault distance using the concept of Time Domain Reflectometry (TDR).

S. Navaneethan, J.J. Soraghan, W.H. Siew, F. McPherson, P.F. Gale [11], this paper uses Time Domain Reflectometer (TDR) method to find the fault of a cable. This method applies the TDR approach along with various signal processing principles. The TDR transmits a tiny duration of low energy signal to the cable. This transmitted signal reflects back from the point of variation in resistance of the cable. This system is processed to find both single-phase and Three-phase open-short faults in the Underground Low Voltage Distribution Networks (ULVDN). If the reflected signal is negative, then the phase is considered have short circuit fault. If the reflected signal is positive, then the phase is considered to have an open circuit fault.

A. Ngaopitakkul, C. Pothisarn, M. Leelajindakraierk [9], this paper shows the behaviour of multiple fault signals in distribution cable network by using Discrete Wavelet Transformer (DWT). The fault is simulated in ATP and analysis of the signal is achieved by using DWT. Different case studies have been performed for both single faults and multiple faults.

Bavithra K, Latha R, Madhugogul P, Devaprasath R [13], in this paper the underground cables are represented by using MATLAB software and faults are simulated. The generated fault phase data from the simulation is given to the input of Fuzzy classifier for differentiating the type of fault in the system. The fault is found by using TDR and is simulated using PSpice.

### III. SCHEMATIC DIAGRAM AND WORKING



**Figure 1 Schematic Diagram of the Proposed System**

The power supplied to the system is 230v A.C which is sent to the step-down transformer. The step down transformer steps down the 230v to 12v ac. Now the output of the step down transformer is given to a full-wave bridge rectifier circuit to convert the voltage from A.C to D.C. The A.C ripples present in the output of bridge rectifier is filtered with the help of a capacitor and given to the input of regulator 7805. The voltage regulator converts the rectified output to 5v constant D.C supply voltage that is used for microcontroller for its functioning.

Our project is based on ohm's law. Microcontroller will be waiting for the input from the current sensing model. The current sensing model contains series resistor representing cable and fault environment is designed using switches. Whenever fault occurs the voltage across series resistors alters. This variation in voltage is sent to the microcontroller through built-in ADC that converts the voltage from analog to digital. The microcontroller uses this converted digital data for making the required calculations for fault detection and once the calculation is done, microcontroller sends out two different signals i) logic signal and ii) display signal.

- i) Logic signal is sent to IC ULN2003A relay driver which drives multiplexed relays. These relays are used to trip the power supply to the set of series resistor where the fault has occurred.
- ii) Microcontroller sends out the display signal, regarding the fault location which is displayed in Km on LCD screen and also the output is displayed in the android app through the IOT.

#### **IV. CONCLUSION**

To conclude, during our course of initial research, we have come across importance of underground cable, various cable breakages which occur and review of different cable fault locating methods. We do believe that cables were, are and always will be an efficient ways of data transfer and communication. Our effort is to help identify cable breakages faster so that a better system can be implemented in most places.

We have developed the initial design using ATmega microcontroller and we plan to utilize the concept of Ohm's law to demonstrate the cable breakages as a proof of concept.

#### **V. FUTURE SCOPE**

Our further plan is to implement our developed design into a working model and tackle the problems associated with it.

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# **IOT BASED MOOD SWING DETECTOR FOR MENTALLY DISABLED KIDS: A REVIEW**

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## **ABSTRACT**

The kids prone to neurological impairments or psychiatric disorders innately and otherwise require real-time supervision of their mental state. In addition to that, a large number of such kids are medically advised to stay at home as they lack the ability to carry out their day-to-day activities. Therefore, the major objective of this paper is to continuously evaluate the brain wave activity of the child against normal wave patterns, and notify through alert messages during emergency conditions. This would be of extreme help to the guardians.

In this survey paper, we will study the mood swing detector along with an alerting system specific for emergency instances. We also study the hardware model built using an EEG (Electroencephalography) sensor and temperature sensor to inspect the neurological and physical health state to predict the overall health of the child. Further, IoT and MATLAB technology can be used for the purpose of brain-computer interfacing and signal processing. This IoT based mood swing detector supervises the electrical activity in the brain and acknowledges the cognitive functions and emotions on real-time basis.

**KEYWORDS:** EEG sensor, emotions, brain wave patterns, emotion recognition, EEG signals.

## **I INTRODUCTION**

Over the years, human beings and the technological world have grown dynamically. As a result, the complexity of life has also increased leading to a dramatic rise in the number of neurological health issues such as hypertension, depression, behavioral disorder, dementia, schizophrenia etc. The healthcare industry has thus been utilizing multiple methods to diagnose the aforementioned psychiatric issues. Even though facial images and voice tones are analyzed to determine the underlying complex emotions, these methods have proven to be less efficient.

Later on, scientists and medical experts carried out extensive research to study the electrical activity in the brain. Although various technological advancements occurred in the psychiatric field, this technique of analyzing brain wave patterns is considered well reliable to successfully interpret the emotional state of an individual. The emotions are interlinked and closely associated with the healthy mental and emotional state of an individual. Better emotional condition signifies better performance; thus, emotions are thoroughly studied to understand the mental state and overall performance of human beings.

Emotion recognition and its evaluation is distinguished under two categories. The initial method was conducted by analyzing the non-physiological signals such as facial expressions, body language and tone of the voice, while the latter advanced method was carried out by analyzing the brain electrical activity which is a physiological signal.

Most of the earlier studies discovered and inspected human emotions based on facial expressions and voice. However, the facial expressions and voice tone of a person can be consciously controlled and modified. Thus, the methods based on non-physiological signals are unreliable. In contrast, the techniques used to measure the signals based on physiological processes in humans such as electroencephalography (EEG), electromyogram (EMG) and electrocardiogram (ECG) are clinically found to be more effective and reliable. This is because, human beings cannot consciously or intentionally control the functioning of the physiological processes and the related health metrics.

Among these methods, the electroencephalography-based emotion recognition technique has evolved as the most reliable and widely used technology nowadays. In this model, the EEG sensors are used to collect the brain waves of an individual or child from the surface of their scalp which is further studied. The inspection of the raw EEG brain wave signals against trained neural networks would predict the emotional or neurological state of the child or an individual.

These brainwave signals are transmitted to the Arduino UNO microcontroller where the signals are processed and stored. Temperature sensor is used to check the physical health of the subject.

Further, the MATLAB technology and signal processing techniques such as Fast Fourier Transform (FFT) or Discrete Wavelet Transform (DWT) is used to interpret the EEG signals in time domain and frequency domain. Further, certain features of the extracted EEG signals are studied against the standard frequency ranges of alpha, beta, gamma and theta. And these techniques will assist in predicting the cognitive states like alert, sleepy or attentive and emotional states like sad, happy or angry of the child. Thus, we have successfully found an effective solution for providing necessary medical care and emergency assistance to the mentally disabled kids.

## **II . LITERATURE REVIEW**

[1] During this research, it was found that human emotions such as anger, surprise and fear are complex to classify. This is because the autonomic nervous system response patterns of these emotions exhibit comparably similar range of arousal and valence levels. So, the major objective of this research was to classify the human emotions based on the EEG signals. For this purpose, an experiment was carried out among 110 students with 57 males and 53 females between the age range of 22 to 24 years. To ensure successful outcomes out of the experiment, the subjects were ensured to not have any history of medical illness. Linear discriminant analysis (LDA) was used to analyze the three kinds of Electroencephalographic (EEG) signals and the identification accuracy was found to be 66.3%. After obtaining the LDA results, it was found that the frequency band features, cerebral asymmetry features, EEG coherence features exhibited a mean accuracy level of 57.9%, 38.8% and 55.3% respectively. Therefore, the outcomes obtained from the experiment indicate that EEG signals were helpful in specifically classifying the three emotions. It can also be noted that this method can be useful when emotions need to be recognized without the utilization of facial and verbal expressions.

[2] This research attempts to suggest solutions for the medical consequences that can arise from the unhealthy emotions and the stress caused during day-to-day life activities. The objective of this study was to utilize the fusion EEG signals and North Indian Classical Music to determine the emotional stress. The music consists of various ragas and it invokes emotions in the person listening to it. During this study, the various EEG signals were extracted and their respective stimuli towards the raga was studied to interpret the emotions of the user such as happy, anger, sad and fear. The technique called as Kernel Density Estimation was utilized to extract the EEG signal features and the emotions were interpreted using Multilayer Perceptron. The music and raga was used to identify the stress levels and identify the emotions in the listener. The neural network classifiers exhibited better accuracy for arousal and valence models. The conclusion shows that performance of emotions during combination of arousal and valence showed maximum accuracy level of 95.36%, while under separate arousal and valence showed an accuracy 91.77%. From these experiments, it was found that EEG can be considered as a reliably promising method to check and evaluate the emotions and stress level in a human being.

[3] As it is observed that the EEG signals effectively classify the positive and negative emotions in an individual, this research study was carried out to find the relationship between human emotions and EEG signals. During this research, an experiment was carried out on 3 men and 3 women, who were right-handed and healthy subjects. Initially, the EEG signal features were extracted from the original extracted EEG data and further linear dynamic system approach was used to smoothen the required features. The extracted features were used with a support vector machine and it resulted in an experimental accuracy of 87.53%. Then, correlation coefficients were used to reduce the dimensions of the extracted features. This resulted in top 100 and 50 subject independent features which resulted in an accuracy of 89.22% and 84.94%. During the final stage, a model was used to plot the trajectory of the emotional changes. It was noticed that the outcomes almost matched the true changes in emotional states. Thus, the research concludes that EEG signals based emotion recognition and classification is a reliable methodology to detect human emotions.

[4] This study was conducted to identify the emotional states by interpreting the EEG signals generated from the EEG sensors placed at the surface of the scalp. The optimal combination of features of the extracted signals were used for recognition. The experiment was performed on 21 healthy children aging between 12 to 14 years old. A 14 channel EEG machine was used to collect the EEG signals of the subjects which showed various response stimuli such as happy, sad, anger and fear. The optimal features necessary for emotional classification were processed by using Support Vector Machine (SVM), k-nearest neighbor (KNN), Linear Discriminant Analysis (LDA), deep learning and four ensemble methods. It was further concluded that selecting optimal feature is a good option for enhancing the performance during EEG based emotion interpretation.

[5] During this research, the experiment was conducted using EEG sensor for various people. This method utilized the 10-20 international system, according to which Ag/AgCl electrodes were attached to the scalp to record the EEG signals. The amplitude and frequency of the main waves of the EEG signals such as alpha, beta, gamma and theta were checked. It was observed that the measurements are usually difficult to obtain due to smaller amplitude and large DC offset. Thus, the EEG signals were amplified using multistage amplifier and it was digitized using 24-bit ADC. The theoretical designs were implemented using TINA-TI software and further the Eagle software was used to design and PCB's and implemented practically. It was concluded that, the use of EEG sensors to diagnose the medical conditions prevents various patient preparation like shaving the head, adding EEG gel to the site of electrodes and skin abrasion.

[6]. The research was conducted using 8-bit AVR RISC-based microcontroller to design and implement a filtering circuit. This research was carried out for efficient signal acquisition of EEG signals with frequencies ranging between 0.15Hz and 50Hz. This methodology is chosen since the low voltage levels of EEG signals makes it hard to digitize. This study was conducted to find an alternative substitute for the expensive ADCs and DSPs which were regularly used to gather and process data. Therefore, it was concluded that this research suggests a complete analog solution to record the EEG signals instead of digital filters.

### III. CONCLUSION

In this paper, the techniques for detecting and classifying the emotions based on the EEG signals are discussed. The neural network algorithms are useful to study the extracted EEG features and various frequencies found in the brain wave patterns of the subject. It also helps in detecting and identify the varying emotional states in an individual. These methods majorly include signal processing techniques and feature extraction, this is further helpful to detect if the subject feels is attentive, sleepy, sad or happy.

The detection of the active state of an individual (active, lazy or drowsy) can be effectively predicted based on the electrical discharges from the brain. Thus, the EEG signals are important elements in the diagnosis of emotions. This project, aims to classify the EEG pattern under three groups (happy, sad and anger), based on the frequency spectrum under different sub-bands. After feature extraction, the classification of the patterns are performed using previously trained neural network based on the frequency spectrum features. The method of classifying emotions based on comparing the EEG signals with trained neural network helps in achieving an accuracy of 99%. Future work in this domain can be carried out towards using the optimization algorithms to determine the optimal structure of the neural network.

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# IMPLEMENTATION OF MACHINE LEARNING FOR PLANTDISEASE DETECTION. (A SURVEY)

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## Abstract

Agriculture plays an important role in our well-being. As population increases production of crops should also increase. But due to diseases, pests, weeds, and weather conditions, there is an abundance of loss in crop yield. Hence espial (early detection) of plant disease is an essential task. To overcome this issue, there are many methodologies used, one among them is Machine Learning. Machine learning is a subfield of artificial intelligence; it is the ability of machine to emulate quick witted human etiquette. It easily identifies patterns and keeps updating itself when it gains experience. In this survey, we examine the use of different ML methodologies based on K-means Clusters, SVM, Random Forest, CNN, etc... To classify between the healthy and unhealthy plants. This also includes different phases that are Data Collection, Feature Extraction, Training, and Classification. Out of these algorithms, Support Vector Machine provides accurate analytical statistics on plant disease identification.

## I. Introduction

**Figure 1:** Plant Disease;



**Source:** Googleimages

Taking the current scenario around the world, plant diseases are pitiful in food industries. It is difficult for a common man i.e., farmer/grower to differentiate between the diseases that occur in their harvests. Identification of plant. diseases and taking necessary actions plays a vital role in a disease management system. Due to diseases, pests, weeds, and weather conditions, the loss is abundant in crop yield. This in turn results in the downfall of food production which leads to food insecurity. Also in emergent nations, the understanding level of weed management and diseases are less. Premature detection of plant diseases or leaf infections is a crucial task in agriculture. Different methods are employed for leaf quality estimation, such as thermography, fluorescence imagery, affinity bio-sensor based on DNA/RNA, chain reactions, gas chromatography, mass spectrometry, and immune fluorescence. However, these methods are inadequate, inconsistent, imprudent, and are highly laborious. Hence, to enlarge the recognition rate and the accuracy of the outcome, modern approaches have been employed such as machine learning plays a key part in spotting the plant disease, and diagnosis (plays a vital role in the detection of plant diseases and diagnosis, as it is sole application of artificial intelligence is Machine Learning. Machine learning is all about the potential to learn automatically and magnify the learning from experience without being programmed explicitly. The main cause to choose machine learning is that a system learns to perform a fixed task by grasping and, considering samples of a training set. There are different machine learning approaches such as random forest [5][8][11], artificial neural network [9], support vector machine(SVM) [1][4][6][8], fuzzy logic, K-means method [1][4][6][9], Convolutional neural networks [1][3][10][12], etc. which are later discussed in the survey paper.

## II. Literature Review:

The authors of [1] designed an Artificial intelligence-based automatic plant leaf disease detection, and classification system. Entails the following pace: Image collection, Image pre-processing, Segmentation, and Classification. Used over 20,000 images which are classified into 19 individual classes. And have used 4 classifiers, Logistic regression, KNN, SVM, and CNN to train the model.

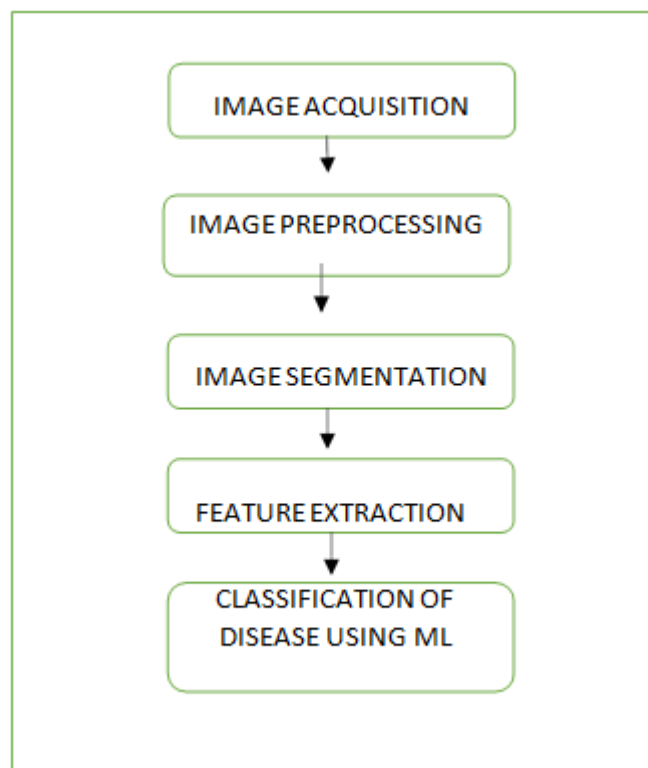
The authors of [4] develop a novel approach to predict plant diseases by using machine learning techniques. Have used the k clustering method for segmentation and have used SVM classifiers using different kernel classes.

In [5] It includes various phases: dataset creation, feature extraction, training the classifier, and classification. Uses Histogram of an Oriented Gradient for withdrawing characteristics of an image. Trained under Random Forest to classify the diseased and healthy images with an accuracy of 70.14%. The system in [8] comprise of five individual processes such as image preprocessing, image segmentation, feature extraction, disease detection, and identification. Using grab cut segmentation approach the leaves are separated from the context of an image. The authors have used 3 different classifiers SVM, Random Forest, and AdaBoost. With SVM Authors achieved an accuracy of 93.035%.

Identification of disease in tomato plants is done in [11] using a system trained with 8 different classes of tomato leaves and different ML methodologies based on K-NN, Logistic Regression, SVM, Decision Tree, Random Forest, are used in this process. The highest accuracy of 95.23% was obtained using the Random Forest algorithm.

## III. Process flow-

**Figure 2 :** Process flow chart



### Methodology:

#### A. Dataset Collection:

The primary step in the construction of a Machine Learning model is to collect a dataset, to train the model. Different images of leaves were collected from different sources like Kaggle, GitHub, or captured directly. Some used images for the dataset are from the Plant Village database. Authors have approximately collected around 15,000 - 50,000 images, of leaves which are later divided into different classes.

## B. Image Segmentation:

The captured image of the leaf needs to be pre-processed for enhancement of its features by removing distortions later segmented.

Segmentation, the technique of splitting data into separate groups their attributes or behavior. Problems related to clustering involved using an unsupervised learning algorithm called K-Means Clustering in machine learning by grouping the unlabeled dataset images into different clusters. K-Means Clustering is used for Image Segmentation. [9] The selections of K Values are very important in the k-means clustering technique. K-means adaptive clustering clusters the pixels by applying it on the saturation channel and labels them. The pixel clusters contain only the leaf part and eliminate the background [6]. The data is classified into k disjoint numbers of clusters. The K-means follows two steps. Firstly, it finds the k-centroids and all the other objects are allocated to one of these clusters later depending on the measure of distance[4].

## C. Feature extraction:

Morphological features give better results in predicting the type of diseases, hence extracting these features is done in this process. Of all the shape, color and texture are the main to be considered. In the shape the geometrical shape of the leaf like length, area, perimeter and rectangularity are calculated. Texture has been identified using different methods like GLCM which identifies leaf based on statistical methods by considering the spatial relation between the pixels and SDGM where the matrix is generated for calculations. In addition, the venation also tells us about the veins in a leaf.

## D. Image Classifiers:

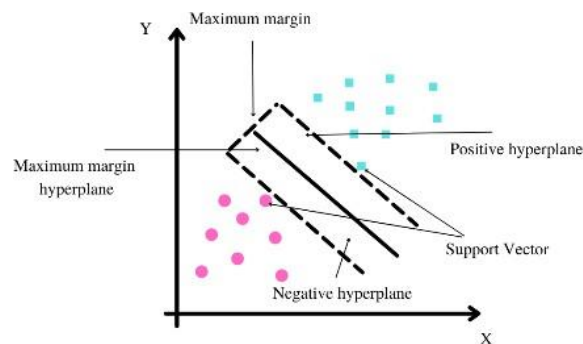
### D.1. SVM (Support Vector Machine):

SVM is a machine learning binary classifier algorithm which uses hyperplane. Here the points are mapped in space in such a way that, points of different classes are split by a gap. Which are separated by boundaries, called the decision boundary and the utmost data points are called support vectors. There are different kernels available that classify training set into multiple classes, such as Non-linear,

Linear, RBF, Polynomial, etc.

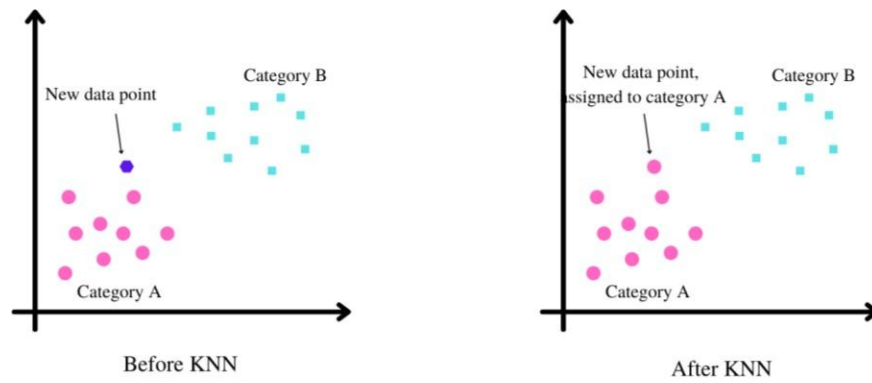
[1] got an accuracy of 53.4% using a linear kernel. In [6] the accuracy computed was to be 93.3% with the Linear Kernel, 94.1% with RBF Kernel, and 93.3% with Polynomial Kernel.

**Figure 3: Graphical Representation of SVM Algorithm**

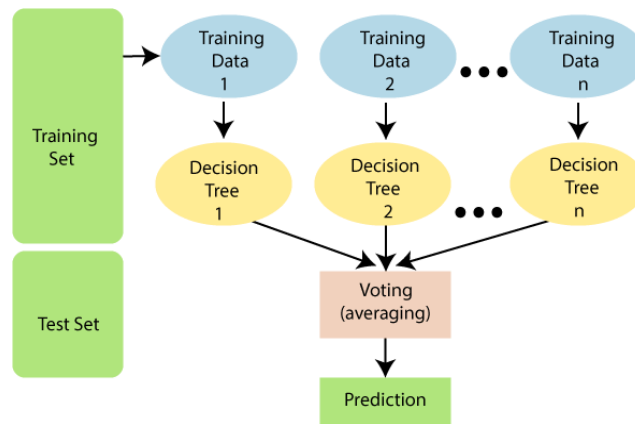


### D.2. K-NN (K-nearest neighbor):

It is one of the simplest supervised-based Machine Learning techniques. It checks the likeness between the new dataset and already available cases, adds the new data points based on the likeness to the already existing categories. Stacks the available data and classifies the new data point based on similarities.



### D.3. Random Forest:



**Figure 5:** Representation of Random Forest Algorithm

Random Forest is a combination training technique for regression, classification, etc. it consists of multiple decision trees and the outcome of these sums up at the training time, also output the class in case of classification problem. Decision tree algorithm has to come across major problem i.e., to overcome the issue of overfitting to this training set. Using this algorithm many trees are constructed. The number of trees in the forest is directly proportional to the robustness of the forest. Therefore, during classifying random forest, if the decision tree is in more number, there will be increase in accuracy, but their decision tree over fits the leaning information and have low gradient, and high depart. Hence to lessen the depart, decision trees are trained on numerous features of a class training set. To form a forest there will be voting of trees for a class. But doing this inclination can be reduced and some loss of interpretability.

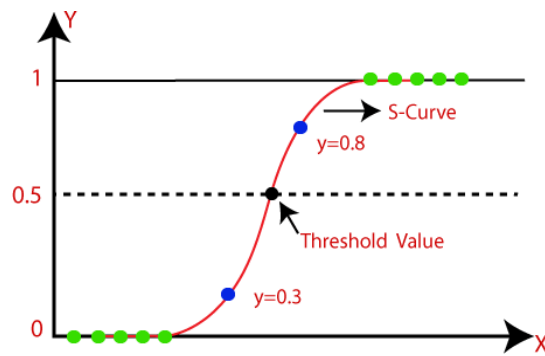
However, the model's performance is considerable and significant. Random forest is versatile to utilize and yields results at a lively rate.

#### A.1. Logical Regression:

It's an elementary yet significant supervised classifier that gives good results. It got the capability to provide probabilities and classify a new set of data using discrete and continuous data sets. It is further divided into 3 types based on different categories.

Binomial, multinomial, Ordinal. It makes use of a sigmoidal function to compress the output range. The author [1] archived an accuracy of 66.4% using logical regression.



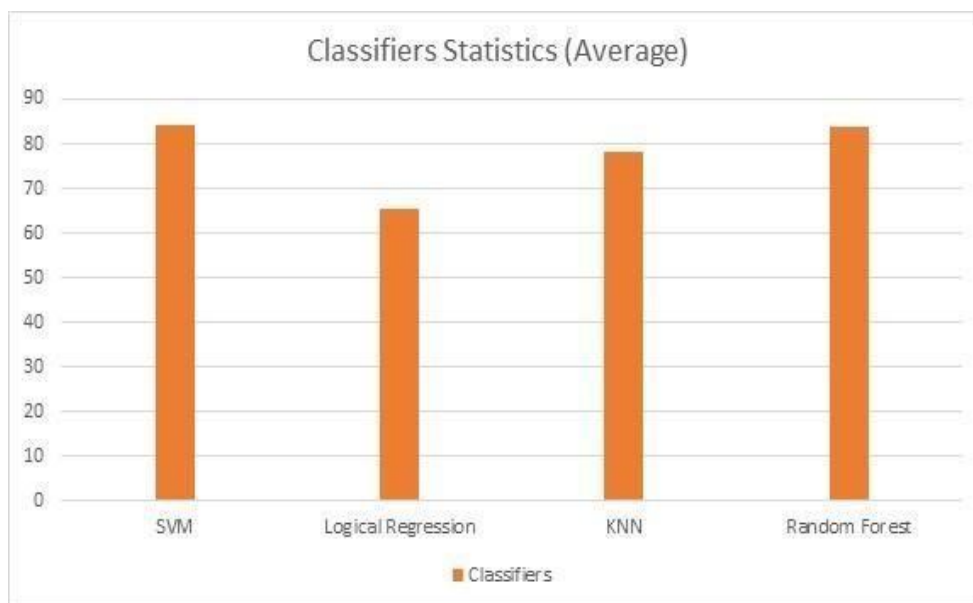


**Figure 6:** Graphical representation of Logical Regression Algorithm

#### IV. Conclusion

This paper reviews the different types of ML algorithms used in detecting plant diseases. Initially, the leaf undergoes image pre-processing followed by segmentation and feature extraction. The different features extracted during this process include colour, texture, venation and shape of the leaf. The extracted features as reviewed act as input for the ML algorithms like KNN, SVM, Logical regression and Random Forest to help us distinguish between various plant diseases. ML algorithms are trained with the test models and as the quantity of samples increases the accuracy of prediction also increases.

Of all the different methods used, the SVM (support vector machine) is proven to give a greater accuracy of prediction and the graph depicting the accuracy of various methods is shown below.



**Table 1: Statistical comparison for the accuracy of different ML algorithms used in plant disease**

Hence using ML techniques for detecting plant disease, help farmers to get accurate results which thereby increases the rate of production efficiently.

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# **IOT BASED ENERGY-EFFICIENT HEALTH MONITORING SYSTEM**

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**Abstract:** The present work deals with the energy efficient bandwidth utilization methods for health monitoring application. In this paper we are going to check the patient vital parameters or data samples such as blood pressure, pulse rate, respiration rate and ECG etc. Based on this parameters /data samples, the Window function are used which will take the last 10 readings of data samples. If the mean value of last 10 readings will not deviate much w.r.t current reading then we will reduce the sampling rate by half. And if we reduce the sampling rate, the energy consumption will also be reduced. So in this paper by using window function method we will reduce the sampling rate. This health monitoring system is very useful for patients due to remote monitoring system where the data samples are collected and transmitted to the doctors. In addition, because of this remote monitoring system, there is no need of visiting to hospitals /no need of staying in hospitals for a long period of time and also the remote monitoring can be done at home or in any place. Also, in this paper, the cluster method is discussed which means that the group of IoT devices and advanced nodes will be used as cluster head. This method will help to gather the patient data samples such as heart rate, blood pressure, and respiration rate , temperature etc. The two performance parameters are taken in consideration for the analysis of the proposed method, i.e., total number of data sample transmission to cluster head and total number of data sample transmission to the cloud platform. And finally the results are verified by comparison of energy consumption which is called as the cluster method.

## **1. INTRODCUTION**

As we all know that health is very important for every each an every one of us. Population is increasing every day with a comparable speed of light so as there needs and health issues. And even the technology's were developing in every generation based on the medical system and so no. now a days the technology were improved and developed on the basis of technology an by using this technology there are various medical instruments and equipment came exists. In which all this facilities are very important for the patients to monitor an we can see this medical equipment in markets and they all are used for daily health basis in the hospitals. The equipment such as ECG machine , Heart beat module, microscope and first aid kit etc. and there are set of hardware like Raspberry pi, GSM module, and Arduino uno etc. All the vital parameters or data samples such as blood pressure, pulse rate and so on are collected and stored in microprocessors. There are many applications are there to collect the data samples from these microprocessors to storage , Android app, cloud fire store app, and hosting etc. To use this application an account is required and this all facilities are available in the google security. And finally this application is provided by doctors, patients and admin. Only admin has the chance to read and write the vital parameters or data samples but patients and doctors can only able to read it.

## **BLOCK DIAGRAM:**

### **IOT BASED ENERGY-EFFICIENT BANDWIDTH HEALTH MONITORING SYSTEM**

Lakshmi V , Kavuri Pavani, Preethi S , and Nature Jyothsna proposed an IOT based energy-efficient bandwidth using health monitoring system in which the vital parameters or data samples are collected from the patients , data samples like blood pressure, pulse rate, respiration rate and ECG etc. all this data samples are taken by last 5 or 10 readings by using an method called Window Function an in which this window function is used to reduce the vital parameters , if we reduce the sampling rate by using window function the energy consumption will get reduced. In according to our project to reduce the patients data samples and to reduce the energy consumption we use a method called window function. Early the research people were reported that healthcare monitoring system but directly they are transmitted the data an they were not performed the sampling rate so, we will reduce the sampling rate if the data redundancy will be their by using the method known as WINDOW FUNCTION. And also in this paper we will use the cluster method which means it is a type of group of IOT devices and advanced nodes will be used as cluster head. This cluster analysis is applied that will helps to reveal hidden structures an this clusters are found in the large data samples. This purpose will identify the change patterns of patients with the (ESRD) which means end-stage renal disease and hemodialysis ( HD) by using different methods of a cluster. And also this method will helps the patients to gather the data samples.

We were discussed about the health monitoring system that is a intelligent and robust to monitor the patients vital samples or data samples like respiration rate, blood pressure, pulse rate, and heartbeat rate an ECG by using IOT. Thus the patients or the users can send the data samples to the doctor rather than visiting to hospitals always.

For this we were use a hardware which is called as Intel Galileo board. This hardware will provides us a Linux platform and it supports the SD card. Then the collected data samples or vital parameters from the patients are transferred to the database server. This data samples can be get any part of the world. In this project we will use a Raspberry pi or Arduino which is shown in the above block diagram. In which the raspberry pi is a credit-card sized computer, in this project it will helps to implement the project which consists of a sensor and hardware called the raspberry pi , it will help's the doctor to know about the patients health and it can be used to monitor anywhere in the world. The sensors gather the data samples or medical information of the patients which includes the heartbeat rate, pulse rate, blood pressure, an so on. Then by using the camera the patients were monitored through the Raspberry kit board and information is sent to the IOT and are stored in a medical server. Thus the doctors can monitor the patients data samples from any place of the world through the IP server address at anytime. The collected vital parameters through IOT will help the patients to recover easily. Here we use a different types of sensor like temperature sensor, ECG sensor and Heartbeat sensor. The common applications for infrared temperature sensors measuring ear temperature , or skin temperature. An also we use a LCD16 \*2 in this project it is a Liquid crystal display were it is very important device in the embedded system. A small LCD is probably the easiest way to free such a project from a computer. we'll start from something very simple like a static message and then we will convert my ohmmeter to display readings on the LCD. And by connecting the LCD to a breadboard and Arduino Uno as shown in the diagram.

### **3. PROBLEM STATEMENT:**

Large data are transmitted because they not processing the data . an so large data they will transmit and large bandwidth required , energy consumption will be higher due to they were transmit all data to avoid this problem we are reducing the data redundancy by reducing the sampling rate . We can reduce the sampling rate by using the window function technology.

### **4. METHODOLOGY:**

This is the methodology of this project in which the Raspberry pi is the main concept of this project is to monitor the patients life status and health conditions from anywhere in the world so that a doctor can able to see the patients conditions in regular intervals of time an as we know that a doctor cant able to see the multiple patients but by using this system a doctor can able to see the multiple patients conditions at a time. And after the system is initialized an connected to internet successfully then it will send a link to doctor mobile through telegram an by clicking on the link it will open a webpage and in this webpage it displays the patients live video and health parameters like heart rate, oxygen levels, temperature and humidity. This is how this system is used to monitor the patients.

**5. CONCLUSION:** This paper will describes the IOT based energy- efficient bandwidth health monitoring system which is used to reduce the sampling rate by using the window function. This paper proposes the patient monitoring system that collects the vital parameters or patients data samples such as blood pressure, pulse rate, respiration rate, ECG an so on and are transmitted the data to the IOT gate-way to the surver and if collected data samples are not changing the readings, we were reduce the sampling rate by using the window function. If we reduce the sampling rate then the energy consumption will get reduced. Finally , we will use the window function to reduce the sampling rate and to reduce the energy consumption.

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## SPYING AND BOMB DISPOSAL ROBOT-A LITERATURE REVIEW

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**Abstract** - Security is the utmost important concern of any country and incorporating technology to build equipment for the same is the need of the day. The main goal of this project is to deal with the anti-social activities by tracking the activities and their location thus by reducing the risk of humans entering certain areas. This can be accomplished by a spy robot with night vision wireless camera. This spy robot is remote controlled, it records in real time and has night vision feature which can be viewed in mobile phone that is paired via Bluetooth through MI spy app. This robot is designed to carry out required military operations and other activities such as lifting light weight medical waste and other necessary goods using gripper attachment. This paper represents the outline development of the robot for spying and hazardous material disposal to save human lives using ATMEGA microcontroller and the review of related literature..

**Index Terms** - ATMEGA microcontroller, Night vision wireless camera, Real Time Videos, Wi-Fi.

### I. INTRODUCTION

In modern day scholarly skillful world, advancement in technology decides the military warfare tactics. More than Evolution in technology gives dominance for any country than the evolution in weaponry, to check a rival ambush in the most implied way. Presently, robots are deployed in the areas that are harmful for humans to carry out the dangerous assessments more dutiful than soldiers.

The military search and saving robot help to trace human debris in precarious environment is inauspicious to human rescue teams. These robots reduce human fatality and helps in effective search operations considering the data given to them. Many countries all over the world utilizes these military robots for search and rescue operations in the war affected areas. These robots are strong, dutiful and free from fear of death. These robots need not look like manlike to shift fatal armaments but they are just gadgets armed with latest technology to support the armed forces [1]. Since human lives are not at stake , one of the many usage of robot is the bomb disposal and dangerous landmines. Bomb discarding robots can be deployed to dispose assault armaments, known as explosive ordnance disposal (EOD) robot. The main function of an EOD robot is to disable or deactivate an explosive considering the safely precautions while the human team works from a fair secure space. The menace of losing a comrade life in the war area is reduced which cuts down cost of coaching a bomb-disposal squad that normally needs a lot of measures and required foundation. Effectively handled bomb disposal robots have rescued many lives thereby supporting the defence in conflict. These robots provides a remote sense of presence for the bomb disposal experts who allow them to look-over tools, without endanger human lives in danger. The safety regulation is the utmost major concern [2]. Most of the research studies on movable robot's control for different applications are carried out. Continuous efforts are done to thrive robots for the various motive such as observe structures such as roads, bridges or settlements and many other applications. In all these framework, adoption of advanced techniques for remote control operation of robots can further improve their potentiality and applications. Using high- level human behaviours such as vision, oration, touch, gestures, the user can also show the robotic actions similar to humans. Earlier some studies proposes robots which uses distinct network technologies. DTMF, Wi-fi and Bluetooth model have been used for communicating in the middle of the operators and devices, for various applications like spying, supervision and guarding [3]. The great advancement is the designing the robot using Wi-Fi. Wi-Fi is useful for remote controlling of robot unit and to obtain audio and video into the gadget for further analysis and decision making. The ATMEGA microcontroller is used to act as a connection linking the camera device and motor driver model established on the chassis of robot. The motor driver module is the controller which controls the movement of the wheels of the robot. The movement of the robot depends on the wheels that operates on DC motor. The camera attached to this robot can rotate 360 degree to record each and every details wherever it is being used for spying purpose [4].

## 2. LITERATURE SURVEY

Rakshana Mohamed Ismail, Senthil Muthu Kumaraswamy, A Sasikala [1] proposed the defense support and rescue operation is further categorized into four phases. Phase one is sensory circuits that are also required to check whether it is useful for human interaction. The analog signal output of the sensors is picked up by Arduino and is transmitted to PC through ZigBee. Second phase is pick and place which is controlled by control buttons on the screen. Third phase includes camera control and detonation of explosives. Fourth phase is combination of all the phases into a single program on the system.

Rakshith et.al[2] discusses a microcontroller based robot. The Arduino UNO serves this purpose and sensors used for audio and video information collected in the surrounding area and take required action as per the pre allocated instructions.

In [3], Tushar Maheshwari, Upendra Kumar, Chaitanya Nagpae, Chandrakant Ojha proposed the development of prototype of a easily controllable mobile smart robot that can be remotely regulated, which provides live video information. This robot is controlled by four modes, DTMF, remote control, voice commands and tilt-gesture control in a smart phone. Connecting protocols such as bluetooth, Wi-fi, DTMF send orders to the robot.

Divya Sharma and Usha Chauhan [4] proposed a RF based robot with the feature of a night vision camera, the captured footages can be viewed in MI app.

T. Akilan, Satyam Chaudhary, Utkarsh Pandey [5] discussed human surveillance featuring robots based on IoT which rely on Arduino UNO microcontroller which can be controlled by a smart phone or PC. The main aim was to improve a spy robotic car which is instructed to provide continuous monitoring in dangerous environment. The bot feature is to record actual-time streaming throughout the day via wireless spy camera. The motion of the robot are hand-operated at the user end. The model consists of sensors like PIR sensor, ultrasonic sensor, and gas sensor interfaced with Arduino board. Tanshen Dhar, Anik Das Gupta, Mithun Chandrasarkar

[6] proposed a robot ArduinoUno with GPS module and various kinds of sensors. A live feedback camera is incorporated which sends images and videos using Wi-Fi module.

In [7], Akash Singh, Tanisha Gupta, Manish Korde, discussed the design of the robot is developed in a way that can be controlled through mobile via Bluetooth interface Arduino UNO and android. This robot is proficient of spying using a wireless camera to see, snap photos and note down videos with laptop.

Ghanem Osman Elhaj Abdalla, T. V.Kandasamy [8], proposed a spy robot system comprising Raspberry Pi, night vision camera and sensors. PIR sensors are used to sense the living objects and this details are uploaded to the web server and camera captures the objects in motion. The motion of the robot is also controlled by barrier detecting sensors to avoid collisions.

Jignesh Patoliya, Haard Mehta, Hitesh Patel, V.T.Patel[9], proposed model which use Arduino and night vision wireless camera which are controlled by android application which give opportunity to people who can learn about expanding android practice which is used to control the robot through wireless application using the platform of MIT app inventor. Two DC motors are used for the robot movement.

In this paper, Anjir Ahmed Choudhury et. al,[10] presented a robot that was anchored on Raspberry pi. It is developed in such a way that it is less expensive for the discarding of the bomb. The main objective was to reduce the human risk.

A Sabarivani, A Anbarasi, Vijayaiyyappan, S Sindhuja [11], discussed bomb disclosure techniques and the tools used for discarding of the bomb. With these the disadvantages of the human arm to that of robotic arm has been explained.

In [12], Oke Alice O, and Afolabi Adeolu, have developed a robotic model for the material discarding with three degree of freedom. It solves the problem in a dangerous situation or if the object is detected to be damaging i.e in bomb jeopardized zone that claim lives on military personnel, by that means guarantees security of security personnel involved.

Juan G. et.al. [13] discussed the overall architecture of a land wheeled self-governing mini-robot (LWAMR) for in-door observation. The LWAMR can send footages in real time with the help of spy cam, controlled by servomechanism. IN LabVIEW human-machine interface was implemented for remote monitoring of health and surveillance purpose.

D.N.S.Ravi, Durgesh Kumar[14], discussed a model design that used robotic arm and robotic vehicle which helps in disposal of the bomb. The main idea is to help the bomb discarding squad with providing safety and freedom from harm from the dangers that they are facing in their day-to-day lives. The receiver unit consists of Raspberry pi with Wi-fi. VNC server sends orders via internet.

In[15] M.Balakrishnan et. Al discussed a robot that is designed using ATMEGA microcontroller. This paper proposed a development of a robot model with wireless regulating and wireless charging system. It has a spy camera and it is controlled through links, Bluetooth and RF frequencies.

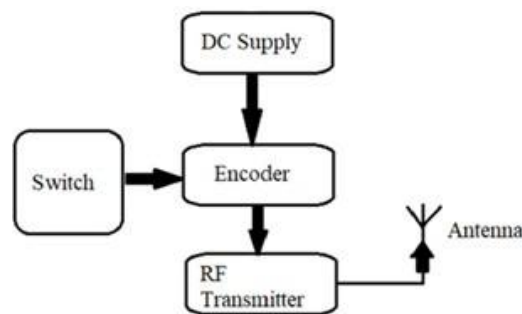
Ghanem Osman Elhaj, T. Veeramani Kandasamy [16] proposed a robot that uses raspberry pi as a microcontroller. The robot can be operated by three modes. First mode runs the code. Based on the sensor status, it leaves the robot to navigate freely. Second mode is to control the movements of the robot to a specific direction with the use of keyboard. Third mode is to monitor the information that is on the web page, and to control it accordingly using different buttons.

In this paper [17], authors proposed a robot which used wireless transmission with Bluetooth module along with the temperature sensor, ultrasonic sensor and activates a buzzer to which detects the rise in temperature because of fire.

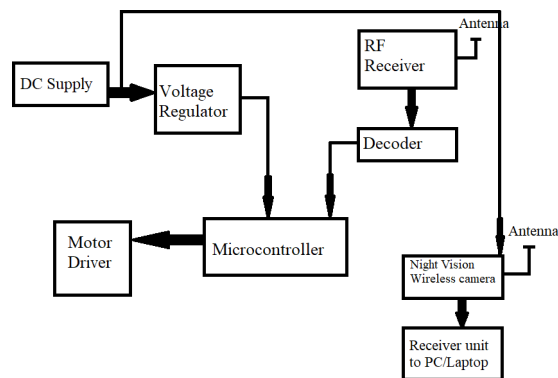
Adnan Jafar, S.M. Fasih Ur Rehman, Nisar Ahmed, Muhammad Umer[18], In this paper, the robot model is an auto regulated prototype that is connected through LAN/WAN . It can also be regulated via netting usage.

### 3. METHODOLOGY

The block diagram of transmitter and receiver unit are indicated in figure 1 and figure 2 respectively.



**Fig-1: Transmitter unit**



**Fig-2: Receiver Unit**

In receiver unit two separate nodes are provided with two external power supply. One supply is given to the encoder and the other is to the voltage converter. Atmega microcontroller is placed on the motor driver. The camera works with 5V supply which captures images and videos , then transmits to be viewed on laptop or mobile (optional) via Wi-Fi connection.



### **i. Encoder and Decoder:**

The CMOS LSI's consists of a series of encoder IC's which encodes 12 bits of information. It consists of N address bits and 12 N data bits. The Decoder ICs are paired. Data format should be selected with the same number of address, for proper operation a pair of encoder/decoder is needed.

### **ii. RF Transmitter and Receiver:**

433MHz RF encoder and decoder is used. ASK transmitter and receiver is used for the remote regulation. 100 Meters is span in open space (Standard Conditions). RX Receiver Frequency: 433 MHz.

### **iii. Night Vision Camera:**

Night Vision Camera which we are using is Mi Camera which has a bunch of infrared LEDs to acquire videos in the night time, smog, or fog when naked eye fails to identify the objects. Infrared light has low energetic radiation. The ratings of the camera are 1] Transmission Control:51mW 2] Transfer speed: 200MHz 3] Control Supply of: 5V 4] Utilization Current:1.1A

### **iv. ATMEGA Microcontroller:**

The brain of the robot will be advanced AT89S52 microcontroller coordinating all the robotic activities which belongs to ATMEL series of 8051 microcontrollers and is placed on the PCB along with other components.

## **4. CONCLUSION**

The major intent of this project is to outline an inexpensive bomb disposal robot with night vision without any human interference. The proposed design must satisfy the needs of the bomb disposal squad who handle hazardous things. With the use of camera it is able to capture images/videos and transmitting the required information to the user through internet. The robot is convenience as it offers upstanding and secrecy on both sides, also since due to its small size and transferability it can be utilized in any sort of environment for monitoring.

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# SMART PARKING MONITORING AND SURVEILLANCE

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**Abstract:** Recognition of images and scenes and understanding them using a software system is called Computer vision. It can be used for reorganization of images, image resolution or even object detection. The major application is face detection, vehicle detection, pedestrian counting and many more. In this project, many algorithms related to object detection with high accuracy are used. Many methods such as Fast RCNN, SVM, SORT and fast yet highly accurate ones like SSD and Yolo have also been used. These methods and algorithms require a lot of mathematical and deep learning frameworks such as neural networks; understanding by using dependencies such as TensorFlow, OpenCV, Image AI etc. Intern these need a better understanding on machine learning. Here detection of objects in an image is done and the area around an object is highlighted in a rectangular box and to make it more specific each object is assigned with a particular tag.

## 1. INTRODUCTION

The demand of automated vehicles in the smart and crowded cities project is common for the control of congestion in traffic. The automated and advanced traffic management system using video has been involved by the implementation of deep neural networks. In this paper we would be going through the different algorithms, applications, implementation and methodology of object detection around us. We would get to know about the tracking algorithm at the real time using methods of background subtraction, SORT algorithm, VGGnet the hybrid satellite - ground based inverse perspective mapping method for camera and auto correlation [1]. We would also see the hierarchical traffic modelling solution based on short- and long-term temporal video flow to understand the traffic flow, bottlenecks, and risky spots for vulnerable road users.

## 2. LITERATURE REVIEW

There have been many works related to Object detection and tracking using different methodology, implementation and approach to achieve the final goal. [2] Through this paper we would be having a look at all those.

### 2.1 “Deep drone: Object detection and Tracking for Smart Drones” [2]

In this the drone model was implanted with the TX1 and TK1 from NVIDIA and in order to reduce the size of TX1, it had been installed on a small carrier board. The detection part was built on Faster RCNN and top of deep learning algorithm Caffe, which requires multiple dependencies, has a number of customized region pooling layers. Tracking part was achieved by the KCF algorithm which was implemented in MATLAB due to the hardware limitation of TK1. As the model proposed the tracker interface provides an init method that takes in a frame and bounding box then it learns through linear regression. The one with the highest score i.e., the new positive patches and negative patches are used to learn. The DJI camera library has been used to take in the input for online and offline detection of objects; it only contained the interface code to talk to the camera. The camera input module provided by djicam.h, which leverage libdcam to read in from the built-in camera.

### 2.2 “Implementation of an object-detection algorithm on a CPU+GPU target in an automated vehicle” Author- Gautier Berthou

This paper provides directions to design time and resource efficient Haar cascade detection algorithms in the area of autonomous vehicles, the idea of this project work is to make an underwater drone that records the seabed, i.e., the lowest part of the sea with rocks and sand. In addition to this, well - built cascades discard large amounts of irrelevant data considerably early in the whole object detection process due to the inefficient work of CPU. Former studies show the GPU architecture to improve throughput based on multithreading.

### 2.3 “Object Detection Algorithms for video Surveillance applications [3]”

In this paper various object detection algorithms such as face detection, skin detection, shape detection, target detection are simulated and implemented using MATLAB [3]. The fundamental on which it works is the foreground object and background object (i.e., the stationary object in a frame as a part of background), this works on subtracting the background from the foreground image in the current frame on process, performed on the current frame. The face, skin and color detection are done by different algorithms to get the optimized results.

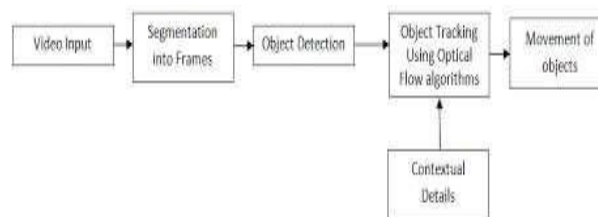
The ViolaJones algorithm is used to detect all facial features [3]. The skin detection is done by skin pixel identification; the frame having no skin pixel is represented by '0' and skin pixel as '1'. For the color detection the primary color values used are the RGB color. The skin detection is done by the YCbCr model. The translation to YCbCr from RGB is mainly the separation of luminance from chrominance. It follows bayes rule for target detection.

#### 2.4 “Frame based Object Detection – An application for Traffic Monitoring” [4]

In this paper a system is described which is capable of detecting and segmenting objects from video frames which helps in traffic surveillance. The major problem faced in any object detection project is the casted shadow which has been resolved here at the preprocessing phase of the system by amplifying the accuracy of detection. The differentiation of the background and the foreground of the video scenes using the MATLAB embedded functions. The video frames are converted into images and the image obtained is stored as a background image. After this the image is used to compare with the sequential frame of the video. The image obtained is then subtracted and we get the foreground image from it. Last step is to find the threshold value to convert the subtracted image to binary image.

#### 2.5 “A motion based object detection method in security” [5]

Most important application of motion detection is in the security field. But using motion detection has few drawbacks which led to new methods in motion detection. There are several application of detection algorithm such as 1) foreground area extraction. 2) it is used in neural network for detection of moving object at certain area. With respect to application in continuous video sequence, one method called the inter-frame difference is used. It is used when there is motion factors in the scene. If it has any such factor then the motion trace will be apparent in different image frames. This method is used when two or more frames which are continuous in the time domain require a difference in value of pixels which are at the same position with different frames, which will be useful in making judgement on the value of gray difference. The object detection network for motion is divided into two categories: regional and end-to-end



[5] Figure 1 : Flowchart of motion based object detection

#### 2.6 “Object detection and tracking using deep learning and AI for video surveillance” [6]

In this research paper we use a trained model to detect and track objects in a surveillance video feed. The general idea is to apply CNN over the image for the extraction for various instances and use hierarchical grouping algorithms such as YOLO (you only look once), SSD (single shot detector).

The YOLO algorithm uses an independent logistic classifier to calculate the likeness of input belonging to a specific label. The SORT (simple online real time tracking algorithm) is used to achieve multi object tracking (MOT). In addition to the detection of the objects in a video other parameters such as speed and color of the vehicle, vehicle type, direction of movement of the vehicle and no of vehicles can also be detected using the KITTI and COCO dataset. OPENCV is used along with YOLO to achieve high accuracy multi object tracking. Multiple Objects are detected and tracked on different frames of a video.

#### 2.7 “Coupled Object Detection and Tracking from St cameras and Moving Vehicles” [7]

This paper focuses on detecting and tracking objects by the use of state-of-the-art object detectors which performs multi view object recognition to detect cars and pedestrians in input images that can be 2D or 3D observations [1]. Multi-object tracking for both static cameras and from a camera equipped moving vehicle is carried out. The exercise is cleared by integrating recognition, reconstruction and tracking in a collaborative ensemble. The approach uses Markov assumption along with integrated information of an extended period to revise the decision and rectify the errors with new proofs. With incorporating real-world physical constraints, tracking-by-detection uses Structure-from-Motion (SFM) approach to deliver camera calibration. A MDL mathematical model, a tool for selecting framework is executed for handling interactions between multiple models necessary for defining a data set. An Implicit Shape Model (ISM) detector which uses this selected framework to create a large number of hypothetical detection of objects monitored. A greater focus is given on the 3D object detection by creating hypotheses, detecting, estimating trajectory over the ground level with the concept of event cones, color model implementing using top-down segmentation.

The entire procedure is kept efficient by incremental computation and necessary hypothesis pruning.

**2.8 “Traffic-Net: 3D Traffic Monitoring Using a single camera” [1]**

The aim of this paper is to use computer vision for an Intelligent Transportation System (ITS) and traffic surveillance. This system is achieved by implementation of deep neural networks. An enhanced algorithm has been used for pedestrian and vehicle detection. To achieve this system the model is trained using the various datasets, which include MIO-TCD, UA-DETRAC and GRAM-RTM, collected from the urban streets and highways intersection. The SORT algorithm is used for a faster tracking model called multi object and multi class tracker. The 2-D bounding box is converted to a 3D bounding box to achieve the desired space for each object.

**2.9 “Application of Object detection system”**

[9] In this paper we went to numerous applications using object detection with a bit of improvement to methods or the technology used then and now, the change in the algorithms etc. The few applications are listed as follows: Optical character recognition, Self-driving cars, Face detection and recognition, Identifying verification through IRIS code, Smile detection, medical imaging, Digital watermarking and many more.

**2.10 Comparative study**

**Table 1: Comparative study of the reviewed papers**

Paper name	Author and year	Observation
Object Detection Algorithms for Video Surveillance Applications	Apoorva Raghunandan, Mohana, Pakala Raghav and H.V. Ravish Aradhya In 2018	The idea proposed in this paper was to use different algorithms and see which one is more efficient such as (LOTS), (Background Subtraction Method), (MGM), (SGM) and W4
Traffic net 3D monitoring using a single camera	Mahdi Rezaei, Mohsen Azarmi, Farzam Md. Pour Mir In 2020	In this paper we came to know about the idea of implementing real-time monitoring, including 3D vehicles and pedestrians, speed detection, trajectory etc.

Implementation of an object- detection algorithm on a CPU-GPU target	GautierBerthou2017	This paper provides directions to design time and resources efficiently. The main aim of this project was to design and develop real time underwater object detection algorithms.
Naastaran Enshaei, Safwan Ahmad , Farnoosh Naderkhani  In 2020	Automated detection of textured- surface defects using Unet- based semantic segmentation network.	In this paper a novel and automated visual inspection system which can outperform the statistical methods in terms of detection and the quantification of anomalies in image data for performing critical industrial tasks.

### 3. CONCLUSION

The addition of AI has made the computer vision responsibilities easy and has replaced the approach of handling a task using image processing. This is because AI has high accuracy in pre trained data for the project. Multiple object detection in the project has been done using yolo for KITTI and COCO dataset. Better results in MAP value are directly proportional to the performance metrics. Rol is used for detection of objects in a video. The results measured a speed of vehicle as well as color of vehicle. Along with this it is used to find different parameters such as vehicle type, at which direction a vehicle is moving and even number of vehicles. Using GPUs in a project helps to create applications which have a real time approach where the dataset is higher in number.

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# **A SURVEY ON THE INTERNET OF THINGS (IOT), MACHINE LEARNING AND CLOUD COMPUTING BASED SMART HEALTHCARE.**

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**Abstract**—India has one of the world's largest healthcare systems with only 10 lakh registered doctors to serve 1.3 billion citizens. There are 55 million people in India suffering from some of the other forms of cardiovascular disease. In today's scenario, people make use of the IoT-based Healthcare systems widely, and also medical devices sector is a minute part of India's healthcare system. But the existing systems require manual monitoring for the disease detection and prediction of disease, coronary illness, etc. Which is unsuitable in emergencies. There are various parts in the smart health care systems containing the Internet of Things (IoT), the Internet of Medical Things (IoMT), edge computing, cloud computing, and wireless communication technology. For all these years research, on machine learning shows quite accurate results in detecting and predicting based on the wide data set produced from the healthcare industry. Many paper deals with the general components of the smart healthcare system. Here we present the broad survey on IoT devices using several machine learning algorithms and cloud computing used in the healthcare systems, which allows the professionals to diagnose, predict and concentrate on the area of the problem and present the perfect solution in a very less period. Machine learning accuracy can be increased with the collection of large data, which additionally improves Disease identification and risk prediction in healthcare systems.

**Keywords**— Internet of Things (IoT), Machine Learning (ML), Cloud computing.

## **I. INTRODUCTION**

The Healthcare industry is one of the most advanced industries as it is related to people's lives and their well-being. Millions of deaths are happening all over the world due to improper care towards health. The majority of the people are suffering from various diseases where they are more prone to cardiovascular disease. It is one of the prominent reasons which is taking the life of youngsters and older people as well. According to statistics of India, 54% of deaths happened due to CVD in 2009 and in recent years, 32% of the deaths are happening due to heart attacks globally. Proper care of their health needs to be taken and get it checked regularly, as catching up with the doctors and getting treated is difficult. During emergency cases, there will be a high need for quick diagnosis and treatment, but there are issues regarding this. It's difficult to diagnose the cardinal parameters of the person during a crisis. If the medical data of the individual is monitored before remotely and the recorded data will be examined by the doctor or the hospital which leads to saving lives against death. Pointing to this circumstance IoT contributes prominence towards the medical field. Which enables the medical professionals to proactively connect with the patients. IoT sensors assist in determining the health parameters remotely, which is an enhancing lead to a personalized health care system. Predicting the disease of the patient plays a vital role here. The machine learning models are trained to predict the present condition and severity level of a person. This leads to the proper treatment of a particular disease. Machine learning algorithms scrutinize several data and exhibit precise outcomes. ML algorithms are initiated in the Virtual machine to enhance the execution services of the health care monitoring system. Accompanying IoT and ML, Cloud computing has played an eminent role in storing medical records and even facilitates sharing medical data. Cloud platforms such as AWS, IBM, etc are used widely. The cloud contains the dataset after training the machine learning model as Cloud computing provides flexibility and scalability. Cloud computing is a virtual data region that permits multiple systems to access particular data. Cloud offers many features to utilize in medical aspects. It tracks the medical history and keeps updating the doctor or health care professionals to safeguard the patients and assist with early diagnosis, which leads to efficient handling of patients during emergencies.



## II. LITERATURE SURVEY

[1] presents the cloud-based four-tier architecture which uses machine learning for early identification of heart disease. Main objective of [1] is to Compute the execution of other types of algorithms and select high accurate results yielding machine learning modules. The Naïve Bayes (NB), Random Forest (RF), Support Vector Machine (SVM), Artificial Neural Network (ANN), Decision Tree (DT) algorithms were used in [1]. By using the dataset of Stat Log Heart Disease from the UCI Machine Learning repository performance of several types of algorithms has been calculated and recorded. In which 270 instances were examined. The presented system contains four-tier architecture which concentrates on gathering and binding data from various sensors. The Kafka pipeline and Cassandra supply huge amounts of real-time data, and machine-learning algorithms included for training and feature extraction, and illustrate the results of the system to users. For evaluating each classification result confusion matrix and 10-fold cross-validation approach has been used. With the help of different statistical techniques, the performance of the classifiers is rated. And ANN acquired good performance than other classification techniques.

[2] presents a generic architecture, for monitoring patients health conditions with the help of cloud computing as a Platform as a service (PaaS) and also machine learning algorithms. The algorithms used by the authors are as follows: Gradient Boosting Classifier, Random Forest Classifier, Naïve Bayes, MLP Classifier, KNeighbors Classifier, Logistic Regression and Decision Tree Classifier. For enhancing the accuracy of the machine learning model Ensemble methods are used. "Model Builder" option is used to create and run Machine learning models in IBM Watson. It has been used as the system requirement suggested by the author and the NDX9073 schema was used to construct the database. The 5000 datasets were used in training and it has been divided for testing and validation. 17 features were found in the dataset, in which 10 categorical and 7 numerical features has been obtained. The visualization of the dataset is achieved with the help of Bar graph, Histogram, and Correlation matrix. Division of the dataset for training, testing and validating was accomplished using the cross-validation technique because the model is weighted with many parameters and hyperparameters. The average accuracy from the models differed from 80%-92%. The Receiver operating characteristic (ROC) curve and Confusion Matrix was utilized for evaluation of the models.

[3] presents an automatic monitoring and alerting system. The system includes three parts a wearable device consisting of sensors for monitoring the vitals, and collected values are transmitted to the cloud server to process and, and a front-end android application for the end-user to see the results. The cloud server used is Amazon Web Services (AWS). Data is shared to cloud by Message Queuing Telemetry Transport (MQTT) protocol a messaging protocol for IoT. The collected data is stored and processed by using the AWS services. The author gathered a dataset having 100 records by a local hospital. An unsupervised learning method, the Gaussian mixture models has utilized and trained on data which results in the prediction of disease. Amazon SageMaker is a service that is used for the purposes of training and deploying ML models in cloud. By using the AWS SageMaker services, two Mixture Models had trained with 2 categories of datasets separately for the male and female, having an age group of 50-60 years. The results of the GMM's were evaluated with the 'Silhouette Score' scores of two models are 0.45 and 0.47 respectively and the average silhouette score was 0.46. Which showed clusters are well divided for all the complexness of human body vitals. The Silhouette Score can be improved by collecting more samples of data. The GMM delivered better outcomes than the other clustering algorithms. Using supervised algorithms can harvest better results and additional information about the severity of the patients is just theorized.

[4] They developed a system that numerous sensors take body vital readings and send the data collected to the cloud for different operations performed by machine learning. The authors acquired data from the doctor's prescription. The main data samples were collected into a comma-separated values (.csv) file by manually entering the readings acquired from survey technique. The author obtained around 650 samples of numerical data, after assembling and limiting about 500 samples of data for the study. Along with that, in numerous samples of E.C.G (Electrocardiogram) reports are sorted into categories of risk. The authors scanned the reports and pulled pictures from them. The jpg format of the images was used. The supervised learning model SVM was chosen and KNN was also used. The SVM attained an accuracy of 0.8674999999999999 and KNN acquired 0.8550000000000001. By using Platform as a service (PaaS) for computing. Configuring computer files in order to train an algorithm and submitting a CSV file as input to the machine learning model and the output are stored in the cloud storage bucket. Amazon Sagemaker has been used as the machine learning tool for AWS. For each dataset, the predicted output value will be acquired and decide the risk factors as output. The design will yield the average of all the expected values and give out an answer.

[5] explains a system that monitors the health of CVD patients. The developed system contains different sensors for vital measurements. The 3 sites architectural design is developed 3 sites as follows

- 1) The Patient site - where patient vitals are measured with respective sensors and collects data and carries to cloud for further operations.
- 2) The Server site – Obtains data samples from the patient and then reserves the samples into the webserver.
- 3) The Doctor site- the doctor confirms the resulting report, and send valid comment to the server.

All collected data are transmitted to the ‘Thingspeak’ server. Along with the sensors, a chatbot system that takes a broad health interview of the patient encircling different factors of patient’s health. The dataset used for training was extracted from the UCI repository for heart disease. It consists around 500 data instances, that are allocated in a 7:3 ratio for training and testing purposes. ML algorithms are used namely Random Forest Classifier (RF), Boosted Tree Classifier (BT), Neural Networks (NN), Support Vector Machine (SVM), Logistic Regression (LR), Fuzzy K-Nearest Neighbor (FKNN), K-Means Clustering with Naive Bayes (KMNB). The authors observed that the Neural Networks (NN) are obtaining a high accurate result. By preventing the overfitting, the model's overall accuracy can be improved.

**Table 1. Data Sets used in previous research experiments**

Sl.No	Paper	Author	Year	ML Models	Accuracy	Highest Accuracy Model
1.	A Cloud Based Four-Tier Architecture for Early Detection of Heart Disease with Machine Learning Algorithms	Md. Razu Ahmed, M Hasan Mahmud, Md Altab Hossin.	2018	Decision Tree (DT), RandomForest (RF), Naive Bayes (NB), Artificial Neural Network (ANN).	84%	ANN
2.	Machine Learning based Health Prediction System using IBM Cloud as PaaS” in 2019 IEEE Third International Conference	Sazid Alam, Asif Ahmed Nelay, Rafia Alif Bindu	2019	Naive Bayes, LR, DT, NN Ensemble methods, KN	95%	KN
3.	Elder Care System using IoT and Machine Learning in AWS Cloud”	Nithya Natarajan, Raj Vignesh Karunakaran, Aparajith Srinivasan, Dr . Radha S, Dr. Sreeja B S, Sabharish Padmanaaban M, Abirami Shankar	2020	Gaussian Mixture Model		GMM
4.	Health Monitoring IoT Device with Risk Prediction using Cloud Computing and Machine Learning”	Anindya Das, Abu Saleh Faysal, Zannatun Nayeem, Fardoush Hassan Himu, Tanvinur Rahman Siam	2021	SVM, KNN	86%	SVM
5.	Remote cardiovascular health monitoring system with auto-diagnosis	Budhaditya Bhattacharya, Saurav Mohapatra, Arka Provo Mukhopadhyay, Sunderam Sah	2019	LR, RF, BT, SVM, FKNN, NN	98%	NN

### III. CONCLUSION

To sum up, with these papers the main focus is to deploy a machine learning model with greater accuracy using IoT-based sensors and cloud computing. Also, to train and implement machine learning algorithms for efficient outcomes. By maintaining and updating the medical record in a cloud computing system and use of systematized data sets over unsystematized data sets, as it plays a vital role that aims to reduce complexity and computing time.

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# IOT BASED BATTERY MONITORING AND MANAGEMENT SYSTEM FOR ELECTRIC VEHICLE

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**Abstract:** The main objective of this paper is to monitor and manage the battery system in electric vehicle. The main problem faced by electric vehicles is limited travel range, lack of monitoring the battery conditions and unable to charge the battery at its low charge level during the usage of vehicle. In this proposal, the battery management system and monitoring system both were integrated which are capable of both monitoring, managing and logging the data to an online database. In monitoring system the condition of the battery and its surrounding environment of the battery can be known in live time. The managing battery system can charge the electric vehicles during running time. This system will help us in dual way in which battery can be charged while the vehicle is at rest and also can be charged using the dynamos which are in contact with the wheel. In monitoring system we collect and store all the database regarding the conditions and current location of the battery sent to the users android application via internet.

**Keywords**—Battery monitoring system, Battery management system, Android app.

## I. INTRODUCTION

Before the gasoline engines, internal combustion engines were used more due to low fuel cost and maintenance. But, In late 19<sup>th</sup> century only electric vehicles become more popular but not effectively used because of some reasons like,

1. Initial manufacturing costs were high.
2. Traveling range is limited.
3. Running and operating costs were high.
4. Speed was limited.
5. Lack of battery maintenance.

As the year passes, the oil crisis in 2008, leads to manufacture of electric vehicles and leads to innovation of alternative ways to generate the electricity. By this manufacturer chooses the battery as the main source to the electric vehicles. Lithium-ion batteries were effectively used at present. The major reasons that lead to increase the usage of the electric vehicles were;

1. To save non-renewable sources of energy for future generation.
2. To control air pollution.
3. To maintain eco-friendly earth atmosphere.
4. Increase in oil prices.

Nowadays, our government encourages and invests for the manufacturers as well as consumers to use electric vehicles over internal combustion engine, but majority of consumers continues with internal combustion engine due to some factors like,

1. Lack of battery maintenance
2. Limited travelling range.
3. High price of electric vehicles.

By solving above problems, significant changes can be made in electric vehicle and effectively used.

In this we use two sectors like monitoring and managing. In monitoring system we collect the data from the respective sensors and stored in database and sent to the user android application through internet. The management system works on Dynamo that used to convert mechanical energy to electric energy. By using this we can generate power and charge the battery while the vehicle is in use.

## II. RELATED WORKS

In recent years in the automotive industries seeming better improvement with the eco friendly electrical vehicles. this vehicles helps customers by reducing the expenses over fuels and give excellent mileage in one charge. by using monitoring system helps to keep the battery life in safe path .it is more eco friendly [1].

Due to power crisis and environmental conditions, we need to make use of updated technology and need to improve the manufacturing of electric vehicles .major issues in the development of electric vehicles is battery condition.so we need more concentration on the battery monitoring and management technology [2].

Due to lack of fossil fuels ,high cost of fuel electric vehicles take some important consideration. the main important problem of battery is lack of monitors, limited range distance issues like fire ,battery conditions, our work gives some suitable conditions to existing problems[3].

This battery monitoring system gives us an time to time update about the battery conditions , live locations and help us to alert. earlier battery management system helps us to extend some distance range than estimated range[4].

In battery monitoring system ,this paper tells us that it is capable of managing both monitoring and logging data to an online database. this system monitors the battery parametry like voltage ,current, temperature, power and state of charge and this parameter are sent and stored in the database via internet [5].

And this paper tells that it is used to monitor and control the charging and discharging of the rechargeable batteries this paper addresses state of charge, state of health ,state of life and also maximum capacity of the battery [6].

This paper deals with the thermal management where the battery heat is controlled by cooling technique where what we are further developing is that we will do overall view of battery were we used the charging and discharging and other parameters like voltage, fire detection and moisture detection for betterment of the battery [7].

Here in this paper, we can see the battery management design and this necessity by using li-ion cell. cell balancing circuit's design and analysis and electronic load, which can also be charged will be explained in this paper. The battery management system of charging and discharging system is discussed in detail[8].

There is no monitoring system in electric vehicles reducing in large scale in India. This has been just a personal project.in this paper we work on production in large scale regarding battery monitoring. here our system will be monitored from the condition like temperature, voltage, power, current, state of charges in the battery. health of the battery to be maintained that is its main objective and that should also been monitored [9].

To balance the battery conditions our software should be designed. the software application should contain the measuring modules of voltage,current,where as these parameters will be present and interacted with the central processing unit that is battery and that units will be displayed in software system, like this in electric scooter the battery management system is done [10].

In this paper electric vehicle will depend on the source of the battery.the performance degradation will happen when the supplied energy of the vehicle is decreasing gradually there are two parts in battery monitoring system using interface and monitoring device which is helpful for the detection of condition of the battery and sends the further notifications to the users[11].

This paper address the condition of the battery life ,charge and state with maximum capacity of the battery.for the monitoring purpose different analog or digital sensors with micro controllers are used[12].

This paper aims to review the energy management systems and strategies introduces at literature including all the different approaches followed to minimum cost. weight and energy used but also maximum range and reliability current requirements needed for the electric vehicles to be adopted and described with brief report at hybrid energy level [13].

### **III. HARDWARE INVOLVRD IN BATTERY MONITORING ANDMANAGEMENT:**

The ATmega2560 is the foundation for the micr0c0ntr0ller board of the Arduin0 Mega 2560,A flame detector is a sensor that recognize and responds to the presence of a flame or fire, attempting to make flame detection possible. The sensors used are the raindrop sensor, humidity sensor (DHT11), gas sensor, temperature sensor (LM35). The NEO-6MV2 is a route planning configuration for the GPS (Global Positioning System). The subsystem simply determines its geographical position and produces an output its position comes latitude and longitude. Pushbuttons are normally closed tactile switches. Only by pressing the button do we have the ability to power the circuit or make a specific connection. A buzzer is a small and easy element to incorporate acoustic characteristics to our system/project. The Lithium-ion battery. After you access the Blynk app, you can develop a project home screen and assemble on screen capture, Gliders, diagrams as well as other control mechanisms.

**IV.METHODOLOGY:**

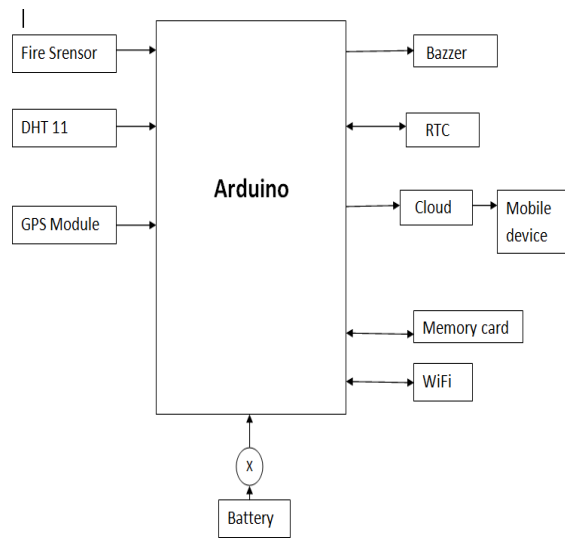
Here we monitor and manage the battery conditions by using MCU microcontroller, we use DHT 11 which helps to sense moisture and temperature , GPS module helps to track the vehicle location, Fire sensor helps to sense the fire which may cause during the short circuit.

The output of these sensors were connected to the microcontroller. The output of those sensors will be in analog form and then converted into digital form using microcontroller’s analog to digital converter.

Wi-fi module is used to connect the available predefined SSIDs, in case of no network, then the data is stored in micro sdcard as temporary storage medium .whenever wi-fi is available, the data in the micro sd card is locked to the server

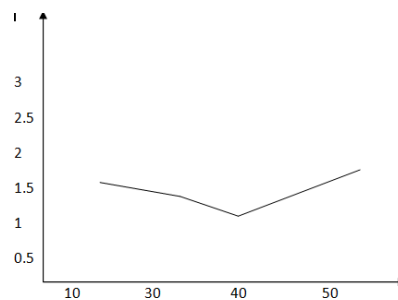
We use the RTC module to find the time so that wifi networks Can be searched every 1.5 hours .the monitoring circuit uses Very low power, the battery used as power source have high Voltage output so to regulate that we used dc-dc converter to Step down voltage to 5 volt for the arduino.

In this battery management system we used two batteries in Switch mode, while one battery is in use, then other battery Will be charged with the help of dynamo and switched to Other respectively. Dynamo which is placed in the wheel we get,



Speed In km	current amps	motor volt	power	correction	battery power per hour	total power for 100 kms
20	5	72	360	5%	378	1890
30	7	72	504	5%	529	1763
40	11	72	792	5%	832	1714
50	15	72	1080	5%	1134	2268

**BATTERY MONITORING**

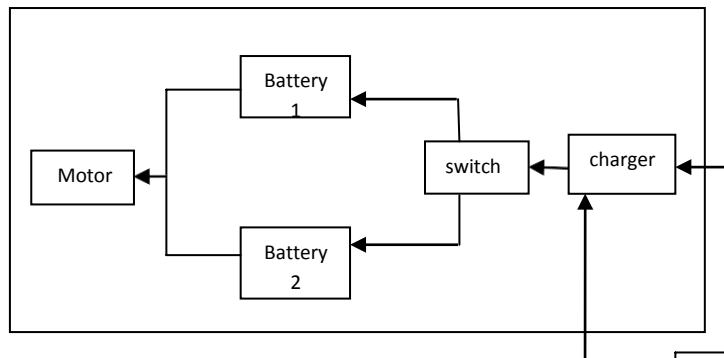


Helps to generate the energy by converting the mechanical energy into electrical energy produced by other wheel due to the battery 1.this is how management system works.

As for starting and during traffic time we take 5% of Battery usage and calculate for 100km.

**V. ANALYSIS OF THEORY**

By conducting some experiments to know the battery Range, power, current is required to run the electric Vehicle with respective speed. We connected the Ammeter to the battery discharging source and get some Respective readings



Speed Km/h	20	30	40	50
Current	5	7	11	15

We know, power = voltage\*current

As normally 72volts motor was used in e-vehicle(bike)

So, for 1 hour respective speed

**BATTERY MANAGEMENT**

Plug Dynamo

20	power = 5*72 = 360w
30	power = 7*72 = 504w
40	power = 11*72 =792w
50	power = 15*72 = 1080w

We use pedal bicycle power generator dynamo which able to produce 500w 12v, 24v and 48v, by this additional power source produced, we can cover around 10-15kms more compared to expected range.

**VI. APPLICATION**

The definitive solution for managing the lifecycle of batteries. This methodology can be used in various organizations or authorities to monitor. The health of the battery can we well maintained. Real time monitoring system is done. Better energy management can also be done at the same time

**VII. CONCLUSIONS**

In this way we are the developing the system model for battery monitoring and management in electric vehicles ,by which we can monitor the battery and its surroundings, vehicles this helps to increase the battery life span and by management system we can overcome the expected distance to some limited range. Moreover the greenhouse gases can effectively reduce by using updated electrical vehicles

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## **BUS TRACKING AND MONITORING USING IOT AND WIRELESS SENSORS**

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### **Abstract**

*Public transportation systems include a variety of options such as buses, autos, cabs, light rail, and two-wheeler options like Bounce, Ola, etc. These systems are available to the public and run at listed times.*

*The purpose of introducing or expanding public transportation is to increase access to and use of public modes of transportation, while, at the same time, reducing personal motor vehicle use and traffic.*

*India has the second largest population worldwide after China, more than one-third of which live in civic areas.*

*Public transportation plays a necessary part in intercity mobility. There's an increased burden on public transportation, like buses, just because of the population. Citizens who use BMTC buses waste a lot of time waiting for bus arrival at the bus stop/station and often, they are crowded.*

*Public transport, buses specifically, are affected by many time-consuming factors, like traffic, passenger wait time and bus dispatch time.*

*However, by providing transparent information, like real time bus location and bus occupancy, to the commuter we increase the responsibility and reliability of the public transport.*

*Our tracking system involves the installation of an electronic device, such as a GPS Module, on the bus along with a network to access the position of that bus. We also plan to fit the bus with IR sensors at the doors, for occupancy tracking and an LCD display at every bus stop, informing the passengers of all these collected data.*

### **I. INTRODUCTION**

The tremendous growth in population has pushed us to make new innovations in the daily commute of public. Nowadays, keeping COVID-19 situation in mind, the ways people travel in public transport system is the main reason where the real problem arises. Most times the mode of transport may be available, but the capacity or availability of seats is unknown. A lot of people face difficulties with respect to time while moving from one place to another. A

bus tracking system helps to track the bus as well as give information about the vacancy of seats in that bus. Keeping all these problems in mind which are faced by the public of our country on daily basis, this idea discussed further in the paper helps us get closer to the solution.

Our main contribution is to design and develop a system that shows all bus tracking details with the help of sensors, it shows the real time tracking of buses. The paper talks about the data of both inside and outside of bus, i.e., the tracking or location of the bus in real time and monitoring inside of the bus for seat availability. We desire to display the information about each bus in bus stops and mobile applications/websites to reduce or estimate passenger wait-time and improve the reliability, making our system more efficient and useful.

### **II. LITERATURE SURVEY**

1. Authors: Anjali Badkul, Agya Mishra

Year: 2021

#### **Abstract:**

The real-time bus tracking system using IoT technologies is implemented in the system proposed in the paper. People can know the whereabouts of a bus such as the location status and the time of arrival using a mobile application. According to this system, RFID tags are used in buses and the RFID receivers are placed in the bus stop and the information is collected and uploaded on the cloud using NodeMCU. The proposed system uses UHF-RFID and NodeMCU based real time bus tracking instead of a GPS Based system.

2. Authors: Mona Kumari, AjiteshKumar, Arbaz Khan

Year: 2020

**Abstract:**The system proposed in this paper helps parents for tracking the school bus in which their children are travelling, using IoT and Android technologies, The safety and the whereabouts of their children is observed through a mobile application, with the help of techniques like GPS, GSM and RFID.

3. Authors: Mehboob Hasan RohitYear: 2020

**Abstract:**

This paper proposes a system whose main aim is to maintain security and safety in public transport. Some of the features of the proposed system are AI-based surveillance system, GPS tracking system, Breath analyser, Blind point assistance.

The data collected in real time can be stored and managed in a cloud database. The communication between real time devices and the cloud can be done using the MQTT protocol, which is a publish-subscribe based messaging protocol.

4. Authors: Amrita P Unnithan, Asiya Abu, Sumo Mariyam Mathew, Simi

Year: 2020

**Abstract:**

This paper discusses the use of Machine Learning concept to identify the fastest and the most efficient bus routes and inform the passenger of the same via mobile application. It also uses a cloud-based database for storing and manipulation of data. The GPS module used for the purpose of tracking the vehicle is interfaced with the microcontroller present in the system.

5. Authors: A. Deebika Shree, J. Anusuya, S. Malathy

Year: 2019

**Abstract:**

The aim of this project is to automate the system services and provide real time tracking experience of public buses, which can be done using RFID tags and GPS module. The real time data is constantly updated to the Arduino for processing.

After processing, the resultant data will be sent to the cloud, which is an interface between the user and system.

6. Authors: Asif Ahmed,

M M Rayhan Parvez, Md Hridoy

Hasan, Fernz Narin Nur, Nazmun Nessa Moon, Asif Karim, Sami Azam, Bharanidharan Shanmugam and Mirjam Jonkman.

Year: 2019

**Abstract:**

This paper talks about the use of RFID identification tags to keep track of students present on a school bus.

7. Authors: Surendranath.H, Sai Ram.B, Praveen Kumar. N, S.Akshay and Pavan.

Year: 2019

**Abstract:**

This paper describes an application that provides the user with information regarding the bus location and how far it is from the nearest bus-stop. The methodology used here is an Arduino IDE program.

8. Authors: Mr. A J Kadam, Mr. Virendra Patil, Mr. Kapish Kaith, Ms. Dhanashree Patil and Ms. Shambhavi Bendre.

Year: 2018

**Abstract:**

This paper also talks about the use of an android application that uses a GPS system to locate the position of the bus. According to this paper, the application also aims to provide information on the occupancy of the bus.

9. Authors: Sarah Aimi Saad; Amirah'Aisha Badrul Hisham; Mohamad Hafis

Izran Ishak; Mohd Husaini Mohd

Fauzi; Muhammad Ariff Baharudin; NurulHawani Idris.

Year: 2018

**Abstract:**

This paper mentions an Advanced Public Transportation System using real-time- tracking that monitors the location of the bus using a Global Positioning System and updates the cloud every second with the bus's position.

10. Authors: Pravin A. Kamble, Rambabu A. Vatti.Year: 2017

**Abstract:**

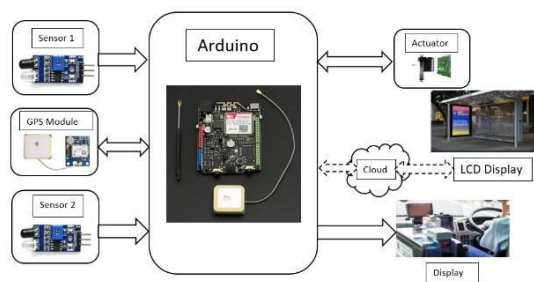
This last paper in our literature survey talks about the use of an IoT system that provides an RFID output to track the bus and display its location on an android application.

**III. PROBLEM STATEMENT**

In respect to Bengaluru City's public transport system,

- According to a 2019 survey, 38.5 lakh passengers commute via BMTC busses, daily, which makes up almost 30% of our population. As a result, city busses are constantly overpopulated and hanging crowds are a norm.
- Covid-19 regulations are rarely followed in these circumstances, thereby making it less appealing to commuters.
- The current system used for tracking location and the frequency of the busses are often inaccurate.

**IV. BLOCK DIAGRAM**



The proposed model given above describes the entire process of fetching the raw payload from the bus, delivering it to a cloud for data processing and then performing the required action (opening/closing entrance and exit doors respectively, displaying location of the bus) based on the raised request.

**On the input side,**

- Sensors collect data from the bus.  
 Number of passengers getting on the bus (sensor 1), number of people getting off the bus (sensor 2) and location of the bus(GPS Module).
- Processing unit processes the collected data (total number of passengers on the bus) and sends it to the cloud via wireless network.

### **On the output side,**

- If the bus's seating capacity is not full, then, actuators open the bus entry doors to allow new passengers in. Otherwise, the doors remain closed at the entry point and only the exit doors are opened, for passengers getting off the bus.
- The display on the bus is to inform the bus driver the seat availability, so he can manually override the actuator system, should it fail.
- The cloud is used to store the real-time location it receives from the GPS module of the bus and seat availability on the bus. The LCD display/monitor at every bus-stop receives the location and occupancy of the bus via the cloud for passengers waiting to board the bus at each bus terminal.

### **V. HARDWARE AND SOFTWARE REQUIREMENTS**

- Processing Unit: Arduino
- Sensors: IR Sensors
- Wireless Network: LoRa WAN
- Tracking Unit: GPS Module
- Google Maps API
- Web interface for displaying seat availability and bus location
- LCD Display

### **VI. CONCLUSION**

The advantages of using public transportation are minimizing traffic congestion, saving fuel, and reducing pollution. People use this service because of reasonable charges and eco-friendly attributes of it.

In this paper, we have attempted to design a low-cost bus tracking system using sensors, GPS module, Arduino, actuators and an LCD display. This system helps the commuters to know the exact location of the bus and expected time of arrival at a particular bus stop along with the seat occupancy both, displayed in the bus stop and on their smart phones. This reduces the waiting time, overcrowding at the bus stops and improves reliability.

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# DEVELOPMENT AND IMPLEMENTATION OF FRAMEWORK OF AN IOT PLATFORM

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**Abstract**—IOT devices and services can be very expensive and time-consuming to set up and manage by an individual or even an organization that deals only with the hardware of these IOT devices. This paper proposes a platform with modular structure that can have multiple parts that work independently to each other can be hosted and managed by different Technologies or microservices platforms, The basic server structure consists of a main server responsible for a Websockets endpoint and a very basic barebones data api, which exists independently from the server hosting the dashboard that is used to access the data and control the devices, the authentication can also be managed separately as we have a database with the only purpose of storing user data, Data in relation to IOT devices is also stored separately in a database, each module has a recommended Platform to host and is designed to be as inexpensive to host as possible, by the current (2020-2022) pricing plans of the platforms we can host this platform and its module for free of charge by any individual or organisation. The platform structure is made open source so it's easier for individuals or organisations to cadre to their own use case, being open source also helps in scalability as it can be re hosted by an individual, and the modular design can allow for scaling of different aspects of the platform to levels that cadre to ones use case. An Arduino C library is also designed in order to make it easy for hardware developers to connect their compatible hardware to the platform.

**Keywords**— IoT Platform, WebSockets, Data Api, Modular, Open Source

## I. INTRODUCTION

Internet of Things (IoT) bridges the gap between sensors and actuators. Smart interaction among these devices results in an efficient system which can be employed in various fields. An IoT platform is what enables these systems to have smart interactions and manage data. IoT enables monitoring of data which provides an opportunity for data marketing from where the Big Data concept arises which is a vital key for marketing. Personalizing and standardizing products based on consumer data, for example, would be possible. This will significantly improve marketing companies to adapt to changes, manage resource efficiency, and maintain logistics. As of 2019, there are at least 49 cloud platforms that cater to the needs of different enterprises, end users, government organization, and healthcare but none of the companies address all challenges involved in the implementation and have surged up their service charges. IoT platform development and implementation using a flexible, configurable, modular, lightweight, cost-effective platform is proposed here.

## II. LITERATURE SURVEY

Nestor B along with Carlos M. Oppus and Gramata Jr. Jose claro N. Monje published in 2019, this note introduces the design and implementation of a reconfigurable, scaleable and low costs Iot platform and additionally addresses the challenges that occur during the execution of its cost efficient IoT platform.

Ranjan Sikarwar, Pradeep Yadav, Aditya Dubey published A survey on IOT enabled cloud platforms, this paper provides a literature survey on different IOT platforms and services that are available and gives us an insight on their drawbacks and comparisons between them.

Malihe Asemani, Fatemeh Abdollahei and Fatemeh Jabbari in 2019 published a better understanding of IoT platforms, adds a better understanding of the ways in which cloud computing and IoT platforms works and additionally supplies major characteristics description.

M.Ullah, K.Smolander in 2019 published a paper where the key factors of an IoT platform were highlighted, this paper attempts to find out the chief requirements of IoT platforms that can be considered before choosing an IoT platform and what to look for while opting for services as the existing services cost more. This collective network connects devices and technology provides communication between devices.

Luca Calderoni, Antonio Magnani in 2019 published IoT manager which is a general framework for managing sensor networks, which has been designed and implemented by the University of Bologna as a case study for an open source IoT platform.

Taking advantage of interworking technique and architecture towards a standardized IoT service layer platform is a recent publication by Jongwan An, JaeYoung Hwang, and JaeSeung Song.

This paper highlights the interoperability problems in many house IoT devices by providing an architecture to support interworking between smart home devices.

Ninging cui, Yi hu, Dong Yu, The paper describes how to design and develop an intelligent workshop IoT cloud platform based on microservices in detail, including a detailed description of architecture and design of the platform. Published in 2019 our research and implementation of intelligent workshop IoT cloud platform.

Terry Guo along with Damon Khoo, Micheal Coultis and Marbin Pazos Revilla in 2018 published an IoT platform for engineering research and education. Applications in secure and smart manufacturing. This paper provides insight on the small scale IoT platform built by Tennessee tech. Also includes 2 case study reports 1) machinery health monitoring 2)Intrusion detection at any manufacturing environment which is supposed to be secure.

### III. PROBLEM STATEMENT

Interconnection between distributed digital devices and their networks can be very time-consuming and expensive. Many groups follow their own methods of integrating devices without a standard. Owing to the nature of the devices' existence, their security will always be an issue and information they are provided with is very sensitive.

The proposed solution would allow organizations to easily integrate various features and functions into their systems.

### IV. METHODOLOGY

Server Environment: The Server Environment is written in Nodejs. Which is an open source and cross-platform runtime environment for JavaScript. It runs on the V8 engine executing JavaScript outside the browser, hosts the Server Environment.

Socket Connections: The Socket Connections are handled by Socket.IO library. It is a JavaScript library used for real time web applications. It also provides a bi-directional communication between server and web clients.

MySQL: Our MySQL tutorial is designed for beginners and professionals. It is cheaper for storing the structural data like sensor values every time.

MongoDB: As device status requires fast read and write speed so that the device responds fast, we use MongoDB which is good for unstructured data like user settings and device status.

Arduino Library: It is a simple high level api to communicate with the web socket connection written in C. We can use libraries to extend the Arduino environment similar to programming platforms in the market. The use of libraries gives us extra functionality.

Hosting: heroku container provider for node enu, vercel for static server hosting to the dashboard, MongoDB Atlas for remote MongoDB instance and GoDaddy mysql hosting for MySQL instance.

### V. LOCK DIAGRAM

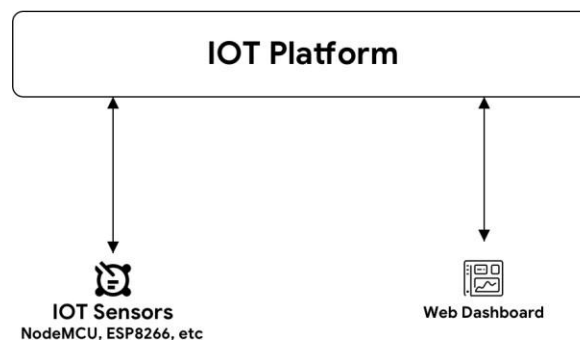
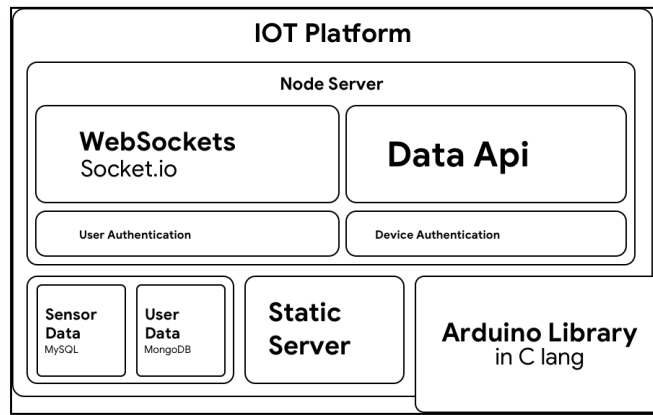


Fig 1: External IoT Platform Block Diagram



**Fig 2: Internal IoT Platform Block Diagram**

## VI. SYSTEM HARDWARE REQUIREMENT

### A. HARDWARE COMPONENTS

Microcontroller Arduino UNO- ATmega328P, with Input Voltage: 7V-12V and Operating Voltage: 5V, Digital I/O Pins: 14 pins (6 reserved for PWM output), Analog I/O Pins: 6 pins, DC Current per I/O Pin: 20 mA, Flash Memory: 32KB (ATmega328P), Clock Speed: 16MHz, SRAM: 2KB (ATmega328P), BUILTIN LED: 13 EEPROM: 1KB

(ATmega328P).

ESP8266: (802.11 supporting WPA2 or WPA )2.4 GHz Wi-Fi. General Purpose input and output (16 GPIO).

Analog to digital convertor (10 bit ADC)

Inter Integrated Circuit (I<sup>2</sup>C) serial communication protocol. Pulse width modulation (PWM)

Serial Peripheral Interface (SPI) for serial communication protocol.

B. SOFTWARE REQUIRED Ideal Hosting option (for lowest cost):

1. Heroku
2. Vercel
3. MongoDB atlas
4. GoDaddy MySQL

#### Server Environment:

1. Written in Nodejs
2. Socket connection: Socket.io

#### Databases used:

1. MySQL
2. MongoDB

#### Dashboard:

1. Reactjs Arduino Library:  
C language

## VII . CONCLUSION

The IoT platform we are designing features a node server consisting of websockets, data api and user and device authentication. The framework for an IOT platform which we are designing is lightweight and can easily be deployed. The deployed platform can allow users to sign up and login into the platform where they can get their api keys that they can use in their hardware design to connect safely to this platform. The connected devices can be controlled pin wise through the Dashboard or can be used to just record sensor data from the device to view it over time.



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# IOT MESH ENABLED ENVIRONMENT MONITORING DEVICE: A REVIEW

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**Abstract-** Wide spread and protean behaviors of the environmental parameters creates hurdles in continuous monitor and achieve consistent results. Internet of Things (IoT) enabled wireless sensor networks (WSN) highlights the dominance of these parameters in our vicinity for better tracking of the behavior. As both the WSN and IoT are of the distinct layered platform, few technical difficulties are encountered while constructing an environment monitoring system with the help of available components. A review of different IoT based techniques used for environment monitoring is presented in this paper. In IoT mesh enabled environment monitoring system, the sensor node can be implemented using most of the easily available sensors, along with particle argon or any other microcontroller at each node. The IoT Mesh can be interfaced with the server using different protocols or platforms or other technologies as well. Various environmental parameters in our vicinity are evaluated and displayed via a user interface.

**Keywords—** IoT, Mesh, Wireless Sensor Node (WSN), Environmental parameters, Particle Argon.

## I. INTRODUCTION

The creative growth in industrialization and urbanization has led to environmental pollution to a larger extent at an astonishing rate of affecting all forms of life. Of all air pollution adversely affects the human health as the contaminants are small and can easily spread over a wide range.

IoT [2,7] is the outcome of mankind's intelligence and never ending curiosity for experimenting in new fields to ease lifestyle and to scale down labor and terminate the chances of human errors. Pollution can be monitored using many leading technologies, one of which is Internet of Things (IoT). IoT technology is rapidly affecting human beings interaction with surroundings, making it more efficient and involving collection and sharing enormous amounts of data. Such smart gadgets are also able to reciprocate to one another, exchange data and autonomously take decisions. By establishing a connection between the devices and the internet, they are been encouraged to gather and distribute data along with making appropriate analysis for precise and accurate result via Machine Learning and Neural Networks (complex mechanisms). There are a number of IOT technology based applications, as it goes hand in hand with various other technologies involving numerous operations with available data, regarding the functionality of the activity and also to monitor and control all the environmental parameters in the vicinity even from the farther distance. Moreover, IoT-based applications are gaining popularity due to its advantages in area like being compact, affordable and limited power consumption. IoT [1] An IoT gateway or an edge device is functioned in transmitting the collected data to the server to be modified and analyzed or for local analyze.

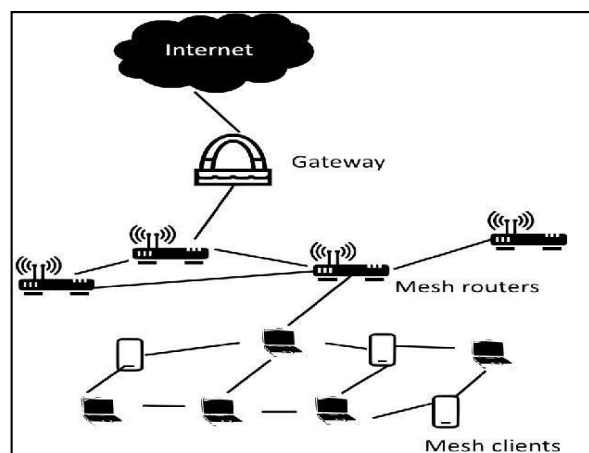


Fig:1 IoT Mesh

A Mesh IoT [1,2,3,4] network can be represented temperature, pressure, humidity and pollution in various parts of the house. The platform named ThingWorx [2] is been used in this project with a set of REST APIs. The system is developed in 4 levels i.e., hardware, Gateway/Network, Platform, Application. The user interface which is a user friend app displays the output remotely on the screen[2,5,6,8,9].

U Bhagat et al. [3] designed a paper to reduce power wastage via IoT based streetlight system which focuses on using Wi-Fi mesh network. A Wi-Fi module, controller and various sensors are used by the street lamp to measure power and to detect the object. The seasonal data is being used to monitor and control the functionality of streetlight by s a local network topology wherein devices are interconnected directly in a non-hierarchical form to transfer data throughout the network. The communication between devices in the mesh network is monitored through the specified predefined protocol that governs the role of each device in transmission of data. All the nodes in a mesh topology work together to circulate data across the different components in the network. The three important components in a mesh topology are-the gateway, the repeater, and the endpoints. Where, Gateways is a point where external devices are interfaced to the internet. While, repeaters correspond to endpoints by capturing data in the network and reiterating it. Repeaters deliver data to endpoints that acts as receiver by receiving the transmitted data.

## II. RELATED WORK

Noori et al. [1] focus on monitoring air and noise pollution at construction sites for the goodness of worker's health. Taking advantage of the present technology they have employed multi-function smart sensors, NodeMCU (microcontroller), ExpressJS, Angular, SQLite3. MFS [1,2,3,4] are connected as a mesh network for collecting data from the surroundings. D Assante et al. [2] implements an IoT- based system for internal environment monitoring , which is used to measure the central base station. Adafruit.IO [3] is operated as MQTT agent or server. R Kashyap et al. [4] proposes a Mesh-based alternative, which leads to significant reduction in transmission power. A single node in the mesh network basically consists of all the passive and active devices i.e., all the smart devices connected over the internet which highlights the interconnections and the path for transmission. This gives a high chance in handling traffic flow in the network and also better optimization. A basic discussion is presented on how MIMO technologies

[4] could be merged with Mesh technologies.

S. H Kim et al. [5] implemented a low-cost air quality monitoring system [5,10] using LTE mobile communication network. The developed system consists of a measuring device and an analyzer (collect and analyze). Its requirements are mobile communication network without any restrictions of space and to give visualized results [5]. J Shah et al.

[6] implemented a framework for an Internet of Things (IoT) enabled environment monitoring system. In the designed system, data is being transmitted and received from the transmitting side and receiving side respectively. An excel sheet is maintained on a PC to store the analyzed value gathered at the receiver side through a Graphical User Interface (GUI) [1,6,10], created on LabVIEW.

T Beibei el.at [7] have tried to interrelate smart device on measuring components such as temperature, humidity, light intensity, fire etc. to develop a smart home gadget with an application of IoT. H Jiang et al. [8] highlights the architecture of the system including LinkIt One [8] system board

[8] with sensors as the core hardware platform, which contributes in storing sensed data and conveying the content to be accessed through the Internet, then transfers the data to the software platform Yeelink [8] a cloud server through Wi-Fi.

J Li et al. [9] the core control device used is STM32 micro-controller [9] and the SHT10 temperature and humidity sensor to accumulate the temperature and humidity in indoors [2,9,12]. The gathered data is fed to the Data Transfer Unit (DTU) [9]. DTU module functions with GPRS [9] network to transmit the indoor environment temperature and humidity data to the dataset.

A D Deshmukh et al. [10] focuses on providing information through wireless sensor technology which consists of Raspberry Pi [1,2,10], Arduino Nano, ZigBee [10], wireless sensor network (WSN) [1,2,10] and sensors. Embedded Raspbian Linux and Graphical User Interface (GUI) are used for analyzing and outputting the gathered information. The Raspberry Pi which is determined as the base station gets the data gathered by numerous sensors related to environmental parameters for further processing. One way includes the sensors directly furnish the processed information to the Raspberry Pi. The other way is by sensors using Arduino Nano through which the data is processed and further sent to the Raspberry Pi via serial interface.

The Raspberry Pi will then transmit the data with the help of ZigBee and the processed data can be seen through GUI via ZigBee at the receiver node.

T.W.Ayele et al.[11] proposed a system with pivots on detecting air pollutants using a Machine learning algorithm[11] called Recurrent Neural Network more specifically Long Short Term Memory (LSTM)[11] along with IoT. The system makes use of air sensors to identify and transmit this data to microcontroller (AVR ATmega-32) [11]. A.Kadri et al.[12] presents an end-to-end IAQM system enabling measurement of CO<sub>2</sub>, CO, SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>, Cl<sub>2</sub>, ambient temperature, and relative humidity. In IAQM systems, remote users make use of a local gateway to establish the connection between the wireless sensor nodes at a specified monitoring site to the external world for access of data. Backup and restoration of the data collected by the sensors is maintained during situations like Internet outage. The system is modified to an open-source Internet- of-Things (IoT) webserver platform, called Emoncms [12], for live monitoring and long-term storage of the obtained IAQM data.

### III.PROTOCOLS AND PLATFORMS

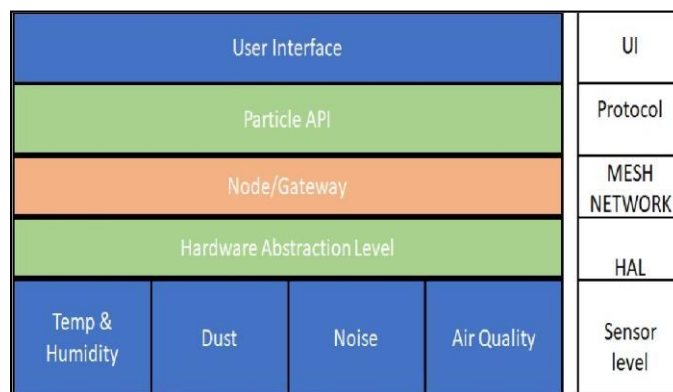
To overcome the limiting criteria of most of the environment monitoring devices a mesh network is used with a number of nodes where extra nodes can be added or removed based on our convenience. For consistent flow of data through different layers various protocols and platform can be used. HTTP protocol[1] which stores data into database. The MQTT protocol [1][3][4] is used to transport messages between two devices. The ThingWorx [2] platform monitors all the connected devices using the AlwaysOn protocol [2]. The TCP protocol [5] is used on top of IP to ensure reliable transmission of packets. LinkIt One [8] platform which is referred to as hardware platform, can store sensed data and convey web content which is reached through the Internet, then transfers the data to the cloud server called Yeelink [8] directed through Wi-Fi.

One of the papers uses Machine learning algorithm [11] called Recurrent Neural Network [11] to implement a successful mesh network. A networking protocol Wirepas, is used to route data locally and homogeneously involving all connected devices of a network. To connect devices without failing a single connection a very versatile protocol named Google's Thread mesh network can be implemented. Bluetooth Low Energy mesh networking is a protocol which specifies its integration via flooding method. The Particle DeviceCloud API is a REST API which uses HTTP protocol. Thingsquare is a platform which builds wireless IoT mesh networks with an impressive range, at massive scales, and with incredibly low power consumption.

IBM Watson IoT Platform is a managed, cloud-hosted service designed to make it simple to derive value from the Internet of Things devices. An Open-source IoT platform, ThingsBoard is used for its combined functions such as collection of data, and then processing involving visualization, and device management. It includes connection of devices involving standard IoT protocols such as MQTT, CoAP and HTTP and maintains both cloud and on-premises deployments.

### IV. ENVIRONMENT MONITORING DEVICE

A monitoring device can be represented using various levels as shown in Fig: 2. Sensor level, Hardware Abstraction level, Node or Gateway Level, Protocol Level, User Interface Level are all the levels interfaced with each other to transfer the data from one to other node or to the server.



**Fig: 2 Levels in an Environment Monitoring System**

The device highlights on monitoring environmental parameters through a system employing a mesh network. The idea can be put down into 5 layers. First, sensor level- individual node are created with specifies sensors along with a particle argon which are interconnected to each other in/as a mesh. Second, HAL, Hardware Abstraction Level describes about the connection used by the sensors.

Third, Node/Gateway the main part of the mesh network acts as the base for all the collected information. Fourth, Particle API which houses the REST API is related to storing and displaying of the collected/ monitored data. Contains the protocols used. Fifth, User Interface, the results are displayed through any wearable devices or smart phones applications or discord to alert and also for usual graphical representation.

## V. CONCLUSION

A review of different IoT based techniques used for environment monitoring is presented in this paper. Design of a low-cost mesh enabled monitoring system which comprises of multi- functional wireless sensor node (WSN) with different platforms available is made easy, as a detailed review of most of the platforms and protocols has been mentioned. The IoT mesh network which can cover a large space and works smartly and efficiently where a single node fails to operate. Low cost, low power consumption, efficient, authentic and simpler to control the system or device can be designed.

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# IOT BASED SMART SECURITY SYSTEM USING LASER AND ARDUINO IMPLEMENTING

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**Abstract:** This project covers the design of a laser-based security system that can be used for home security. In this program LASER is used to find people who are illegal. There are different types of security systems developed worldwide and they are very important in our daily lives. The wireless sensor based on the nRFLO1 trans receiver is used to connect the gate to other sensors. The laser light safety system can discover moving objects whenever it passes or crosses the laser light and takes up less space and covers larger distances. LDR determines the number of blocked lasers. Then the Arduino programming board decides whether to sound the alarm or dial the desired phone number over the GPRS / GSM system, depending on the number of LASER blocked. The system satisfies both cost and safety compared to other existing network.

**Keywords** - IR sensor, Metallic sensor, humidity sensor, Arduino controller, LCD display, IoT module.

## I. INTRODUCTION

Nowadays, the number of occupants is growing gradually as the society grows compared to the previous century. In the first century, crime rates had dropped dramatically, however eventually the illegal activities raised. Even today, the perpetration does hardly decline. Offence is defined as doing something unnecessary, which has an impact on people and their possessions. The biggest effect is losing the valuable things, which is robbed by well-known and unknown people. During night time, when no one is in house or anywhere else and you are unaware of the situation that is about to occur at your place, now the trouble is you just do not know about the situation. So now we have a quick fix for this problem that is low-cost smart security system using lasers.

Here the title implies security, thus giving warning or protection. To prevent crime, these programs help you know about your people and your belongings which are in danger even prior to crime scene and quickly deal with the trouble using this system. It can be fixed in house very easily and occupies very little space and can be used for security purpose.

According to the latest IO-based user experience it has the best security system and creates a comfortable working environment. Automatic use of IoT is becoming increasingly popular because it provides ease, security and security. For this project, we will implement a home security system using laser and Arduino. The laser ray can travel a long distance without creating a scattering effect. Radiation points and the scene are transparent. Therefore, with this security project you can create an unseen limits of the diplomatic zone

## II. LITERATURE SURVEY

Ashis Rai, Bikash Rai has proposed a laser light protection program at Low cost for a smart home. In this paper we have seen how laser works and what the benefits of this method are now and in the future. It contains very small particles, especially the ability to detect a moving body whenever it passes or crosses a laser beam and can remain in a small area and cover long gap. In this study, light-dependent resistor is utilized as a sensor. Due to the rising crime rate, research has been done on how to protect and affordable items called the low-cost laser light protection system.

Azfarina Jaafar and Murizah Kassim have proposed a dynamic home automation security system with user interaction. The Dynamic Home Automation Security (DyHAS) Warning System with a laser interface for web pages and mobile applications was proposed in this paper. Home security has been identified as one of the most important issues in modern life. Burglary cases continue to occur on a daily basis and existing home security systems face problems such as, non-web-based, lack of flexible and difficult to handle features, so the main goal of this paper is to develop a flexible home security alert.

Raj G Anvekar, Dr. Rajeswari M Banakar proposed the development of an IoT application: home security system. In this paper one of the most important components of the Internet of Things material is in the Defence Sector. This paper aims to provide a low-powered, inexpensive Io-based home security system that assists in the presence, identification and verification of a stranger. This paper proposes a solution that uses a photography unit, an actuator and a telegram bot to build solutions compatible with Raspberry Pi IoT infrastructure.

Soupan Sarkar, Ariful Islam has proposed a Laser-based security system using a wireless sensor network and GPRS / GSM Technology. In this paper, they have proposed a solution for in land aquacultural such as shrimp / prawn breeding in Bangladesh by designing and implementing a laser-based protection system.

The proposed system uses LASER as a detection method for attackers. Gateway and sensors are connected via a wireless system established on the nRF24L01 trans-receiver. LDR determines the number of blocked lasers. Then the Arduino system board decides whether to ring or call or dial the desired mobilenumbar via the GPRS / GSM network; depending on the digit of LASER blocked.

Harshal Hemani, Debarti Sen proposed a Laser-based home security system. In this paper they used a laser light to cover a greater distance. That is because of its two main features namely, it can travel long distances without the effect of dispersion and these lasers are only visible by incident and in the source area, otherwise they are invisible. Using these two features (structures) they built a modern security system and named it "Laser Security".

Kushank Sehgal et al. proposed an IoT-based wireless home security system. This paper aims to make our homes smarter and more secure. The technology used in this paper is basically IoT and cloud-based services that are current and future. IoT-based devices are used to monitor and manage power and provide direct message or SMS support to the user with a single tap, and all of these functions are controlled by a cloud system with active internet support.

Roshan Fernandes, Anisha P Proposed IoT-based security for blind people. A face recognition system using the Internet-based Raspberry Pi (IoT) is proposed in this paper. In this system Face detection is performed on live video and attempts to remove facial recognition features. This program has also been found to be useful for theft offices / homes by quickly detecting theft and allowing the user to view stolen information. In this paper their proposed program uses video processing techniques to detect and visualize faces. This proposed project is found to be useful for the blind, deaf and even disabled as the program incorporates voice recognition to assist and guide.

Malti Bansal et al. have proposed a 24 \* 7 integrated IOT-based home security system. Smart IoT based Integrated Home Security System is an integrated way to keep the user's home safe, under all circumstances through sensors and modules. This application is used to detect gas leaks, fire breaks or a burglar in the house from time to time showing the user actual time via a short message service (SMS).

Sharadha Somani, Parth Medhi proposed smart and automated IoT-based home security. This paper uses the technique of installing in our house and making electrical appliances easier and more automated. The project focuses on building a wireless home security system. Through AES encryption, security is achieved over the network. In the event of any violation, it may sound an alarm, when necessary, which is why home security is maintained by sending user notifications using the Internet.

Xin Hong, Chunming Rong has proposed a smart home security monitor using IoT concepts and wireless sensor network (WSNs). In this paper, an internal sensor alarm system is used to send sound and images to other media. system. The existing system provides an activity check for rare real-time events, while sending an alarm message to the user. Considering the careful transfer of data, only alarm data is sent to the data centre. The user finally checks the alarm messages. False alarm level can be reduced by this male scan procedure, and it saves the normal operation when detected.

### **III. PROBLEM STATEMENT**

Most of the house security systems accessible within the market include a control panel installed somewhere in the house. The downside of the system is that home users cannot access and customize the control panel when away from home. In addition, house users do not seem to be able to monitor the safety of their home remotely. The motive for building this program is due to the high number of burglaries and burglaries reported annually.

The home security system should provide a home security feature by intimidating residents with threats such as theft, invaders and invading animals. The financial costs that residents have to bear due to repairs and replacements. And most importantly all other existing programs cost what cannot be afforded by ordinary people. In our project we are trying to make the cost of technology more efficient and accessible to ordinary people which is why we are using laser and LDR as our key component to make the cost of results more effective. In addition to using sensors and alarms we use a cloud-based app to notify any evacuation of the owner when the owner is not at home so they can communicate and stop crime.

## IV. METHODOLOGY

Intelligent Io-based security using laser and using Arduino is the proposed solution to this problem. Laser safety systems are a technology that is part of home-based security that is only available to the rich. It has an automatic sensor and a basic alarm unit. When someone cuts off a laser light, they will activate a system alarm. And the alarm indicates a company that monitors security and local laws. The basic alarm unit will sound like a loud alarm. Both analysis and testing indicate that complex requirements must be met in order to obtain effective optical heterodyne detection.

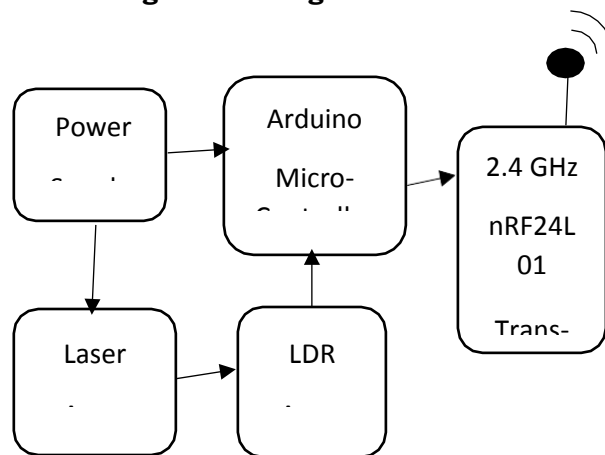
In some wavelengths it may provide the only way to overcome noise and detect sound problems. The effectiveness of LDR depends on the photoconductivity process.

This protection system uses laser light and LDR. The LDR module has an internal potentiometer to adjust the LDR sensitivity, so that only laser light falls on it. The concept is simple and similar to what we see in movies where, old, precious ornaments are protected under laser lights. As someone crosses the lights, an alarm goes off to indicate an unauthorized presence. This project works the same way. Under normal circumstances, where there is always a laser light falling on the LDR, the LDR module always provides a high signal on the small controller. When someone skips this laser light, it will act as a barrier between the LDR module and the laser lamp, resulting in light not entering the LDR. In such cases the LDR module provides a small control signal, indicating that the alarm is on.

### A. BLOCK DIAGRAM

In our proposed design of the safety network contains:

**Fig: Block Diagram of sensor node**



The circuit consists of an Arduino board, Laser, LDR array and transceiver. The materials used are evenly spaced on each other's edges for example laser, LDR, etc. LASERS are set down on the close and light-dependent resistors on the other aspect. The LASER-LDR set changed into bend; as LASER is very direct and a tiny departure will cause an error.

### B. WORKING

The LASER indicator lap is a voltage separator system that combines series resistance and LDR. Your combination of both is connected to the analog PIN on the Arduino board. Therefore, analogue studying of the sensors is taken the Arduino board which makes the system more versatile. The first two sensor readings are taken, one when LASER is turned on and the alternative when LASER is becoming off. Then measure two readings to find the median value. Any reading above this institutional value is taken into consideration excessive and that below is low. This method allows to reduce the natural outcomes at the nerves.

Whilst a voltage is implemented to a buzzer there's an active piezoelectric wherein while a capability difference is carried out to the complete internal piezoelectric oscillator it produces or creates noise. The light-emitting diode is connected in line with the buzzer. The BC547 transistor has 3 terminals. If the flat facet is going through then you the primary pin is called the collector, the second pin is referred to as the base and the third pin is known as the emitter.

Alarm and negative LED end connected to the collector BC547 NPN transistor (performing as a circuit switch) that accepts the contemporary within the transistor; has a small modern cost. every transistor needs a threshold voltage to show on. The threshold voltage states that a minimum voltage is needed from the bottom to the collector to behaviour a direction among the collector and the emitter.



Transistor used to expand sign (cutting-edge). the base of the transistor blocks the cutting- edge due to the fact its miles hooked up at a lowvalue due to the fact it is an NPN transistor andconsequently has a small doped because of the presence of p junction. In this cycle the resistor is 150k and the light-dependent resistor is near two Mega ohm resistivity, light is the occasion.the bottom connected to the resistor and light- dependent resistor note the separator. If we use a dc supply there may be a high voltage drop throughout the light-dependent resistor and a small voltage drop within the resistor word thatthe LED anode within the resistor and the cathode are inside the collector.

Similarly, link the cell; a separate nice battery against us and a terrible side on one facet of thelight-dependent resistor. As quickly because the cell is attached, the LED and alert can be directly to recognised the laser at the light-dependent resistor and you can see the LED andAlarm transfer OFF, if you break in the light- dependent resistor -targeted laser light on the other side, circuit triggers and alarm buzzer willsound. To start this procedure as it works the voltage used to pressure the transistor base needto identical or exceed the most voltage to skip the contemporary to it and the emitter obtain present day from the source root and the circuits closes and the buzzer starts off evolved ringing. On the equal time the light-emitting diode startsoff evolved too mild up again.

The light-emitting diode is made of silicon diode whilst it has a cracking place of zero to 3v, so the entire diode is operated below precipitation mode. When the light depth beneath LDR has a low resistance stage it means permitting modern-day to bypass through the LED and piezoelectric begins to make noise. If the mild depth is as excessive as LDR and increases its resistance it means that LDR resistance is at once associated with mild depth. So, when the light does now not hit the LDR higher than the LED and the buzzer starts making sound and mild. The LDR activates high Resistance and there may be no voltage go with the move at the base of the transistor so thetransistor will shut down, when the laser light isstop up.

## **SYSTEM HARDWARE REQUIREMENTS**

### **A. HARDWARE COMPONENTS**

#### **1) PCB**

A lap board or printed circuit board is a non- collaborative substance including conductive traces published or carved. Electronic element is installed in the board along with the strains which attaches the additives collectively to shape an operating lap or meeting.

#### **2) LDR SENSORS**

LDR is a synthetic device which reduces resistance in relation to detecting light on its sensitive part of a component.

#### **3) GSM MODULE**

Global System for Mobile Communications (GSM) component or GPRS component is a circuit which is utilized to set-up transmission linking a cell phone/computer and theGSM/GPRS system.

#### **4) LASER SOURCE**

The device that emits light through the optical amplification process found in the renewable magnetic field production is called Laser.

#### **5) BUZZER ALARM**

A buzzer is a audio signalling device, that is either electrical or mechanical. It is commonly used in alarm devices and timers.

#### **6) LED SOURCE**

A light emitting diode, which is used as light source which starts to emit light when electricity is passed through it.

### **B. SOFTWARE REQUIREMENTS**

1) Visual Studios - Used to generate native as well as managed code. This software allows 36 different editing languages and permits the codeeditor and solution to allow all editing languages, as long as there is a specific language service.

2) Eagle Software – EAGLE, Graphical Layout Editor Easily Applicable. Provides multi- window user visibility as well as a menu plan, project management and customization interface and design parameters.

## V. EXPECTED OUTCOME

Security has become a very important need in recent times as the crime rates are increasing day by day. The idea of a laser security system proposed can be useful and helpful even to the middle-class families as it is cost-effective. Laser is unparalleled and can be of great use as it occupies less space, covers long distances, and we can utilize it to build a security system which is more efficient and secure than the human resource. Proposed ideas of our project are given, and a comparison of various projects are shown along with their disadvantages.

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## SMART PET CARE SYSTEM

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### ABSTRACT

In this ongoing 21st century, many relationships are deteriorating day by day, yet one of the innocent and pure relationships between a man and his pet still exists eternally. Every pet serves as a friend, a playmate, a companion who never complains and there are endless reasons for pets to be a part of human life. Monitoring the activities of the pet such as feeding, water consumption, and pooping is vital, but also a challenging task for the pet owners indulged in their busy schedule. Therefore, to overcome these challenges an IoT-based automatic food feeder, water dispenser, and litter box are implemented through a mobile application in the proposed model. Tracking the pets feeding habits, charging of the feeding tray, timely water dispensing, frequency of defecation, and important of all a virtual presence of the pet owner to be connected to the pet at all times of the day is attained by the Internet of Things (IoT) in the proposed system.

### KEYWORDS

*Internet of things (IoT), Arduino, ESP32, Wi-Fi module, smart pet care system, Blynk App.*

### INTRODUCTION

In our society, factors such as aging, loneliness, work load, and changes in social structure have a major impact on human relationships, because of these factors, many people choose pets as companions. However, due to a busy work schedule, most pet owners do not have the opportunity to give their pets the attention they deserve.

To resolve these issues in this paper we have aimed for the development of a Smart pet care system, which consists of a food feeder, water dispenser, and a litter box. This study is based on the concept of Internet of Things (IoT) using Blynk application software and Arduino Uno board as development platform. This project is designed with components like Arduino, ESP32 Wi-Fi Module, servo motor, sensors, and home gateway. Pet owners can use IoT technology to remotely track and control their pets. Here Arduino is used to controlling all processes. Three subsystems are connected to the Arduino Uno board and the Wi-Fi module along with the sensors: feeder, water dispenser and tray. In addition, the data received from each sensor is processed and displayed by a smartphone application called blynk. This helps the pet owners to monitor the pet's food, water, and also defecation frequency even when there they are out.

This paper includes the following sections. Section 1 studies the various literature survey. Section 2 presents the Implementation which includes hardware and software design. Section 3 includes the Expected outcomes of the project. Section 4 concludes the paper. Section 5 presents the references.

### I. LITERATURE SURVEY

In [1], the author has discussed the IoT -based pet care system using the prototype such as food feeder, water dispenser, and litter box. Food feeder helps in timely feeding of the pet, Water dispenser takes care of the timely refilling of the water tray, litter box measures the frequency of pet defecation. However, there is no presence of -an alarm system when the food is stuck in the feeder nozzle. There is no measurement of the amount of water consumed by the pet, the litter box does not replace the pooping pad after use.

In [2], the authors have discussed smart feeders and Android clients that use wireless communication such as MQTT, and this article presents a dog feeder prototype running on IoT technology using an Arduino Uno and ESP8266 Wi-Fi module. The module also includes a Raspberry Pi camera that monitors autofeed. However, the feeder prototype can have a larger dispenser to store a large amount of food. Features such as gestures can be added to this module.

In [3], the author defines an Automatic Pet Food Dispenser using the Internet of Things, this paper features a smart feeder that facilitates scheduled feeding, sets the food quantity, and adjusts an amount of food if the pet could not finish its previous meal. However, there is no voice module to feel the virtual presence of the pet.

In [4], the authors define the Internet of Things for pet-human interaction and monitor pets. This article includes a camera service to monitor your pet, a temperature sensor to measure your pet's temperature, and a heart rate sensor to detect your pet's heart rate. All of the above functions are implemented in the form of a wearable device on a pet's collar with Wi-Fi connected. Although this paper does not have a feeder to feed the pet and also a speaker on the device for the pet to hear the voice of the owner.

Nowadays, most pet owners do not have the opportunity to properly take care of their pets due to their busy schedules. To overcome this issue, in [5] the author has discussed an intelligent pet management system using the Internet of Things. In this article, we propose a system that allows pet owners to feed their pets and track their movements when they are not at home. This system also contains a pooping pad that monitors the frequency of defecation. Although this paper does not have a water dispenser that can measure the amount of water in the tray and refill the tray continuously.

In [6], the author describes an automated monitoring and feeding system for pets using IoT. This paper includes a pet care system with a smart pet feeder and pet collar, which detects the presence of pets and opens the lid to allow pets access to food from the dispenser. The pet collar functions as a GPS tracker, that tracks the location of the pet, these modules are functioning through a mobile application named "things speak". Although this pet collar can only track the location of the pet - an additional feature such as a buzzer can be included which alarms the pet as well as the owner when a limited boundary of the area is crossed.

In [7], the author has discussed the Simulation of an automatic food feeding system for pet animals, this paper consists of an automatic food dispenser that uses an Arduino Uno as the virtual controller, this paper also has a buzzer feature that alarms the pet owner when the food is stuck in the prototype and hence cannot dispense the food. However, there is no implementation of water dispenser and litter box in this paper.

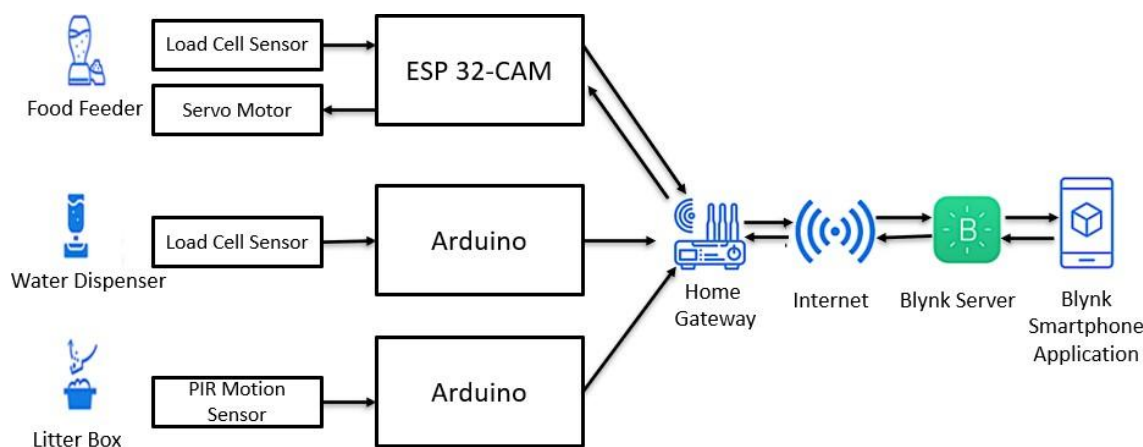
In [8,9,10], the author defines an IoT Smart Pet Care mobile application. This paper includes scheduled feedings, monitoring camera service, and cleaning the toilet pad. There is an additional feature of remote music activation that enables the pet owners to play music for the pets while the pets are at home. However, the mobile application which is used in this paper is to function the prototype which is suitable only for the Marshmallow android version.

According to the research paper [11,12,13,14], entitled Development of Smart Monitoring System the author has described a scheduled smart feeder that uses an Arduino cam for monitoring the pet and a recording module. An additional feature of the waste food compartment is present in this paper which collects the waste food thus preventing the pet from consuming stale food.

In [15], the author have discussed smart pet feeders, and this paper presents feeders that owners can use to provide food and water to their pets at any scheduled time. The owner can specify the amount of food. However, a smart pet care system doesn't just include a feeder and water dispenser, it will be called a complete system even if the litter box is implemented, which is not present in this paper.

## II. IMPLEMENTATION

### BLOCK DIAGRAM



## **The Proposed Block Diagram**

### Hardware Design

This proposed pet care system consists of a food feeder, water dispenser, and pooping pad. These 3 modules are connected using IoT technology and a blynk application.

#### **A. Food feeder**

The function of the food feeder is the timely input of food on the food tray and monitoring the food consumption by the pet. This prototype includes a meal storage container and also a container that can pour out the meal, a flip flop at the opening of the nozzle to outlet the food at timed intervals of food to be served.

The flip flop is connected to the server motor to function the flip flop at necessary times. The food tray measures the required amount of food that is essential for the pet, based on the weight of the food dispensed on the food tray which is calculated using a Load cell sensor, which is having a maximum capacity of 4kg. Once the right amount of food is dispensed the flip flop returns to its original position therefore the feeder will stop dispensing.

#### **B. Water dispenser**

The primary function of the water dispenser is to measure the remaining water in the water container.

Above the load cell is a water dispenser that works under the action of gravity. The maximum loading capacity of the weight cell is 4 kg to determine the amount of water remaining in the water tray.

#### **C. Litter Box**

The function of the poop pad is to measure the frequency of your pet's bowel movements and the interval of time the pet last visited the poop pad. The PIR motion sensor is used in this prototype which is majorly applied for the above functionality.

The HC-SR501 motion sensor is a sensor with adjustable delay duration, range, and trigger mode, where the delay time and the range are set to the lowest approximately three seconds and three meters respectively and the trigger mode is repeated mode.

A buzzer is implemented to notify the pets to have their meals.

### **Software Design**

This paper consists of three different prototypes, the food feeder, water dispenser, and litter box. These three prototypes work based on the Internet of things (IoT) interfaced with Arduino board and Blynk application software. The instructions for the working of this prototype are programmed through Arduino software. The Blynk application software helps us to control and monitor the working of the prototype just by selecting the particular function present on our smartphone.

#### **A. Food Feeder**

The software design of a food feeder consists of a servo motor, load cell sensor, ESP32 wi-fi module, and communication with Blynk. All these components of the food feeder are connected to the Blynk software through an internet gateway. When we press the specific function knob on the Blynk application, the servo motor of the food feeder starts to rotate from completely to 180 degrees. When the motor reaches its first 180 degrees then it starts to rotate backward until it reaches its initial position. The pet food is dropped into the food tray during this rotation. If we keep on pressing the function button on the software, the rotation of the servo motor will proceed with this loop continuously. By selecting the particular function button each time drops the same amount of food. In this way, we can control the amount of food that is been consumed by the pets. Regarding the amount of food left out in the container, we make use of load cell sensors. Since these load cells are associated with Blynk, it includes the ability to display values. Initially whilst the food feeder can be loaded with meals, we set the beginning weight as zero, hence any food that is consumed decreases the weight. Finally, the amount of food consumed will be displayed on the application

#### **B. Water Dispenser**

The water dispenser module is connected with the load cell sensor. The working of this is similar to the load cell sensor that is used in food feeders. These load cell sensors are interfaced with the Blynk software where it displays information about the amount of water that is left out in the container. Using this information, the pet owner can refill the water container through this application.

### **C. Litter Box**

The litter box module is attached to the Arduino Uno and esp8266 module with an HC-Sr501 PIR movement sensor. This PIR Motion sensor is interfaced with blynk software which displays the information when pets come in and defecate, it shows the frequency of the pet defecation when it defecated last time, and the timing and duration when the pet is inside the litter box. By using this information, pet owners can keep track of their pet's health.

### **III. EXPECTED RESULTS**

To implement a comprehensive system, the activities of a pet are monitored via the mobile application. The information on the food feeder is presented firstly. The food dispenser features to show the quantity of food being ingested by the pet and dispenses food in the food tray remotely.

The water dispenser determines the amount of water left in the container and continuously refills the tray.

The third prototype, which is a litter tray, updates the last time the pet left the tray and the time the pet was in the tray.

### **IV. CONCLUSION**

In this paper, we have developed a connection of communication between a pet and pet owner with the help of a food feeder, water dispenser, and litter box.

This automated prototype is possible by using the Internet of things (IoT) along with Arduino. Other components include sensors, actuators, ESP32 wi-fi module, and Blynk application software.

Here the food feeder monitors the amount of food consumed. The water dispenser monitors the water consumption of the pets and also notes down the amount of water present in the container. The litter box records the animal's defecation frequency. To bring together all these three subsystems under one platform, we use a smartphone application called Blynk. This application helps in controlling and monitoring the three prototypes and provides a statistical record of the same. This smartphone application is integrated into the Wi-Fi module, allowing the owner to control the device with a smartphone from home. In this way, any deviations in a pet's behaviour can be detected by the pet owner and an appropriate health check can be performed. Lastly, as there are many pet care works and products that are available in the market like the temperature and heat sensors, smart toys, smart cages, and so on, this project aims to provide a good approach to pet lovers and also to achieve all the demands of the pet owners with the help of more advancements in existing software and hardware.

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## WOMEN SAFETY DEVICE USING IoT

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**Abstract**—In today's reality, women in our society do not feel safe to step out. Women are being threatened, pursued and harassed. We proposed a smart women's safety device which supports women's safety and will assist women and even children in our society in feeling safe whenever they are threatened or involved in any type of harmful situations. In order to determine the safety of women GPS and GSM modems are being used for detecting women's safety. The technology can be linked to an alarm system to send out a warning to nearby residents. It includes a GPS, Microcontroller and a GSM Modem which is used in detection and messaging systems. In the form of latitude and longitude, the GPS receiver receives location information from satellites. This data is processed by the microcontroller and relayed it to the user via a GSM modem. The MCU is equipped with a GSM modem. The current location of the victim is sent from GSM modem via SMS to the pre-programmed mobile phone number and concerned police station. This action permits facilitation outright from the police in addition as public which can save the victim in the proposed system.

**Keywords**— Arduino Nano, NeoGM GPS, SIM900, 433MHz RF receiver and transmitter.

### I. INTRODUCTION

Women's safety is at peril in today's globe, notably in India. Harassment, abuse, eve-teasing, assault, abduction, murder, physical harm, sexual exploitation and domestic violence are all forms of harassment against women are not on the decline, but are on the rise. The government has tried a number of preventative steps to prevent these disruptive behaviors, but they have had little influence and have gone unreported due to the increased number of these crimes. Sexual harassment in the workplace is becoming more widespread by the day. Sexual harassment at work occurs when one person engages in undesired behavior that makes the other feel uncomfortable, offended, or distressed. The majority of these incidents occur when men in high-ranking positions in an organization that targets women. For every 44 minutes a woman is being kidnapped and for every 47 minutes women are being raped.

While waiting to board or exit a school bus, students are vulnerable to child trafficking and kidnapping. If you have women's security apps installed on your phone, you may use them to send emergency notifications to specific persons as well as to let people know where you are if something goes wrong. When a woman has an accident late at night and no one is there to help her, she will be unable to communicate her distress. They also lack basic first-aid training and are unable to identify the incident's perpetrator. With just a touch, a click, or a shake of the phone, a profusion of apps and devices for women's safety are now available.

### II. LITERATURE SURVEY

As in [1] The Kavach - women safety device with GPS tracking and SMS alert. This project shows how to use GPS and GSM modems to determine women's safety. The system can be linked to an alarm system to notify the neighbors.

As in [2] the project's authors developed a smart security device based on the Internet of Things concept. Watch Me, a device that incorporates a sensor to monitor a person's pulse rate, The device, which will rise whenever a woman feels she is in danger an alarming sound will be generated to alert nearby people in order to seize their attention, has been revealed, shedding focus on the societal challenges that women face.

The device may also make automatic calls to registered contacts and track the victim's location via GPS.

As in [3,4] in relation to this paper we noticed that how authors of this paper have worked on using IoT technology to Smart Security technologies. They have highlighted the development of a smart band which is used as a safety device, which communicates with a Smartphone with an Internet connection and uses GPS tracking and message services to notify the victim's family and friends, and authorities regarding the crime.

As in [5,6] this paper proposes a method by which a woman can immediately notify the appropriate authorities if she is in danger or any other critical situation. The proposed method obtains the coordinates of the smart phone by using GPS tracking. The image and alert message are also used in this manner to notify the family and police officers.



As in [6] the objective of this project is to develop and build a device that is so small that it functions as a personal security system in and of itself. This design will address the most of the major concerns that women have and will assist them in feeling safe. However, we discovered that if the amount of numbers input into the system is large, notifications will be delayed.

As in [5,6] Abhaya app: It's an android software app designed specifically for women's safety that gives registered contacts quick location updates by tapping a single power button on the phone.

As in [7] the authors of this paper have worked on the project with the title "FEMME" is a security device with multiple functionalities like audio and video recording, Designed specifically for ladies who are at a time of crisis or hardship. It has a variety of functions and is simple to use and carry.

As in [8,9] in reference to this paper, we notice that the authors have created and constructed a simple personal safety device that uses an Arduino Uno and connects an Arduino circuit board with a GSM SIM900 to deliver Text message and calls.

As in [9] this research proposes a successful women's protection programme, based on the development of a prototype system that safeguards women's safety in both infrastructure-rich and infrastructure-poor areas. This helps to ensure the safety of family members as well as timely police reporting. This idea showcases a simple and compatible combination of GPS and Beacon technologies that will empower individuals while also acting as a multipurpose gadget that adds an extra layer of security.

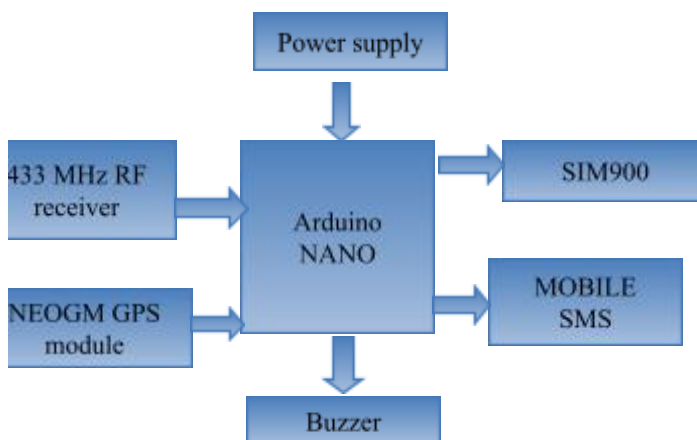
As in [10] this research proposes a smart device with an internet-connected camera to avoid the aforementioned problem (IoT). When a person is in distress, GSM and GPS are used to track them down. A neighboring police station is notified of the victim's location, as well as a pre-registered cell phone number. The buzzer raises awareness of the victim's surroundings.

This proposed system's main purpose is to give people the power to defend themselves against bodily violence, molestation, harassment, and sexual abuse. The real-time working kit could be made into a wireless device.

### III. BLOCK DIAGRAM



**Figure 1**



**Figure 2**

#### Working of the block diagram:

The Transmitter and Receiver components of the Women's Safety System with GPS Tracking and Alerts can be separated into two sections.

The following are the circuit schematics for each section:

### **Section of the transmitter:**

There will be a button and a 433 MHz RF transmitter in the RF Transmitter component of Figure 1 to wirelessly communicate data to the receiver part. To make the transmitting module smaller and usable as a wristband, the two components are separated.

### **Section of the receivers:**

As illustrated in Figure 2, the data is transferred from the Transmitter portion by the wrist band and is received by a 433 MHz RF reception in the RF Receiver section. The data is then delivered to the Arduino nano through a RF receiver's digital pin. The signal is subsequently received by the Arduino Nano, which processes it according to the programme that has been loaded into it. When the victim in danger presses the button in her wrist band, a HIGH signal is created and delivered to the Arduino, which then sends a signal to the SIM900 modem, which then sends a text message to the registered user as well as the GPS coordinate kept in the Microcontroller using the NEO6M GPS module.

### **NEO6M GPS MODULE:**

A low-cost, which is widely used, featuring a high-performance GPS system, on-board storage, and a standby battery that can be readily coupled with a broad range of microcontrollers.

The GY-GPS6MV2 and the GY-GPSV3-NEO are the two most popular NEO-6M GPS modules nowadays.

It has a high sensitivity for indoor use as well. A rechargeable MS621FE battery is also included and an EEPROM for recording configuration data. The module performs best when the DC input voltage is between 3.3 and 5 volts.

In the GPS modules, u-NEO-6M blox's GPS engine is employed. The ROM/FLASH version of the NEO-6M is ROM 7.0.3, and the type number is NEO-6M-0-001. (UBX-TN-11047-1) PCN One UART port on the NEO-6M module can be set for serial connection.

### **SIM900 MODEM:**

The SIM900 is a comprehensive Quad-band GSM/GPRS solution packed as an SMT module for client application integration. In a tiny feature set with low power consumption, the SIM900 provides a corporate interface and enables GSM/GPRS 850 or 900/800 or 1900MHz phone, Messages, data, and fax. SIM900 can accommodate practically all of your Machine to Machine application space needs, especially when a tiny and compact design is required. It is a quad-band GSM/GPRS phone that can be used for voice communication via a microphone and a tiny loudspeaker and SMS in addition with the Internet access.

It appears to be a massive package which is 0.94 inch x

0.94 inch x 0.12 inch with 4 L-shaped ports that may be attached from both the side and the bottom. The module within is controlled by an AMR926EJ-S CPU, which manages phone interaction, data transmission (via an integrated TCP/IP stack), and communications with the circuitry interfaced with the mobile phone (via a UART and a TTL serial interface). A SIM card (3 or 1.8 V) must be linked to the module's outer wall, and the CPU is in charge of it. An analogue interfaces, A/D converters, RTC, SPI buses, I2C, and a PWM module are also included in the GSM900 device.

### **ARDUINO NANO:**

The Arduino Nano is a compact, breadboard-friendly and comprehensive board based on the ATmega328. It contains many of the same functionality as the Arduino Demilune, but it is packaged differently. It only has a Current ( dc ) power outlet and utilises a Mini-B USB port instead of a standard USB cord.

Each of the Nano's 14 digital pins can be utilised as an input or output using the pin Mode (), digital Write (), and digital Read () operations. 5 volts is used to power them.

Each pin has a 20–50 ohm pull-up resistor built in, which is disconnected by default and may give or receive up to 40 mA.

The eight analogue inputs on the Arduino Nano each have a ten-bit resolution.(that is, it can distinguish between two different values).

### **433 MHz RF TRANSMITTER AND RECEIVER:**

The 433 MHz Radio Frequency transmitter and receiver module comprises 2 small RFS (radio-frequencies) electronic modules that allow any two devices to send and receive radio waves. The transmitter module sends data from the transmitter module to the receiver module, which it then receives.

#### **433MHz RF Transmitter Module Features:**

Over the 433.92MHz frequency, the Transmitter only offers only one-way interaction at a data rate of 1Kb. It runs on a voltage range of 3 to 12 volts, which is the same as most microcontrollers and motherboards. The data is sent using the ASK (Amplitude Shift Key) modulation method. It is one among the most cost-effective power modules available for usage by businesses, hobbyists, and developers. With a wide range of applications and the ability to interface with practically any microcontroller, the 433MHz Transmitter is one of the most cost-effective RF transmitters available.

#### **433MHz RF Receiver Module Features:**

The RF receiver's output is decoded and supplied to the data pin. The maximum functioning voltage range of the module is 5V. The frequency of the receiver may be adjusted using a node on the receiver. It's a popular and low-cost receiver that uses very little power. A 433MHz Receiver module receives the ASK signal as an input.

### **BUTTONS:**

A push-button is a basic switch for controlling a machine or activity. Hard materials, such as plastic or metal, are widely used to make these buttons. And to also make it easier for a sentient touch or hand to depress or push it, the surface is generally flat or curved. Biased switches are commonly implemented using buttons. The "push-button" has been used for calculations in calculators, push-button in telephones, home appliances, and a wider array of other mechanical and electrical household and commercial equipment.

### **BATTERY:**

An electrical battery is a type of power generator composed with one or more electrochemical cells with external connections that may power electrical devices. The positive terminal of a battery is known as the cathode, while the negative terminal is known as the anode, when the battery is supplying electricity. The negative terminal works as a source of electrons, which flow through an external electrical circuit to the positive terminal of the battery. When a battery is linked to an external load, a redox reaction occurs, converting high-energy reactants to lower-energy products and supplying the free-energy difference to the external circuit as electrical energy.

The term "battery" originally referred to a device made up of numerous cells, but it has now evolved to refer to devices which are made up of only one cell.

Batteries come in a number of different forms, varying from tiny cells that helps in power hearing aids and wristwatches to modest, slender cells that provide power to the smartphones, to huge lead acid or lithium ion batteries in vehicles, to massive battery banks the size of halls that provide backup or emergency power for telephone systems exchange and computer data centres. Batteries offer a far higher power rating than traditional fuels like gasoline.

### **BREADBOARD:**

A breadboard, also known as a protoboard, it is used as a building base for testing circuits. The word originally referred to a shining piece of wood used for bread slicing. In the 1970s, Solderless breadboards (which is also known as plugboards or terminal array boards) were widely used, and the name "breadboard" was coined to describe them. Because it does not require soldering, the solderless breadboard may be reused. As a result, it's ideal for prototyping and conducting circuit design tests.

Solderless bread boards are becoming increasingly popular as a result.

In technical education and among students, it's quite popular. On prior breadboard models, this capability wasn't accessible. Stripboards (Veroboards) and other prototyping printed circuitary boards, which are used to build semi-permanent soldered prototypes or one-offs, are difficult to reuse. Breadboards may be used to prototype a variety of electrical devices, ranging from simple analogue and digital circuitry to full central processing units (CPUs).

Modern breadboards feature very high resistance and parasitic capacitance when compared to more permanent circuit connection technologies, as well as less stable connections that are susceptible to shaking and physical wear. The signalling frequency is restricted to 10 MHz, and even at that frequency, not everything works well.

## **JUMPERS:**

A jumper wire which is also known as a jumper cable or wire, DuPont cable or wire, jumpers are electrical wire or group of electrical wires in a cable with a cord or pin at each end (or without – simply "tinned") that is typically used to connecting multiple components of a circuit board or other prototype or even for test circuit, internally or with other hardware or equipment, without soldering. Individual jump wires are hooked by inserting their end connectors into gaps of a breadboard, a circuit board's header connector, or testing equipment.

Jumper wires available in a multitude of form factors. On a few, the electrical connectors on both the ends are the same, whereas on others, the connectors are different. Among the most popular connectors include solid tips, banana connections, crocodile clips, Registered jack (RJ45), connectors, jumper cables, and RF connectors.

## **IV. FUTURE IMPROVEMENTS**

This work can be improved further by adding cameras and voice recorders, as well as administering electric shocks to aid the victim's escape. It can also be improved by experimenting with other battery kinds for longer duration.

## **V. CONCLUSION**

Finally, the Women Safety Device was able to successfully retrieve the woman's present position. All of the applications and devices are made with new technologies and processors, making it difficult for women in rural regions and illiterate people to use them. This also makes it tough for them to use smart phones and their updated features. Furthermore, if the phone's battery runs out, the phone's application cannot be used. As a result, we propose a fresh idea for making the gadget simple to operate for rural women. It can also be used in a simple set.

When a threat is detected, the gadget can be designed with a button that can be pressed when the threat is detected, where the relevant and appropriate instructions will be programmed into the button. When the button is pressed, the alarm sensor is triggered, and an emergency message is sent to the preset contacts. If a woman is in a bind or gets separated from her friends on a night out, or if someone is following her with malicious intent, or if she loses her way home, this gadget will safeguard her and summon assistance whenever she requires it by reporting her current position through SMS to both friends and the control centre. This equipment not only helps the family, but it also helps the police.

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## LPWAN BASED SMART IRRIGATION SYSTEM

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**Abstract**— Due to global warming, natural calamities and human intervention has caused a lot of impact on natural behavior which directly or indirectly affects agriculture and its productivity. Agriculture is the backbone of our country, a decline in productivity will have a serious impact on our country which may lead to starvation of the citizens. Drought and heavy rain are some of the major problems faced by the farmers, hence proper control measures must be needed for water management. Overuse of fertilizers can also spoil the quality of the soil; agriculture has also faced a lot of threats from wild animals. Precision agriculture or smart irrigation can be a solution to these problems. In past decades there have been much research on this field and a lot of projects has been implemented using WSN, Lora, SIGFOX, etc. which are not efficient to communicate over a long distance, have less battery life, and requires more power, which in turn leads to increase in the cost which cannot be practically feasible for farmers to use. To overcome these drawbacks of the above-implemented technology here in this paper presents, using NB-IoT technology which is Narrowband IoT and it is based Low power wide-area (LPWAN) Network with 5G technology and standardized by 3GPP and open standard technology.

Keywords— NB-IoT, Precision farming, Smart irrigation

### 1. INTRODUCTION

The history of agriculture in Asian countries dates to the Indus Valley Civilization it's the first supply of support for concerning fifty-eight percent of India's population and is called the Backbone of our country. The population of individuals will increase; they must be compelled to be a lot of agricultural productivity to support this growing population. It's been calculable that the world's population can reach up to 9.2 billion by 2050 in line with the Food and Agriculture Organization of a global organization (FAO). Moreover, with the hair-raising deficiency of water resources, a decline of productive lands, and agricultural labor pool underneath these serious conditions, it's a challenging task to support the population. As agriculture is the foundation of our country and therefore the ancient strategies utilized by farmers in agriculture don't seem to be a lot economical with the rise within the growth rate, to beat this drawback we tend to introduce a new technique known as "LPWAN based smart irrigation system", that could be a part of precision agriculture (PA).

In our proposed system we introduce LPWAN based irrigation which uses NB-IoT technology, which transmits data over long distances with wireless transmission of the device at a much lower cost while consuming less power which increases the life of the battery. This is our main objective to achieve. Our proposed system detects the soil nutrient content which increases the knowledge about the soil-dependent crops and fertilizers to be used.

### 2. LITERATURE SURVEY

In [1], the author has discussed the food security aspects which are concerned with the increasing population, and how PA found its path to solve this problem by increasing the quality and productivity of the crop. PA facilitates optimal resource management i.e. with limited resources such as water, knowledge about the soil quality, or the nutrient content. PA can be used to monitor, measure, and estimate the requirements accurately which has to be provided.

In [2], the author defines Irrigation as one of the most prominent water concentrated agricultural activities, that management depends on having on the market information within the observation field. Usually, we tend to apply irrigation management, particularly in dry regions with insufficiency of rain. Outlier removal techniques like Z score, MZ score, and Chauvet afford a lot of precise irrigation management. The framework additionally synchronizes weather and soil information, furthermore because of the crop stage for the chosen irrigation management setup.

These days we tend to face such a large amount of issues in agriculture fields, concerning irrigation and maintaining the rate of productivity, these requirements have found many issues, such as lack of communication system and the massive distances to electricity offer points. To beat these issues, In [3] author have implemented LPWAN wireless communication networks like NBIOT, SIGFOX, and Lora Wan, which is the increasing market of electronic controllers that supports free software package and hardware Arduino, Raspberry, ESP, etc. the combination of WSN allows the event of irrigation plans supported energy savings, obtainable water, or the reduction of greenhouse gases.

The author in [4], have discussed that Water management is overriding in places with water scarceness, we have to save water usage by victimization this irrigation method which has inflated over the years, because of the recent improvements in IoT and WSN technologies that will be applied within the development of these systems and the industrial sensors which are expensive thus it's going to be not possible for all farmers to shop for this, rather than that we will use NBIOT technologies.

Sensible devices are wide employed by a variety of individuals from farmers to entrepreneurs. It helps to search out the period standing of crops and soil wet content. [5] Shows the study of security and privacy during a sensible farming system. It provides a summary of the sensible farming-based multi-layered design, with multiple entry points, and communication across layers.

An analysis of challenges on security and privacy problems where IoT-based agriculture is not experienced much in [6]. It tends to analyze block chain-based solutions for privacy-oriented problems likewise the agreement algorithms for IoT applications. Security & Privacy indicates the survey targeted thought of the safety and privacy counter measures to shield the IoT network. Block chain indicates the survey is considering a blackening-based answer for IoT security and the targeted IoT-based application indicates whether the survey has targeted specific or general IoT applications.

In [7], the author describes, Agriculture plays a major role and the way it must be progressive by victimization sensible technologies to search out solutions for the problem to utilize limited resources effectively which can satisfy the requirements of the increasing population. With the help of advanced technologies of the IoT and Digitalizing the rural areas, it is potential to remotely monitor soil wetness, growth of a crop and take preventive measures to find crop damages and threats by using AI-based analytics knowledge combined with third-party data, like weather services, professionally advises, etc. the most space of focus for this analysis activity is that the automation and remote management of agricultural activities victimization new technologies. The remote management that is solar-powered and automation for agricultural activities is finished via the Internet of things and wireless sensors comprising a microcontroller hardware platform that is predicated on a raspberry pi microcontroller that's designed to attach with the user device and is accessible via the net. It has an information collection unit that gathers knowledge about agricultural parameters and from the sensors, The user device ex: mobile, tablet, etc is connected to an online network to a server with a package of applications from that the appliance (mobile-app) put in within the user device helps in displaying an inventory of information which is collected from wireless sensors victimization the IoT.

An appropriate answer to the challenges like water insufficiency, deterioration of soil properties, and absence of food is the exactness of agriculture. This [8] paper tries to search out a sensible appropriate and possible wireless communication technology for the exactness of agriculture. The exactness agriculture applications area unit supports 3 styles of wireless sensor networks architecture which are narrowband net of things (NB-IoT), Zigbee wireless communication, and long-range (LoRa) wireless communication technologies. The feasibility of any one of the three WSN architectures is verified by testing and is compared by the conventional communication time, the 2 wireless communication technologies known as appropriate for field agriculture situations were LoRa and NB-IoT, whereas Zigbee is that the more sensible choice for observation facility agriculture supported the great analysis and field trial results.

The author in [9], introduces WSN as the best solution for agricultural-related issues such as optimization of limited farming resources and monitoring of land. It also discusses a practical, cheap, and environmentally-friendly Intelligent Greenhouse Monitoring System (IGMS) which is based on WSN technology and developed a novel IGMS which is specially designed for management of greenhouse which is not only friendly to user but also reliable, portable, scalable, and gives a result which shows that the automatic irrigation is much efficient compared to scheduled irrigation.

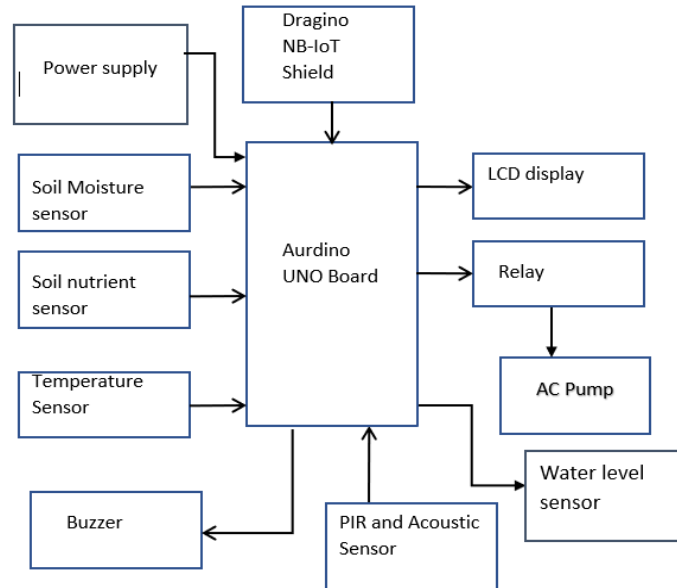
Different approaches have been proposed by different authors in [10],[11],[12],[13],[14] with cost effectiveness approaches for parametric analysis of sensors with reconfigurable systems.

This article [15], proposes a sensor node with new topology which is of cheap and more efficient sensors, such as rain sensors, water level, temperature, soil moisture and humidity which uses LoRa as transmission module.

The implemented system suggests the schedule for watering plants and the water capacity based on the real time data collected from the sensors deployed in the field. It also provides a schedule with date and time so that the user can turn on the water pump if the level falls under threshold value using his mobile where the data is transmitted to his mobile app which is an added advantage and user itself can prepare his plan for watering plants. This system is designed to send alarm message to users and implemented to control environmental factors affecting in agriculture

Usages of PIR sensors to detect the movement of wild animals are found in [16], [17]. The frequency emitted from the animal is detected with PIR sensors, and then inaudible devices can emit a frequency wave which is of hearing-loss. This can improve the productivity of crops. Passive InfraRed sensors will find the movement of objects that radiate IR lightweight (like human bodies). This can also misinterpret humans as animals and give false alarm.

### 3. BLOCK DIAGRAM



**NB-IoT Shield:** It is mounted on an Arduino Uno board to prototype NB-IoT solutions.

**PIR Motion Sensor:** This sensor is used to detect movements such as animals or birds to protect crops from them.

**Water Level Sensor:** It is used to sense the level of water in a tank or well.

**Soil Moisture Sensor:** It is used to sense the moisture content that is the wetness or water content of the soil.

**Soil Nutrient sensor:** It detects the soil nutrient content so that crops or fertilizers can be used according to the soil quality.

**Temperature Sensor:** It senses the environment temperature.

**Relay Sensor:** It is an electronic switch, which is used to turn on and off the AC pump.

### 4. CONCLUSION AND FUTURE SCOPE

By using NB-IoT technologies we can control and manage irrigation systems at the best level. In this system, there is no problem related to connectivity because it's a wireless connection. It helps farmers in rural areas. Even we can analyze the real-time data by using hardware and software equipment. It helps to develop high reliability and new irrigation strategies. We can monitor the parameters of water level quality, soil, climate, and weather conditions To implement the NBIOT technologies which improve the crops irrigation and management system. We can develop a water balancing level, a system that can control the on/off the pump automatically and helps to track the livestock and precision farming. Using technology supports the battery life of smart sensors.

The main intention of this system it increases the productivity level which helps farmers. We can protect our crops from animals. People can control this system from long distances also. We have designed a module to support irrigation management with our prediction models. All farmers can afford these kinds of sensors. (Low costs). We can analyze different parameters in this system at the same time.

### 5. EXPECTED OUTPUT

By implementing NB-IoT technology in the agricultural field, which is the backbone of the global economy, it changes the Indian/global farmers' approach towards their farming activities.



The system helps the farmers in crucial watching activities like programmed pumping water, sensing animal movements, and alerting to protect plants from animals, etc. which is remotely managed with the help of Mobile sensors and Mobile Apps. The proposed system is power and energy-efficient and additionally cheap so that it's accessible to farmers

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# A SURVEY PAPER ON- ROBOTIC WASTE SEGREGATION USING RASPBERRY PI

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**Abstract**— Rapid urbanization without good planning has created a waste problem, making it difficult to dispose of garbage. Overpopulation in India is one of the main causes of waste, and as the population grows, so that the amount of waste has produced This must be handled properly in terms of waste segregation, handling, transportation, and disposal in order to reduce complications, which improve people's and the environment's health and safety. Wastes should be treated safely and hygienically for the benefit of people's health, on Robotic waste segregation with the Raspberry Pi smart waste segregation which eliminates human contact waste and improves health.

## I. Introduction

In early garbage disposal has caused a huge concern to the world. In huge volume the waste is generated is disposed by adverse effect on the environment. The disposal of the waste is a common method which is uncontrolled and unplanned to open dumping at the landfill sites. This landfilling is very dangerous to human being, animal and plants. This hazardous waste disposal method can produce liquid leachate, which can contaminate surface and ground waters, contain disease vectors, and destroy the natural environment's aesthetic value. It is also an inefficient use of land resources. Rag pickers play a critical part in the recycling of urban solid trash in India. Skin infections, respiratory, gastrointestinal, and multisystem allergic illnesses, as well as a high prevalence of mouse, dog, and other vermin bites, cause increased morbidity in rag pickers and conservancy employees. Segregation at the source of municipal waste generation can reduce reliance on rag pickers. The economic value of created waste is not recognized unless it is totally recycled. Several technological breakthroughs have also enabled garbage to be turned into valuable entities, such as Waste-to-Energy, in which waste is utilized to make synthetic gas (syngas) made up of carbon monoxide and hydrogen. The gas is subsequently burned to generate electricity and steam in a Trash-to-Fuel process, in which the waste is converted into biofuels. When garbage is separated into fundamental streams like wet, dry, and metallic, it has a higher chance of being recovered and, as a result, recycled and reused. The wet waste component is frequently processed into compost, methane gas, or a combination of the two. Compost can be used to replace chemical fertilizers, and biogas can be used as an energy source. Metal trash could be recycled or reused. Despite the presence of large-scale industrial waste segregators, it is always preferable to segregate garbage at the source. The advantages of doing so include retaining a higher quality of material for recycling, which implies that more value may be recovered from waste. Waste employees' occupational risk is also decreased. Also, instead of being routed to the segregation facility and from there to the recycling plant, the segregated garbage might be sent directly to the recycling and processing plant. At the moment, there is no system in place to separate dry, wet, and metallic waste at the household level. According to J. S. Bajaj, a low-cost, acceptable technical option for safe management should be devised. The goal of this project is to provide a small, low-cost, and user-friendly trash segregation system for urban households in order to simplify garbage management.

## II. Literature Survey

1. Aravindaraman B A,P.Ranjana proposed a work on Design of a Monitoring System For Waste management Using IoT.In this paper we can see that the level of waste disposal is being determined to reach the goal of cleanliness in the city in a smart way using raspberry pi. Where the ultrasonic sensor is being used to determine the depth of the wastage disposal which in turn provides information to the near by governing body to remove the wastage. Gas sensor is also used to determine the toxic gasses which is being released inside the disposal container.

2. Teoh JI Sheng, Mohammad Shahidul islam, Norbahiah Misran, Mohd.Hafiz Baharuddin, Haslina Arshad, MD. Rashedul islam, Muhammad E.H.Chowdhury, Hatem Rmili & Mohammad Tariqul Islam proposed a work on An Internet of Things Based Smart Waste Management System using LoRa And Tensorflow Deep learning Model in this paper we can see that the traditinal waste management system can be replacedwith smart sensors to perform real time management system by using a LoRa communication protocol which sends the sensor data tensorflow it is a pre-trained detection model where the images of the waste and inference graph level Gps module is used to detect the location and real time of the bin.

3. Mis. Megha S.Chaudhari, Mrs. Bharti Patil, Mr.Vashali Raut proposed a work on Iot based waste collection management system for Smart Cities in this paper we can see that smart bin is built a microcontroller from raspberry pi Uno board is interfaced with GSM modern ultrasonic sensor is placed at the top to read the status of the bin and weight sensor where weight sensor is placed at the bottom of the bin to detect the weight of the dustbins when the threshold limit is reached to an extend then the GSM modem will be indicated by area expert will send message to the separate administrator and get refuse with the assistance of robot component

4. Mary Jane C. Samonte, Shaddi Hercules baloloy, Carl Kenneth, J.Datinguinoo proposed a work on e-TapOn: Solar-Powered Smart Bin with Path\_based Robotic Garbage Collector in this paper we can see that AGV(automated guided car) idea is adapted it is mainly used to build in industrial machineries and also to design robotic garbage collector an addition for the solar powered, infrared sensor assembled with HC-SR04+Ultrasonic sensor and SG90 servo motor. etap-on system will display the percentage of the bin weather it is full are not and also reflects the green line around the percentage if it is full then it monitor the status through the display.

5. Aishwarya, Parth wadhwa, Owais, and Vasudha Vashisht proposed a work on A Waste Management Technique to detect and separate Non-biodegradable waste using machine learning and YOLO algorithm. In this paper we can see that it works on the principle of machine learning and YOLO (you only look once) algorithm used to detect the custom object and also non-biodegradable waste so that the waste can be easily separated from the bins where each image is labelled by labelling tool in the format of Yolo.

6. Amrutha Chandramohan, Joyal Mendonca, Nikhil Ravi Shankar, Nikhil U Baheti, Nitin Kumar Krishnan, Suma M S proposed a work on Automated Waste Segregation In this study, we can see that AWS is a low-cost, easy-to-use option for a home segregation system that can be transmitted straight to processing. Its purpose is to classify garbage into three categories: metallic waste, wet waste, and dry waste. To recognise metallic materials, the AWS uses a parallel resonant impedance sensing method, while capacitive sensors distinguish between wet and dry waste. The segregation of garbage into metallic, wet, and dry waste has been successfully implemented utilising AWS, according to experimental data.

7. S.Vinoth Kumar, T.Senthil Kumaran, A.Krishna Kumar and Mahantesh Mathapati suggested a project using the Internet of Things to create a Smart Garbage Monitoring and Clearance System. The IoT-based smart waste management system in this article uses sensor systems to check the waste level above the dustbins. As soon as it was recognised, the system was changed to concern permitted via GSM/GPRS. Where the Microcontoller is used as an interface between the sensor system and the GSM/GPRS system to monitor and integrate an android application for the needed information relating to various levels of waste in various locations.

8. Mohammed Rafeeq,Ateequrahman,Sanjar Alam,Mikdad In the Scarap Industry, a work on Automation of Plastic, Metal, and Glass Waste Materials Segregation Using Arduino. In this document, we can see that it is designed to classify trash into metallic waste, plastic waste, and glass waste, so that they can be handled independently for the next step of the process. The approach uses inductive sensors for metalic products and capacitive sensors for dry waste.

9. T.M.B.Shankar Balu, R.S.Raghav, K.Aravinth, M.Vamshi, M.E.Harikumar, Rolant Gini J A work on an Arduino-based Automated Domestic Waste Segregator was offered. We can see that segregation at the primary level builds the groundwork for recycling programs at a higher level and also helps in successful waste collection. The signals from the inductive and capacitive proximity sensors are evaluated using an Arduino UNO, and servo motors are used to move and sort the debris.The sort of waste deposited on the segregating bin and whether the bins are full are displayed on an LCD.

10. Shamin.N, P.Mohamed Fathimal, Raghavendran.R, Kamalesh Prakash proposed work on Smart garbage segregation and management system using internet of things and machine learning. In this paper we can see that a smart trash segregation and management device that is connected to the internet of things that detects garbage in the environment. Sensor devices are used to monitor the dustbins, and as soon as it is full, it is emptied. The waste substances in it will be identified and sorted with the help of sensors, and data is immediately sent to a cloud database via IoT. The microcontroller serves as a link between the sensors.as well as an IoT module to differentiate the objects, an ultrasonic sensor is used. Proximity to the waste material the moisture sensor is used to determine the amount of moisture in the air. And the moisture content of the garbage, as well as if there is any moisture in the waste

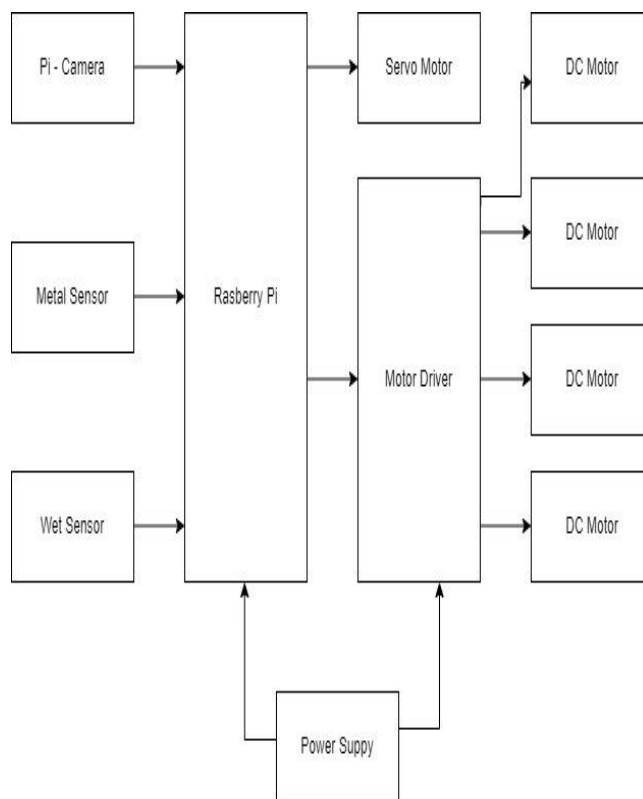
If there is no content accessible, the waste cannot be thrown away. Metal sensors are used to separate metal things, which are then divided into sections.

11. Plastics and biodegradable objects are identified using an image processing method and split into various groups. The data from the dustbins is uploaded to the cloud in real time utilizing IoT. This aids in the efficient and effective removal of waste from the trash can.

12. Nandhini. S, Mrinal Sharma. S, Naveen Balachandran, K. Suryanarayana, D. S. Harish Ram Prakash proposed work on Electronically assisted automatic waste segregation. In this paper we can see that the robotic arm is set in place and can spin 360 degrees to cover its workspace, and it can work in any flat environment. Within its work space, the robot can transport objects from one location to another, but only one object at a time. The major goal is to create a robot that can pick up household waste such as paper, plastics, and board from one location and deposit it in the classifier platform.

13. Pratyaksh P. Rao, Siddhanth P. Rao, Rohit Ranjan proposed work on Deep learning based smart garbage monitoring system. In this paper we can see that a deep learning model was utilized to estimate future garbage levels. With an accuracy of 80.33 percent, the suggested neural network model was able to forecast garbage levels. The findings support the accuracy of the rubbish level forecast. Bar charts were also used to analyse the data. The combination of IoT and deep learning can result in a technological revolution that can be used to trash management. As a result, forecasting and examining garbage levels may assist municipal authorities in implementing an efficient garbage management system and reducing rubbish bin overflow.

### III. Construction



**Fig:1**

### IV. Acknowledgment

I would like to express my special thanks of gratitude to my college Atria Institute of Technology and teacher Dr. Mangala Gowri who has gave us this opportunity to do this project on “Robotic Waste Segregation using Raspberry Pi”.

This is has given us a lot of experience and knowledge about this paper.

### V. Conclusion

This paper has been addressed an overview of many technologies and its applications on Waste Segregation, and also made a review on existing systems. The robotic based waste segregation is very effective to detect the waste and segregate the waste into different categories.

There are many sensors used to detect the waste in the surroundings and the data is sent to the controllers, from which the robot moves accordingly. The sensors used over here are IR sensor, wet sensor, metal sensor, pi camera, motor driver, power supply etc. These above components are used for the function of the robot for segregating the waste. This method can be used for a clean environment and help to reduce pollution.

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# CLOUD BASED FACE RECOGNITION AND SPEECH RECOGNITION FOR ACCESS CONTROL APPLICATION

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**Abstract** - Face recognition is one among the foremost wide used technologies, from a phone's lock screen to the foremost personal safe. it's used for identification, and security functions. It's accomplished by face detection, that is allotted by mapping an individual's face employing a combination of neural network and machine learning. Similarly, Cloud Computing is one among the trending technologies, it's a model for sanctioning omnipresent, sociable, high society network access to a shared pool of configurable computing resources. it's thought-about one among the foremost economical ways in which to store information firmly. Speech-to-text technology could be a widely used technology that is employed in google assistant, alexa, siri, google home, etc. This practicality of those services is extensively employed by individuals all around the globe, attributable to its ease of access, even by those that are unfamiliar with the smartphone world. This technology has conjointly exhibited hefty improvement in speech accent recognition. During this paper, we have a tendency to aim at implementing face recognition of the staff attempting to realize access to the workplace premises, by comparing the new non heritable facial info with the info set accessible within the cloud information. Speech-to-text technology is utilized so as to produce access to the guests.

**Keywords:** Face recognition, cloud computing, machine learning, speech-to-text

## I. INTRODUCTION

In recent days, most of the events are machine-driven with the assistance of computing and machine learning. With the increase within the field of AI/ML, there has been an acute rise within the space of statistics, cloud-based information interpretation and storage. However, in fact, with the rise in new inventions, there's continuously the danger of an extra legal breach or spoof attack being created. In particular, with everything being biometric it's become easier to hack into one's security system resulting in fraud, security breach of prime organizations, inflicting a large loss. Like several different discoveries to be occurring within the past few years, Face recognition system has got to be one among the foremost economical contrivances. During this paper we have a tendency to discuss the effective ways in which FRS may be used for the betterment and a simple future. so as to enter the workplace nowadays, workers would like a tag-key or associate access card. And usually there may be casualties wherever associate workers may lose one's access card or forget to hold it with them. throughout these things, the door has got to be opened manually by another person, worrying about the operating setting. This doesn't solely consume time and needs further man supply however conjointly falters the main target of the workhouse. This paper deals with how face recognition could be a terribly powerful tool to keep up a high level of security in a corporation. This methodology conjointly comes handy as a preventive security live throughout an occurrence response. It will establish a strong police investigation and watching system at the entry and exit points. As we have a tendency to be aware that, to enter bound licensed places, we'd like a tag key or associate echt ID. Just in case of the tag key larceny, or if the staff miss or forget the tag key, it needs for the door to be manually opened, and also the worker has to bear many stages of authentication. To avoid such consequences this project aims to develop a system that uses a face recognition system to regulate the lock system of the doorway door and speech-to-text recognition module for the guests or delivery waiting outside. The system helps the staff to unlock the doorway while not needing tag-keys. On the other hand, guests or delivery service waiting outside are requested to mention the name of the several workers, which individual workers are going to be notified with a mail regarding their presence. By doing thus, the corporate are going to be in advantage in 2 ways in which. First, it'll modify the method of getting into the workplace for workers. Second, it'll scale back the disturbance once a visitor desires to enter an associate workplace. The project setup looks to be terribly elementary and minimal creating it easier to put in moreover as use. The project is split into 2 sections; the experimentation section and also the implementation phase. If the experimentation section aims to seek out the foremost appropriate setup for the system, the implementation section lays the muse however the system is going to be enforced. The hardware consists of a tiny low laptop, camera, display, mic and speaker module for speech-to-text conversion. To hold out the face recognition and speech-to-text conversion, the cloud-based platforms like Drop box, Amazon internet Services etc are used severally. The ballroom dance authentication mechanism provides further security and protection against spoofing attacks and security breach techniques.

The goal of this cloud-based face recognition and speech recognition access management application is, to beat the antecedently mentioned issue, and to change a cloud-based application, so the info may be changed over the net.

## II. LITERATURE SURVEY AUTHOR, TITLE AND YEAR CONTRIBUTIONS AND OBSERVATIONS

[1] Nathalie Tkaue, Thao Tran, Kevin Hernandez-Diaz, Fernando Alonso-Fernandez, "Cloud primarily based face and speech recognition for access management applications", ITE 2020.

This paper describes the implementation of a system to acknowledge workers and guests eager to gain access to a physical workplace through face pictures and Speech-to-text recognition. The ballroom dancing face Authentication mechanism for workers provides AN enhanced level of security and protection against spoofing attacks while not the requirement of carrying tag keys or access cards, whereas disturbances by guests or courier area units decreased by notifying their arrival to the proper worker. Face recognition and speech to text conversion area unit through with the cloud-based solutions provided by Amazon internet services and Google speech to text severally. The common time spent by AN worker till the door unlocks is of twenty.3 seconds, which can be perceived as high, though it provides a secure and correct technique for access management.

[2] S Snigdha, K Haribabu, "IoT primarily based system victimization raspberry PI and mail server", IJITEE 2019. This project aims to extend the security of homes with the assistance of IoT integration of web security Integration with a mail server. The main reason for the event of this method is that it saves time and energy, still as making certain security and convenience. It includes the specifications still as methodologies of Raspberry Pi provide and Pi camera. These devices additionally profit users with reduced quality that will be tough to get or maybe reach lightweight changes. The final word goal of this project is to form a home security system victimizing Raspberry slices.

This project relies on the fashionable value and may be simply managed as our homes can experience their house conversion, constant interaction with networks that square measure perpetually seeking to enhance energy management and full home automation to confirm comfort, safety and privacy.

[3] Amit Chakraborty, "Image process and Image Pattern Recognition, a Programming Tutorial", IEEE2018.

This paper delves into the conception of Pattern Recognition. Pattern recognition could be a major field as an associate degree application of machine learning that is evolving dynamically with a variety of platforms out there to its users. The methodology of image and pattern recognition consists of a sequence of image and pattern process tasks, classifier formula development, coaching and testing that is followed by development. So as to supply sensible programming experience the paper emphasizes on three reality applications of image and pattern recognition like ALPR mistreatment Tesseract OCR.

[4] Muhammad Azam, Nizar Bouguila, "Speaker Verification mistreatment custom-made finite Gaussian Mixture Model", IEEE 2018. This paper discusses the application of finite Gaussian Mixture Model (BGMM) to speaker verification. The BGMM is utilized for UBM that is employed in biometric verification. The projected UBM could be a large BGMM trained to represent speaker-independent issues of options. In the changed speaker approach, a hypothesized speaker model is brought out by adapting the parameters of BGMM based mostly on universal background model mistreatment of speakers coaching speech and most a posteriori (MAP). We've introduced TIMIT and TSP speech corpora for the event of UBM and any testing of speaker verification by custom-made speaker model. The brought forward framework has incontestable its effectiveness by improved speaker detection rate.

[5] Shilpi Singh, S V A V Prasad, "techniques and challenges of face recognition: A important review", ICACC 2018.

In this paper, the author says face recognition is one amongst the foremost issues in recognizing objects and laptop vision. A variety of biometric applications square measure out there in our daily life for human recognition like eyes, fingerprint, face recognition, etc. Face recognition is employed in numerous applications like security, rhetorical investigation etc. For up the accuracy on completely different info, they introduced face synthesis. The foremost drawback in alternative biometric options is that they need active cooperation of the person for authentication. not like face recognition. Verification and identification square measure the 2 necessary tasks in recognition of face.

Their square measures four main options like eye, lip, nose and mouth in face recognition. and that they primarily have second and 3D dimensions with completely different textures and facial expressions. There square measure four major steps in face recognition, detection the face, face alignment, feature extraction, feature matching from info to recognised face. {different|totally completely different|completely different} techniques square measure compared with different face info for accuracy and recognition rate.

[6] Girish Talmale, "Raspberry PI based mostly security system on IoT Platform", analysis gate 2017.

This paper discusses the survey on completely different security strategies on movement discovery yet advances in the ease checking framework visible of Raspberry Pi, a solitary Mastercard estimate board laptop that takes once motion detection calculation written in python as a debating default programming environment. we have a tendency to any perceive the safety system with IoT in numerous frameworks like, human motion detection mistreatment passive infrared sensing element, coming up with and implementing on security systems supported GSM technology, good police work mistreatment PIR network, proximity motion sensing element security system, advanced guard with PIR sensing element then on. It conjointly includes issues/ limitations expected from face recognition systems. It conjointly includes issues/limitations expected from the favorite recognition system. This examination venture is completed to come to a decision on some of the elemental human movement location calculation that had been established or created or maybe investigated in the past.

[7] Letter N Natsheh, B Li, A G Gale, "Security of multi- frame DICOM pictures mistreatment XOR encoding approach", ScienceDirect 2016.

According to this paper, transferring medical/surgical connected pictures over networks is exposed to a good sort of security risk. Hence, there's a requirement of a secure mechanism to exchange medical/surgical pictures over the net. The DICOM conjointly referred to as as Digital Image and Communication in drugs provides attributes for information|the info|the information} confidentiality however not for the pixelated image data. During this paper, the approach for element information is easy and effective encoding that is provided for multi-frame DICOM medical/surgical pictures. The aim of the projected approach is to scale back the encoding and decoding time of those pictures, mistreatment AES i.e, Advanced encoding customary wherever just one image is encrypted and XOR cipher for encrypting the remaining multi-frame DICOM pictures. The projected formula is calculable and evaluates mistreatment process time, normalized correlation, entropy, PSNR (Peak-Signal-to-Noise-Ratio) and bar chart analysis. The results reveal that the projected approach will cut back the encoding and decoding time and ensures the image confidentiality.

[8] Prerana Das, Kakali Acharjee, Pranab Das, Vijay Prasad, "Voice recognition system: Speech-to-text", JAFS 2015. This paper discusses varied approaches out there for developing a Voice Recognition System, that enables the pc to translate voice request and dictation into text. it's a system that consists of 2 elements, one is for process signals captured by the electro-acoustic transducer and also the alternative to interpret the processed signal, this processed signal is then mapped to words.

[9] Xuee Maya Lin, Jian yang, Juan Zhao, "The text analysis and process of Thai language text to speech conversion system", IEEE 2014.

This paper deals with the text-to-speech conversion of Thai language, which can contain non-Thai customary characters like range, currency symbols, and alternative such special characters. During this paper, they need enforced text standardization methodology.

[10] Abdullah A, Albahdal and Terrance E, Boulton, "Problems and guarantees of mistreatment of the cloud and biometrics", IEEE 2014.

This study provides a fast summary of the mutual benefits of the bioscience era and cloud computing. It conjointly tells the USA however cloud computing will profit from the durable authentication assets of bioscience so as to appear into the security of the cloud and introduce new carrier models. On the opposite hand, the bioscience era will use the cloud's infinite process resources and appealing homes of flexibility, quantifiability, and worth discount to cut back the biometric system's wants for varied process resources like process energy or record storage and to boost the performance of the biometric system processes. And here we tend to conjointly see the five capability regions wherever they square measure mutual advantages between the cloud and bioscience. Moreover, for each five regions, bioscience or the cloud will clear up the problems with the present state of design.

Later, the challenges of coping with bioscience or the cloud packages in each place square measure mentioned.

[11] Diego von Sohsten, Sergio Murilo, "Multiple Face Recognition in period mistreatment Cloud Computing, EmguCV and Windows Azure", IEEE 2013.

This article proposes the utilization of cloud computing- a lot of specifically, Windows Azure platform- to spot potential performance gains whereas testing the EmguCV framework.

[12] Kui Ren, Cong Wang, Qian Wang, "Security challenges for the general public cloud", IEEE 2012.



This paper discusses tremendous advantages of cloud computing, regarding however it provides opportune access to a centralized pool of computing resources, and just in case of crisis, the cloud ensures that the information is insured and guarded, despite the advantages, security and privacy considerations have forever been the first obstacle in wide adoption of this technology. Cloud platforms each face internal and external privacy threats from software package bugs, malware, malicious insiders and such. This paper discusses however cryptography strategies, like absolutely homomorphic cryptography (FHE) , is adopted to enhance the safety of cloud computation. Therefore, by addressing security challenges that don't seem to be nevertheless recognized by the present security thrusts, this text intends to inspire more investigation of the many security problems which may impact the longer term of public cloud.

[13] Di Huang, Mohsen Ardabilian, Yuhong Wang, Liming subgenus Chen, "Automatic Asymmetric 3D-2D face recognition", IEEE 2010.

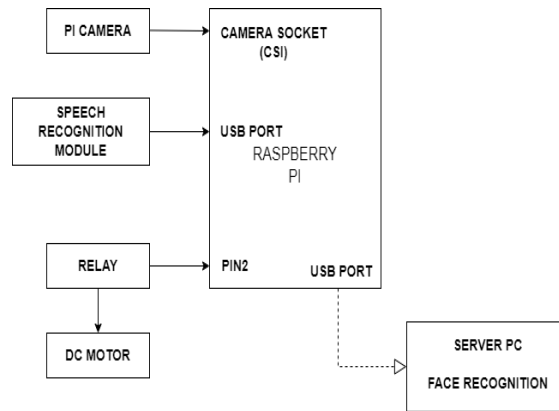
This paper presents the problems of 2nd face recognition, that happens because of variation in illumination, creating and varied alternative facial expressions, which will modify overtime. On the opposite hand, 3D face recognition techniques also are restricted because of their high computation value. The goal of this paper is to limit the usage of 3D information. The strategies conferred by this paper consists of 2 matching steps, distributed illustration Classifier (SRC) for 2D-2D matching and Canonical Correlation Analysis. The uneven 3D-2D face recognition technique projected during this paper, improves the hardness of the popularity method to illumination and create variation.

[14] D. Kesavaraja, D. Sasireka, D. Jeyabharathi, "Cloud software package as a service with Iris Authentication", JGRCS 2010.

This paper presents a security mechanism, so as to change solely licensed access to Saas, from cloud server. The safety technique projected here is, Cloud Iris Verification System (CIVS). This method compares a freshly obtained iris with a retrieved pattern of iris, from the info. The iris recognition technique employs an accumulative ad primarily based on gray modification analysis. This paper proves that CIVS server stands distinctive in providing secure service. Here, so as to extract iris options, the iris image is split into basic cells. The experimental lead to this paper, shows that this approach incorporates a smart credit performance, and provides extremely secure service to consumers.

[15] Andrea F Abate, Michele Nappi, Daniel Riccio, Gabriele Sabatino, "2D and 3D face recognition", ScienceDirect 2007. The 2nd image analysis that isn't nevertheless strong enough to be utilized in sure security applications. By operating in 3D, this limitation is overcome however it's quite expensive. This paper has come back up with associate degree ideology to effectively solve this downside by mistreatment associate degree uneven protocol whereby the face is recognized in 3D however the identification is being performed for the 2nd pictures of a similar as in to succeed in the goal of constructing a lot of strong system that may be utilized in security applications because the facial expressions keep ever-changing. The 3D analysis of the face of a replacement user is completed beneath controlled lightweight and with neutral expressions and has been added to the info. Then the management points square measure settled on the 2nd image which can then correspond to the points in 3D and this may then be recorded within the info. This paper deals with the matter of selecting these management points for addressing the invariants of 3D imaging. The localization of the management points is simulated by selecting the points by hand on the probe and so rotating them supported the poses thought-about during this projected model thereby creating it a lot stronger than the opposite strategies.

### III. PROPOSED BLOCK DIAGRAM AND METHODOLOGY



The pi camera is custom created for raspberry pi. The employee's facial information is non-inheritable by the pi camera and it's uploaded to the raspberry pi. This info is processed by the Raspberry Pi supporting the program i.e drop into the microcontroller and also the processed info is compared with the facial info of the workers out there within the info that is given on the cloud. looking on whether or not the match is found or not, a message is distributed back to the raspberrypi.

If a match is found, the program is intended in such a way that the raspberry pi controls and activates the relay for a specific quantity of your time for the door to be opened and closed. The mechanism of gap and shutting of the door/the lock system is doled out by the DC motor. The speech to text module permits the traveller to fulfill the several workers by recording the speech of the traveller, which can be either the employee's name or the employee's code and it's fed into the raspberry pi. The software package converts this speech into text and compares the reborn text with worker the worker} details offered within the cloud information and notifies the various employee.

### IV. CONCLUSION

Security of a company is very necessary and so cannot be simply compromised. higher than may be a study on varied face recognition strategies to implement face detection of the workers. Storage of information of the facial info of workers is enforced victimization cloud computing technology, wherever the datasets square measure holds on firmly and square measure invariably secured with the assistance of the net. The recently non-inheritable facial info is uploaded to the Raspberry PI and analyzed on the cloud, by examination with the offered dataset. Corresponding message is passed to the microcontroller once a match is found. Speech-to-text module allows the guests to satisfy the various workers by causing a message to the worker. Thereby, the whole system reduces manual power to access the doors of the workplace.

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- [10] Abdullah A, Albahdal and terrance E, Boult, "Problems and guarantees of victimization of the cloud and biometrics", IEEE 2014.
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# ANALYSIS OF LANE DETECTION TECHNIQUES USING KITTI ROAD DATA SET

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**Abstract**— In recent years, the use of driverless technology has exploded. Vehicles must recognise road lane lines in order to achieve automatic driving. The location of roadways is included in lane detection. As a result, lane line detection is a critical component for driverless vehicles. Many research investigations and efficient methods for lane detecting have been conducted. Lane detection systems, on the other hand, have various issues due to real-time constraints such as sluggish processing speed, complexity, and variety of roadways. In this paper, we are exploring and analyzed two different techniques lane detection using KITTI road dataset [11]. First technique named “Method 1” focuses on Canny edge detection and Hough transformation whereas second technique “Method 2” focuses on Color and Gradient Thresholding, perspective transform, and sliding window search. The performance of both the methods are evaluated on the basis of accuracy and computation time.

**Keywords**—*Canny Edge Detection, Hough Transformation, Sobel Operator, Bird's Eye View, Region of Interest, Sliding Window Search, Polynomial fitting*

## I. INTRODUCTION

Through many reports, it has been seen that many road accidents happen due to driver's fault or very slow response in time. Many researchers are finding ways to overcome this issue. Detection of the lane lines helps to realize the intelligent driving technology of smart cars and implement driverless technology. Various techniques are used to notify the driver about lane structure and other automobiles present on the lane.

It has become a very important issue as it provides important symbols and helps to act accordingly for a safe drive. Lane detection based on gadget vision

provides the information like the edge of the lane and the structure and shape of the lane. Using that, it is easier to determine the position of the vehicle relative to the lane.

Lane detection methods should work on different types of environments such as shadowed, lighted, foggy and rainy backgrounds and it becomes very exacting to identify features. Shadows can lead to detection of noise which can lead to wrong edges and corners which leads to many errors while driving on roads. Due to the developing environment, increase in economy and continuous improvement of urban traffic and increments of vehicles year by year, to reduce no. of road accidents, Self-driving cars are the demand of society. The motive behind this is to provide a safe, smart and comfortable environment for this generation and to solve problems like public transportations urban traffic consumption and it is very beneficial for future aspects also. With the rapid growth of computer vision-based technology, the camera has gained more importance as it can capture any situation of the environment in any direction in real time.

Detecting lane lines from the images and videos of roads is a vital component for many intelligent driving systems in development. There has been very active research on lane detection with techniques like Canny Edge Detection, Hough transform, Sobel Edge Detection, Perspective Transform, etc, but with real-time constraints like slow processing speed, the lane markings are detected based only on simple gradient changes, and most of the older work on this problem has presented the results for straight roads and highways with clearly visible lane markings or with an absence of shadows and obstacles on the road.

The main objectives of the study are listed below:

1. Detects the road lanes by using two different sets of techniques
2. Finding accuracy of both sets of techniques.
3. Comparing both sets of techniques using different parameters.

## II. LITERATURE REVIEW

A lot of techniques have been developed to detect lane lines for autonomous vehicles and driver support as the number of vehicle accidents have increased in the recent years. These technologies use sensors like Lidar, Radar (used for obstacle detection), and vision sensors (used for lane and vehicle detection). Detecting lane markings and vehicles works as a warning system for drivers and autonomous vehicles. Strong graphical processing units and hardware in today's times allow real-time implementation of lane detection.

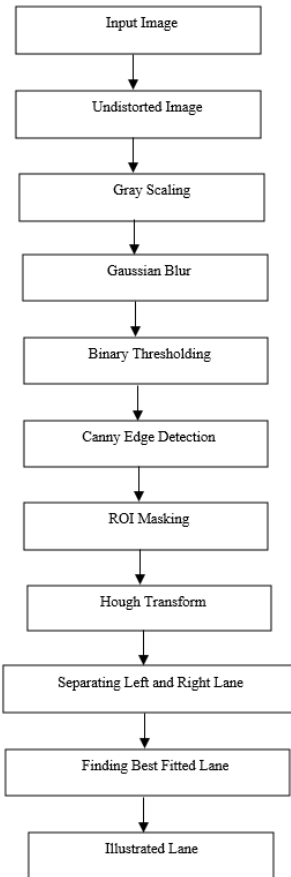
For these reasons, lane detection and vehicle detection using a vision sensor is still a very interesting topic for researchers and engineers.

Talib et al.[1] used different techniques of Canny, Sobel, and Roberts for edge detection. Improved Hough transformation to extract the features of structured roads. Chandwadkar et al.[2] another study came out that also uses Canny and Sobel techniques for edge detection on different environmental conditions. They claimed that canny edge detection handles the deficiency of Sobel edge detection and concluded that canny edge detection is better for pattern matching and object recognition. Low et al.[3] used a preprocessing technique which was Grayscale Conversion to reduce noise. Then Canny edge detection is applied to feature out the edges. Then Hough Transform is implemented to connect discontinuous lines and differentiate right and left lane lines. Batista et al.[4] used the images from Bird's Eye View (perspective transformation) for easier data manipulation than the original images. But this technique usually assumes that the terrain is flat. So, they used Probabilistic Hough Transform to detect the lanes in different situations of variable light conditions and during the night time. Ozgunalp et al.[5] used a Sobel edge detector to detect the edges and then Inverse Perspective Mapping(IPM) to create an edge orientation histogram which improves the signal-to-noise ratio(SNR). Then the lane lines are further detected by fitting parabolic lane orders to the featured points, in the region of interest by using hough transformation. Humaidi et al.[6] used different techniques for lane detection and tracking algorithms like Hough transformation and color thresholding. Hough transform included grayscale conversion, edge detection, Hough space accumulation, and un-Hough step to draw the lane line, while color thresholding algorithm comprises of steps like color thresholding, morphology filtering, and drawing tracking label. And they found out the Hough transform technique outperformed the color technique for lane detection in terms of both reliability and efficiency. Wei et al.[7] introduced Improved Hough Transformation for calculating lanes. They used the images which were captured by the camera in real-time for performing edge detection techniques. They converted real-time images to grayscale then detected edges and then applied Hough Transformation Improved by Region of Interest (ROI).

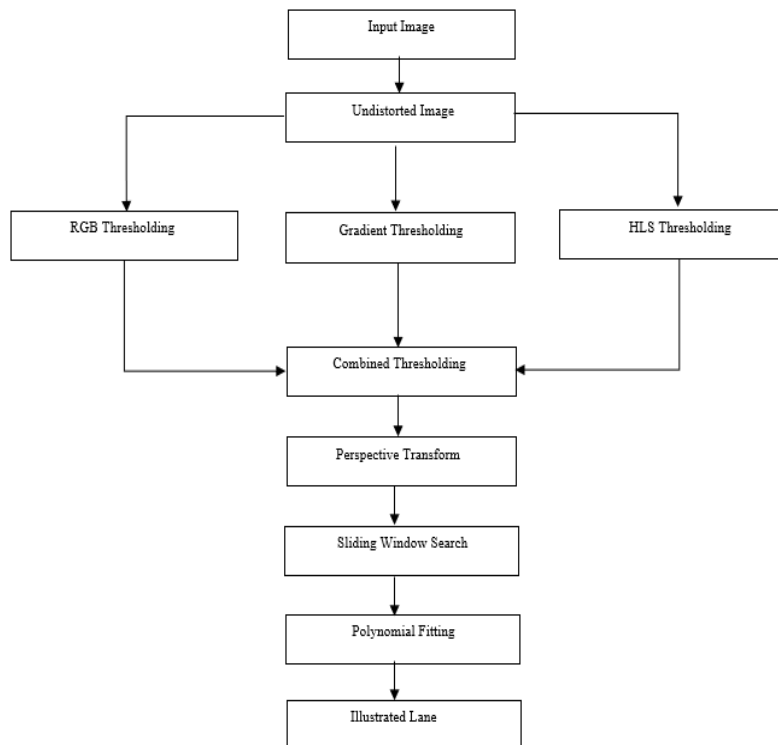
Haque et al.[8] used a KITTI dataset for performing the lane detection techniques. They used undistorted images, camera matrix, and distortion coefficients. Then they cropped the unwanted part and applied Gradient and HLS Thresholding for getting a binary image. Then they applied Perspective transformation for converting a 3D image to a 2D image and illustrate the lane lines from sliding window search. Liu et al.[9] introduced a robust and efficient method with shadow interference for detecting lanes. This method was based on Vertical direction IPM followed by a Canny edge detection algorithm. Then they applied improved lane lines for detecting lanes. Muthalagu et al.[10] introduced a perception algorithm. They introduced different algorithms to calculate lane lines. Firstly, they presented a minimalistic approach on edge detection with polynomial regression which was the baseline approach for detecting only the straight lane lines with no curves. Then, they proposed an improved lane detection technique based on bird's eye view (perspective transformations) and histogram analysis.

### **III. RESEARCH METHODOLOGY**

In this section, the two proposed sets of techniques of lane detection are illustrated which are then compared based on accuracy, average time per frame, number of false positives, number of false negatives, false-positive rate, false-negative rate. Fig. 1 illustrates the first set of techniques named "Method 1" and Fig. 2 illustrates the second set of techniques named "Method 2". Preprocessing technique is common in both of the proposed methods.



**Fig. 1 Workflow Diagram for Method 1**



**Fig 2. Workflow diagram for Method 2**

### A. Dataset:

The dataset used in the proposed methods is “The KITTI Vision Benchmark Suite”[11]. It has various sections, out of which we have used the road subsection of raw data. It has a total of 434 images of roads with lane markings. This dataset provides us with footage from 4 cameras, two grey-scale cameras on the left and right sides of the car, and two-color cameras on the left and right sides of the car. We used footage from the left color camera. The camera coefficient and distortion matrix for this camera is also provided in the dataset which is used to undistort the image.

### B. Preprocessing:

Due to the nature of the photographic lens, the image captured in any camera has some distortion due to which the pixels at the corners of the image tend to stretch. The major disadvantage of distortion is when straight lines start appearing as curved lines, which makes it difficult for any lane detection algorithm to detect the actual shape of the lane. The KITTI dataset provides us with the camera coefficients and distortion matrix which can be used to remove the distortion along with the help of the OpenCV-python library. From Fig. 3, the effect of undistortion can be seen.



(a)



(b)

Fig. 3 Preprocessing the input image (a) Original Image  
(b) Undistorted Image

### C. Method 1:

**1) Gray Scaling:** It is a method to convert a 3D colored image array to a 2D grayscale array. This method removes all the color information and contains only shades of gray varying between black and white. The grayscale image is hence left with only the luminance of each pixel in the original image. Fig 4. Illustrates input image after gray scaling



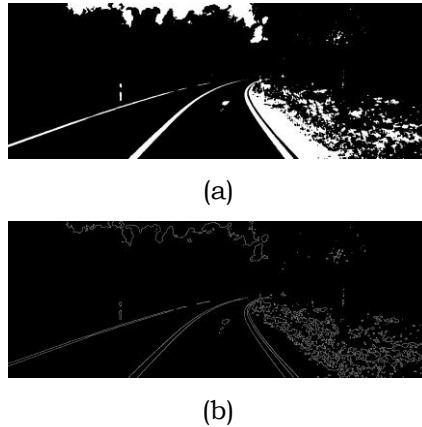
Fig. 4 Gray scaled image

**2) Gaussian Blur:** It is a method used to blur an image by using a gaussian function. It uses a low pass filter which reduces the high-frequency components. It is used for removing noise from the image, blurring the edges a little, and hence making the image smooth.



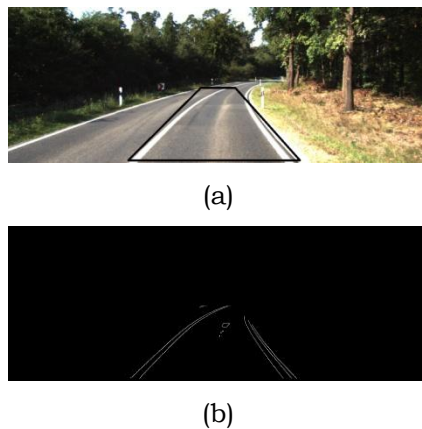
Fig. 5 Image after applying Gaussian Blur

**3) Canny edge detector:** John F. Canny proposed this technique in 1986 to detect a wide range of edges in images. It accepts a grayscale image as input and it is a multi-level algorithm. It calculates the gradient amplitude and direction by using the first-order partial derivative finite difference [9]. It performs the non-maximal suppression on the gradient amplitude and it uses a double threshold to detect and connect an edge with few false edges based on the high threshold. But if the threshold is high then the edge may not be closed. Hence, another threshold is set. Fig 6(a) illustrates a binary thresholded output of the input image and Fig. 6(b) illustrates canny edge detector output.



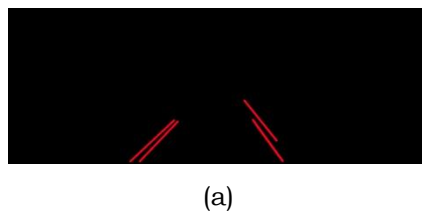
**Fig. 6 Edge Detection outputs (a) BInary thresholding (b) Canny edge detector**

**4) Region of Interest:** Region of interest i.e., the bounding box is the region that captures all the regions that contain the lanes or have a high likelihood of containing the lane lines. Fig. 7(a) shows the region of interest which is in the form of trapezium for a given image. We mask the region of interest to look for lane lines in specifically the defined bounding box. Fig. 7(b) shows the masked image of Fig. 6(b)



**Fig. 7 Choosing region of interest (a) bounding box (b) masked image**

**5) Hough Transform:** It is used to detect lane lines present within the bounding box and returns their coordinates. It allows some tolerance towards the gaps and holes in the edge of the lane boundary and can detect shapes and lines even if the image is a little distorted. This method is efficient and works even if the image has some noise [6]. To perform this step, an edge detected image is desired and hence we use the image after canny edge detection as input for this stage. Fig. 8(a) shows the lane lines and fig. 8(b) shows the lane lines overlay (lanes plotted on the original image).







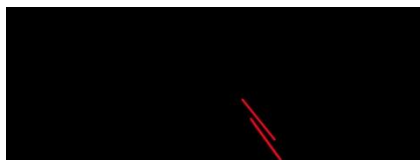
(b)

**Fig. 8 Hough transform outputs (a) lane lines (b) lane lines overlay**

**6) Selecting Best fit lines:** From the lines which we get from hough transformation, we will extract out the best fitting lanes for both the right lane and left lane respectively. We first separate the left and right lane lines by finding the midpoint of the bounding box. Then those lanes whose mid-point will be greater than the midpoint of the bounding box will be considered as the left lanes and others will be considered as right lanes. Fig. 7(b) shows the right lane lines and Fig. 7(a) shows the left lane lines. The coordinates for these lanes were then plotted and fit along with a polynomial function. The polynomial function gives the equation for best fitting right and left lanes. Fig. 7(c) shows the best fitting right lane line and left lane line in an overlay of the original image.



(a)



(b)



(c)

Fig. 9 Outputs (a) Left lane hough lines

(b) Right lane hough lines (c) Best fit lane lines

**7) Illustrated Lanes:** The final output shows the finally detected lane. Fig. 10 shows the illustrated lanes.



Fig. 10 Illustrated lanes

#### D. Method 2:

1) **Combined Thresholding:** **Combined thresholding** is referred to as a combination of multiple thresholding [13] techniques. Thresholding is just a way to create a binary image where every pixel that meets the condition is given value 1 and the rest are given value 0. Color spaces are a very useful tool to analyze images because it helps in image segmentation by color thresholding. We experiment with two types of color channels. The first one is RGB thresholding since lane lines are expected to be either yellow or white as illustrated in Fig. 11(a), second is the S channel of the HLS color channel which helped to split the lane in highly illuminated environments with less noise as illustrated in Fig. 11(b), Gradient helped us in detecting the regions which had a sharp change in intensity or color.

2) By applying gradient thresholding we pick desirable gradient values which have the least noise and are detecting edges of the lane lines effectively. Since the lane lines are mostly close to the vertical and parallel to the line of motion of the vehicle, the gradient in the x direction is better suited. OpenCV has a Sobel function to take the gradient in the x-direction. After this, we combined all the thresholding outputs using an OR operator so even if any one of the binary images has a white pixel, the combined binary output will eventually have a white pixel. It helps in detecting desirable pixels even if any of the thresholding misses. Fig. 11(c) illustrates the output after Gradient thresholding and Fig. 11(d) illustrates the output after applying to combine all the discussed thresholding techniques.

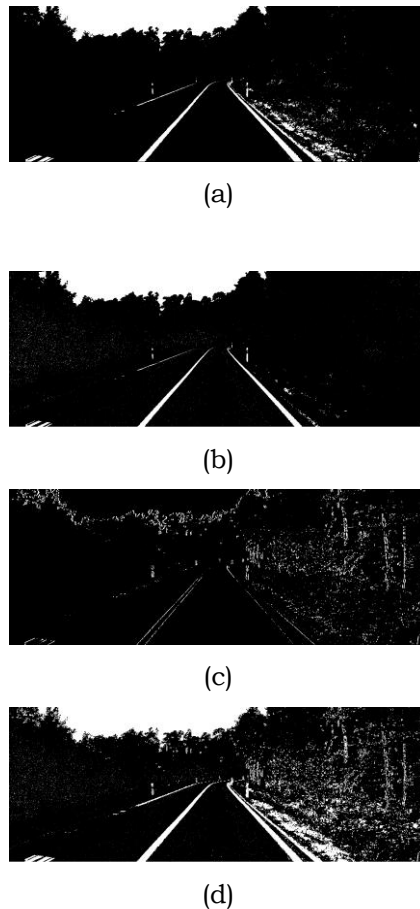
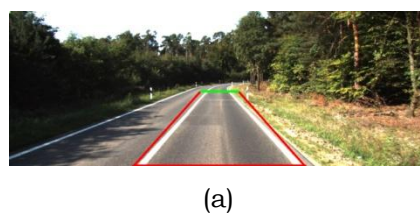


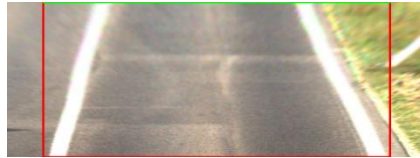
Fig. 11 Outputs of different steps of Combined Thresholding

- (a) RGB Thresholding
- (b) HLS Thresholding
- (c) Gradient Thresholding
- (d) Combined Thresholding

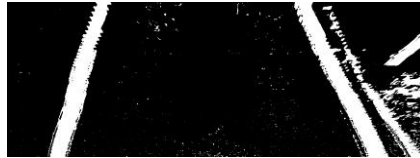
### 3) *Perspective Transform: The perspective transform*

[12] helps in transforming a flat view into a top view(Bird's eye view). It is crucial as in flat view, a small horizontal shift in the camera can cause large distortion in lanes, whereas in top view, the shape of lane lines is more stable which makes lane detection more robust and helps in achieving better performance. An ROI of trapezium shape is chosen which best fits the perspective of the road and it is then transformed into a rectangle which in turn warps the image into a bird's eye view. Fig. 12 illustrates an undistorted image with highlighted ROI, top view with a highlighted warped rectangle, and combined threshold on the transformed image





(b)



(c)

Fig. 12 Perspective transform (a) Undistorted image along with highlighted ROI (b) Warped image with highlighted destination region

(c) Combined Thresholding on warped image

4) *Sliding Window Search*: The sliding window search

is then applied to the binary image illustrated in Fig. 10(c). Initially, the image is vertically divided into two halves, a histogram depicting the frequency of white pixels in each column is made using the lower half. Since the road has two-lane lines, therefore this histogram will have two peaks that represent the left and right lane lines. The histogram array is further divided into two halves and a column with the maximum frequency is selected from both the halves of the histogram and marked as the base of the lane lines. Then the image is vertically divided into equal parts called windows with a fixed height and width. Initially, the first window is placed at the base of both of the lanes. Every white pixel value lying inside the window is recorded. Then the mean of the x coordinate of these white pixels serves as the base value for the next window. These operations are iterated over each window from bottom to top of the frame separately for both of the lane lines. The result of this is the pixel values of both lane lines as illustrated in Fig. 13. The green bounding rectangles represent the windows for both lane lines and the teal color represents the white pixels that are now marked as part of the lane line.



Fig. 13 Sliding Window Search

5) *Polynomial Fitting*: The pixels of both lanes in

Fig. 11 are then subjected to polynomial fitting to get the lane line out of them. A second-order polynomial is fitted to easily get the result on curved roads. Fig. 14 illustrates the fitted lines for the lane pixels with white color passing through the windows

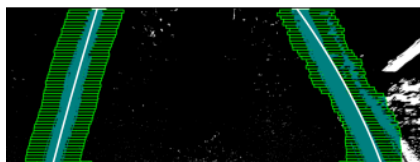


Fig. 14 Polynomial Fitting

6) *Illustrated Lane*: The coordinate sequence of the lane

lines are used to draw lane lines on the image in Fig. 12(b). The enclosed area between the lane lines is filled with red color. Then an inverse transformation is performed to convert this top view image back onto a flat view. The result is an image with a lane illustrated. Fig 15 illustrates the final result obtained with the lane highlighted in red color.



Fig. 15 Highlighting lane in unwarped image

#### IV. RESULTS AND CONCLUSION

Parameters	Method 1	Method 2
Accuracy	42.16 %	85.94 %
No. of False Positive	195	61
No. of False Negative	56	0
Average Time Per Frame	0.098 s	0.227 s

Method 1 takes less time to detect the lane on average, but it fails to detect lanes on curved roads, in different weather conditions, and when there are shadows on the road. As a result, there are a lot of false negatives. We tried with many parameters in order to find the function that gives the best results. Method 2 has an accuracy that is roughly twice that of Method 1, and it produces good results for non-curved roads, but the edges detected by canny edge detection can vary dramatically depending on the noise. Edge detection will be influenced by unremoved noisy pixels. As a result, detecting lanes becomes more challenging. We focus more on the illumination of each pixel in Method 2 because we pick the brightest pixel during sliding window search. It is less impacted by noise and can produce results even when Method 1 fails.

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# MULTI-CLASSIFICATION CNN MODEL FOR BRAIN TUMOR MR IMAGES WITH TUMOR SEGMENTATION BY USING THE RECURRENT RESIDUAL U-NET

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## ABSTRACT

Now a days CNN model is widely used to classifying the brain tumor MR Images into multi classes. Binary classification CNN models are classifying the brain tumors up to the mark. But multi class classification CNN models are giving low accuracy. To enhance an accuracy of CNN model, it is better to consider segmented tumor images instead of MR Images directly as the input. U-Net is a well-known deep learning system for segmenting medical images. R2U-Net is a Recurrent Residual U-Net model that we proposed for segmentation purpose. The suggested model employs U-Net, residual, and recurrent convolution networks. There are various benefits with these structures in segmentation process. First, a residual unit aids in the training of deep structures. Second, for segmentation tasks, utilising recurrent residual convolutional layers to accumulate features provides superior feature representation. Third, it enables us to create superior U-Net topologies for brain tumour MR image segmentation with the same amount of parameters in the network and improved performance. The segmented images are passed as the input for a CNN Model to classify the brain tumor into Normal, Glioma, Meningioma, Pituitary and Metastatic with enhanced accuracy. The proposed model is tested on the brain tumor benchmark datasets BraTS2018 and BraTS2019. The experimental results show that the suggested model giving higher accuracy than the existing models.

**Keywords:** semantic segmentation; U-Net; residual U-Net; recurrent U-Net; recurrent residual U-Net; CNN.

## 1. INTRODUCTION

Deep learning (DL) now offers cutting-edge performance in image segmentation [2], classification [1], tracking and detection [3], and captioning [4]. AlexNet [1], VGG [5], GoogleNet [6], ResidualNet [7], DenseNet [8], and CapsuleNet [9] are some of the deep convolution neural network (DCNN) technics that have been suggested since 2012. For various newly established advanced methods, such as activation functions, enhanced regularisation techniques, and optimization approaches, a deep learning-based technique (CNN) gives up-to-date performance for segmentation, detection and classification tasks [1][10]. In most situations, however, techniques are investigated and assessed by using the classification job on the large datasets similar to ImageNet [1], with the classification tasks' outputs being labels or probability values. For semantic image segmentation tasks, tiny methods with structural variants are utilised instead. For segmenting the images in computer vision, a fully convolution network also gives up-to-date results [2]. SegNet, another FCN alternative, it's also been suggested [11] for segmenting images.

Deep convolution neural networks (DCNNs) have been employed in a different medical imaging modalities, including detection, segmentation, and classification, due to their success in the area of computer vision. Different imaging techniques, such as ultrasound, computed tomography (CT), magnetic resonance imaging and x-ray are used in medical imaging. The goal of automated diagnosis is always to obtain a faster and more accurate diagnosis so that a big group of people can be treated more efficiently at the same time. Furthermore, effective programmed processing decreases manual error while also saving time and money. Because manual segmentation is time-consuming and exhausting, there is a great need for computational models that can perform segmentation quickly and consistently without the need for manual interaction. Medical image segmentation does, however, have significant drawbacks, such as data shortage and imbalanced data. For a variety of reasons, a high number of labels are rarely accessible for training [12]. Labelling the dataset necessitates the services of an expert in this subject, which is costly and time-consuming. For expanding the number of labelled samples accessible, various data augmentation or transformation methods (data scaling, translation, rotation and whitening) are sometimes used [13-15]. Patch-based approaches are also utilised to address issues of class imbalance. We tested the recommended methodologies on patch-based and complete image-based methods in this study. In semantic segmentation, the image backgrounds are labelled, while the foreground or target areas are divided into classes. As a result, the issue of class imbalance is easily rectified. Dice similarity and Cross-entropy loss are two advanced strategies that have been presented for effective segmentation and classification task training [14] [15].

Furthermore, for localization tasks context modulation and global localization are used frequently in medical image analysis. In identification process, a class label is given to each pixel that corresponds to the shape of the targeted lesion's planned boundary. We must stress the relevant pixels in order to determine these target lesion boundaries. One example is landmark detection in medical imaging [16] [17]. Different image-processing and machine-learning methods for medical picture segmentation methods existed before the DL revolution, including region-based segmentation [19], amplitude segmentation with global histogram characteristics [18], and the graph-cut technique [20]. But, now a day, semantic segmentation technics with deep learning have gained a lot of traction in the area of medical picture segmentation, localization and lesion detection [21]. Furthermore, deep learning-based techniques are referred to as general learning techniques because a single method may be used well in a variety of medical imaging methods such as x-ray, CT and MRI.

As per a present study, deep learning methods are used in practically every medical imaging modality [21] [22]. In addition, many publications have been available on segmentation in various medical imaging modalities [21] [22]. In Ref. 23, DCNN-based tumor detection in brain MR Image's system was developed. From structural standpoint, the CNN framework for classification tasks necessitates the use of an encoding unit and outputs class label based on probability. Convolution operations with activation functions were used in classification tasks, and for reducing the dimensionality of the feature maps subsampling layers were used. The feature maps count increases as the input move over the network layers, but decreases the feature maps dimensionality. The number of network parameters grows in lockstep with the count of feature mappings in deeper layers. SoftMax procedures are employed at the network's end to estimate the probabilities of the class labels.

In contrast to classification challenges, segmentation tasks that require both encoding and decoding units in their architecture. The encoding block is responsible for converting input into a greater number of low-dimensional mappings. The decoding unit performs up-convolution (transpose convolution, or de-convolution) procedures to generate segmented maps to the same dimensions as that of the source input picture. As a result, the architecture for segmentation tasks often requires about twice as many network parameters as the architecture for classification tasks.

This study shows a hybrid multi-class classification framework with two modules: one that uses recurrent residual convolutional network and the other that uses convolutional neural network. To achieve our objectives, the proposed models are tested using BRATS2018 and BRATS2019. This work's contributions can be summarised as follows:

- One new model called the Recurrent Residual U-Net (R2U-Net) is used for Brain tumor MR image segmentation.
- Segmented brain tumor MR images are fed to CNN to classify the MR image as Normal, Glioma, Meningioma, Pituitary or Metastatic tumor.
- Experimentations are conducted on BraTS dataset, which is a popular, publicly available and benchmarked dataset for brain tumors.
- When compared to equivalent methods with same amount of parameters in the network, the recently suggested state-of-the-art techniques exhibit greater performance.

The following is how the paper is structured: The second section discusses similar work. Sec. 3 shows the structure of the suggested framework and R2U-Net model. The experimental setup and performance measures are explained in Section 4. Sec. 5 contains the dataset specifics as well as a description of the experimental results. Sec. 6 contains a comparison of experimental findings over SegNet and U-Net. Sec. 7 discusses the conclusion and future directions.

## **RELATED WORK**

In semantic segmentation, which is powered by diverse hard datasets with in disciplines of machine learning and medical imaging [23-26], deep CNNs are utilised to categorise every pixel in the image individually. Prior to the Deep Learning revolution, a previous machine-learning approach depends heavily on custom features for identifying pixels individually. Several models were proposed in recent years, which show that the types of deep networks are superior for identification and segmentation methods [5]. The vanishing gradient problem is handled by using current activation functions like ReLUs or ELUs [5][6], makes training very deep models problematic. He et al. [24] suggested another solution to this difficulty; a deep residual approach solves the problem by assisting the learning with identification mapping.

Furthermore, convolutional neural networks-based segmentation approaches outperform natural picture segmentation methods [2]. FCN performance has been improved by recurrent neural networks that have been fine-tuned on really huge datasets [25]. One of the most advanced methods is Deep Lab semantic image segmentation [26]. The two halves of SegNet are the encoding networks; it is really a 13-layer VGG-16 network [5], as well as the matching decoder network, which uses pixel-wise categorization layers. The fundamental contribution of Ref. 11 is the decoder's method of up sampling its lower resolution input image feature maps. Later, in 2015, a better version of SegNet dubbed Bayesian SegNet was proposed [27]. Computer vision applications are used to investigate the majority of these designs. However, different deep learning technics have been introduced for segmentation of medical images, as they take into account the class imbalance issues.

The U-Net [13] is a popular algorithm for semantic medical picture segmentation. U-Net network is comprised with two different components: convolution encoding and decoding blocks. In both portions of the network, fundamental convolution functionalities are done, shadowed by ReLU activation.  $2 \times 2$  max-pooling functions are conducted in the encoding unit for down sampling. During the decoding step, convolution transpose (also known as up convolution or de-convolution) techniques are employed to up sample the feature maps. Cropping feature maps and copying them from encoding blocks to the decoding blocks were done utilizing the original version of a U-Net. For segmentation tasks, a U-Net has numerous advantages: first, this permits the simultaneous usage of global location and the context. Second, it works with a small amount of training data as well as it is superior at segmentation [13]. Third, an end-to-end workflow analysis an actual picture in forward pass and gives segmented maps in the right away. This demonstrates that, unlike patch-based segmentation systems, the U-Net retains the entire context of input MR images, it has a substantial gain.

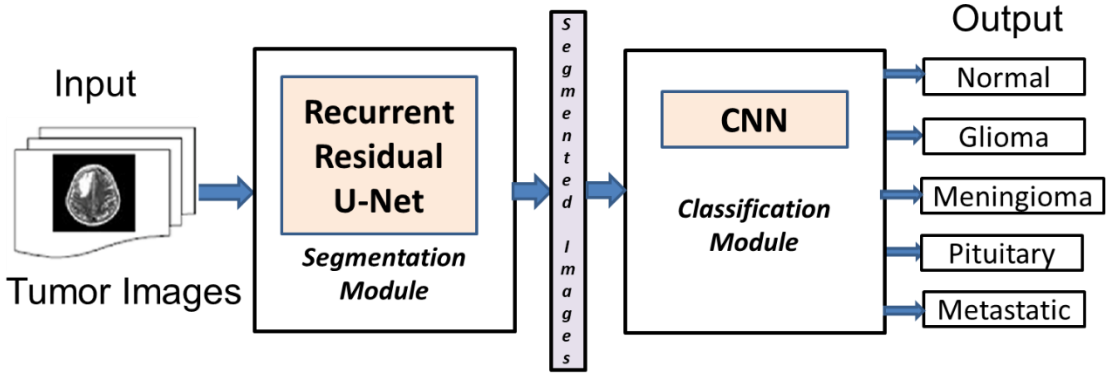
But, U-Net is no longer restricted to medical imaging applications; it is now also used in computer vision [28] [29]. Various U-Net models have been developed in the meantime, including a simple U-Net variation for CNN-based medical imaging data segmentation [30]. The original concept of U-Net is modified in this model in two ways: To begin, a sum of many forward feature and segmentation maps are computed (element-by-element) from the one region of network to next region. Feature maps collected from various layers of both the encoding as well as decoding modules, and summation (element-by-element) were performed outside of the blocks. Researchers indicate a good performance gain during the training phase with greater convergence than U-Net, but there was no advantage detected during the testing phase when utilising a summation of features [30]. However, this approach demonstrated that feature summing has an impact on network performance. The impact with skipping connections during medical image segmentation methods has been extensively examined using U-Net as well as the residual networks [31]. The deeper contour-aware system was created in 2016, and it works effectively [32]. It can retrieve contextual signals using a hierarchical design for effective gland identification of histology photos.

Other U-Net-based deep learning techniques for 3-D medical picture segmentation methods have also been developed. Learned from minimally labelled volumetric pictures, the three-dimensional U-Net structure aimed at volumetric segmentation [14]. V-Net, a sophisticated three-dimensional image segmentation based on volumetric pictures that comprises of a fully connected network by residual connections [15], has been proposed. A Dice loss layer is also introduced in this paper [15]. In Ref.33, introduced a 3-D deep supervised technique for automatic segmentation of medical images. HighRes-3D Net [34] was proposed in 2016 for 3-D segmentation challenges using residual networks. As a CNN-based tumor segmentation technique, a three- dimensional CNN model with an interconnected conditional random field was suggested in 2017 [35]. In Ref. 36, proposed pancreas segmentation. This structure relied on residual networks and the summing of feature maps from many levels [37].

## **2. PROPOSED MODEL**

Classifying medical images correctly is critical for improving clinical care and therapy. CNN is a finest model and it is widely used to build classification framework for medical image classification task. R2U-Net is an efficient architecture for medical image segmentation. By integrating these two models, we proposed a framework for multi class classification of brain MR images. The introduced framework contains two main components: one component is R2U-Net, which is for segmenting the brain tumor MR images and the second component is the CNN, which is for classifying the segmented brain MR images into tumor classes as normal, glioma, meningioma, pituitary or metastatic.





**Fig.1. Framework for Multi-class classification of brain MR images**

## 2.1 R2U-Net Architecture

The first architecture used in this research is R2U-Net and this is applied for the brain tumor MR image segmentation purpose. Encoding and decoding parts are present in the R2U-Net architecture. R2U-Net architecture is showed in Figure 2. Two convolution layers' units are present in the encoding architecture. In encoding architecture, a  $2 \times 2$  pooling (down-sampling) and rectification layer (ReLU) with stride are present. The feature channels are doubled at each down-sampling step. A  $2 \times 2$  up-convolution layer is present in corresponding decoding architecture that reduces the feature channels halve. A ReLU with two  $3 \times 3$  convolutions, cropped feature map with a concatenation operator from encoding unit are also present in decoding layer. Finally, component feature vectors are mapped based on a  $1 \times 1$  convolution for segmentation. The soft-max energy function is computed and merged with the cross-entropy loss function based on the final feature map. At each position, the soft-max deviation ( $M_{\lambda(x)}(x)$ ) from one is used to penalize the cross-entropy, as shown in Eq. (1).

$$\varepsilon = \sum_{k'=1} \log \left( M_{\lambda(x)}(x) \right), \quad (1)$$

Where each pixel true label is denoted as  $\lambda : \Omega \rightarrow \{1, \dots, K\}$  at the position  $x \in \Omega$ , with  $\Omega \subset Z^2$ . The final segmentation is generated by networks soft-max layer as a probability map. Specific pixel value indicates whether or not the pixel belongs to the tumor. Context information is spread to suitable resolution layers by a high number of selected channels in the network, enabling for end-to-end training with a limited amount of training data. We used the Keras library in Tensor Flow framework is used to implement this network.

We employed R2U-Net in brain MR image segmentation, which was motivated by deep residual architecture [7], RCNN [38], as well as U-Net [13] framework. This method makes use of the advantages of the all these three recently created deep learning models. Using various benchmarks, The RCNN as well as its derivatives was already demonstrated higher accuracy on object identification process [39] [40]. The recurrent residual convolution functions can be illustrated analytically using better residual networks [41]. The RCLs (recurrent convolution layers) perform their functions with discrete time intervals as stated by the RCNN [38]. Consider the  $x_i$ , an input sample for the RRCNN block's  $i^{th}$  layer and the centre pixel of a patch located at  $(j, k)$  in an input sample on the RCL's  $l^{th}$  feature map. Furthermore, let us consider that  $O_{jkl}(t)$  is the network output at time step  $t$ .  $O_{jkl}(t)$  is formulated as:

$$O_{jkl}(t) = (w_f)^T * x_i^{f(i,k)}(t) + (w_r)^T * x_i^{r(i,k)}(t-1) + b_l \quad (1)$$

$x_i^{f(i,k)}(t)$  is the input for the normal convolution layers and  $x_i^{r(i,k)}(t-1)$  is the input for  $i^{th}$  RCL.  $w_f$  is a weight of the normal convolution layer and  $w_r$  is the weight of the RCL with bias  $b_l$ . The output of RCL is routed to the conventional ReLU and is represented as

$$F(x_i, w_i) = f[O_{jkl}(t)] = \max[0, O_{jkl}(t)] \quad (2)$$

Here  $F(x_i, w_i)$  denotes an outputs of the RCNN unit's at  $i^{th}$  layer. The RU-Net model's convolutional encoding and decoding blocks for down and up sampling layers, respectively, employ this output  $F(x_i, w_i)$ . As illustrated in Fig. 3, the RCNN unit's final outputs are relayed by R2U-residual Net's unit. We can compute it as follows if we assume the R2CNN block's output is  $x_{i+1}$ :

$$x_{i+1} = x_i + F(x_i, w_i) \quad (3)$$

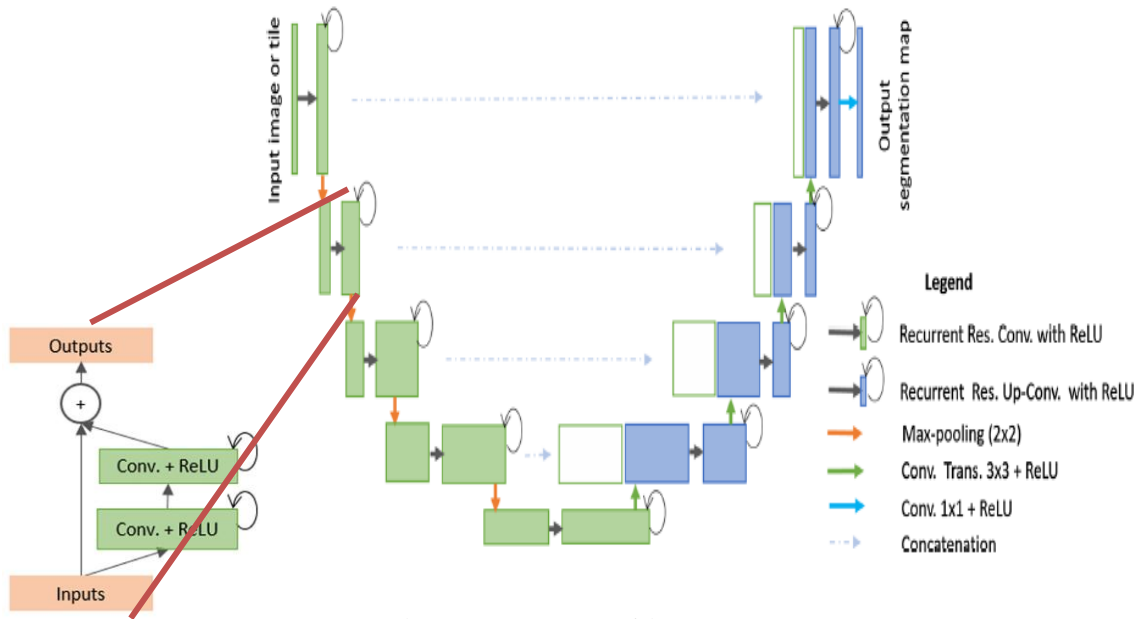


Fig.2. R2U-Net Architecture

The R2CNN block's input samples are represented by  $x_i$ . The  $x_{i+1}$  sample is used as an input to the R2U-Net model's encoding and decoding convolutional units' immediately following subsampling or up sampling layers.

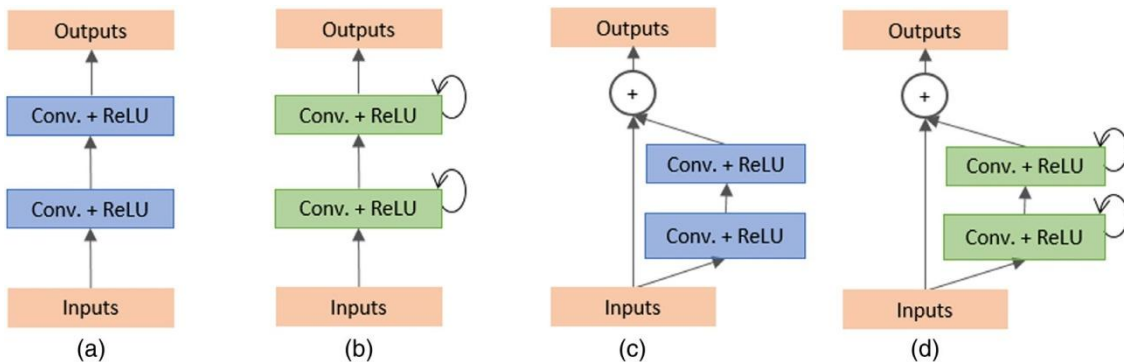
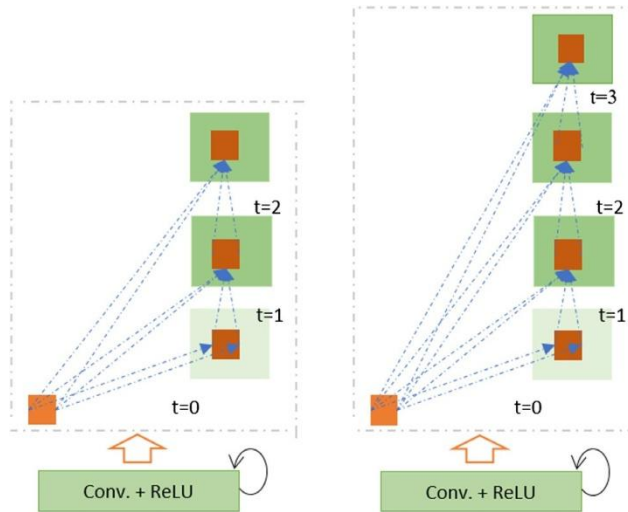


Fig.3. a) Basic Convolution Unit    b) Recurrent Convolution Unit    c) Residual Convolution Unit    d) Recurrent Residual Convolution Unit

The suggested deep learning model serves as the foundation for the stacked convolution blocks depicted in Fig.3. (d). this research compares and contrasts four different architectures. First, the U-Net with feature concatenation was used like an alternate instead of crop-and-copy technique used for the initial version of U-Net [13]. Fig.3(a) depicts the model's basic convolution block. Second, a residual U-Net approach with forward convolution layers and residual connectivity are utilised [15, 31], sometimes it is referred to as a residual U-Net (or ResU-Net). The RU-Net design is based on the U-Net concept with the forward RCLs, which is represented in Fig. 3(b). The final architecture is the R2U-Net, which is a U-Net structure with recurrent and residual connectivity, as illustrated in Fig. 3(d). Fig. 4 shows a diagrammatical presentation of an unfolded RCL with regard to the time step. The recurrent convolutional operation  $t = 2$  (0 to 2) refers to one individual convolution layer consists of 2 sub sequential RCLs.



**Fig. 4 RCL blocks with t=2 and t=3**

The feature maps of encoding and decoding blocks of R2U-Net structure were concatenated in this implementation. There are three distinctions between the suggested method and a U-Net model. The convolution encoding & decoding blocks in the design are identical to U-Net model encoding & decoding blocks. In both encoding and decoding units, however, RCLs are employed instead of forward convolution layers. With RCLs, the residual block supports in the development of more efficient model. Second, the proposed model's RCL units provide an efficient feature accumulation mechanism. The segmentation strategy with CNN for medical imaging proves the effectiveness of feature accumulation in between network portions. In this, an element-by-element feature summing is done from an outside of the U-Net structure [33]. The U-Net structure only exhibits an advantage in terms of better convergence throughout the training process. However, because of feature accumulation within the model, our suggested approach shows benefits for both the testing and training phases. Accumulation of features ensures stronger and better feature maps at different time stages. As a result, it aids in the extraction of required features for segmentation in various medical imaging modalities. Third, the cropping and copying units have been removed from the fundamental U-Net architecture, leaving only concatenation operations. As a result of all of the adjustments, the proposed models perform significantly better than analogous U-Net, SegNet, and as well as ResU-Net models. The proposed model provides greater accuracy with the small amount of parameters in the network.

When related to U-Net, there are various advantages to implementing the proposed design. The first is network efficiency, which is measured in terms of number of parameters in the network. Compared with ResU-Net and U-Net, the suggested R2U-Net architecture is designed to have the same amount of parameters in the network, and the R2U-Net model performs well on segmentation. The network parameters count is not increased by recurrent or residual operations. This is a general method, because it has deep learning technics such as SegNet [11], 3D-U-Net [14], as well as VNet [15], resulting in increased segmentation performance.

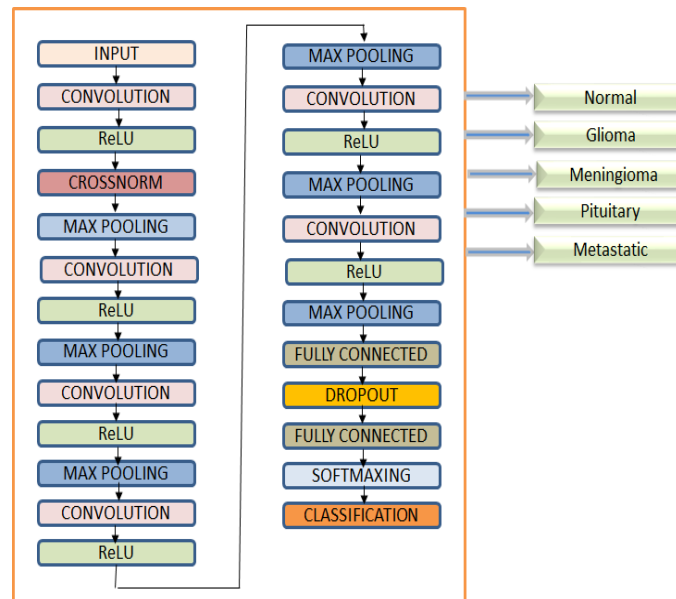
SegNet [11], U-Net [13], ResU-Net [31], RU-Net, and R2UNet are some of the models we've used in our research. The number of convolution layers in the convolution units are found with regard to time step  $t$ , and these methods are assessed with various number of convolution layers with in the convolution units. Feature fusion gets accomplished using an element-wise addition procedure in various residual, recurrent, and recurrent residual units. Each convolutional block in the network's encoding unit is made up of two or three RCLs, each with three convolutional kernels, followed by ReLU activation layers, and finally a batch normalisation layer. Between the convolutional blocks, a  $2 \times 2$  max-pooling and a  $1 \times 1$  convolutional layer are utilised for down sampling. Each block in the decoding unit has a convolution transpose layer, two convolution layers, and a concatenation layer. Different fusion approaches, such as concatenation, addition, and concatenation & addition in between an encoding & decoding block, have been empirically investigated. When compared with the other approaches, the concatenation function procedure better. As a result, concatenation procedures are employed between the network's encoding and decoding blocks. These features transferred to single output feature map using a sigmoid activation function and a  $1 \times 1$  convolutional kernel. Finally, a threshold ( $T$ ) is used to construct the segmentation region, which in our experiment was empirically chosen at 0.5.

## 2.2 CNN Model

CNN is one of the most extensively utilised deep learning methods in neural networks. Extracting the features and classification are the two components of a usual CNN model. An input, convolution, pooling, fully connected, and the classification layers are the five key layers that make up the CNN architecture. CNN extracts and categorizes features by placing sequentially trainable layers step by step. The fully connected and classification layers are often located in the classification section of the CNN, whereas the layer's convolution and pooling are typically found in the feature extraction section. Although CNNs have recently been focused on classification of images and accepts image as input, CNNs are also usually employed in a variety of additional disciplines where the audio and video signals are the input data [9].

The main purpose of this research is to create a CNN for multi-class classifying tumors in the segmented brain MR images. Grid search optimization automatically tunes critical hyper-parameters in the CNN architecture. Normal, glioma, meningioma, pituitary, and metastatic tumors are the five forms of brain tumors classified by the introduced framework.

As presented in the Fig.5, the CNN model contains total 25 numbers of weighted layers: one input, six ReLU, six convolutions, six max pooling, one cross channel normalization, two fully connected, one SoftMax, one dropout, and one classification layer. Since the suggested CNN framework is intended to classify the tumor MR image into five classes, the last layer (output) includes 5 numbers of neurons. The Soft Max classifier receives output of final fully connected layer, a 5-D feature vector, which produces the final tumor type prediction. See Table 1 for more details on the CNN architecture.



**Fig.5. CNN model for classification task**

**Table 1: Structural particulars of proposed CNN framework**

	<i>Layer in CNN</i>	<i>Type of Layer</i>	<i>Activations in Layer</i>
1	227x227x3 input layer	Input	227x227x3
2	128 convolutions of 6x6x3, stride [4 4], padding [0 0 0 0]	Convolution	56x56x128
3	ReLU-1 layer	ReLU	56x56x128
4	cross channel normalization	Normalization	56x56x128
5	2x2 max pooling layer with [2 2] stride and [0 0 0 0] padding	Max Pooling	28x28x128
6	96 convolutions of 6x6x128, stride [1 1], padding [2222]	Convolution	27x27x96
7	ReLU-2 layer	ReLU	27x27x96
8	2x2 max pooling layer with [2 2] stride and [0 0 0 0] padding	Max Pooling	13x13x96
9	96 convolutions of 2x2x96, stride [1 1], padding [2 2 2 2]	Convolution	16x16x96
10	ReLU-3 layer	ReLU	16x16x96
11	2x2 max pooling layer with [2 2] stride and [0 0 0 0] padding	Max Pooling	8x8x96
12	24 convolutions of 6x6x96, stride [1 1], padding [2 2 2 2]	Convolution	7x7x24
13	ReLU-4 layer	ReLU	7x7x24
14	2x2 max pooling layer with [2 2] stride and [0 0 0 0] padding	Max Pooling	3x3x24
15	24 convolutions of 6x6x24, stride [1 1], padding [2 2 2 2]	Convolution	2x2x24
16	ReLU-5 layer	ReLU	2x2x24
17	2x2 max pooling layer with [2 2] stride and [0 0 0 0] padding	Max Pooling	1x1x24
18	34 convolutions of 4x4x4, stride [1 1], padding [2 2 2 2]	Convolution	2x2x32
19	ReLU-6 layer	ReLU	2x2x32
20	2x2 max pooling layer with [2 2] stride and [0 0 0 0] padding	Max Pooling	1x1x32
21	512 fully connected layer	Fully Connected	1x1x512
22	30% dropout layer	Dropout	1x1x512
23	5 fully connected layer	Fully Connected	1x1x5
24	Soft Max layer	Soft Max	1x1x5
<b>25</b>	<b>Output layer</b>	<b>Classification</b>	---

## 4. EXPERIMENTAL DESIGN AND METRICS FOR EVALUATION

### 4.1 Experimental Design

We evaluated the suggested framework using the BRATS2018 and BRATS2019 brain MR imaging datasets to demonstrate its performance. The Keras and TensorFlow are utilised in this implementation on a single graphics processor unit with 32 GB of RAM and an Nvidia GTX 980-Ti.

### 4.2 Metrics for Evaluation

Several evaluation metrics like sensitivity (SE), accuracy (AC), specificity (SP), F1-score, Jaccard index (JA) and Dice coefficient (DC) are examined for quantitative examination of the experimental outcomes. We use the variables True Positive, True Negative, False Positive, and False Negative to compute these. The following equations are used to compute the overall AC, SE, SP, DC and JA.

$$AC = \frac{TP + TN}{TP + TN + FP + FN}$$

$$SE = \frac{TP}{TP + FN}$$

$$SP = \frac{TN}{TN + FP}$$

$$DC = \frac{2 \cdot TP}{2 \cdot TP + FP + FN}$$

$$JA = \frac{TP}{TP + FP + FN}$$

Furthermore, we done an experimentation to calculate the Dice Index (DI) [44], and the Jaccard Similarity score (JS) [45]. Formulas for DI and JS are given below: The ground truth is referred as GT, and the segmentation result is referred as SR.

$$DI(GT, SR) = 2 \frac{|GT \cap SR|}{|GT| + |SR|}$$

$$JS(GT, SR) = \frac{|GT \cap SR|}{|GT \cup SR|}$$

Where GT is ground truth & SR is segmentation results. The F1-score is determined by using below mentioned formula:

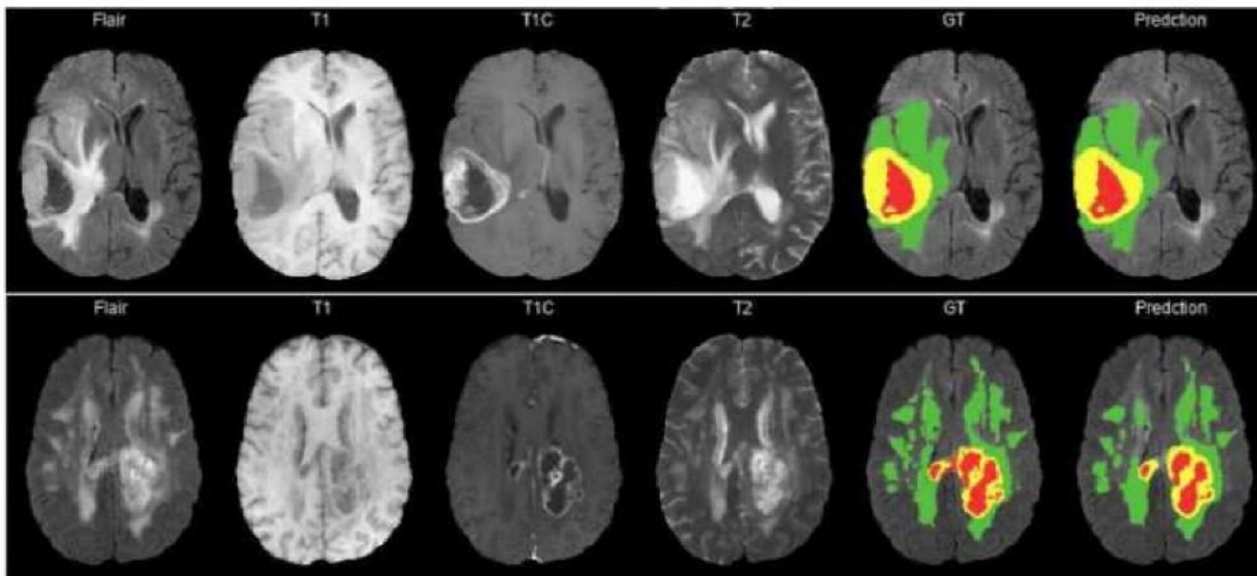
$$F1 - score = 2 \times \frac{Precision \times Recall}{Precision + Recall}$$

Where the Precision and Recall are expressed as

$$Precision = \frac{TP}{TP+FP} \quad Recall = \frac{TP}{TP+FN}$$

## 5. RESULTS

### 5.1 Dataset details



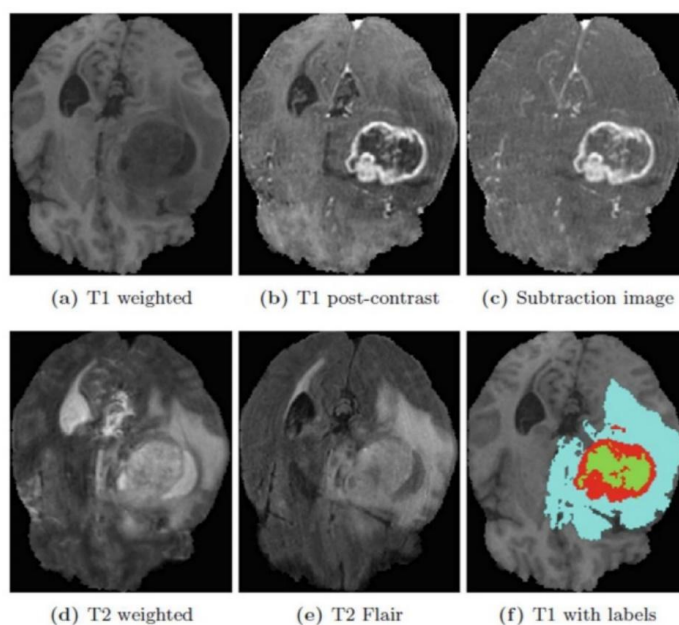
**Fig.6.** MRI images with ground truth for various modalities. Green, red, and yellow highlight the ED, NET, and ET areas, respectively.

#### ***BraTS 2019***

The BraTS 2019 dataset containing 259 high and 76 low grade glioma MRI scans. The ground truth of all the images has been created manually using the annotation protocol. An experienced neuro-radiologists were approved these annotations. The peritumoral edema (ED label2), enhancing tumor (ET label 4), and the necrotic or non-enhancing tumor core (NCR/NET label 1) are some of the annotations. Fig.6. shows sample images of the BraTS 2019 dataset.

#### ***BraTS 2018***

The BraTS 2018 dataset containing 210 high and 75 low grade glioma scans. 66 different MR image scans are included in the validation dataset. All MR images of the BraTS 2018 have a volume dimension of  $240 \times 240 \times 155$ . The MR images have been segmented manually by one to four ratters, and experienced neuro-radiologists approved their annotations. Each and every tumor is segmented into necrosis, edema, active/enhancing and non-enhancing tumor. Example images from the BraTS 2018 dataset are represented in Fig.7.



**Fig.7.** MR images with ground truth for various modalities. Blue, Red and Green highlight the ET, NET, and ED areas, respectively.



## 5.2 Experimental results

When comparing with the U-Net, ResU-Net, and RU-Nets, the suggested framework with R2U-Net model gives greater performance throughout both the training and validation stages. Quantitative findings are obtained using the BraTS dataset with the four distinct models, as represented in Table 2. In most circumstances, while comparing the efficiency of suggested approach we use the total AC and AUC. In maximum situations, the results of the suggested model with 0.841M parameters are efficient than those obtained with advanced methodologies. R2U-Net is assessed with different network parameters to compare with the recently introduced approach, which demonstrated the largest AC and a better AUC. Most notably, when comparing with the U-Net and RU-Net architectures, we can see that the suggested R2U-Net model performs better in terms of AC and AUC. The proposed brain tumor multi-class classification model with R2U-Net is giving 99.22% of accuracy; this is better accuracy than the remaining existing models.

**Table 2: Experimental results of suggested model with R2U-Net and existing models for t=2.**

Model	SE	SP	JSC	F1-Score	AC	AUC	DI
Seg-Net	0.9757	0.9931	0.9887	0.9777	0.9887	0.9844	0.9754
U-Net	0.8645	0.9929	0.9635	0.9156	0.9635	0.9287	0.9780
ResU-Net	0.9781	0.9975	0.9781	0.9522	0.9781	0.9568	0.9792
RU-Net	0.9747	0.9962	0.9911	0.9811	0.9911	0.9855	0.9831
R2U-Net	<b>0.9861</b>	0.9940	<b>0.9922</b>	<b>0.9830</b>	<b>0.9922</b>	<b>0.9901</b>	<b>0.9857</b>

## 6. CONCLUSION

We provided a framework for multi-class classification of brain tumour MR images in this research. Recurrent Residual U-Net model was utilised for segmenting the brain MR images. These segmented images were classified by the CNN model. The BraTS-2018 and BraTS-2019 brain tumour MR image datasets were used to test this system. When compared to current approaches, such as the SegNet, U-Net, and ResU-Net models, using BraTS-2018 and BraTS-2019 dataset, the suggested model performed better in most situations for segmentation and classification tasks. The proposed framework classifying the brain tumor MR image as Normal, Glioma, Meningioma, Pituitary or Metastatic with accuracy 99.22%. We hope to extend our model to a 3-D network in the future to do 3-D medical imaging segmentation and classification.

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# IN-MEMORY COMPUTING PROCESSING OF VOLUMINOUS DATA SETS USING NOVEL SPARK ANALYSIS

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**Abstract.** Big data consists of enormous data collections not handled by conventional computer technologies. For example, the amount of data that Facebook or YouTube must collect and process every day can be classified as big data. Both Hadoop and Apache Spark are Apache Software Foundation open source projects, and both of them are premier large data analytic tools. Hadoop has led the big data industry for five years. The processing velocity of the Spark can be significantly different, up to 100 times quicker. However, the amount of data handled varies: Hadoop Map Reduce can process data sets that are far bigger than Spark. Image segmentation is a crucial stage in the processing of the image, and the popularity of content-based image recovery is becoming extremely essential and significant in the rapid extraction of the features of large-sized images. Spark is a memory-based data processing framework with apparent benefits over processing speeds in many Big Data frameworks. This article compares the performance of both spark and map and discusses the advantages and disadvantages of both above-noted technologies with results on a massive quantity of structured data employing multi-split and multi-mappers, and discusses the feature extraction of voluminous image data sets along with architectural changes for the performance improvement of spark.

**Keywords:** Hadoop, spark, in-memory computing, Map reduce, feature extraction.

## 1.Introduction

The large-scale information scanning has become a remarkable platform for organizations to take advantage and exploit heaps of vital information. In the course of this vast information rise, Hadoop has progressed fiercely as an on-or cloud-based stage as the single-size solution for the huge scale problems of the corporate sector. [1] While Utilizing Hadoop has met a substantial part of the advertising, the best arrangement may be in some conditions while performing tasks on a traditional data collection. Hadoop is not an information base, but a general programming system was deliberately used to handle enormous quantities of structured and moderately information. [1] For large-scale information evaluation, associations contemplating using Hadoop should examine if their present or future information demands require the type of capabilities that Hadoop offers. Organized information is described as information that resides in the fixed bounds of a record or document. Due to the way structured information may be recorded, disclosed, questioned and explored, even in large quantities, in an essential and immediate method, a conventional set of data is usually implemented. [2] Unstructured data is referred to as information from a variety of sources, including communications, text archives, recordings, pictures, sound records, internet media postings. A usual dataset cannot handle or examine unstructured Information as both puzzling and voluminous. Hadoop's ability to add, Totals, and explore huge multi-source information stores without initially structuring allows associations to gain additional knowledge quickly. In this sense, Hadoop is perfect for storing, monitoring and evaluating large quantities of unstructured information for companies [3].

## 2.Existing Methodology

### 2.1 Map Phase

The Hadoop Mapper measures every record by setting key, value>. Sets of key, value> cannot be entirely the same as the entry pair. The output of the mapper job is the whole range of each key, value > set. Before the output is composed for every mapper task, the output is divided by a key and arranged afterwards.[6] The breakdown of these output records depends on the partitioning key. For instance, if there are just three unique keys output for the mapper assignments and you have arranged three reducers for the work, there will be three mapper output files. In this model, if a specific mapper task measures an information split and it creates output with two of the three keys, there will be just two output files.[7]

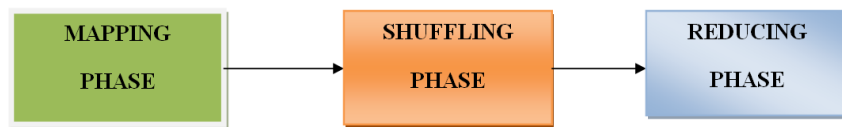


Fig 1. Processing pipe line in Map-Reduce

## 2.2. Key value pair generation

Input split: This is the sensitive information display. It is anything but a work unit containing a single guide in Map Reduce software. [8]

Record Reader: It connects with the Input Split, which may be read by the Mapper, and changes the information to key values. [9]

## 2.3. Shuffle

Contribution to the Reducer is the arranged output of the mappers. At this stage, the structure brings the important split of the output of the multitude of mappers, through HTTP. [10]

## 2.4. Reduce

For each pair of aggregated inputs, the reduce (Writable Comparable, Iterator, Output Collector, Reporter) method is invoked in this phase. Typically, the output of the Reduce is sent to the File system using `OutputCollector.collect (Writable Comparable, Writable)`. [11]

## 3 .Spark Map Reduce

Apache Spark analyzes the data in system memory (RAM), whereas Hadoop Map Reduce writes data to disk after running a map or reduce function. [12] Spark demands a large amount of memory. Spark, like conventional databases, loads a job into memory and retains it there until further notice for caching purposes. If you run Spark alongside other resource-demanding Services on Hadoop YARN, or if the data is too large to fit fully in memory, Spark's performance may suffer significantly. [13] On the other hand, as soon as the work is done, Map Reduce terminates its process so that it may be operated with other services with small changes in performance. Spark works better, particularly on dedicated clusters, if the data fits into ram. Hadoop Map Reduce is built for non-memory data and can work well with other services. [14]

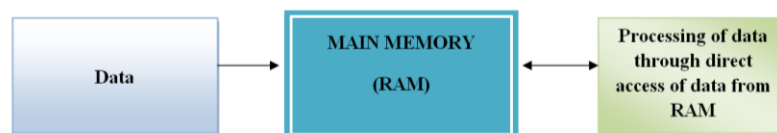


Fig 2. Processing of data in spark

Hadoop Map Reduce is a programming technique that makes it easier to process Big Data stored on HDFS. To process massive volumes of organized and unstructured data, Hadoop Map Reduce makes use of the capacity of numerous linked computers. Hadoop Map Reduce was the sole player in Big Data Processing prior to the arrival of Apache Spark and other Big Data Frameworks. [15] Apache Spark is an engine for general and rapid data processing of huge scales. Apache Spark has superseded most of these technologies as the most popular instrument for big data analytics since it is faster than other big data processing solutions. [16]. Apache Spark is quicker since it operates on RAM rather than disc. Apache Spark may be used for a variety of purposes, including distributed computing. Hadoop Map Reduce works by distributing data pieces among Hadoop Cluster nodes. The aim is to divide a dataset into pieces and apply an algorithm to each chunk for parallel processing. [17]

## 4 .Feature Extraction of Images in Big Data Using Spark

The extraction of functionalities is the important stage in CBIR and pattern recognition technologies, which influence the correctness of the findings. Furthermore, the extraction of the functionality is one of the most time consuming portions of all processing, especially in large-scale imaging systems.

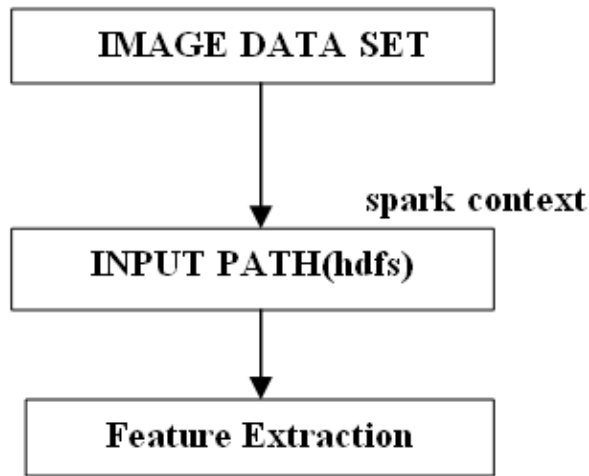
### 4.1 Algorithm for feature extraction

Step 1 :An image data set of 10000 images were initially loaded in to Hadoop distributed file system.

Step2:Using spark context, the input path of the directory of hdfs where images are stored is located.

Step3:Features of the image like binary form of image, height and nChannels are generated.

Step4: The scalability of the image data set has rapidly increased to a million images.



**Fig 3. Flow chart of feature Extraction**

**Observations and Cons of Spark**

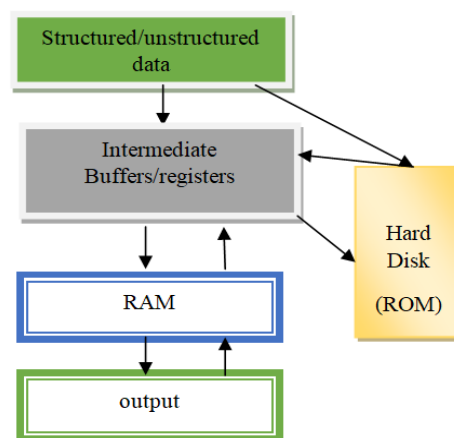
Though spark works on the principal of in memory computing, its computation on large data sets structured as well unstructure data is not feasible from the above analysis (Table 1).

Following are the cons observed from spark batch processing.

1. Increase of scalability of size of data leads to an increase in time of throughput.
2. Spark is not feasible for processing data sets of 100s of GB's where execution time takes days to weeks to get throughput.
3. Since data is stored and processed through RAM. Processing of data using spark is highly expensive, which leads to running out of memory.

**Novel Spark**

- 1 Usage of intermediate buffers/registers instead of RAM to reduce the cost of storage and processing.
2. Virtual RAM processing can be done to swap data which is already processed using RAM and new data is swapped from buffers in to memory.



**Fig 12. Intermediate buffers/registers can e used to decrease cost of architecture**

**5 .Novel Big Data Analysis**

In spark analysis the total no of slits on input data will be 13 same as that of basic map reduce as shown above and processing size of data is 15000MB

```
scala> val txtData = sc.textFile("/input/*",13)
txtData: org.apache.spark.rdd.RDD[String] = /input/* MapPartitionsRDD[1] at textFile at <console>:28

scala> txtData.cache()
res0: txtData.type = /input/* MapPartitionsRDD[1] at textFile at <console>:28

scala> spark.time {
  txtData.flatMap(1 => 1.split(" ")).map(word => (word, 1)).reduceByKey(_ + _)
  val wcData = txtData.collect().foreach(println)
}
[Stage 0:>] (0 + 4) / 23
[Stage 0:====>] (1 + 4) / 23
[Stage 0:=====>] (2 + 4) / 23
[Stage 0:=====>] (3 + 4) / 23
[Stage 0:=====>] (4 + 4) / 23
[Stage 0:=====>] (6 + 4) / 23
```

**Fig 9. Total no of partitions in above process shows 13 same as that of map reduce**

```
[Stage 0:====>] (2)
[Stage 0:=====>] (3)
[Stage 0:=====>] (4)
[Stage 0:=====>] (6)
[Stage 0:=====>] (7)
[Stage 0:=====>] (9)
[Stage 0:=====>] (10)
[Stage 0:=====>] (12)
[Stage 0:=====>] (13)
[Stage 0:=====>] (15)
[Stage 0:=====>] (16)
[Stage 0:=====>] (18)
[Stage 0:=====>] (19)
[Stage 0:=====>] (20)
```

**Fig 10. DAG Execution and stage execution in spark**

```
(regarding,6)
(XML,1)
(Enhance,1)
(often,1)
(valid,12)
(dictum.,13500)
(neque.,11610)
(contributions,1)
(Ad,1)
Time taken: 18767 ms
```

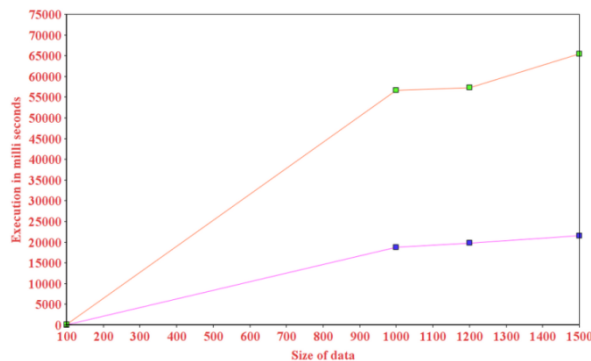
**Fig 11. Total time to process 15000 MB of data is 18767 ms**

## 6 Performance Comparison and Analysis

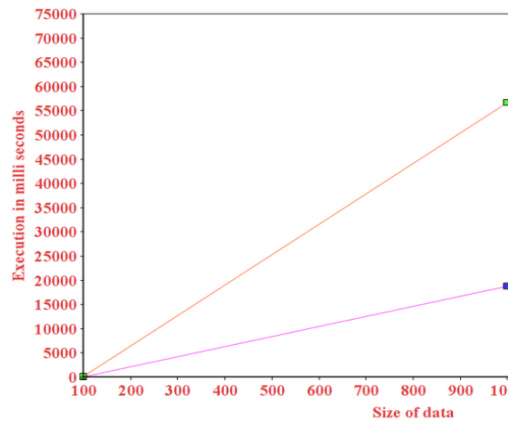
**Table 1.** Execution speeds of data in Traditional vs Novel Big Data Analysis

Dataset No	Size	Traditional Analysis (ms)	Novel Analysis(ms)
1	500MB	163	58
2	1000MB	56660	12767
3	11200MB	57250	13764
4	15000MB	105443	18767

The traditional and novel spark analysis are both used for processing large data sets, but spark the processing time of the spark is decreased by 1/3 of the traditional map reduce model due to in memory Computing where all data is stored and processed from RAM, where as in Traditional Map Reduction the intermediate output of each and every mapper will be stored on the local disk of the data node.



**Graph 1:** Performance comparison on 15000MB data



**Graph 2:** Performance of feature Extraction based on size of images

### Machine learning in Spark Analysis

The Spark framework contains its own machine learning module called MLlib. PySpark is a higher level Python API to use spark with python. For this tutorial, I assume the readers have a basic understanding of Machine Learning and SK-Learn for model building and training. Spark MLlib used the same fit and predict structure as in SK-Learn.

### Regression Analysis

Regression analysis is a reliable way for determining which factors have an influence on a certain subject of interest. The method of doing a regression enables you to accurately establish which elements are most important, which ones may be disregarded, and how these factors impact each other.

$$Y = \alpha + \beta X + \text{error term.}$$

### Naive Bayes Theorem

The Naive Bayes algorithm is a supervised learning method based on the Bayes theorem. It is mostly utilized in text classification with a large training dataset.

A simple explanation of the Naive Bayes algorithm is that it uses two words:

**Naive:** It assumes that the occurrence of one trait is unrelated to other features. As an example, if the fruit is distinguished by its colour, shape, and flavour, then it is an apple. To recognise it as an apple, each aspect independently contributes to the process.

**Bayes:** It's named after the Bayes' Theorem premise.

$$P(A|B) = P(B|A) * P(A) / P(B)$$

### Conclusion

This article compares the performance of both spark and map and discusses the advantages and disadvantages of both above-noted technologies with results on a massive quantity of structured data employing multi-split and multi- mappers, and discusses the feature extraction of voluminous image data sets along with architectural changes for the performance improvement of spark.The novel spark analysis executes 40 percent faster than existing map reduce technologies.

In the above experiment the execution speed of the map reduce engine is directly proportional to the number of mapper and reducer instances in traditional map reduce where as the execution time of novel spark analysis marginally changes with respect to numberof splits.The architecture can be extended for analyzing cloud data with few architectural changes. The drawback of new novel spark analysis is it cant be used on server side data analysis.

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# SMART GRINDING OF Ti6Al4V ALLOY USING A NEWLY DEVELOPED AUGMENTED REALITY (AR) ENHANCED INTELLIGENT GRINDING SYSTEM

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## Abstract

Research has shown that an intelligent grinding system (IGS) improves the reliability and maintenance of grinding operations, as it has the capabilities for real time monitoring and failure prediction. This research addresses the additional feature towards enhancing IGS, through Augmented Reality (AR) techniques. AR will provide a visual monitoring and failure prediction mechanism, as an overlay to the IGS. Thus, allowing the operator to view and compare the grinding process to a simulated model, in real time. This improves the on-line support offered to the operator and has the potential to greatly influence the down time, reliability, quality and inspection of grinding operations. The grinding of the Ti6Al4V alloy results in high temperatures at the grinding wheel - work interfaces and results in a thermal damage. Previous research conducted on IGS, found that operators generally use the acoustic emission (AE) signals and grinding force signatures as a check for characterizing the grinding process. Prediction of the grinding burn in real time offers better monitoring capabilities for mission critical components. In this study the grinding spark characteristics such as: color, spark area and quantity of spark lines was used as a measure for establishing the grinding process behavior. The prediction of the time to reach grinding burn, under several conditions, was established using an artificial neural network (ANN) method. The ANN model is fed with the experimental data and the model was trained to make the predictions of the burn time. Spark images were used to assess the grinding processes in real time, with the use of a thermal imaging camera. To create the AR environment in the IGS system, a FLIR C5 thermal camera was used to capture the object's depth and dimensions. Conclusively, the research investigations on AR and IGS systems, indicate that it could accurately track the grinding process and extract useful information regarding the failure mechanisms of the grinding wheel and workpiece and the system works in near real time.

## Keywords

Intelligent Grinding System, Augmented Reality, Prediction modelling

## 1 INTRODUCTION

Manufacturing processes such as the grinding process, undergoes extensive digitization and the digitized grinding system is often termed as an Intelligent Grinding System (IGS). Through technological advancements, IGS has greatly improved its ability to provide process monitoring and fault diagnosis abilities in real time, thus drastically changing the conventional maintenance and predictive reliability techniques. The main aspects contributing to an IGS system is the grinding science, grinding experiment-based signals and the application of algorithms, to develop a model that can provide predictive process behaviours. Grinding process monitoring is fundamental to creating a robust IGS system. In order to skilfully capture signals and analyse the grinding processes, a variety of techniques are employed. These include, applying fuzzy logic rules, acoustic sensors, designing sensors into the grinding wheel and developing prediction models that can operate in real time [1].

Augmented Reality (AR) is defined as a system that brings together both the real and virtual environment, it is interactive and operates in real time, and both environments are placed in the 3D space [2]. It is important to distinguish between augmented reality and virtual reality. In the case of virtual reality, the real life environment is completely replaced and one sees and interacts with a new form of an environment that is computer generated [2]. This manuscript explores the aspects required to integrate AR in an IGS system, to create an enhanced grinding process monitoring system.

## 2 AR IN MANUFACTURING

Egger and Masood [3] noted that in creating a smart factory, AR is a key technology that allows for a human level of engagement within the manufacturing space. Despite the advancements in AR, there are still areas that require massive improvements in order to create a technological system that is powerful and effective, both for the operator and the manufacturing performance. The authors stress the importance for future AR technologies to be developed with the operator in mind.

Even the most advanced technology can fail during implementation, if the user acceptance is poor, thus resulting in failure. The AR tracking system can use a marker based system. In order to improve the marker based system, which is effected by environmental conditions, algorithms can be improved to identify the markers correctly, under a range of conditions.

It is noted that another form of improving the AR application in the manufacturing, is for the conditions that affect the operator's experience to be integrated into the software. In addition, a system that adapts to the operation, in real time, can greatly enhance the operators experience [3]. If one had to consider the grinding process, the operator uses the grinding noise as a tell of the state of the grinding wheel [4]. Although this practise is commonly used, it is not a valid indicator, as the result can vary from operator to operator. Lee et al. [4] developed an intelligent system using the data from machining sounds and applying deep learning algorithms to determine the grinding wheel wear. Therefore, by implementing an AR system that takes into account the data from visual and audio signals, processed from the IGS, a more visual and interactive prediction can be achieved in real time.

### **2.1 Developing a successful AR application in manufacturing**

Ong et al. [5] highlight that AR systems should aim to improve the manufacturing experience by decreasing the lead time, reducing the cost of production and improving the quality. AR has the potential to be greatly beneficial to the grinding of titanium alloy. The accuracy required on hard materials, results in grinding challenges which in turn impacts on the cost and time required to replace the grinding wheel and restart the machining process. There is an opportunity within this space to be explored, through AR, that will reduce time and cost. By decreasing the time to change the grinding wheel, the overall lead time is reduced. If a successful prediction model can be developed to predict the wear on the grinding wheel in real time, this can improve the quality of the workpiece, as it prevents defects from occurring from a worn grinding wheel. The prediction model will be complimented with an AR system which will provide an interactive visual monitoring system for the operator to perform the grinding process with improved accuracy. Overall, this contributes to a sustainable form of manufacturing as the material wastage of defected components and worn grinding wheels, is reduced. The AR system was devised to align to the following hardware and software requirements, outlined by Ong et al [5].

- The AR system is reliable, simple to use and cost effective.
- The AR system allows the user to easily interact with both the real world and virtual manufacturing space.
- The AR system is devised to be internet based to allow for collaboration, regardless of geographic location.

### **2.2 Grinding spark analysis**

#### **• Predicting grinding burn**

Grinding burn arises from the high grinding wheel- work interface temperatures and results in a poor surface quality. With changes to the microstructure and an increase in grinding wheel wear, this necessitates redressing [6]. Using the grinding burn on the workpiece as a criterion for assessing the wheel life, prior research was able to successfully predict the burn time using an Artificial Neural Network. A back propagation algorithm was used to predict the burn time using various grinding conditions as the inputs, namely the wheel speed, material diameter, in feed and grinding power. In the grinding experiments conducted on C60 steel, the pyrometer measured the spark temperature and found that burn occurred when 900°C was exceeded. The research concluded that spark temperature was a significant determinant of the grinding zone temperature and that burn time dropped as the grinding power increased. It was also found that the 4-3-1 network, in which the hidden layer consists of 3 nodes, displayed a strong correlation between the predicted burn time and the actual burn time [6].

#### **• Predicting normal and faulty grinding conditions**

Another study focused on monitoring the grinding process in real time, to determine whether the condition is normal or faulty [7]. The study characterised a faulty grinding condition by the chatter vibration and burn, which in turn impacts on the surface roughness of the workpiece. Therefore, an online system was established to predict the state. To develop the prediction model, data in the form of signals, thermal images and visual images were acquired. To capture the thermal images, a 16x16 IRISYS IRI 1002 thermal camera was used and measured the grinding zone temperature. A Logitech web camera captured the visual images, in order to determine the spark area.

Image processing was conducted using two methods, namely binary thresholding and image processing. The binary thresholding method was applied to the visual images. The method determines the spark area in the grinding zone, in terms of pixels. Each pixel that contains a grinding spark is represented with white, whilst the background (non-spark) pixels is represented by black.

The image processing method was applied to thermal images and involved subtracting the image with no sparks (reference image) from an image with sparks that you want to determine the sparks from. The output is an image with only sparks.

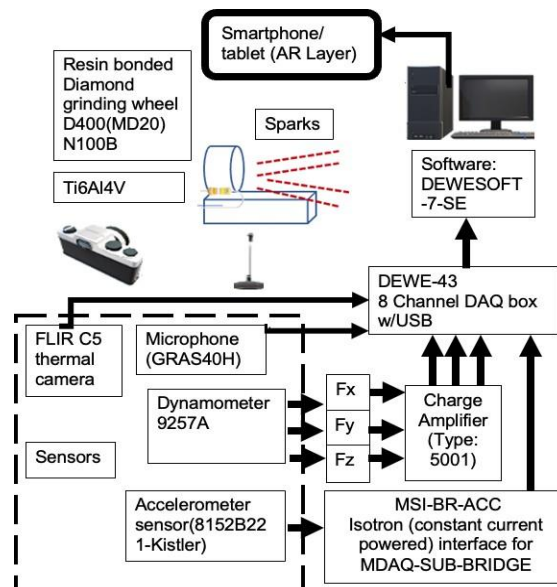
The results from the experiment found that the spark area was a significant indicator of the grinding zone temperature as an increase in the spark area, corresponded to an increase in the grinding zone temperature. The backpropagation neural network was applied to the visual images of the spark area in order to predict a normal or faulty grinding conditions with a 95% accuracy.

The radial basis neural network was applied to the thermal images to predict the grinding conditions with close to a 100% accuracy [7].

### 3 EXPERIMENT SETUP AND GRINDING CONDITIONS

Figure 1 is the experimental set up. The grinding of Titanium alloy (Ti6Al4V) uses resin bonded Diamond grinding wheel D400(MD20) N100B. The grinding conditions are; wheel speed of 30 m/s, a feed rate of 3000 – 30000 mm/min and a depth of grinding 0-10  $\mu\text{m}$ . The audio signals were captured using a microphone (GRAS40H) and the grinding behaviour with an accelerometer sensor (8152B221-Kistler). The dynamometer was used to acquire the grinding forces, accelerometer to measure the vibrational change and thermal camera to measure the temperature in the grinding zone. The experimental study was focused on thermal analysis of the grinding process in determining the state of the grinding wheel in terms of wear. The temperatures obtained from the grinding zone, was compared against the spark images in the grinding zone obtained from the thermal camera.

**Figure 1-** Grinding experimental set up for feature extraction and correlations

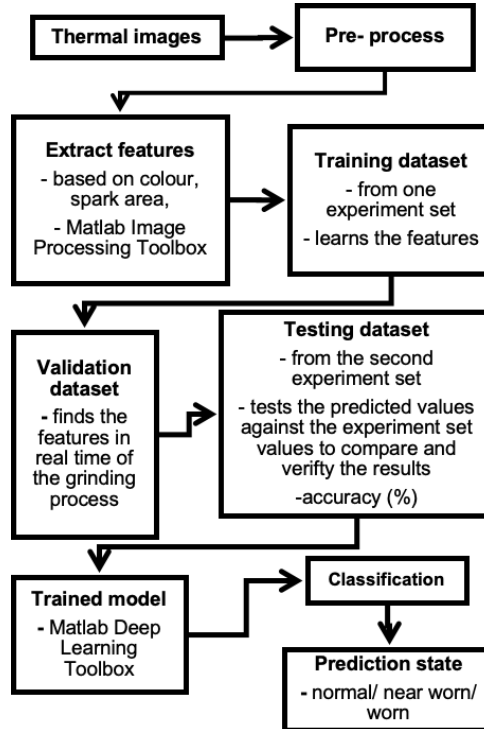


The thermal camera selected for the study, is the FLIR C5 model [8, 9]. The camera detects temperatures in the range -20 to 400  $^{\circ}\text{C}$ . The frequency is 8.7 Hz which translates to 8.7 frames per second. The camera is classified as long wave as it has a spectral range of 8-14  $\mu\text{m}$ , which is the range of wavelengths that can be detected. The fixed focus feature of the camera suggests accurate measurements of temperature will be captured as the camera will always be in focus. The noise equivalent temperature difference (NETD), which is the smallest temperature difference between the target and the background, is less than 70 mK. The resolution of the camera is 160 x 120 i.e., 19200 pixels. The data obtained from the measurement devices was conveyed to Dewesoft Data Acquisition software in real time, where it was further analysed. The thermal images displayed did undergo image processing on MATLAB and thermal studio software. The prediction model enables implementation in real time, and MATLAB was used along with the Deep Learning toolbox.

The augmented reality layer created for the IGS, have used both Google ARCore and Unity softwares for development. The AR monitoring system shall assess the grinding wheel state in real time and provide visual prompts/ notifications to the operator.

#### 4 PROPOSED FRAMEWORK FOR PREDICTION MODEL OF WHEEL WEAR

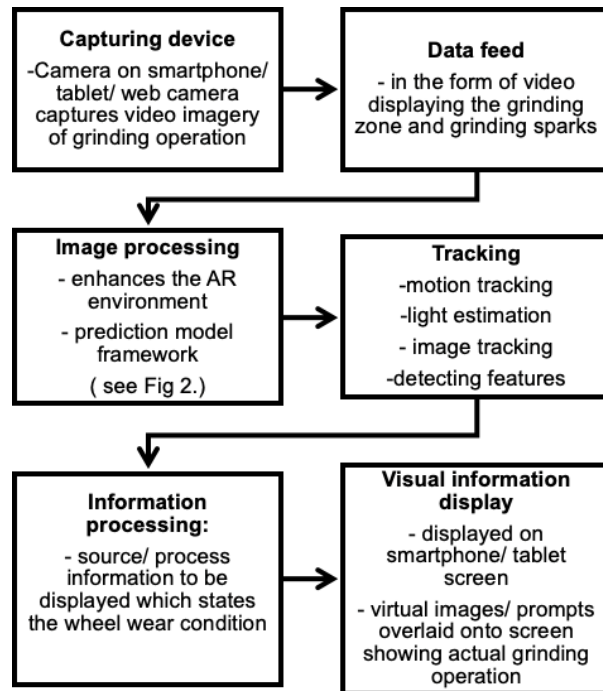
The framework developed by Lee et al. [4] in monitoring the grinding wheel wear, considered the audio signals from the machining process. The extracted features from the audio signals in each experiment, were applied to a convolution neural network (CNN), in order to classify the extracted features into categories. This was applied in determining the grinding wheel condition. The classification used the back propagation algorithm. The framework (See Fig.2) was adapted for thermal imaging processing, which would lead to predicting wheel wear in terms of normal, approaching worn state and worn.



**Figure 2-** Proposed framework of prediction model based on thermal imaging analysis

#### 5 AR SOFTWARE AND COMPONENTS

Google ARCore is an open-source library that is used to digitally overlay the information onto the actual environment, whilst Unity is the software which provides the 3D rendering functionality, which converts 3D models into 2D images that can be displayed onto the tablet or smartphone [10]. The built-in features of Google ARCore are instrumental in creating the AR application: motion tracking, light estimation, image tracking and detecting feature points. The key components of an AR environment is the capturing device (camera), data feed, image processing, tracking capabilities, information processing and visual information display [11]. Shown in Fig. 3, was the development from Wang et al. [11], which presented a diagram of the AR environment for assembly. Although this study will not focus on assembly, the diagram served as a useful reference to understand the elements of AR in the case of a monitoring system for the prediction model of wheel wear.



**Figure 3-** AR components used for the study

## 6 IMAGE PROCESSING

One of the key aspects of this study involves image processing. MATLAB was used to conduct the image processing. The process involves the following key stages: import, pre-process, segment, post-process, and classification [12]. The importing stage involves bringing the image into MATLAB, working with the grey scale and colour images to extract colour planes and intensities and adjusting the contrast. Images in MATLAB are stored as arrays in which every element of the array represents the pixel of the image. The number of array rows is equivalent to the images height, and the number of columns is equivalent to the image's width in pixels. In terms of grey scale images, each element in the array is stored by a number between 0 and 255, whereby the low values are low intensity (dark areas) and the higher values are high intensity (bright areas). For colour images, the elements in the array are similarly stored as numbers between 0 and 255, however, the colour image is stored as a combination of the intensity of 3 colours: red, green and blue (RGB). The colour plane for each of the RGB values is transformed to a grey image, where the higher values represent the brightness or intensity of the specific colour.

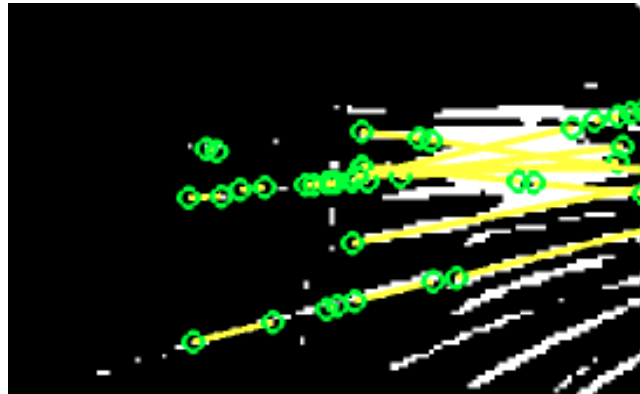
The segmenting stage involves separating the image into the characteristics shown on the image, in order to create binary images from the pixel values. The binary image comprised of 1 for the parts of the image you want to keep, and 0 for the parts to be excluded. Using the histogram feature to display the intensities of the grey image, is useful in identifying which values the pixels are concentrated at, and determining whether the image contains more darkness or brightness. Depending upon the image intensities, a threshold was introduced and hence the displayed information contained the necessary features. When dealing with many images, a MATLAB function to identify the best threshold for the image is used.

Pre- and post-processing techniques were performed to improve the segmentation, as well as filtering the noise and removing the background. An averaging filter is used to remove the noise from the image. Once the filter is applied to smooth out the image, a binary image was produced, which is made of two pixels to represent the bright and dark. "Opening" an image was applied to emphasize the dark aspects of the image, and "closing" an image was applied to emphasize the bright regions. This is used to isolate portions of the image.

Classification is developing a metric for the image and then applying this metric across multiple images. In order to process hundreds of images, a datastore is created to access these numerous files. By using a for loop, the program classified the image and it is applied across all image files in the folder [12].

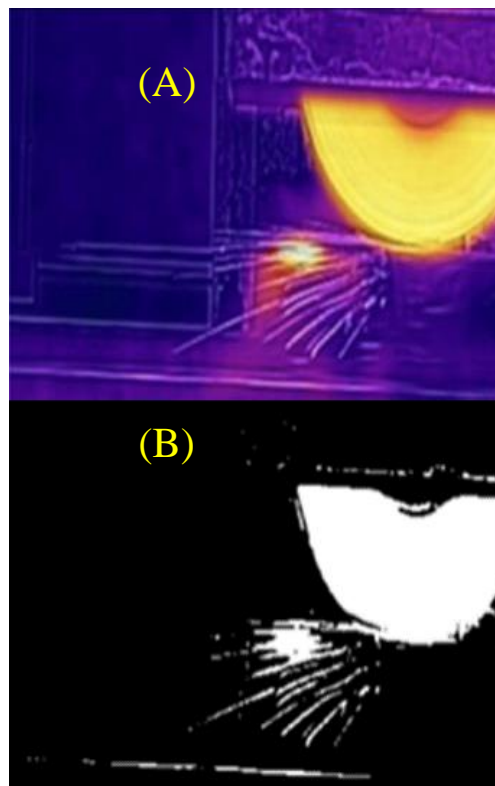
The following code sequences in the MATLAB program was developed in order to extract digital information from the image. In the program, a binary image is generated from a thermal image, the spark lines in the area of interest were isolated using the crop feature, lines were identified using the Hough Transform and thereafter plotted and counted [13], [14].

The program in MATLAB converted the initial thermal image to a grey image, thereafter it converted the grey image to black and white (binary image).



**Figure 6-** Identified spark lines (represented as yellow lines) with endpoints (green circles) from Hough Transform

The program then determined the quantity of sparks within the cropped spark area. Based on the code, the number of spark lines identified from this image is 22.



**Figure 4-** Thermal image (A) converted to black and (B) white image

The area of interest is then cropped from the binary image by stating the size and position of the cropping rectangle.

Thereafter, the Hough Transform was applied. The purpose of the Hough Transform is to identify the lines in the black and white image. It does this by representing a line in terms of  $\rho$  and  $\theta$ .

$$\rho = x \cos \theta + y \sin \theta \quad (1)$$

Where:

$\rho$ - distance from origin to line, at  $90^\circ$  to the vector

$\theta$ - angle from the x-axis to the vector, clockwise from positive x- axis

The 'houghpeaks' function in MATLAB returns the row and column co-ordinates of the Hough Transform, which are used to search for lines in the binary image. Thereafter, the identified lines are plotted on the binary image.

**Figure 5-** MATLAB code for Hough Transform

```
%% Hough transform

% displays peaks on Hough matrix
[H,T,R] = hough(I_BW_crop);
imshow(H,[],'XData',T,'YData',R,'InitialMagnification','fit');
xlabel('\theta'),ylabel('\rho');
axis on, axis normal, hold on;

% detecting lines in black and white image
P = houghpeaks(H,8,'threshold',ceil(0.5*max(H(:)))));
x = T(P(:,2));
y = R(P(:,1));
lines = houghlines(I_BW_crop,T,R,P,'Fillgap',5,'Minlength',5);
figure
imshow(I_BW_crop)
hold on
max_len = 0;
```

## 7 CONCLUSIONS

Previous research found that grinding sparks served as the basis for determining the carbon content in steel and predictions for grinding burn, faulty and normal grinding operations, and the material removal rate. Grinding sparks have been analysed with features such as quantity, spark area, colour, and texture. This study has revealed a method to analyse the spark features: colour, spark area, line features and quantity of lines towards predicting the state of the wheel wear which is used as an early warning system of grinding wheel failure. The prediction model forms part of the image processing component in the AR environment. The influence of AR in IGS allows the prediction model to be translated to a dynamic visual display in the form of text and images. This contributes to sharing knowledge expertise to the operator in real time and improves wheel wear monitoring capabilities, which will in turn reduce down-time and manufacturing costs.

## 8 ACKNOWLEDGEMENTS

This project was supported by fund NRF GRANT: INCENTIVE FUNDING FOR RATED RESEARCHERS (IPRR) –South Africa through Reference: Reference: RA191118492767 and Grant No: 136118. The views expressed and the conclusions drawn in this paper are those of the authors and cannot necessarily be attributed to the references.

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## DESIGN AND FABRICATION OF MULTI AXIS SOLAR TRACKER

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### ABSTRACT

The world has been dependent on the fossil fuels for generation of power. Solar energy is one of the purest forms of energy and it is available in abundant form. This abundant energy, if used efficiently can maximize the output power. In a static solar panel, the sun aligns with the panel only for some particular time of the day.

The aim of the paper is to design and fabricate very precise solar tracker using **IoT**. We are developing a multi axis solar tracker which automatically changes its position and tracks the position of the sun using **LDR** sensors and **maximizes the output power**.

### INTRODUCTION

For many decades we are still majorly dependent on coal thermal production for the generation of electricity. Coal is one of the non-renewable sources of energy and a form of conventional fuels and it is not an everlasting solution for power generation. The future crises can be averted if we can change the dependability to non-conventional sources. Under this we have wind, hydro, geothermal and solar energy sources. And in our project we are using solar is because-

- solar energy is one of the most abundant
- all time available
- the purest form of energy available
- pollution free
- reliable source

The government and the people are taking steps to generate electricity from the solar panels, but these solar panels are in static position, North-South direction for countries above the equator and South-North direction below the equator. These static solar panel receives very less amount of solar rays and hence very less electricity is generated.

In this project we are developing a multi-axis solar tracker using IoT to prove that the use of a multi-axis solar tracker is much more efficient than a static solar panel.

The aim of the project is to determine and compare the result of efficiencies between a multi-axis solar tracker and a static solar panel.

This project is divided into 2 parts, the hardware components and the software. The hardware parts consist of 2 solar panels (primary and secondary) to absorb the solar rays, Arduino the processing unit, 4 LDR sensors that are used to locate the sun's position by sensing the sun's rays, 2 servo motors which helps in motion control of the solar panels both horizontally and vertically, belt drive is used to control the motion of the secondary panel and the resistors.

The software part consists of the code which is the instruction stored in the Arduino which then processes it depending on the input given by the LDR sensors and the output is given through servo motors. We use C program in Arduino IDE for coding purposes.

In this project we will be developing a solar tracker where only one tracking system can be used and multi solar panels can be operated using belt drive system.

**Keywords** – IoT, solar panel, belt driven system, Arduino, LDR sensors.

## COMPONENTS

### Solar Panel



A solar panel is a combination of photo-voltaic cells mounted on a frame, these panels use solar radiations as source of energy to generate direct current. In this project we are using 6volt,100ma panel. The solar panels rotate with the help of the 2 servo motors.

### Arduino UNO



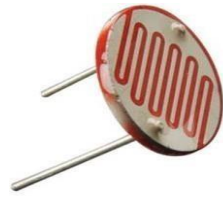
In this project we are using Arduino Uno R3 microcontroller. The Arduino consists of 20 input / output digital pins. The programs are composed and loaded onto the Arduino. This makes it very easy working with embedded electronics. The Arduino R3 used is the latest revised version of the Arduino UNO. We connect the servo motors and the LDR sensors to the Arduino and it processes the data.

### Servo motors



Servo motor is a closed mechanism in which feedbacks are given. A servo motor consists a DC motor which is connected to control circuit and gear system. The feedback system helps in positional feedback. And in this project we are using 2 servo motors, one for the horizontal rotation and the other for vertical rotation of the solar panels.

## LDR sensors



LDR stands for Light Dependent Resistor that changes resistance as the light level changes. As the luminosity increases resistance of the semiconductor decreases. The LDR contains a comparison unit which further transfers this information to the microcontroller.

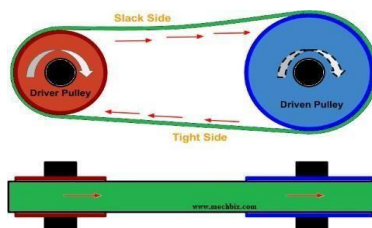
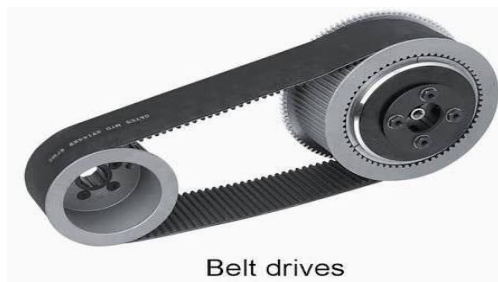
The top right and the bottom right LDR sensors are used to track the sun's movement from North-South direction. The top left and the bottom left LDRs are used to track the sun's movement from East-West direction

## Resistors



Resistor are constructed of metal wire or carbon wire. These wires are made to maintain resistance stability for various environmental conditions. These resistors are used in circuits to adjust the flow of current or electrical signal.

## Belt Drive System



Belt drive has a pair of pulley which are in parallel to each other and these are connected by encircling belt which is made of flexible material. And this can be used to transfer rotary motion from one shaft to another using the belt.

There are 5 types of Belt Drive system-

- Crossed belt drive
- Open belt drive
- V belt drive
- Flat belt drive
- Timing belt drive

In this project we will be using the open belt drive system.

## **METHODOLOGY**

A device which tracks the position of the sun throughout the day and the absorbs the solar rays is called solar tracking system.

There are 2 types of solar tracking system-

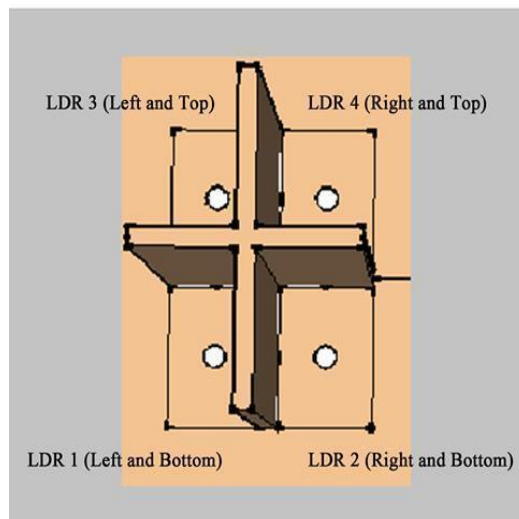
- a) Single-axis solar tracker
- b) Multi-axis solar tracker

In this project we prefer multi axis solar tracker because in single axis solar tracker, the solar panel rotate only in vertical direction i.e. north-south direction.

In multi-axis tracking system, the sun rays are captured by the solar panel to the maximum by tracking the movement of the sun in different directions.

This tracker system has both a horizontal and a vertical axle and so can track the sun's apparent motion in any direction.

To develop this, we mainly use the 4 LDR sensors, one pair senses the position of sun in east-west direction and the other pair is used to locate the position of the sun in north-south direction. The working of the LDR is simple, when the light from the sun hits the sensors and as the brightness level increases the resistance decreases and becomes a conductor and it creates electric signal and when luminance brightness decreases the resistance of the LDR increases. And the electric signal which was created is passed to the Arduino.



The Arduino which then computes the signal and regulates the movement of the servo motors in both horizontal and vertical axes. When the servo motors rotate, the solar panel is aligned with sun. When sunlight hits the cell, electrons that reach the electric field are propelled out through the metal conductor strips atop the cell.

Since the solar panel is directly aligned with the sun's rays, maximum power is generated.

The belt drive system is connected to the vertical servo motor. And this belt drive is used to control the vertical movement of the secondary solar panel. The horizontal movement of both primary and secondary panel is controlled by the horizontal servo motor. And since we use 2 solar panels in a single tracking system the power generated will be maximized.

When the solar panel rotates in the horizontal direction an angle is created from due north and this angle is called as azimuth angle. This angle can be calculated using the formula:

$$\cos(A) = \frac{[\sin(a) * \sin(L)] - \sin(D)}{\cos(a) * \cos(L)}$$



Where, A=azimuth angle a = altitude angle

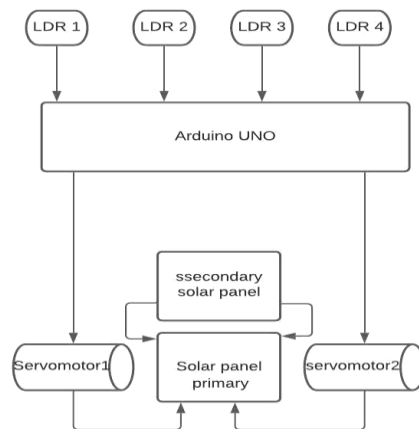
D=declination angle L=latitude

This can also be written as Z=360-d Where, d=distance in form of degrees from due north

When the solar panel moves in the vertical direction an angle is created between the solar panel and the sun's rays and this is called zenith angle. It can be calculated using the formula using:

Zenith angle = 90deg - elevation

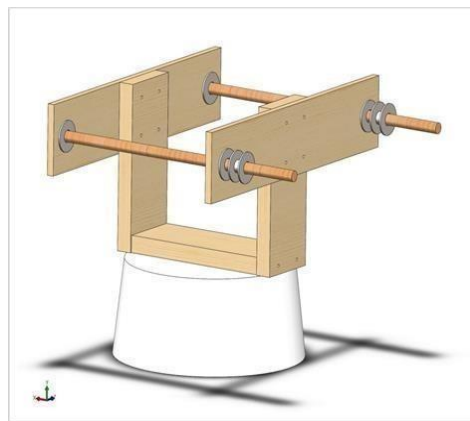
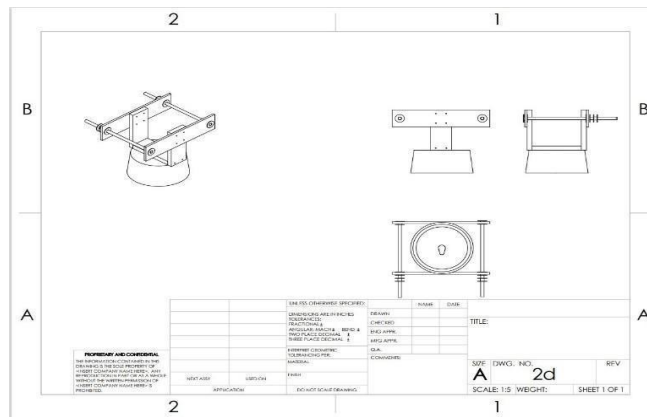
**BLOCK DIAGRAM**



In this block diagram we can see LDRs 1,2,3&4 are connected to the Arduino.

This computes the input signal and the output is given through the servo motor. As the servo motors rotates the solar panel rotates in which ever position the sun is positioned.

**DESIGN AND FABRICATION**



**RESULTS**

As a result, we successfully designed and fabricated a multi-axis solar tracking system in which a secondary solar panel was fixed and its motion were controlled using a belt drive and a single tracking system.

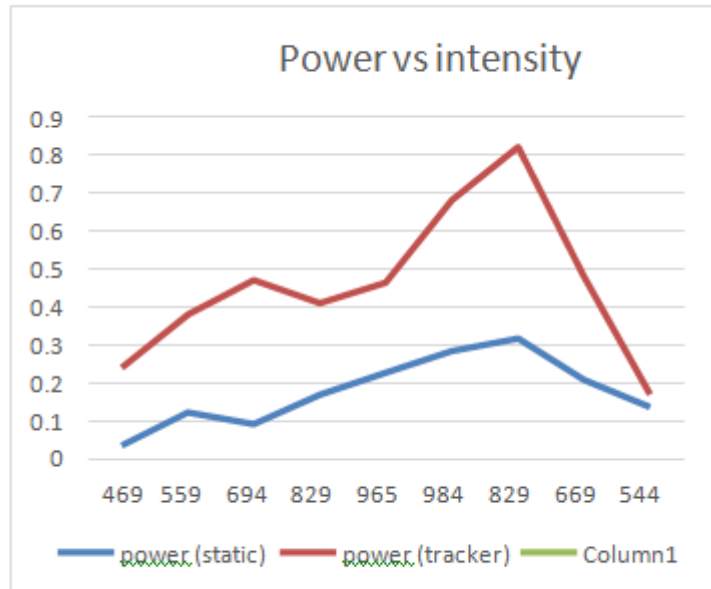
For a given duration, both the static and the multi-axis solar panel were kept under the sun light to compare the output of both and the readings were noted down, tabulated and the graphs.

**Tabular Column**

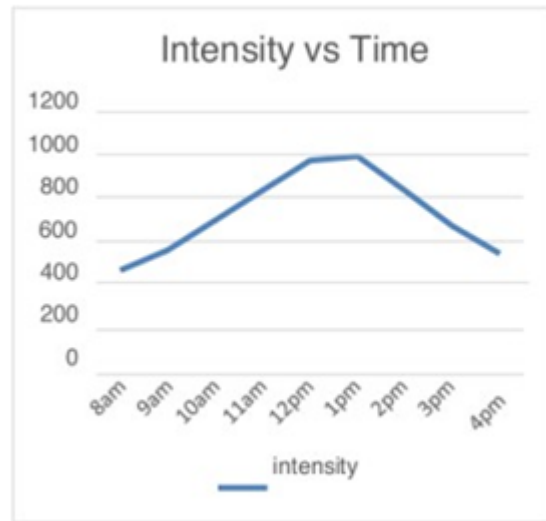
**Graphs**

Intensity kwh	Power Watt (Static)
469	0.036
559	0.123
694	0.092
829	0.169
965	0.227
984	0.284
829	0.317
669	0.209
544	0.137

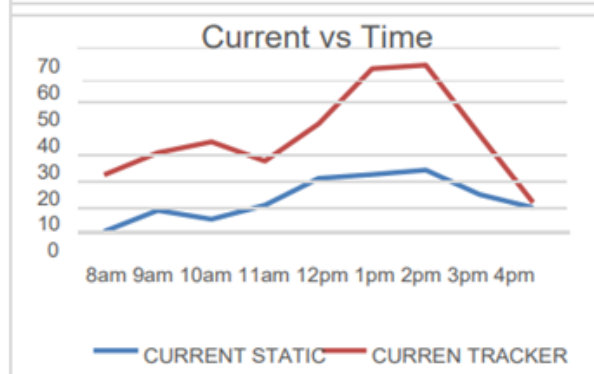
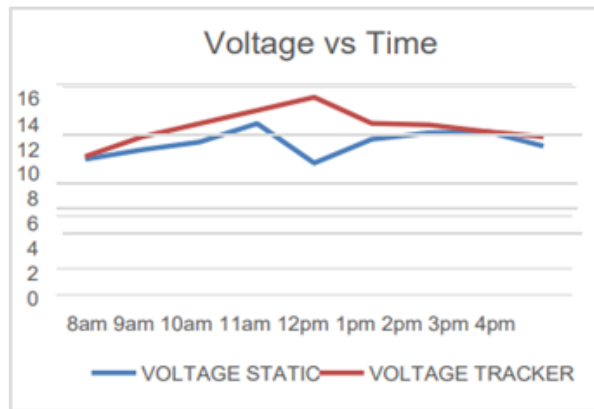
Intensity kwh	Power watt (tracker)
469	0.24
559	0.38
694	0.47
829	0.41
965	0.464
984	0.68
829	0.82
669	0.48
544	0.17



Time hr	Intensity kwh
8am	469
9am	559
10am	694
11am	829
12pm	965
1pm	984
2pm	829
3pm	669
4pm	544

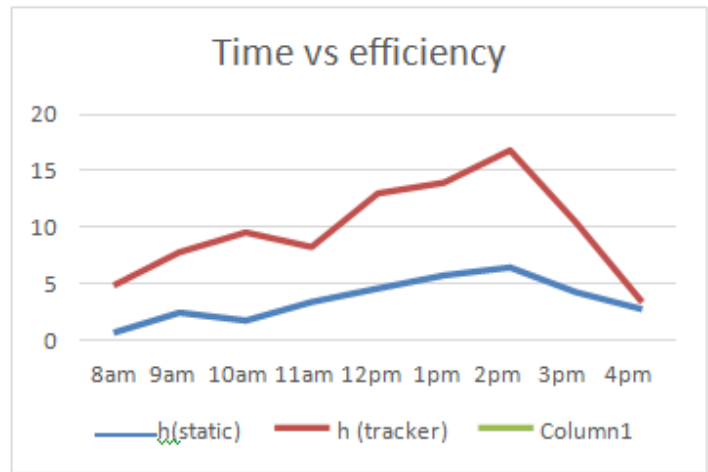


Current ma (static)	Current ma (tracker)	Voltage V (static)	Voltage V (tracker)
3..5	24	10.3	10
11.2	32	11	12
8	36	11	13
13	29	13	14
22.75	42.5	10	15
24.1	52.5	11.8	13.02
25.8	63.8	12.3	12.9
16.92	38.6	12.4	13.9
12.15	14	11.3	12





Time hr	$\eta$ (static)	$\eta$ (tracker)
8am	0.74	4.89
9am	2.51	7.84
10am	1.81	9.55
11am	3.45	8.29
12pm	4.64	13.01
1pm	5.8	13.95
2pm	6.48	16.79
3pm	4.28	10.45
4pm	2.8	3.43



## CONCLUSION

We successfully designed and fabricated a multi-axis solar working on a belt drive system, where the secondary panel motion is controlled by the belt drive. And was tested and compared between static panel and the solar tracker and the conclusion was drawn that the multi-axis solar tracker's efficiency is much higher than the static panel. And in future we can add more panels to a single tracking system and to reduce the temperature of the solar panel.

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# FRAGILITY RESPONSE OF A COMMERCIAL COMPLEX UNDER EARTHQUAKE LOADING

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## Abstract

The life expectancy of the building is generally taken to be as 100 years. Which is frequently analysed by different approximation techniques. Eminent researchers have suggested, fragility analysis as the best way to find the failure probability. And further can be used to assess the life span and stability of structure.

Another technique, Pushover analysis, uses a simplified nonlinear technique to estimate seismic structural deflections. The Building redesigns itself during earthquakes. As individual components of a structure yield or fail, the dynamic forces on the building is going to be shifted to other components.

The structure considered in the study is a business complex of Ground+5 storey, located in Yadagir, Karnataka, India. It has been analysed using SAP-2000 software.

For TYPE I SOIL and FOR ZONE II, the value of seismic co - efficients  $C_a = 0.05$ ,  $C_v = 0.05$ , the value of spectral acceleration and spectral displacement is found to be 0.066 and 0.0090 respectively. And also at performance point, the shear value is 1005 kN and displacement of 1.2mm. also, effective time period of performance is 0.734 seconds.

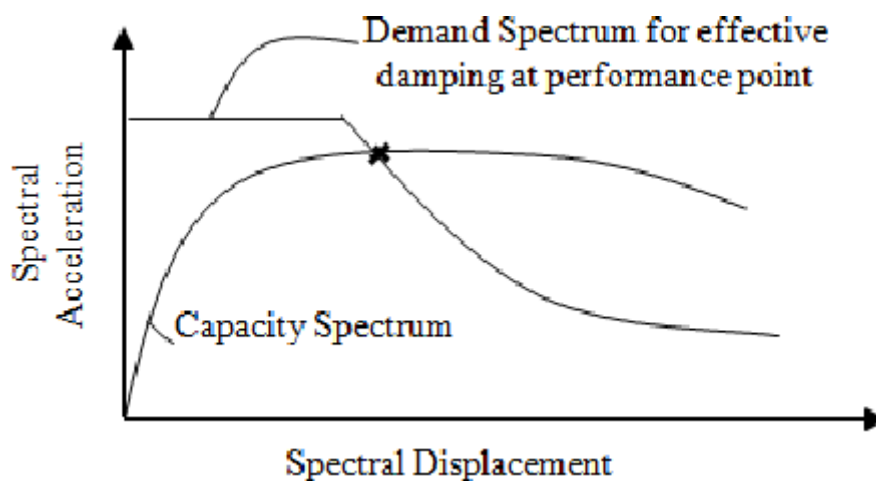
Finally, to Conclude the Analysis is safe for Seismic Zone II and not for Zone V, However the site location is in Seismic Zone II, Therefore, The Construction is Sound and Safe.

**Keywords: Fragility, Stochastic, Pushover, Fragility Curve, Probability of failures.**

## Introduction:

In the wake of the recent earthquakes, which inflicted great losses on modern buildings, renewed calls for investigations on the seismic safety. Fragility relationship is the key component in seismic loss assessment, have emerged as a result of this pressing need. A structure's susceptibility to ground damage can be described as its seismic vulnerability. a given degree of shaking [1] The purpose of a vulnerability assessment is to find out the likelihood of various building types sustaining damage as a result of an earthquake. The damage assessment functions should be developed to quantify the amount of damage resulting from a specific level of earthquake. Once you have finished a vulnerability assessment, the information gained is directly applicable to estimation of the potential losses. The current study is specifically designed to evaluate the seismic performance of various RC frames, including regular and setback designs, on hard ground and for Seismic Zones II and III using the Response Spectrum Method of analysis.

The various methods adopted in various studies to measure the seismic performance of the structures are Time History Analysis, Pushover Analysis, Dynamic Analysis. [2].

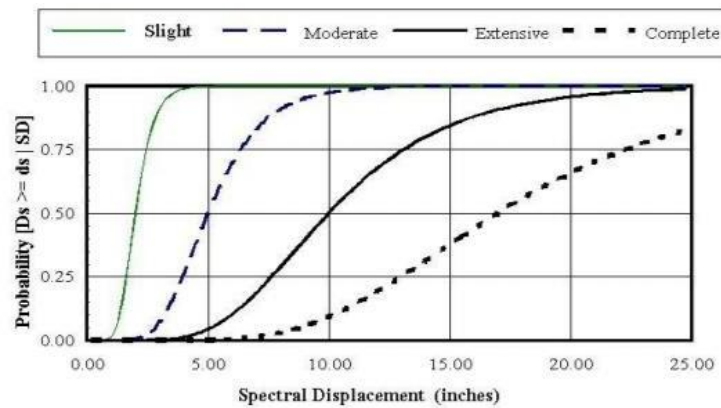


**Figure 1: Capacity Spectrum method (2)**

Some expertly crafted [4] and [5] for measuring seismic fragility of RCC frames with variations. ELF procedure is followed as per UBC 97 code is effective in predicting seismic response of mass ratio five. This study [7] investigated how different types of vertical irregularities impacted the building's seismic response. Goel and Chopra [8] created a formula for resisting the period of a moment in structures. Seismic response was not substantially affected by the vast mass irregularity. [9]. Das and Nau [10] The seismic response of multi-story buildings with stiffness and strength irregularity as parameters was analysed using the equivalent lateral force approach given by UBC 97. It was discovered that the reaction varied around the irregularities. Based on the plastic hinge distributions and rotations, Choi [11] found that the frames with mass irregularity were especially responsible for significant seismic response. EF procedure overestimates the seismic response, according to analytical studies conducted by Ayidin [12]. According to Athanassiadou [13], the designs that used setback frames showed better seismic performance. In this study, the authors developed expressions for seismic response parameters for multi-story steel frames, using regression analysis. Based on their analytical studies, Sehgal et al. [16] discovered that stiffness and setback irregularities could lead to the maximum seismic response. In this study, conducted by Michael et al. (17), Studies discovered that the seismic fragility of RC framed and wall-frame structures constructed to EN-Eurocodes is significantly larger than previously assumed. According to the results of Varadharajan et al. [18], the performance of the building varies greatly near the locality of irregularity. [19] IS 456, which assert that setback framed structures have an inelastic seismic response. According to the European Commission's guidelines, the results of the analytical study are too conservative in their estimation of seismic demands. The idea here is that variation results from the presence of irregularity.

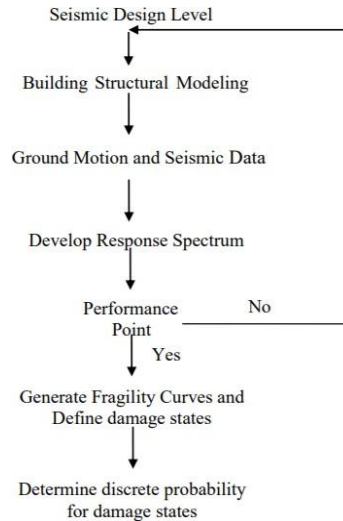
**Methodology:**

Fragility curves are used to evaluate the level of building damage [21]. An assessment of the probability of reaching or exceeding structural and non-structural damage states is achieved by creating a fragility curve based on the median spectral response estimate, for example, a displacement amplitude. When fragility curves are applied, the extent of damage a system takes can be separated into four damage states: slight, moderate, extensive, and complete. It is as easy to find discrete damage-state probabilities as it is to calculate cumulative damage-state probabilities. For fragility curves, each median demand parameter (e.g., spectral displacement) for the threshold of that damage state corresponds to the threshold of that damage state, and the variation in that damage state is defined by that particular demand parameter. Fig. 3 depicts the typical fragility curve. Fig. 4 illustrates the seven-step process as explained in [21] HAZUS-MH MR1.



**Figure 3. Building fragility curves with a log-normal distribution [21]**

**Figure 4. Flowchart to develop probability damage matrix (22)Theoretical fragility curves are described as below ([22] and [23]):**



Categories of Structures and The Classification Buildings are classed according to their occupancy class, usage, or structure. Seismic Design Levels and Construction Quality of Different building's performance during an earthquake is likely to vary. States of Damage, Individual damage statuses are specified for a building's structural and non-structural systems. Determination of the Cumulative Probability of Damage in a Specific Damage State

[24] It is assumed that the damage function is lognormal.

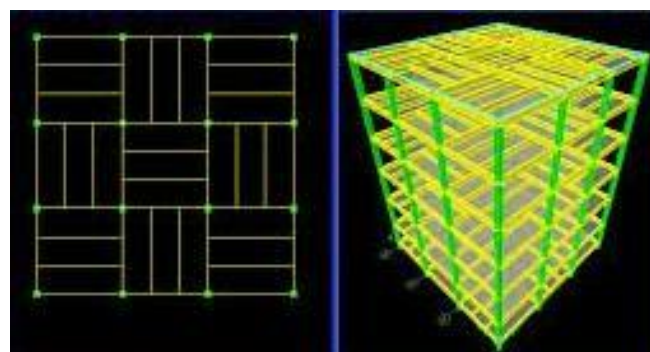
$$P\left[\frac{ds}{S_d}\right] = \varphi\left[\left(\frac{1}{\beta ds}\right) \ln\left(\frac{S_d}{S_{d,ds}}\right)\right]$$

**Table 1: Damage state thresholds (Barbat [26])**

Median Spectral Displacement	Damage State
$\bar{S}_{d,S} = 0.7 S_{d,y}$	Slight
$\bar{S}_{d,M} = S_{d,y}$	Moderate
$\bar{S}_{d,E} = S_{d,y} + 0.25 (S_{d,u} - S_{d,y})$	Extensive
$\bar{S}_{d,C} = S_{d,u}$	Complete

Then, using the method above, the width of the struts is computed and obtained as follows. External infills Struts (W1)ext = 0.638 m

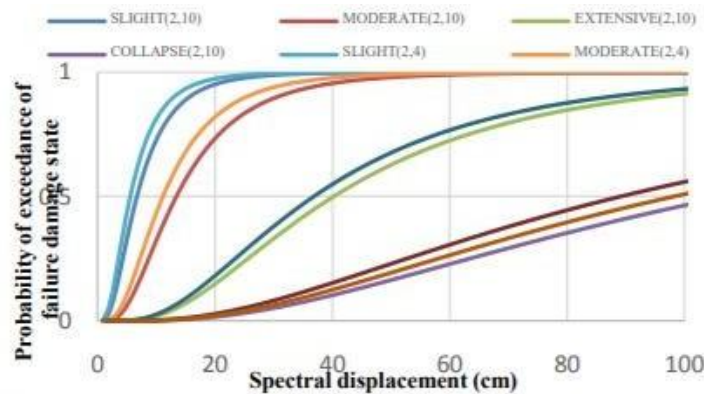
Internal infills Struts (W1)int = 0.683 m External infills Struts (W2)ext = 0.590 m Struts in internal infills (W2)int = 0.635 m



**Figure 5. Elevation and plan of a two-bay construction with setbacks and a shear wall in the second bay.**

## Results and Discussion:

Seismic fragility analysis for structures with vertical setbacks The four-story bare frames with vertical setbacks are given at various levels across the bays. These frames are then subjected to pushover analysis [30] to determine their probability of exceeding for various damage conditions. Additional fragility curves were created.



**Figure 6. Fragility curves for setbacks for typical bay**

As illustrated in Figure 6, When setback is given on the fourth level, the likelihood of failure in different damage stages is higher regardless of whether the damage stages are done on the first, second, or third floors. Using these graphs, we can see that the damage states of severe damage, moderate damage, and small damage (for example, collapse, extensive damage, and moderate damage) are more common in the fourth level, while the presence of setbacks is shown on early floors. RC building designers should exercise more care when setting back their designs, and it is strongly suggested that such designs not be set back on the middle levels.

## Conclusions:

Conventional RC frames and vertically geometrical irregular frames have been investigated for varied intensity areas and soil conditions when investigating for the seismic susceptibility of RC frames and irregular frames. Fragility curves have been constructed for the various HAZUS manual performance levels for the buildings above.[21].

For TYPE I SOIL and FOR ZONE II, the value of seismic co - efficient  $C_a = 0.05$ ,  $C_v$

$= 0.05$ , the value of spectral acceleration and spectral displacement is found to be 0.066 and 0.0090 respectively. And also at performance point, the shear value is 1005 kN and displacement of 1.2mm. also, effective time period of performance is 0.734 seconds.

Based on the analysis that has been done, the following findings are apparent.

1. In contrast to frames with setbacks at other stories, it was revealed that setback injuries are likely in RC frames when they are located at middle storey.
2. The likelihood of damage increases by 5%, 10%, and 20% when compared to RC frames with infill walls.
3. Structurally, RC frames that are made with infill walls are less susceptible to earthquakes than their RC frame counterparts without infill walls for all damage states.
4. The consideration of infill wall (diagonal strut) stiffness has a greater impact on the building with a middle-storey setback as compared to buildings with a middle-storey setback that do not have diagonal struts in 3rd bay.
5. R.C. building resistance to seismic motion can be improved by increasing the stiffness of the infill walls.
6. This fragility analysis is extremely valuable while revising the seismic zones; it enables the investigation condition of the structure.

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# IOT BASED SURVEILLANCE WAR ROBOT

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**Abstract**— In our proposed paper, we provide a new approach to this technology in the realm of robots for military monitoring, based on the Internet of Things (IoT). This robot, which is designed to replace humans in combat zones, detects strange things, monitors temperature, and detects the presence of live individuals and metals within the field. The latest smart technology based on the Internet of Things (IoT) enables all linked devices to upgrade themselves in response to disturbances in the environment and to be ready to adapt in any situation. We will monitor and repair the sector's conditions. Robots are frequently controlled in a variety of situations.

**Keywords** - ARMLPC2148 microcontroller ,metal detector,ultra sonic sensor, zigbee ,wireless camera.

## I. INTRODUCTION

A robot is an electronic device that can perform work based on a programme, so replacing human efforts, producing highly desirable results, and effortlessly overcoming human constraints.

We focused on monitoring events in combat areas and areas outside human reach in this paper. The Indian government spends more money on military and security, and there are various border concerns in locations like Kashmir and Ladakh, as well as terrorism threats in Mumbai. Investigating these locations during the disaster is a human threat. In recent wars, the military was using Daksh forces.

The advantages of this robot is that it assist to keep the area under control by providing regular surveillance. It also overcomes the drawbacks of a limited frequency range by means of Internet of Things concept to receive information from the bot and to manage the bot's movement. These benefits include the ability to use the robot in autonomous mode, which involves the bot changing its route when an obstruction is spotted ahead of it using ultrasonic sensors. The sensing element sensor placed beneath the robot is live streamed by the night-sight camera. With the help of GPS, it also sends the precise location of the robot.

## RELATED WORK

[1] Wai Mo MoKhaing, KyawThiha's project uses the PIC 16F628A and PIC 16F877 to create a mobility spy robot with a foreign controller. A wireless camera, an antenna, a battery, and four movable wheels make up the spy robot. Two separate PICs are used to remotely operate and manage the Spy robot via a wireless connection. The information surrounding the robot is recorded using a CCD camera. The remote controller has a four-bit LCD display that outputs user commands. The CCD is brought up with LED that is connected by wiring to use the Spy robot in a dark place at night. Module signals are commonly used during wireless remote systems to transmit and receive wireless logic signals in order to monitor the motors of the Spy robot system. The Remote Operated Spy Robot system uses three Brush DC motors along with two L298N. The comb DC motors will not be driven by the L298N. The Remote Operated Spy Robot device described in this study could be a small robot developed for spying, surveillance, and inspection.

[2] The project of AaruniJha, Apoorva Singh, Ravinder Turna, and Sakshi Chauhanin aims at developing an RF-based surveillance robot system with a wireless camera that will limit the number of human victims. Using a wireless camera, this robot transmits a signal to the bottom station. One of the project's key applications will be reviewed, which will involve employing an Android-based smart phone to control the robot's movement. The robot transmits a signal to an RF receiver mounted on the robot through the bottom station's RF transmitter. This function allows the robot to send real-time films with vision capabilities while remaining undetected to attackers in the fighting zone.

[3] The Ghanem Osman ElhajAbdalla,T. Veeramanikandasamyin project focuses on numerous military divisions that use robots to perform hazardous things that soldiers cannot. During this project, a Raspbian-based spy robot platform with a remote monitoring and control algorithm via the Internet of Things was evolved, which can save human lives, eliminates unnecessary mistake, and protect the country from attackers. The Raspberry Pi (tiny single-board computer), night-sight pi, cameras, and sensors make up the spy robot system. The knowledge of PIR sensor recognition of living objects is communicated to users via the online server, and the pi camera captures the moving object, which is concurrently posted inside the webpage.

The user has entered the mark room and clicks on the wheel drive remote control on the webpage to access the robot. To avoid a collision, a robot's movement is also automatically controlled by an obstacle detection sensor.

This spy robot-assisted closed-circuit television system can be modified for a range of applications, includes industries, banks, and shopping malls.

[4] Tondarkar, Krishna Solanke, and Rohit Jagtapi's research focuses on a new technique for surveillance in remote and border areas using multi-functional robots that are supported by current IOT in military and defense applications. This robotic vehicle can take the place of a soldier at the border and offer surveillance. Using the internet as a medium of communication, the robotic car can perform as both an autonomous and a manually controlled vehicle. This multisensory robot will detect the presence of an adversary, capture them in private, and provide live streaming to the authorised person. Surveillance will play a key role while we work on the border area with such a robot. This article demonstrates how to build a smart surveillance robot for military use employing a Raspberry Pi for security. A Raspberry Pi in the field gives a wireless order, which is received by an authorised person on the website, and the robot moves as a result. The Raspberry Pi camera is used to finish the video streaming. Python is the language of programming used on the Raspberry Pi. The video streamed at a rate of up to 15 frames per second, according with results of the trial.

[5] Ibrahim Adabara<sup>1</sup> and Kasiimbura Osbert<sup>2</sup>'s project focuses on the design of an Embedded Real-Time Security System supported by a Raspberry Pi for intruder observation, which reinforces surveillance technology to create crucial security and associated control to our lives. The proposed robotic unit is used for video surveillance of a faraway location as well as remote control of the unit via Bluetooth. The Raspberry Pi acts as a server in the same manner that the system's microprocessor does. An embedded web server makes it simple to monitor and control any device that is located in a remote location. Our innovative integration of cameras and an obstacle detector into the online application is the basis of the proposed security solution. For remotely sensed and surveillance, the Raspberry Pi operates and controls an obstacle detector and a pi camera, feeds live video and records it for later replay. This study aims to develop a closed-circuit television system which allows property owners to keep a keen eye on their property to prevent burglars using a Raspberry Pi camera and wireless Bluetooth technology.

[6] S. P. Dhanure, Soumya Kumari's project focuses on finishing dangerous work. Robots are used to perform tasks that soldiers cannot. During this research, a spy robot platform based on the Raspbian operating system with a remote monitoring and control algorithm via the Internet of Things (IoT) has been built, which could save human lives, reduce the manual mistake, and protect the country from attackers. The Raspberry Pi (a small single-board computer), a camera, a PIR sensor, and a firing gun makes up the system. The Raspberry Pi serves as the system's brain. Moving in a specific route is controlled by an Android app, which also includes a camera for live streaming videos of needed regions for tracing and assaulting. As a result, external stimuli via IoT are used to activate the PIR sensor. The user can utilise the android app's control buttons to access the system from any room.

[7] Here In their project, A. Aashraya and P. Munaswamy monitor the environment in various dangerous conditions and providing live video feedback. The basics of robotics, such as sensors and actuators, provide a framework for robotic creations. The proposed system can indeed capture real-time videos that are necessary for monitoring of a certain individual or location. The Raspberry Pi3 CPU is being used to control the robot entirely. This robot is more usually associated with military purposes, like as surveillance in a particular area. It will provide you a tactical edge in hostage situations or on hazardous terrain. It can walk on any surface as well as provide surveillance over a large area. With the use of high-quality video transmission, surveillance becomes simpler, and it detects warm temperatures while also avoiding the use of water sprinklers to reduce the hearth. Within the proposed system, video quality is raised. These will be crucial in applications including such civilian and military robots.

[8] Prof. Baswaraj Gadgayin and Aishwarya K Telkar's initiative focuses on surveillance robotics that will reduce mortality in conflict areas. Before the invader is attacked by soldiers, the robot serves as a surveillance robot, recording the intruder's surrounding information. The robot's laser gun is designed to shoot the invader on sight. The challenges of short-range communication involve managing the robot's movement and overcome them with IoT technology. The robot's movements can be controlled from anywhere in the world using an Android phone. Controlling the Robot in manual control using IoT technology or in automatic mode via android/PC, Wireless night-sight camera live video streaming with voice communication, PIR and Metal detecting sensors, GSM & GPS technology, and a Laser Gun are the five phases of this project.

When the Robot comes to a halt due to the detection of the PIR and detector sensors, the execution begins. The project's aim is to reduce casualties and increase safety on the battlefield.

If any bombs are put in public spaces, the robot can function as a bomb detector using the detector sensor, and the location of the bomb discovered can be tracked using GPS. The robot is commonly used in disasters such as earthquakes, when a PIR sensor on the robot detects any people trapped beneath the building.

[9] Lavanya K N and Ramya Shree Din's project aims to implement a real-time closed-circuit television systems that can replace humans in the military sector. The vision-based interface works by using gestures to control the robot, bypassing the limitations of speech recognition systems. This process includes four stages: image capture, gesture recognition, robot navigation, metal detection, and fire detection. The robot is stopped by either a fire or a metal detector in order to complete the implementation. The work's impact aspires to raise battlefield safety and reduce the number of lives lost.

[10] P.Raja, Swapnil Bagwarietal's research focuses on a MASS (military aid and monitoring system) that uses various types of sensors to monitor the soldier's location, health, surroundings, and transferring data to the base station, among many other things. As a wearable gadget, it monitors the heart rate and sends the relevant data to the bottom station, and the location can even be monitored by a military base station using the GPS module. Because it is a wearable installation, it will be cost effective and will make a contribution to the soldier's pack load.

[11] Aditya Prakash and Rahee Walambeetal described a couple of simple military surveillance robots in which commands for moving forward, backward, right, left, and stop are received from the remote controller and fed to the Raspberry Pi 3, which causes the robot setup to behave as instructed. The Kinect sensor functions likewise to a camera with the furthermore of depth measurement, in that it depicts the distance between an object and itself by representing the object in grayscale values ranging between 0 to 255, where 0 equals black and 255 equals white, indicating that the item is closer and farther away.

[12] In this paper, Siva karteek boliseti, Mohammad patwary, and Mohamed abdel-maguidetal propose an RF sensing-based target detector that is expected to provide an energy-efficient solution for target detection in sensing situations. The sensor nodes must monitor and detect environments with clutter and interfering signals in order to function properly. Where sensor nodes are capable of forming a preliminary decision before transferring the information to the control centre, using a basic low complexity target detector at individual sensor nodes could be explored. This reduces the frequency of information exchange between sensor nodes and the control centre, extending the IoT's lifespan. A dependability of 70% has been attained.

[13] Majdghareeb, Alibazzi, Mohamadraad, Shamihabdulnabietalin his research is focused on using a wireless robo pi for landmine detection as a low-cost automated sensing element to substitute human detectors in the mission of identifying and recovering mines in a highly suspect region of land. This detector will link wirelessly to a server to relay the location of detected mines or metal, as well as a captured photograph of the land where it was discovered. Because the detector is built on a Raspberry Pi, we may convert it to an IoT device for further communication.

[14] Widodo Budihartoetalin's research focuses on a Tracked Robot with Remote for Surveillance, where the robot's performance can be measured in terms of the gap, and thus the ability to deliver video streaming from the output raspberry pi and a pair of. Video transmitter operating at 4 GHz. The simplest distance for transmitting commands is no more than 20 metres, according to experimental results with varied distances. Because only one distance sensor is used, the sensor system is exceptionally low-cost. The standard speed for presenting video streaming on a Raspberry Pi is 33 frames per second, which is suitable for surveillance. The most significant flaw of this type of ultrasonic sensor is the interference between several sensors, resulting in a restricted ability to detect obstacles.

[15] Andrea Claudi, Francesco Di Benedetto, Gianluca Dolcini, Luca Palazzo, and Aldo Franco Dragonietalin's project focuses on the MARVIN, a mobile autonomous robot that can be used in video surveillance applications. The robot's major purpose is to detect human faces in the observed surroundings and to move independently to keep a face in the exact centre of the screen. The robot's architecture is designed to achieve a perfect balance of reactivity and accuracy. In terms of speed, the study showed that LBP is a suitable candidate for a real-time face-detection method, processing a single frame with six faces in approximately 40 milliseconds. ORB's performance does not appear to be sufficient to recommend its usage under the reference scenario's conditions. In terms of accuracy, LBP with a small low search window can achieve a 73 percent accuracy, but at a significant cost in terms of temporal performance.

[16] Change Zhengetal's project focuses on mechanical design, including a miniature flexible driving mechanism, as Miniature autonomous surveillance robot BMS-1 for covert surveillance using a set of sensors, and so the system for tasks selects to enter and conceal in potentially dangerous regions and feed information back. It employs pyroelectric sensors that are specifically developed to detect human movements. Because it is only sensitive to light and has low infrared and ultraviolet sensitivity without the use of optical filters, this light sensor is ideal for detecting cover. The ADC module of the DSP controller in BMS-1 samples the output voltage of this sensor. The two photovoltaic sensors facing upward are mounted on the two ends of BMS-1 in our robot.

This allows for the detection of BMS-1's dark location.

### **Research gap**

Limitations of this study paper[1] include the lack of a USB port, the spy robot's ability to travel only in a straight backward direction, and the bot's inability to gaze at objects in the dark or at night.

Limitations of the paper[2] The system will be connected to the internet via zigbee, and no simulation tool will be needed when software is used.

Paper [3] technology has limitations which are better suited to a relatively flat surface on which the robot can operate. Due to their wheeled systems, this design would not be ideal for tough terrain environments like as rocky or mountainous terrain.

The paper's limitation [4] is that the most commonly deployed surveillance robots are wheel robots. Robots with wheels are more suited to flat platforms. The movies captured by the wheel robot are widely viewed remotely on a computer or laptop, thanks to the advances in wireless connectivity and the internet. The video streamed at a rate of up to fifteen frames per second, according to the results of the trial.

Paper's limitations[5] They employed the driver IC L298N in their device, which is used for forward and reverse direction with a speed control dc motor. It's not possible to move in a 360-degree circle here.

Limitations of the paper[7] they employ the majority of the robot's components, which are 8 servo motors and a Raspberry Pi3 model. It took up more space, the PIR sensor is active, and the external stimuli are appropriate, Instead of using a regular camera, a sight camera might be employed.

The robot's inability to rove through the rain in paper [9]. By employing innovative design and modern components to create a robot, the dimensions and weight of the robot are further reduced.

### **Conclusion**

The Robot model is frequently claimed to produce a robot whose motor movement and mode of operation, i.e. automatic or manual, are controlled by a keil software version 4, which is commonly used to develop IoT-based applications. The wireless vision camera is used to capture video as well as the live stream of the detector sensor installed beneath the robot. Zigbee modules are used to communicate data collected by various sensors to the receiver transfer RF module. The proposed robot has the potential to prevent the loss of life in border areas and other areas where military duty is required. For obstacle detection in the suggested project, an ultrasonic sensor is used. A landmine detector and a wireless camera with night vision for surveillance are included.

Further research is being carried out to overcome the limitations of the proposed robot, such as the robot being provided with interactive voice feedback and the ability to incorporate a ME (Medical Emergency) band inside the robot to monitor health problems.

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