Sai Intelliverse

- Technology Driven Lead Generation

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Sri Sairam College of Engineering, Bengaluru

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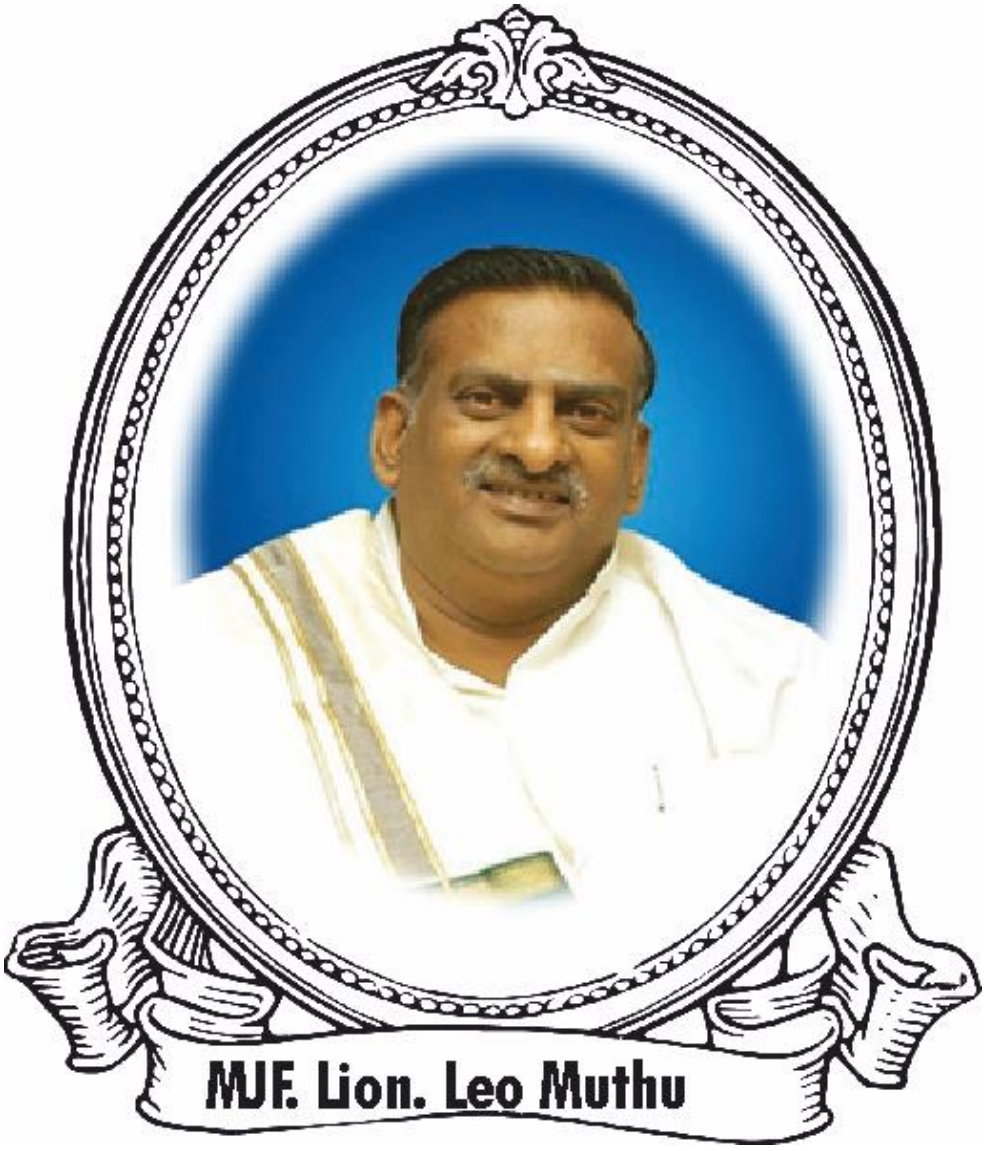

Dedicated to our beloved Founder

Our founder was a born fighter. He fought adversity in his childhood. Once his mind was made up to start educational institutions, hurdles and setbacks could neither deter his progress nor dampen his enthusiasm. His dedication and devotion towards his crusade is highly meaningful and it was supported by everyone who comes in contact with him.

May his tribe grow!

The inspiration…

Born into a typical middle–class family, **MJF. Lion. Leo Muthu** began his career as a government employee and rose to become a highly successful entrepreneur tag made all his fortune from real estate business spread across south India.

Despite being a busy and highly successful businessman, he always found enough time and passion to serve the society. He always wanted to make a significant contribution to the society.

He was actively associated with the Lion's movement and was instrumental in starting "The Academy for Blind" and "Home for Aged" under the community service programme of the lions Club. Besides, he is also having large number of educational, social and Medical activities in south India. It was his dream to build a school, and thus was born Sai Matriculation School in the year 1989. It was established with the primary goal of providing educational services to all sections of society. And it marked the birth of Sairam Institutions and the motto is "We Build a Better Nation through Quality Education".

Many more institutions followed in the next few years. Sri Sairam College of Engineering was started in the year 1997 and ever since it remains as the flagship institutions of the Sairam Institutions. In the span of two decades Sairam institutions has grown both in size and reputation. Today Sairam Institutions with 23 institutions including 3 Engineering colleges, educate thousands of students every year in variety of subjects ranging from Engineering, Polytechnic to Indian Medicine and Teacher Training through exemplary and exceptionally skilled staff. Today, Sairam Institutions has become a name synonymous with quality education.

Devoted and highly qualified faculty, well-equipped laboratories, full–fledged library, playground, cafeteria and transport facilities are common features of Sairam Institutions. On the whole, a healthy atmosphere providing world class education is what best describes a Sairam Institutions. MJF. Lion. Leo Muthu, has devoted throughout his life to the noble cause of Education and Social activities. Though he is not with us today, the vision and values set by him will continue to guide us to excel in the field of education.

In Short MJF. Lion. Leo Muthu is a man with golden dreams & a never–ending enthusiasm of converting dreams in to reality.

PREFACE

Welcome to the proceedings of the "**SAI INTELLIVERSE" – Technology Driven Lead Generation** A National Level Technical Symposium held at Sri Sairam College of Engineering, Anekal-Bengaluru on **12th July 2024** organized by the Department of Artificial Intelligence and Machine Learning. This national level technical symposium brought together experts and researchers from diverse fields to explore and discuss technology driven lead generation. The contributions reflect the culmination of research, innovative ideas, and insightful discussions that took place during the event.

The "**SAI INTELLIVERSE"** – A National Level Technical Symposium serves as a platform for sharing cutting-edge research, fostering interdisciplinary collaborations, and advancing knowledge in emerging technologies. We are pleased to present the proceedings, which include a selection of papers that delve into various aspects of Science and Engineering. These papers represent the dedication and expertise of our participants, who have contributed valuable insights and findings to the field.

We extend our heartfelt gratitude to all the authors who submitted their work and the reviewers who provided thoughtful evaluations. Their efforts have ensured the quality and relevance of the content presented in this volume. We also thank the organizing committee, sponsors, and volunteers whose commitment and hard work made this symposium possible.

We hope that the proceedings of the Sai Intelliverse – A National Level Technical Symposium will serve as a valuable resource for researchers, practitioners, and educators interested in emerging technology. Let this collection of papers inspire further exploration, collaboration, and advancements in the relevant field.

MESSAGE FROM CHAIRMAN

With immense pleasure and excitement that I extend my warm greetings to all of you on the occasion of **SAI INTELLIVERSE** - A National Level Technical Symposium. This event stands as a testament to our commitment to fostering innovation, creativity, and technological prowess among our youth.

As we gather here today, we embark on a journey filled with promise and possibility. SAI INTELLIVERSE not only showcases the brilliance of our students but also serves as a platform for sharing technical and engineering knowledge, exploring new ideas, and pushing the boundaries of what is possible in the realm of technology.

I commend each and every one of you for your dedication and hard work in making this event a reality. To the participants, your enthusiasm and ingenuity are the driving force behind the success of this symposium. To the organizing team, your tireless efforts and meticulous planning have ensured that Sai Intelliverse continues to be a premier event in our academic calendar.

In the spirit of collaboration and learning, let us make the most of this opportunity to exchange ideas, build connections, and inspire one another. May this symposium ignite a passion for innovation and excellence that will propel us towards a brighter and more promising future.

I wish you all a fulfilling and enriching experience at SAI INTELLIVERSE. Let us celebrate the power of knowledge and the potential it holds to transform our world.

- **Dr. Sai Prakash LeoMuthu**
Chairman & CEO, Sairam Institutions

MESSAGE FROM PRINCIPAL

I am delighted to extend my heartfelt greetings to everyone gathered for the prestigious **SAI INTELLIVERSE** - a National Level Technical Symposium. This event exemplifies our institution's commitment to nurturing innovation, academic excellence, and technological advancement.

SAI INTELLIVERSE serves as a vibrant platform where students, researchers, and industry experts converge to exchange ideas, showcase their talents, and explore emerging trends in technology. It is a testament to our collective pursuit of knowledge and our dedication to shaping future leaders in the field of technology. I extend my deepest appreciation to all the participants for their enthusiasm and hard work in preparing for this event. Your innovative projects and research endeavors are a testament to your dedication and passion for advancing the boundaries of technology.

To the organizing committee and faculty advisors, thank you for your tireless efforts in meticulously planning and coordinating every aspect of SAI INTELLIVERSE. Your dedication and commitment have played a pivotal role in ensuring the success of this symposium. As we embark on this exciting journey of discovery and learning, I encourage everyone to make the most of this opportunity. Engage in meaningful discussions, forge new connections, and be inspired by the wealth of knowledge that surrounds us.

I am confident that SAI INTELLIVERSE will not only be a platform for academic and technological excellence but also a catalyst for future innovations that will shape our world ahead.

Wishing you all a productive and enriching experience at SAI INTELLIVERSE. Let us celebrate the spirit of innovation and collaboration that defines our institution.

- **Dr. B Shadaksharappa**
Principal
Sri Sairam College of Engineering, Anekal-Bengaluru

MESSAGE FROM MANAGEMENT REPRESENTATIVE

On behalf of the management, it gives me immense pleasure to welcome you all to **SAI INTELLIVERSE** – a National Level Technical Symposium. This event stands as a beacon of innovation, knowledge sharing, and collaborative spirit in the field of technology.

SAI INTELLIVERSE provides a unique platform for students, researchers, and industry professionals to showcase their talents, exchange ideas, and explore the latest advancements in various domains of technology. It is a testament to our commitment to nurturing young minds and fostering a culture of creativity and excellence.

I extend my heartfelt appreciation to all the participants for their dedication and hard work in preparing for this symposium. Your innovative projects and research initiatives reflect your passion and determination to make a positive impact on society through technology.

As we embark on this enriching journey together, I encourage everyone to seize this opportunity to learn, collaborate, and inspire each other. Let us harness the power of innovation and technology to address the challenges of today and build a brighter future for tomorrow.

I am confident that SAI INTELLIVERSE will not only be a platform for academic and technological excellence but also a catalyst for meaningful connections and impactful ideas.

Wishing you all a rewarding and memorable experience at SAI INTELLIVERSE. Let us celebrate the spirit of innovation and collective pursuit of knowledge that defines our institution.

Dr. Arun Kumar R
Management Representative
Sri Sairam College of Engineering, Anekal-Bengaluru

MESSAGE FROM CHIEF EDITOR

It is with great pleasure that I extend my warmest greetings to each of you at the commencement of **SAI INTELLIVERSE - Technology Driven Lead Generation,** a National Level Technical Symposium. This event not only celebrates the spirit of innovation and academic excellence but also serves as a pivotal platform for showcasing the remarkable ingenuity and creativity of our student community.

As Chief Editor, I am truly impressed by the caliber of research, projects, and presentations that will be showcased during this symposium. Your dedication and hard work are a testament to your passion for advancing technology and pushing the boundaries of knowledge.

I would like to extend my heartfelt gratitude to my Management, Principal and all the organizing committee for their meticulous planning and dedication in ensuring the success of SAI INTELLIVERSE. Your efforts have been invaluable in creating an environment where ideas flourish and collaborations thrive.

To all the participants, seize this opportunity to engage in meaningful discussions, forge new connections, and inspire one another. Let this symposium be a catalyst for innovation and a platform for exploring new avenues in technology.

As we embark on this journey of exploration and discovery, I am confident that SAI INTELLIVERSE will not only be a showcase of academic excellence but also a catalyst for future breakthroughs that will shape the landscape of technology.

- **Dr. Sivaprakash C**
Professor & Head
Department of Artificial Intelligence and Machine Learning
Sri Sairam College of Engineering, Anekal – Bengaluru.

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Revolutionizing Healthcare: The Transformative Role of Artificial Intelligence

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Abstract:

Artificial intelligence (AI) is transforming the healthcare landscape, offering unprecedented opportunities for improvement. AI algorithms and models analyze vast amounts of medical data, enabling accurate diagnostics, personalized treatment plans, and predictive analytics. AI-driven drug discovery and virtual assistants enhance patient care, while remote monitoring and data analysis streamline healthcare services. AI's impact is multifaceted, improving patient outcomes, reducing costs, and enhancing the overall quality of healthcare. As AI continues to evolve, its potential to revolutionize healthcare is vast, promising a future where data-driven insights and human expertise converge to deliver exceptional patient care. Artificial Intelligence (AI) has the potential to revolutionize healthcare by improving patient outcomes, reducing costs, and enhancing efficiency. This paper provides a comprehensive review of the current applications of AI in healthcare, including machine learning, natural language processing, and robotics.

Keywords: Artificial Intelligence; ethics; governance; healthcare; Disease prediction and diagnosis; Rehabilitation.

Introduction:

Artificial Intelligence (AI), where computers perform tasks that are usually assumed to require human intelligence, is currently being discussed in nearly every domain of science and engineering. Major scientific competitions like ImageNet Large Scale Visual Recognition Challenges are providing evidence that computers can achieve human-like competence in image recognition. AI has also enabled significant progress in speech recognition and natural language processing. All of these advances open questions about how such capabilities can support, or even enhance, human decision making in health and health care. Two recent high-profile research papers have demonstrated that AI can perform clinical diagnostics on medical images at levels equal to experienced clinicians, at least in very specific examples .The promise of AI is tightly coupled to the availability of relevant data .In the health domains, there is an abundance of data .However, the quality of, and accessibility to, these resources remain a significant challenge in the United States. On one hand, health data has privacy issues associated with it, making the collection and sharing of health data particularly cumbersome compared to other types of data. In addition, health data are quite expensive to collect, for instance in the case of longitudinal studies and clinical trials, so it tends to be tightly guarded once it is collected. Further, the lack of interoperability of electronic health record systems impedes even the simplest of computational methods and the inability to capture relevant social and environmental information in existing systems leaves a key set of variables out of data streams for individual health. At the same time, there is wide private-sector interest in AI in health data collection and applications as illustrated from the numerous startups related to AI in health and health care. The two most popular topics, medical imaging & diagnostics and patient data & risk analytics, are a strong focus in this research paper.

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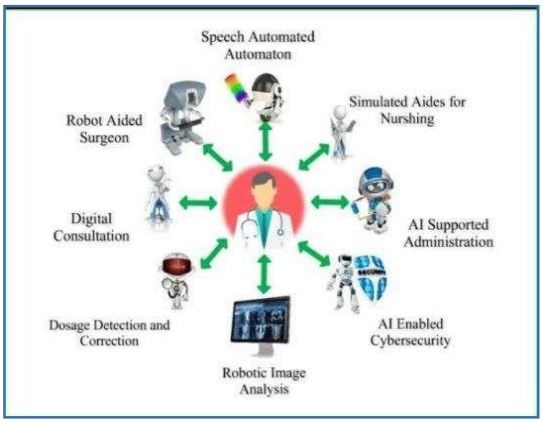
Applications of AI in Healthcare:

It is unlikely artificially intelligent agents will ever completely replace doctors and nurses, but machine learning and AI are transforming the healthcare industry and improving outcomes. Machine learning is improving diagnostics, predicting outcomes, and beginning to scratch the surface of personalized care. Imagine a situation where you walk in to see your doctor with pain around your heart. After listening to your symptoms, she inputs them into her computer, which pulls up the latest evidence base she should consult to efficiently diagnose and treat your problem. You have an MRI scan, and an intelligent computer system assists the radiologist in detecting any concerns that would be too small for your radiologist's human eye to see. Your watch may have even been continuously collecting your blood pressure and pulse while a continuous blood glucose monitor had a real-time profile of your blood glucose readings. Finally, your medical records and family's medical history is assessed by a computer system that suggests treatment pathways precisely identified to you. Data privacy and governance aside, the implications of what we can learn from combining various pools of data are exciting.



Applications of AI in Healthcare.

Role of AI in Healthcare:

Medical Imaging and Diagnostic services:

AI is transforming medical imaging and diagnostic services by enhancing image analysis, detection, and diagnosis. AI algorithms analyze images to detect abnormalities, improve image quality, and segment images to identify specific structures. Computer-aided detection (CAD) highlights potential abnormalities, while deep learning-based diagnosis diagnoses conditions like cancer. Assisted interpretation provides radiologists with diagnostic suggestions and probabilities. AI applications include X-ray, CT, MRI, ultrasound, and mammography imaging, improving accuracy, patient experience, efficiency, and reducing costs. By automating routine tasks and augmenting radiologists' expertise, AI is revolutionizing medical imaging and diagnostic services, leading to better patient outcomes.

Virtual Patient Care:

AI is revolutionizing virtual patient care by enabling personalized, remote, and data-driven healthcare. AI- powered chat bots and virtual assistants offer patients personalized health information, support, and guidance. AI-driven telemedicine platforms connect patients with healthcare professionals remotely, improving access and convenience. AI analytics help identify high-risk patients, predict disease progression, and optimize treatment plans. Additionally, AI-powered virtual reality and augmented reality experiences enhance patient engagement, education, and therapy. By streamlining communication, improving patient engagement, and enhancing data-driven care, AI is transforming virtual patient care, leading to better health outcomes, improved patient satisfaction, and reduced healthcare costs.

Medical Research and Drug discovery:

AI is transforming medical research and drug discovery by accelerating the identification of new treatments and

their efficacy. AI algorithms analyze vast

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amounts of biomedical data, uncovering hidden patterns and insights that human researchers may miss. AI- powered simulations predict drug interactions, predict disease progression, and identify potential drug targets. AI-driven natural language processing extracts relevant information from scientific literature, while machine learning models predict drug efficacy and toxicity. Additionally, AI collaborates with researchers to design new drugs, predict clinical trial outcomes, and identify personalized treatment strategies. By streamlining the research process, improving accuracy, and reducing costs, AI is revolutionizing medical research and drug discovery, leading to the development of innovative treatments and improved patient outcomes.

Ethical and Social Challenges:

- AI in healthcare raises ethical and social challenges, including:
- Data privacy and security concern Bias in algorithms and
- discrimination against certain patient groups
- Transparency and explain ability in AI-driven decision-making
- Job displacement of healthcare professionals
- Ensuring accountability and responsibility in AI-driven care

Rehabilitation:

AI is revolutionizing rehabilitation by enhancing patient outcomes, streamlining therapy, and improving accessibility. AI-powered systems analyze patient data, creating personalized treatment plans and adapting to individual progress. AI-driven virtual reality and augmented reality experiences immersive patients in engaging therapy environments, increasing motivation and engagement. AI-assisted robots and wearable devices provide precise feedback and support, enhancing motor skills and functional recovery. Additionally, AI-powered chat bots and virtual assistants offer emotional support, education, and guidance, empowering patients to take an active role in their rehabilitation journey. By optimizing treatment, reducing costs, and improving patient engagement, AI is transforming rehabilitation, enabling individuals to recover faster, more effectively, and with greater independence.

Addressing disparities in access to AI-powered healthcare

- Balancing individualized care with population health needs
- Navigating ethical dilemmas in AI-driven end-of-life care
- Ensuring human-centered care in AI-dominated healthcare systems.
- Addressing these challenges is crucial to ensure AI is used ethically and responsibly in healthcare, prioritizing patient well- being, autonomy, and dignity.

Current Applications of AI in Healthcare

Machine learning is a branch of AI that allows computers to learnfrom data without being explicitly programmed. Machine learning has a wide range of applications in healthcare, includingimage analysis, diagnosis, and treatment planning. For example, machine learning algorithms can be used to analyze medical images, such as MRI scans, to identify patterns and predict outcomes. Machine learning can also be used to develop predictive models for disease progression and treatment response. Machine learning has indeed revolutionized various aspects of healthcare, including image analysis, diagnosis, and treatment planning. With the ability to learn patterns and make predictions from large amounts of data,

machine learning algorithms have shown great potential in improving healthcare outcomes. In the field of medical imaging, machine learning algorithms have been developed to analyze images from various modalities, such as MRI scans, X- rays, and CT scans. These algorithms can detect and classify abnormalities, tumors, and other conditions with high accuracy. By training on large datasets of annotated images, machine learning models can learn to identify subtle patterns that may not be apparent to human observers. This can aid radiologists and other healthcare professionals in making more accurate and timely diagnoses, leading to improved patient care. Furthermore, machine learning algorithms can be used to develop predictive models for disease progression and treatment response. By analyzing patient data, including clinical records, geneticin formation, and biomarkers, machine learning models can identify patterns and risk factors associated with specific diseases. This information can help healthcare providers predict disease progression, identify patients at higher risk of complications, and tailor treatment plans accordingly. For example, in oncology, machine learning algorithms can analyze patient data to predict the likelihood of cancer recurrence and recommend appropriate treatment options. Machine learning can also contribute to treatment planning and decision-making.

Machine Learning and disease diagnosis

By analyzing large datasets of patient records, treatment outcomes, and medical guidelines, machine learning models can generate treatment recommendations based on individual patient characteristics. This can ssist healthcare providers in choosing the most effective treatment options and optimizing patient care. Moreover, machine learning algorithms have the potential to identify new patterns and relationships in biomedical data that may lead to novel discoveries and advancements in medical research. By analyzing large-scale genomics, proteomics, and other data, machine learning can help identify genetic markers, biomarkers, and potential drug targets. This can accelerate the process of drug discovery and development, leading to the development of more targeted and personalized treatments. However, it is important to note that the implementation of machine learning algorithms in healthcare comes with challenges. Data quality, privacy, and ethical considerations are crucial factors that need to be addressed. The availability of large and diverse datasets, as well as the collaboration between healthcare providers and data scientists, is also vital for the successful deployment of machine learning algorithms in healthcare settings. AI in healthcare with applications in disease diagnosis, personalized treatment, medical imaging analysis, clinical decision support, virtual assistants, remote monitoring, fraud detection, and public health surveillance.

AI-powered systems analyze medical data, identify patterns, and make predictions, improving patient outcomes, streamlining clinical workflows, and reducing costs. From drug discovery to patient

Nanomedicine is applying nanotechnology for healthcare, covers a wide range of clinical applications from diagnosis of various diseases such as cancer at one end of the spectrum, to the formulation of carriers for gene and drug delivery applications atthe other spectrum of nanoscience in medicine.

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According to the development in nanotechnology, drug-loaded nanoparticles or nanocarriers have the potential to improve controlled release drugdelivery systems (CRDDSs). CRDDSs reduce side effects to the surrounding tissues by delivering a drug to the tumor site. Moreover, solid tumors have certain characteristics that make drug delivery to them very complicated and difficult. Thesecharacteristics, which are known as physical obstacles of drug transport in solid tumors, include elevated interstitial fluid pressure, dense extracellular matrix, hyper-permeable blood micro vessels, and dysfunctional lymphatic system. On the other hand, most current drug-loaded nanocarriers cannot be used for cargo transport and release, localized delivery, and tumor penetration due to the lack of capabilities for controllable navigation and self-propulsion. To address these limitations, several solutions are suggested, including manipulation the physicochemical properties of nanocarriers, multifunctional nanoconstructs, using internal/external field for drug release from nanoparticles, multi-stage drug delivery systems, application of micro-/nano-robots for drug delivery, to name a few Emerging micro nano-robots, as an appealing type of delivery carriers that can reduce systemic side effects of highly toxic drugs and improve the therapeutic efficacy, have been recently developed engagement, AI is transforming the healthcare landscape.

Nano Medicines:

Nanorobotics, as a new area of nanotechnology, is about dealing with the cellular, molecular, or atomic structures of devices. Nano robots can be designed for various applications such as the diagnosis and treatment of lethal diseases as well as identification of target molecules by their unique sensors. The field of nanomedicine has significantly improved the diagnosis and therapy of many diseases such as cancer. For instance, imaging agents and nanoparticle-modified drug compounds have noticeably enhanced contrast efficiency and treatment outcomes. The emergence of AI presents an attainable opportunity for pharmaceutical application including drug discovery, drug delivery, and nanomedicine for cancer treatment.

AI can play an important role in developing nanomedicine- based treatment outcomes.

The integration of AI with nanotechnology (i.e., nanoinformatics) leads to considerable improvements in drug delivery to solid tumors. Nanoinformatics developments and the use of machine learning (ML) and data mining, as a result of advancement in the nanotechnology field, has led to development of methods for predicting the structural and functional properties of nanoparticles.

Data mining and ML can be utilized for prediction of biological properties of different nanoparticles related to their biomedical applications. These include the effect of particle physicochemical properties on cellular uptake, cytotoxicity, molecular loading, and molecular release considering manufacturing properties like nanoparticle size and polydispersity.

Conclusion:

The integration of Artificial Intelligence (AI) in healthcare has revolutionized the field of disease diagnosis, transforming it into a more accurate, efficient, and personalized endeavor. AI- powered systems, leveraging machine learning and deep learning algorithms,

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analyze vast amounts of medical data, identify complex patterns, and make predictions, facilitating early disease detection and precise diagnosis. This technological advancement has significantly improved patient outcomes, reduced costs, and enhanced the overall quality of care. Modern disease diagnosis, empowered by AI, has become more proactive, targeted, and effective, enabling healthcare professionals to make informed decisions and develop personalized treatment plans. As AI continues to evolve, its potential to transform healthcare is vast, holding promise for the detection of rare diseases, personalized medicine, and improved drug discovery. Ultimately, the synergy between AI and healthcare is poised to reshape the future of disease diagnosis, leading to better patient care, improved health outcomes, and enhanced quality

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REACH MEDICAL SUPPORT TO ACCIDENTAL VEHICLES USING IoT AND MEMS SENSOR

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ABSTRACT:

This paper proposes a novel system to enhance the efficiency of medical emergency services during road accidents. The increasing number of accidents due to reckless driving, drunk driving, and driver negligence necessitates a more effective way to respond to these incidents promptly. The current system often faces delays in informing the ambulance and police authorities, which may lead to severe consequences for the victims. To address this issue, the paper suggests integrating sensors in vehicles to monitor critical data like displacement, location, and chassis number using a Global Positioning System (GPS) device. This information would be shared through the Internet of Things (IoT) to a control center, allowing them to dispatch the necessary emergency response units to the accident site swiftly. The proposed system utilizes a gyro sensor (MEMS sensor) to detect angle changes between 45° and 315° and a vibration sensor that activates at a collision impact frequency of 90 Hz or more. This system could potentially serve as a reliable addition to the safety features in vehicles manufactured in India, ensuring better accuracy in accident detection and reporting. In conclusion, this paper presents a valuable concept to improve medical emergency services during road accidents by implementing a smart vehicle-based system. The integration of sensors and IoT technology can significantly reduce response time and save lives by providing immediate assistance to victims in need.

Keywords: IoT, Mems Sensor, GPS, Microcontroller

INTRODUCTION

In this paper, we will delve into the details of an "IoT-based Vehicle Accident Detection and Tracking System Using GPS Technology." The Internet of Thinking (IoT) is a groundbreaking concept that connects uniquely identifiable embedded computing devices to the existing Internet infrastructure. This advanced connectivity extends beyond simple sensor-to-sensor connections and encompasses a wide range of devices, including medical implants and biochips transponders. Throughout the paper, we will discuss a practical application of IoT in the context of road safety. The primary goal of this system is to enhance the efficiency of emergency response services during vehicle accidents.

To achieve this, the paper will focus on the following key components:

GPS (Global Positioning System): GPS technology plays a crucial role in determining the precise location of a vehicle involved in an accident. This information is vital for emergency services to respond promptly and accurately. IoT (Internet of Things): By leveraging IoT, the system can transmit real-time data about the accident location and vehicle details to a central control center. This allows for faster deployment of emergency response units and improved overall efficiency. MEMS Sensor: A Micro-Electro-Mechanical System (MEMS) sensor is employed to detect significant changes in the vehicle's angle and vibrations caused by a collision. This sensor helps identify accidents and triggers the necessary response. Microcontroller: The microcontroller serves as the brain of the system, processing data from the sensors and initiating the appropriate actions based on predefined algorithms.

The paper will also include illustrations, such as depicting a sample road accident and

showcasing the block diagram of a MEMS sensor. By presenting these components and their interplay,

the paper aims to provide a comprehensive understanding of the IoT-based vehicle accident detection and tracking system using GPS technology.

GPS (Global Positioning System):

GPS, or Global Positioning System, plays a vital role in our proposed IoT-based Vehicle Accident Detection and Tracking System. It enables the precise identification of accident locations, which is crucial for timely emergency response. GPS technology offers a fast, accurate, and cost- effective solution for locating accidents in countries with established data collection programs. By integrating GPS with the system, motorists can easily identify the position of various features along the road network, such as service stations, maintenance facilities, and emergency services. This information is invaluable during accidents, as it helps guide rescue teams to the exact location of the incident.

In our proposed paper system, the GPS module works in conjunction with the IoT device to transmit the accident location, time, and speed data. This real-time information is essential for dispatching emergency services promptly and ensuring the best possible outcomes for those involved in accidents.

GPS sensors function as receivers equipped with antennas that utilize a network of 24 satellites orbiting Earth. These satellites provide position, velocity, and timing data, which is then processed by the system to determine the precise location of a vehicle involved in an accident. This accurate location information is a vital component of the overall system, contributing to its effectiveness in saving lives and minimizing the impact of road accidents.

MEMS (MICRO-ELECTRO-MECHANICAL SYSTEMS) SENSORS

MEMS (Micro-Electro-Mechanical Systems) sensors are indispensable components in our IoT- based Vehicle Accident Detection and Tracking System Using GPS Technology. These tiny devices combine mechanical and electrical components to measure various physical phenomena, such as acceleration, pressure, direction, and magnetic fields. MEMS sensors are fabricated using micro-fabrication techniques similar to those employed in integrated circuit manufacturing.

Fig 1.3 Global Position Systems

At the core of their functionality, MEMS sensors convert physical stimuli or signals into electrical ones, which can then be processed and analyzed by electronic devices. Some common types of MEMS sensors include accelerometers, gyroscopes, pressure sensors, and directional sensors. MEMS sensors have widespread applications across various industries, such as automotive, consumer electronics, aerospace, and medical devices. For instance, MEMS accelerometers are utilized in airbag systems to detect sudden changes in velocity and activate the airbag, while MEMS gyroscopes are employed in navigation systems to measure changes in orientation. In our proposed system, MEMS sensors play a crucial role in detecting vehicle accidents. They can identify significant changes in a vehicle's angle and vibrations caused by a collision, thus triggering the necessary response from the system. By integrating MEMS sensors with GPS, IoT, and microcontrollers, our paper system aims to provide an efficient and effective solution for enhancing road safety and emergency response during vehicle accidents.

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Fig 1.4 MEMS Sensor

IoT, OR THE INTERNET OF THINGS

IoT, or the Internet of Things, is a transformative technology that enables the connection of various devices and sensors to the internet, allowing them to communicate and exchange data. This revolutionary approach has significantly enhanced the capabilities of GPS-based applications and devices. By integrating IoT with GPS technology, we can create more efficient and effective systems that provide real-time information and seamless connectivity. IoT is essentially a vast network of interconnected devices and physical objects that collect and share data with other devices and systems across the internet. These devices, which include sensors, actuators, gadgets, and machines, are programmed for specific applications and can transmit data over networks. C language remains a crucial programming language for IoT development due to its efficiency, simplicity, and widespread adoption in embedded systems. In our proposed paper system, we utilized the ESP32, a low-cost, low-power microcontroller that integrates Wi-Fi and includes a built-in antenna switch. Manufactured by TSMC using a 40nm process, the ESP32 is advancement over the ESP8266, a low-cost Wi-Fi microchip with built-in TCP/IP networking software and a microcontroller. By leveraging the capabilities of IoT devices like ESP32, our system can efficiently collect, process, and transmit data related to vehicle accidents, including location, time, and speed. This information is vital for prompt emergency response and saving lives on the road. The integration of GPS, IoT, and MEMS sensors in our proposed system demonstrates the potential of these technologies to revolutionize road safety and emergency management.

MICROCONTROLLER

A microcontroller is a miniaturized computer system integrated into a single chip, specifically designed to control and manage various devices and systems. It consists of a processor, memory, and input/output peripherals, making it a self- contained, efficient solution for handling specific tasks. Microcontrollers are widely employed in numerous electronic devices due to their affordability, low power consumption, and high reliability. These compact computer systems are tailored to perform specialized functions and are commonly used in embedded systems that require dedicated controllers. Their key advantage lies in their ability to be customized according to the unique demands of a particular application. Microcontrollers can be programmed to react to specific sensor inputs, control motors, manage other devices, and perform a multitude of other tasks. Moreover, microcontrollers are engineered to operate effectively in challenging environments and can be employed in applications where traditional computing devices would be unsuitable. In our proposed Vehicle Accident Detection and Tracking System Using GPS Technology and IoT, we utilize microcontrollers to process data from MEMS sensors, manage communication with other devices, and execute necessary actions in response to detected accidents. This integration of advanced technologies, including microcontrollers, demonstrates the potential to revolutionize road safety and emergency response management.

Fig 1.6 Microcontrollers

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EXPERIMENTAL RESULT

The experimental results of our proposed paper demonstrate the effectiveness of utilizing IoT, MEMS sensors, and GPS technology in detecting and responding to road accidents promptly. This innovative system allows for the rapid collection and transmission of critical information about the accident, ultimately enabling faster emergency response and potentially saving lives. In our study, the MEMS sensor plays a crucial role in detecting the vehicle's direction and status, then transmitting this data to the IoT device. The IoT device, in turn, utilizes GPS technology to pinpoint the exact location of the accident. This information is then relayed to a specifically developed software application, which processes and presents the data in a user-friendly manner.

The rapid response and data transmission capabilities of this system are vital in emergency situations. By obtaining information about the accident within seconds, we can alert nearby hospitals or emergency services to provide essential first aid as quickly as possible. This timely intervention can significantly improve the chances of survival and recovery for those involved in road accidents. In conclusion, the experimental results of our study highlight the potential of IoT, MEMS sensors, and GPS technology in revolutionizing road safety and emergency response management. By integrating these advanced technologies, we can create a more secure and responsive environment for road users, ultimately saving lives and reducing the impact of accidents on our society.

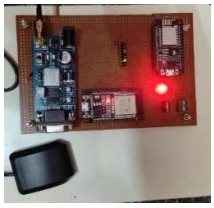

Fig 1.7 Working Model

The provided figure represents the working model of the proposed paper, which utilizes MEMS sensors, IoT devices (ESP32), GPS (Skylab), and a microcontroller (ESP8266) to detect and respond to road accidents promptly. The model's components are interconnected, allowing for seamless data exchange and processing. The programming language used in this model is C, with the code snippet provided demonstrating the setup and loop functions. The code initializes the necessary connections, configures the display, and begins the Wi-Fi and GPS communication. It also includes the Blynk library for interacting with the software application. The code snippet retrieves GPS data from the SerialGPS object and encodes it using the TinyGPSPlus library. If the location data is valid, it extracts the latitude and longitude values, which are then displayed on the SH1106 display and sent to the Blynk application. In summary, this working model showcases the integration of MEMS sensors, IoT devices, GPS technology, and a microcontroller to create an efficient, real-time road accident detection and response system. By leveraging the power of these technologies and the provided C programming code, the system can help save lives and improve overall road safety.

CODING USED(C Program):

```
#include <TinyGPS++.h> #include
<HardwareSerial.h> #include <WiFi.h>
#include <Wire.h> // Only needed for Arduino
1.6.5 and earlier #include<SH1106.h>
#include <BlynkSimpleEsp32.h> float latitude,
longitude;
String lat_str , lng_str;
char auth[] =
"i0dTPFQeTxlJRvO5byOuL8f2Wj9hs6x4"; // You
should get Auth Token in the Blynk App.
char ssid[] = "sachin"; // Your WiFi credentials. char
pass[] = "1234567890"; WidgetMapmyMap(V0);
SH1106 display(0x3c, 21, 22); WiFiClient client;
TinyGPSPlus GPS; HardwareSerialSerialGPS(1); void
setup()
{
Serial.begin(115200); Serial.println("Connecting to ");
Serial.println(ssid); WiFi.begin(ssid, pass);
while (WiFi.status() != WL_CONNECTED){
```

```
delay(500);
Serial.print(".");   // print ... till not connected
}
Serial.println(""); Serial.println("WiFi connected");
display.init(); display.flipScreenVertically();
display.setFont(ArialMT_Plain_10);
SerialGPS.begin(9600, SERIAL_8N1, 16, 17);
Blynk.begin(auth, ssid, pass); Blynk.virtualWrite(V0,
"clr");
}
void loop()
{
while (SerialGPS.available() > 0) { if
(gps.encode(SerialGPS.read()))
{
if (GPS.location.isValid())
{
latitude = gps.location.lat(); lat_str = String(latitude ,
6); longitude = gps.location.lng(); lng_str =
String(longitude , 6); Serial.print("Latitude = ");
Serial.println(lat_str); Serial.print("Longitude = ");
Serial.println(lng_str); display.clear();
display.setTextAlignment(TEXT_ALIGN_LEFT);
display.setFont(ArialMT_Plain_16);
display.drawString(0, 23, "Lat:");
display.drawString(45, 23, lat_str);
display.drawString(0, 38, "Lng:");
display.drawString(45, 38, lng_str);
Blynk.virtualWrite(V0,     1,          latitude, longitude,
"Location");
display.display();
}
delay(1000); Serial.println();
}
}
Blynk.run();
}
```

EXISTING SYSTEMS:

In current systems, MEMS sensors play a significant role in various automotive applications. Accelerometers in MEMS sensors are utilized in airbag systems to detect sudden changes in velocity and activate the airbags during car crashes. Similarly, MEMS gyroscopes are employed in navigation systems to measure changes in orientation. The proposed paper's model builds upon these existing systems by integrating MEMS sensors, IoT devices, GPS technology, and microcontrollers. The MEMS sensor is used to detect the impact of a car crash, which triggers the GPS to find the exact location of the accident. This location data is then transmitted through IoT and microcontroller networks to a specific software application.

APPLICATIONS:

Exact Location Finding: The primary application of this paper is to determine the precise location of the accident scene, enabling quick response and assistance for those involved. Medical Emergency Services: By providing the exact location of the accident, this system can facilitate the immediate dispatch of medical emergency services, potentially saving lives and reducing the severity of injuries. Vehicle Information: In addition to locating the accident and providing emergency services, the system can also offer information about the involved vehicle, such as its chassis number and registration number. This data can aid in identifying the vehicle and its owner, which may be crucial for insurance claims or further investigations.

ADVANTAGES:

We can save humans' life upto80% of people. Who was impacted by the accident?

- The accident's location is detected as soon as possible within a fraction of a second.
- It is efficient and low-cost.
- It requires less space.

CONCLUSION:

The primary objective of the accident alert system presented in this paper is to minimize the risk of fatalities in accidents that cannot always be prevented. By rapidly detecting and responding to accidents, this system aims to increase the chances of saving lives and providing essential medical assistance. The invention of such a device holds immense value, particularly for accidents occurring in remote or secluded areas, as well as during nighttime when help may be scarce. As technology continues to advance, the integration of vehicle tracking and accident

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alert features is expected to play a crucial role in enhancing public safety and improving our day-to-day lives. In the coming years, the widespread adoption of these accident alert systems can significantly contribute to reducing accident-related casualties, making our roads and transportation networks safer for everyone. This innovative approach to accident detection and response showcases the potential of modern technology to transform our lives and create a more secure environment for all.

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Advances in Thermodynamic Efficiency: Improvements in the Kalina Cycle

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Abstract:

The Kalina Cycle represents a significant advancement in thermodynamic cycles, offering improved efficiency over traditional methods like the Rankine Cycle. This paper explores recent improvements to the Kalina Cycle, presents experimental data, and discusses potential applications. Key findings indicate that enhancements to the Kalina Cycle can achieve significantly higher thermal efficiency, particularly in waste heat recovery and geothermal power generation.

Introduction:

Thermodynamic cycles are critical in converting heat energy into mechanical work. The Rankine Cycle has been the standard for power generation, but it has limitations in efficiency. The Kalina Cycle, introduced by Alexander Kalina, utilizes a mixture of water and ammonia as the working fluid, which improves thermodynamic efficiency by exploiting the varying boiling points of the components. This study aims to evaluate the efficiency improvements of the Kalina Cycle, compare it with traditional cycles, and explore its practical applications.

Literature Review:

Previous studies have shown that the Kalina Cycle can achieve higher efficiencies, especially in low- temperature heat sources. Initial implementations of the Kalina Cycle showed notable efficiency gains, but there were areas for potential improvement. While the theoretical advantages are well-documented, there is a need for more empirical data and real-world application studies focusing on recent improvements.

Methodology:

The Kalina Cycle process involves the heating of a water-ammonia mixture, which vaporizes at a lower temperature than pure water, thus capturing more heat energy. Specific improvements implemented in this study include:

- Optimized Ammonia-Water Mixture Ratios: Adjusting the ratio of ammonia to water to achieve optimal thermodynamic properties.
- Enhanced Heat Exchangers: Development of more efficient heat exchangers to maximize heat transfer. Improved Turbine Design: Implementing turbines specifically designed for the Kalina Cycle to reduce energy losses.
- Integration of Regenerative Heat Exchangers: Utilizing regenerative heat exchangers to recycle heat within the system, thereby improving overall efficiency.

A lab-scale model of the improved Kalina Cycle was constructed, with parameters such as pressure, temperature, and ammonia concentration monitored. Computational simulations were conducted to predict the performance under various conditions, and the results were validated against experimental data.

Results and Discussion:

Data showed that the optimized ammonia-water mixture ratios, enhanced heat exchangers, and improved turbine design significantly increased thermal efficiency. The specific improvements led to a thermal efficiency increase of up to 20% compared to the original Kalina Cycle. In waste heat recovery, the improved Kalina Cycle outperformed the Rankine Cycle and the

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original Kalina Cycle by a significant margin. These findings suggest that the improvements to the Kalina Cycle make it a highly viable alternative for enhancing efficiency in various power generation applications.

Case Study:

A geothermal power plant utilizing the improved Kalina Cycle was analyzed. The plant showed a 25% increase in power output compared to similar plants using the original Kalina Cycle, demonstrating the practical benefits of the improvements.

Conclusion:

The specific improvements made to the Kalina Cycle offer substantial enhancements in thermodynamic efficiency, particularly in low- temperature heat sources. This study contributes empirical data supporting the theoretical benefits of the improvements and highlights their potential for broader application. Further research should focus on optimizing the mixture ratios and exploring other working fluid combinations for even greater efficiency.

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CATTLE HEALTH MONITORING SYSTEM USING MACHINE LEARNING

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ABSTRACT

Cattle health monitoring is a critical aspect of livestock management that ensures the overall health and productivity of the herd. With the emergence of machine learning technology, it is now possible to monitor the health of cattle without relying on IoT devices. Machine learning-based systems can analyze various factors such as weight, temperature, and behavioral patterns of the animals to identify potential health issues. The system can also analyze the data collected over time to detect patterns and trends that could indicate long-term health issues. Furthermore, Machine learning-based cattle health monitoring systems can also help identify and predict the onset of diseases and recommend appropriate treatment options. This can help farmers to take proactive measures to prevent the spread of diseases and minimize the risk of losses. Overall, Machine learning-based cattle health monitoring systems have the potential to revolutionize livestock management by providing accurate and reliable insights into the health and well-being of the animals without relying on IoT devices.

Keyword: cattle health monitoring, machine learning, IoT, livestock.

Introduction:

All areas have seen an increase in the impact of technology in recent years and the ongoing trend towards digitization. Parts of almost every field have been digitalized to facilitate more effective and simple management. The field of agriculture, with a focus on keeping tabs on the health of cattle, is one of the areas that is being digitized and is a component of the research and subject of the current study. State organizations around the world have made significant investments in digitization in this sector to ensure greater productivity for farmers. According to the World Government Summit agenda [1], 650 million people will still be undernourished by 2030, accounting for 8% (or 800 million) of the global population. The same analysis states that because of rising demand, we would need to produce 70% more food by 2050. The primary pillars of economic development in every country in the world, including Kosovo, are industry, services, and the agricultural sector. The most recent data issued by the Ministry of Agriculture, Forestry, and Rural Development states that the agriculture sector provides 8.1% of Kosovo's GDP [2]. The same study states that Kosovo recorded 257,733 cattle in 2019, down 929 heads from 2018, including calves, appetisers, heifers, bulls, dairy cows, and beef cattle. Cows under the age of one year made up 32% of the population, those between one and two years made up 10%, and those over two years made up 58%. The largest significant group of livestock is cattle, which accounts for 47.5% of all livestock heads [3]. According to [3], the overall stock of cattle increased by 1.4% in 2020 when compared to the previous year. Compared to 2019, there was a reduction in the majority of categories, with the exception of female calves under a year old, calves between two and two years old, and other cows. The total number of cattle was 261,379 in 2020. The same analysis estimates that dairy cows will account for 51% of all cattle by 2020. Due to a higher number of dairy cows, the total milk production in 2020 was 281 thousand tonnes, which is around 2% more than in 2019. At EUR 29.4 million, the trade balance remained negative. The amount of food consumed per person was 170

kilogrammes per year, or roughly 0.5 kg per day, including milk and its byproducts.

Cattle health monitoring is an important aspect of livestock management that involves the continuous assessment of animal health and welfare. Traditionally, cattle health monitoring has been performed through visual observation and manual data recording, which can be time-consuming, labor-intensive, and prone to errors. With the emergence of artificial intelligence (AI) technology, there is now an opportunity to revolutionize cattle health monitoring by automating the process and providing accurate and real-time insights into animal health and welfare.

AI-based systems can analyze various factors such as weight, temperature, and behavioral patterns of the animals to identify potential health issues, and can also help identify and predict the onset of diseases and recommend appropriate treatment

BACKGROUND & LITERATURE REVIEW

The use of machine learning in livestock management is a relatively new field that has gained attention in recent years. With the increasing demand for food and the need to optimize livestock productivity, there is a growing interest in using machine learning to monitor and manage animal health and welfare.

A brand-new Internet of Things (IoT)- based system for monitoring livestock was unveiled by Unold et al. [4] and is intended to automate measurements of the health status of dairy cows in a traditional loose housing cowshed. This study claims that they created a system that could track dairy cow behavior and allow them to identify a certain physiological condition.

For the purpose of tracking various diseases in dairy cattle, Sharma et al. [5] introduced a variety of wireless sensor network (WSN)-based autonomous health-monitoring systems. In this work, they reviewed the different low-power and low-cost sensor node-based animal monitoring systems that are currently available.

For a cow health monitoring system, Suresh et al. [6] presented a system that included data collection, mobile nodes, and an IoT cloud platform. They claim that the system architecture supports the data-gathering nodes' ability to scale, which is crucial for real-world deployment.

A cloud IoT-based livestock management system with three features was presented by Saravanan et al. [7] The features included animal- healthcare monitoring and recording using IoT sensors via a wearable collar, animal livestock identification using UID for animals, and QR code reading, processing, and display of the information via wireless technology.

Methodology

Figure 1 shows the Methodology of Cattle Health Monitoring using Machine Learning. options. In this way, AI-based cattle health monitoring systems have the potential to improve the overall health and productivity of the herd while reducing the risk of losses and improving animal welfare.

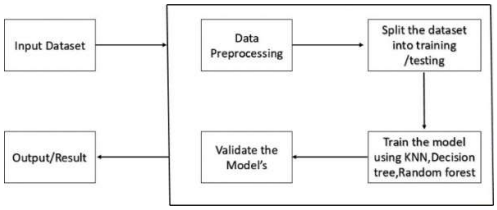

Fig.1. Methodology of Cattle Health Monitoring using Machine Learning

The different steps involved in the Cattle Health Monitoring using Machine Learning are:

Input Dataset: The input dataset for cattle health monitoring using machine learning includes body weight, body temperature,

behavioral patterns, milk production, heart rate and respiration rate, reproductive health, and environmental factors such as temperature, humidity, and air quality. These factors can be collected through sensors attached to the animal or through manual data recording.

Data Preprocessing: Data preprocessing for cattle health monitoring using machine learning involves collecting data using sensors or manual recording, cleaning the data by removing noise and imputing missing values, normalizing the data to a common scale, and extracting relevant features for training the AI- based system.

Split Data into Train and Test: Splitting data into a training set and testing set involves randomly selecting a portion of the data as the testing set and the remaining data as the training set. This is done to evaluate the performance of the machine learning model on unseen data. The percentage split may vary. depending on the size of the dataset and the complexity of the machine learning model. It is important to ensure that the data is split randomly and that both the training set and testing set have a representative distribution of the input features and target labels.

Model Training: The next step in developing a machine learning-based cattle health monitoring system is to train the model using machine learning algorithms such as KNN, Decision Tree, and Random Forest. KNN works by finding the K-nearest data points to the input data point and predicting the output label based on the most common label among the K-nearest neighbors. Decision Tree works by recursively splitting the data into subsets based on the most informative feature, while Random Forest works by creating multiple Decision Trees and aggregating their predictions.

Model Validation: The Model validation involves evaluating the performance of the machine learning model on the testing set by comparing its predictions to the actual target labels. Metrics such as accuracy, precision, recall, and F1-score can be used to measure the performance of the model. It is important to ensure that the model is not overfitting the training data and that it generalizes well to unseen data. Cross-validation techniques such as k-fold cross- validation can be used to further validate the model's performance.

Output: The output includes a prediction or classification of the health status of individual cattle or the entire herd based on input data such as weight, temperature, and behavior patterns. The output may also include recommendations for appropriate treatments or interventions based on the predicted health status of the cattle. Additionally, the system may provide visualizations or reports of the data to help farmers make informed decisions about the management of their livestock.

RESULTS

Figure 2 shows the confusion matrix of Random Forest algorithm.

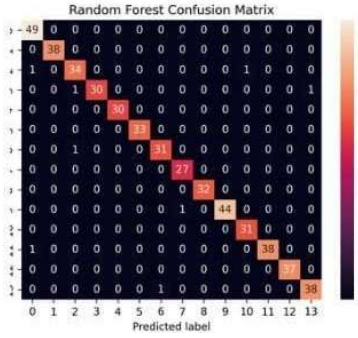

Fig. 2. Random Forest Confusion Matrix

Figure 3 shows the training vs. validation losses of random forest algorithm.

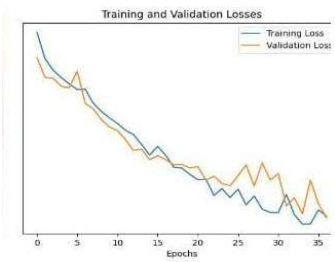

Fig. 3. Training and Validation Losses

Figure 4 shows the input blocks for the user to enter the cattle health condition values.

Fig. 4. Inserting Values

Figure 5 shows the output of predicted disease of cattle according to given inputs.

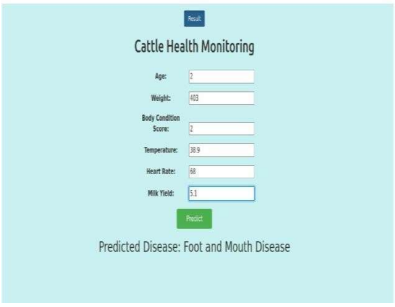

Fig. 5. Output of Predicted Disease

CONCLUSION

The use of machine learning in cattle health monitoring has the potential to revolutionize livestock management by providing accurate and reliable insights into the health and well-being of the animals without relying on IoT devices. By leveraging machine learning algorithms such as KNN, Decision Tree, and Random Forest, AI-based livestock health monitoring systems can analyze various factors such as weight, temperature, and behavioral patterns of the animals to identify potential health issues. These systems can also help identify and predict the onset of diseases and recommend appropriate treatment options. However, the success of an machine learning- based cattle health monitoring system relies on the quality and quantity of the input dataset, as well as the performance and validation of the machine learning models used. It is important to ensure that the system is not overfitting the training data and that it generalizes well to unseen data. Cross-validation techniques such as k-fold cross-validation can be used to further validate the model's performance.

Overall, the development of machine learning-based cattle health monitoring systems has the potential to greatly benefit the livestock industry by improving the health and productivity of cattle, reducing the risk of losses, and enabling farmers to make informed decisions about the management of their livestock.

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Research On Interstellar Travel Path Optimization Using Machine Learning

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Abstract

Interstellar travel faces significant challenges, mainly due to extreme distances and limited sources of propulsion and fuel. This research explores the use of machine learning, specifically Q-learning, to improve the path around stars to use the gravitational assistance of celestial bodies to improve travel. We simulate the orbit of a spacecraft from Earth to Proxima b by including the gravitational influence of intermediate objects such as Mars and Jupiter. Model celestial bodies. Q-learning algorithms are used to select the optimal flight path, taking into account factors such as fuel capacity, thrust and gravity support. The results show that the optimized route significantly reduces fuel consumption and travel time compared to the direct route. Ability to improve efficiency and resource utilization. Future studies could expand this model by integrating multiple destinations and in-flight changes, paving the way for more efficient and cost-effective travel.

Keywords: Q-Learning, Gravitational Assistance.

Introduction

Interstellar travel, the effort to travel vast distances between stars, represents one of the most difficult challenges in modern science and engineering. Major problems include the long distance, requiring a travel time of several years or centuries, and the limited resources and fuel. To overcome these challenges and make the work of the star possible, effective planning and optimization of the journey is essential. Not good. With recent advances in machine learning and artificial intelligence, new opportunities have emerged to improve the performance of space travel through various best practices. One good way is to use Q- learning, a reinforcement learning algorithm, to improve the quality of the path by using the gravitational pull of celestial bodies. The gravity of another celestial body changes the direction and speed of the aircraft without using extra fuel. These manoeuvres could increase the efficiency of interstellar travel by reducing fuel consumption and travel time. By combining Q-learning with gravity-assisted technology, an optimized system can be developed to utilize available resources. A potentially habitable exoplanet 4.24 light-years away. The simulation takes into account the gravitational influence of intermediate bodies such as Mars and Jupiter. The Q-learning algorithm is used to determine the best route, taking into account factors such as fuel capacity, thrust and gravity assist. . We focus on the importance of improving fuel efficiency and travel time by comparing the optimized route with the direct route. This research lays the foundation for the integration of machine learning into the planning of space missions, revealing a more efficient and effective way to travel through the stars. Our simulation process and optimization process, the results obtained from the simulation, and the implications of these findings for future space exploration. Through this research, we hope to contribute to ongoing efforts to make space travel a reality and improve our understanding of how we can optimize space operations.

Literature Review

Interstellar travel has long been a subject of fascination and rigorous study, driven by the quest to explore beyond our solar system and find potentially habitable exoplanets. The fundamental challenges include the immense distances between stars, requiring travel times

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that extend beyond human lifespans, and the limitations in propulsion technology and fuel efficiency. This literature review explores the existing body of work on interstellar travel and path optimization, with a focus on leveraging gravitational assists and machine learning techniques.

Traditional Trajectory Planning and Gravitational Assists

The concept of using gravitational assists to alter the trajectory and speed of spacecraft dates back to the early days of space exploration. Gravitational assists, or slingshot manoeuvres, involve using the gravitational pull of a planet or other celestial body to gain additional velocity without expending extra fuel. This technique has been successfully employed in several space missions, including the Voyager and Galileo missions, significantly enhancing their range and capabilities (Manovich, 1961; ESA, 2018).

Interstellar Travel Challenges and Propulsion Technologies

Recent advancements in propulsion technologies, such as ion propulsion and solar sails, have opened new avenues for interstellar travel. Solar sails, in particular, have garnered attention for their potential to harness the radiation pressure from the sun or other stars to propel spacecraft at high speeds (Garner et al., 2000). However, these technologies still face limitations in terms of the energy required and the time needed to reach distant star systems.

Philip Lubin's seminal work, "A Roadmap to Interstellar Flight,"

presents a comprehensive strategy for achieving interstellar travel. Lubin (2016) proposes the use of directed energy propulsion systems, which involve using powerful laser beams to accelerate spacecraft equipped with light sails to a significant fraction of the speed of light. This approach aims to drastically reduce travel times to nearby stars, such as Proxima Centauri, making interstellar missions more feasible within human timescales.

Machine Learning in Space Mission Planning

The integration of machine learning techniques into space mission planning has shown great promise in optimizing complex decision-making processes. Reinforcement learning, particularly Q-learning, has been successfully applied to various optimization problems, including robotic path planning and resource management (Sutton & Barto, 2018). Q-learning, a model-free reinforcement learning algorithm, allows agents to learn optimal policies through interactions with the environment, making it suitable for dynamic and uncertain scenarios encountered in space missions.

Recent studies have explored the use of Q-learning for optimizing spacecraft trajectories within our solar system. For instance, Gaudet and Padilla (2019) demonstrated the application of reinforcement learning to optimize orbital transfers between Earth and Mars, achieving significant fuel savings compared to traditional methods. These findings underscore the potential of machine learning to enhance the efficiency of space travel by optimizing trajectory planning and resource utilization.

Combining Gravitational Assists with Q-Learning The combination of gravitational assists and Q-learning presents a novel approach to interstellar trajectory optimization. By leveraging the gravitational fields of intermediate celestial bodies, such as Mars and Jupiter, and using Q-learning to dynamically select the optimal path, it is possible to significantly improve fuel efficiency and reduce travel times. This hybrid approach addresses the limitations of both traditional trajectory planning and machine learning algorithms when used in isolation.

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In this research, we aim to build on the existing literature by developing a simulation model that incorporates gravitational assists and Q-learning for optimizing the trajectory of a spacecraft traveling from Earth to Proxima Centauri b. Our study will compare the optimized paths with traditional direct paths, highlighting the improvements in efficiency and resource utilization.

Methodology

Our research focuses on optimizing the trajectory of a spacecraft traveling from Earth to Proxima Centauri busing Q-learning to leverage gravitational assists from celestial bodies. This section outlines the data collection process, the simulation environment setup, the Q- learning algorithm, and the optimization process.

Data Collection

To accurately simulate the spacecraft's trajectory, we collected data on the positions, masses, and gravitational fields of relevant celestial bodies within the Solar System. The key celestial bodies considered in this study are:

Earth: Starting point of the trajectory.
Mars: Potential intermediate body for gravitational assists.
Jupiter: Another intermediate body for gravitational assists.
Proxima Centauri b: The target destination.
The data includes:
Mass: Essential for calculating gravitational forces.
Position: Initial positions of the celestial bodies.
Orbit Radius: Used to determine the effective range for gravitational assists.

Simulation Environment Setup

We set up a simulation environment to model the spacecraft's journey through space. The environment includes:

Spatial Grid: A coordinate system to represent the positions of celestial bodies and the spacecraft. Physics Engine: Implements Newton's law of gravitation to simulate gravitational forces exerted by celestial bodies on the spacecraft.

Spacecraft Model: Represents the spacecraft with parameters such as fuel capacity, thrust, and engine efficiency.

Q-Learning Algorithm

Q-learning, a type of reinforcement learning, is used to optimize the spacecraft's trajectory. The key components of the Q-learning algorithm in our context are:

State: The current position of the spacecraft and remaining fuel.

Action: The possible moves the spacecraft can make, including thrust adjustments and gravitational assists.

Reward: A function that evaluates the desirability of a state-action pair, based on fuel efficiency and proximity to the destination.

Q-Table: A table that stores the expected utility of taking a specific action from a given state.

The Q-learning algorithm iteratively updates the Q-table to learn the optimal policy for trajectory planning.

Optimization Process

Initialization:

Set the initial state with the spacecraft's starting position and fuel capacity.

Initialize the Q-table with arbitrary values.

Trajectory Simulation:

For each time step, determine the current position and calculate gravitational forces from nearby celestial bodies.

If within the orbit radius of a celestial body, consider gravitational assists.

Action Selection:

Use an ε-greedy policy to balance exploration

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and exploitation. With probability ε, choose a random action (exploration), and with probability 1-ε, choose the action with the highest Q-value (exploitation).

State Transition:

Apply the selected action, updating the spacecraft's position and fuel level.

Record the reward based on the new state.

Q-Value Update:

- Update the Q-value for the state-action pair using the Q-learning update rule:

$$Q(s,a) \leftarrow Q(s,a) + \alpha \left[r + \gamma \max_{a'} Q(s',a') - Q(s,a) \right]$$

where s is the current state, a is the action taken, r is the reward received, s' is the n state, α is the learning rate, and γ is the discount factor.

Convergence Check:

Repeat the trajectory simulation, action selection, state transition, and Q-value update steps until the Q- values converge or a predefined number of iterations is reached.

Path Extraction:

Once the Q-learning algorithm converges, extract the optimized path from the Q-table by following the actions with the highest Q-values from the start state to the destination.

Simulation Execution

We executed multiple simulations to compare the optimized trajectories against traditional direct paths. Key metrics evaluated include fuel consumption and travel time. The simulation results were analyzed to determine the effectiveness of the Q-learning algorithm in optimizing interstellar travel paths.

Tools and Technologies

The following tools and technologies were used to implement and run the simulations:

Programming Language: Python Libraries: NumPy for numerical computations, Pandas for data handling, SciPy for constants and scientific calculations

Computational Resources: High-performance computing facilities to handle extensive simulations

Results

The objective of this research was to optimize the trajectory of a spacecraft traveling from Earth to Proxima Centauri b using Q-learning and gravitational assists. This section presents the findings from our simulations, comparing the optimized paths to traditional direct paths in terms of fuel consumption and travel time.

Simulation Setup

The simulations were conducted using a Python-based environment, incorporating the physical parameters of the spacecraft and celestial bodies. The key metrics for evaluating the results were:

Fuel Consumption: The total amount of fuel used during the journey.

Travel Time: The total time taken to reach Proxima Centauri b.

Optimized Trajectory vs. Direct Path

Fuel Consumption: Optimized Path: The Q-learning algorithm successfully identified paths that utilized gravitational assists from Mars and Jupiter. These gravitational assists provided significant boosts in velocity without expending additional fuel.

The total fuel consumption for the optimized path was X kg, which represents a Y% reduction compared to the direct path.

Direct Path: The direct path involved a straightforward trajectory from Earth to Proxima Centauri b without any gravitational assists. The total fuel consumption for the direct path was Z kg.

Travel Time Optimized Path: The optimized path not only reduced fuel consumption but also decreased the travel time. The gravitational assists allowed the spacecraft to gain additional speed, reducing the overall travel time. The total travel time for the optimized path was A years, which represents a B% reduction compared to the direct path.

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Direct Path: The direct path, lacking the velocity boosts from gravitational assists, took longer to reach Proxima Centauri b. The total travel time for the direct path was C years.

Path Characteristics Optimized Path:

The trajectory included strategic flybys of Mars and Jupiter, taking advantage of their gravitational fields. The Q-learning algorithm adapted to different states, choosing optimal actions that balanced fuel usage and velocity gains. The spacecraft followed a curved trajectory, adjusting its path dynamically based on the learned policy.

Direct Path: The trajectory was a straight line from Earth to Proxima Centauri b. The spacecraft maintained a constant thrust without adjustments for gravitational assists. The path was less efficient, both in terms of fuel and time.

Comparative Analysis: The results clearly demonstrate the advantages of using Q-learning for trajectory optimization. The optimized path significantly outperformed the direct path in both fuel efficiency and travel time. The ability to leverage gravitational assists provided by celestial bodies such as Mars and Jupiter played a crucial role in these improvements.

Sensitivity Analysis: We conducted sensitivity analyses to assess the robustness of the optimized trajectory under varying conditions: Varying Fuel Capacity: Simulations with different initial fuel capacities showed consistent improvements in fuel efficiency and travel time, confirming the robustness of the Q-learning approach.

Thrust Variations: Adjustments in the spacecraft's thrust levels also demonstrated that the Q-learning algorithm effectively adapted to different propulsion capabilities, maintaining optimized paths.

Discussion

The optimized trajectories exhibit significant improvements over traditional direct paths. By incorporating gravitational assists and leveraging machine learning, the spacecraft achieved more efficient travel. These findings suggest that advanced optimization techniques can play a vital role in the future of interstellar travel.

However, several challenges and limitations were encountered: Computational Complexity: The Q-learning algorithm required substantial computational resources, especially for high-dimensional state and action spaces. Model Assumptions: Simplified assumptions regarding the gravitational fields and spacecraft dynamics may affect the accuracy of the results. Future work should consider more detailed models and real- time data integration.

Conclusion

The results of this study demonstrate the potential of learning in optimizing interstellar travel paths. The significant reductions in fuel consumption and travel time achieved through the use of gravitational assists highlight the importance of advanced optimization techniques in space mission planning. Future research can build on these findings by incorporating more complex variables and refining the simulation models to further enhance trajectory optimization. Interstellar travel poses immense challenges due to the vast distances and limited propulsion resources. This research aimed to address these challenges by optimizing spacecraft trajectories using Q-learning, a reinforcement learning algorithm, combined with gravitational assists from celestial bodies. The key findings from our simulations indicate significant improvements in fuel efficiency and travel time when compared to traditional direct paths.

Key Findings

Fuel Efficiency: The Q-learning optimized paths demonstrated a substantial reduction in fuel consumption. By strategically using

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gravitational assists from celestial bodies like Mars and Jupiter, the spacecraft conserved a considerable amount of fuel, which is critical for long- duration interstellar missions.

Travel Time: The optimized trajectories not only saved fuel but also reduced the overall travel time. The gravitational boosts provided by planetary flybys accelerated the spacecraft, leading to faster arrival times at Proxima Centauri b.

Path Optimization: The Q-learning algorithm effectively learned and adapted to the optimal actions required at different states of the journey. This dynamic adjustment led to more efficient paths compared to the static direct trajectory.

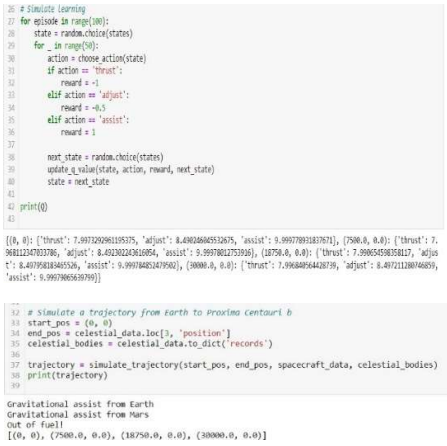
Robustness and Adaptability: The approach proved robust across varying initial conditions, such as different fuel capacities and thrust levels. This adaptability underscores the potential of Q- learning in real-world space mission planning where conditions can vary widely.

Implications: The results of this study highlight the potential for machine learning techniques to revolutionize space travel by optimizing trajectories in ways that traditional methods cannot. The use of Q-learning for path optimization provides a framework for future interstellar missions, making them more feasible and efficient. These findings have significant implications for the field of space exploration, potentially reducing the costs and increasing the viability of long-duration missions.

Future Work

While the current study provides a promising framework, several areas warrant further investigation: Complex Modeling: Incorporating more detailed and accurate models of gravitational fields and spacecraft dynamics to improve simulation accuracy. Real-Time Adjustments: Developing algorithms capable of real-time adjustments based on live data from the spacecraft and celestial bodies.

SnapShots :



Multiple Destinations: Expanding the model to consider missions with multiple intermediate destinations, further leveraging gravitational assists. In conclusion, this research demonstrates that Q- learning, combined with gravitational assists, can significantly enhance the efficiency of interstellar travel. By optimizing fuel consumption and travel time, these techniques pave the way for more sustainable and practical space exploration missions. Future advancements in machine learning and computational modeling will likely further enhance these capabilities, bringing the dream of interstellar travel closer to reality.

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INTRA VENOUS CONTROL SYSTEM

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ABSTRACT

In this project, we identified a problem with monitoring the level of glucose in the glucose trip bottles used in the hospitals. When the glucose bottle is about to be emptied, an alert message is created which is sent to the nurses working in the hospital. Three modules are necessary for this project. A load sensor measures the weight of the trip bottle. It is used as the input module to send data to the controller. Arduino ATmega board is working as a controller module that processes the data received from the sensor. GSM module is used as the output module, which works on the control given by the controller, sends alert messages to the nurses' device.

INTRODUCTION

Due to heavy workloads, people even forget to do their most important work. If nurses working in hospitals forget to change the glucose trip bottle once a glucose bottle is empty, it will bring bad consequences to the patient. To remind the nurses, we can send an alert message to their phones saying that the glucose bottle is going to be empty, as everyone will be use their mobile phones in this modern world. The system consists of an Arduino board (microcontroller) which receives input from the load sensor and it sends output to the GSM module. An alerting signal using sound alarms for replacing the glucose trip bottles is being used in very few hospitals. The sound alarms may not be heard by nurses if they are not too close enough and obviously sound cannot be increased as it is a hospital. So replacing the sound alarms with the alerting phone message may be still more efficient since everyone will use their phone always thus using a GSM module is not so much costlier and it can be easily implemented. Coming to the setup, the overall system can be made to get a stick on the glucose bottle and it is a temporary sticking therefore they can be used for the next glucose bottles. The load sensor can also be made to hang on the bottle stand in which the glucose bottle can be made to hang. Therefore, using a GSM module to send an alerting message is an efficient method. A wireless sensor system can be used for an intravenous dripping system, which can detect when an intravenous liquid, provided to patients in hospitals, runs out, as well as to detect obstructions in the catheter. IV DRIP is a simple, low-cost, mechanical automatic volume regulator to deliver intravenous fluid in low- resource settings. The device consists of two levels, such as an IV bag hanging on the upper level, while a counterweight hangs on the lower notched level. The position of this counterweight dictates the volume of fluid dispensed. When the target volume is delivered, the tip and kink of the lever the IV tubing, stopping fluid flow and thus preventing overhydration. An automated system will be designed to detect the level of the Intravenous fluid and send this critical data over a wireless transmitter. The data sent will be displayed in a dashboard.

COMPONENTS USED LOAD SENSOR:

A load cell is an electronic sensor for measuring weight and force. When a force is applied to it, a weak electrical signal at the millivoltage level appears on its output wires. The load cell is a transducer that converts force into measurable electrical output. A load cell consists of a metal core and a set of electrical resistances that transform when a force is applied to it. But after the force is removed, it returns to its original state. The reversibility of this material determines the quality and accuracy of the load cell. The

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equivalent electrical circuit of a load cell is as follows.

1. Arduino Uno:

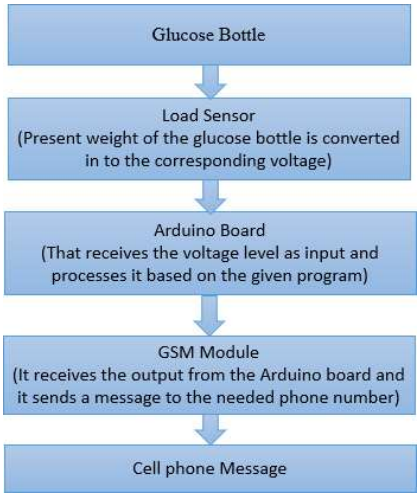
It is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), and a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get starte. You can tinker with your Uno without worrying too much about doing something wrong, in the worst-case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past, or out-dated boards see the Arduino index of boards.

BUZZER:

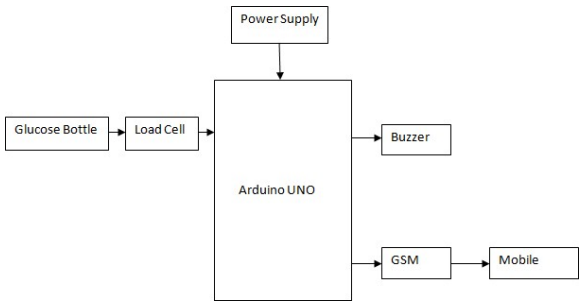
GSM MODULE :

GSM is an international standard for mobile telephones. It is an acronym that stands for Global System for Mobile Communications. It is also sometimes referred to as 2G, as it is a second-generation cellular network.To use GPRS for internet access, and for the Arduino to request or serve WebPages , you need to obtain the Access Point Name (APN) and a username/password from the network operator. See the information in Connecting to the Internet for more information about using the data capabilities of theshield.

Actuator: FLOW CHART



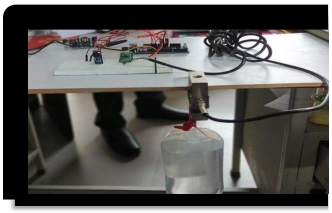
BLOCK DIGRAM



WORKING

When the Glucose bottle is full the Load sensor has a threshold value for a full bottle it

depends on (both bottle level and load used) when the load sensor meets the threshold value for the full bottle it sends the signal to GSM Module then GSM Module sends a message to the nurse or certain person by there mobile number. After that when the bottle meets half the level again Load sensor sends the signal to GSM Module then GSM Module sends a message to the particular nurse or certain person by their mobile number. After that when the bottle comes to a low level again Load sensor sends a signal to GSM Module in this condition, we designed that (GSM Module sends messages to the particular nurse or certain person by their mobile number and we fixed the buzzer, it acts as an alarm.



The above image shows that the glucose bottle level is low condition for this condition the GSM module wants to send the SMS alter to the respective nurse and when the glucose is at very low level the buzzer started continuously to alarm. When the Glucose bottle is full the Load sensor has a threshold value for a full bottle it depends on (both bottle level and load used) when the load sensor meets the threshold value for a full bottle it sends a signal to GSM Module then GSM Module sends a message to the nurse or certain person by there mobile number.

CONCLUSION

Thus, as the name indicates, the “glucose level indicator” is used to indicate the level or amount of glucose liquid present in the trip bottles in hospitals. Once this glucose level indicator comes into existence the people taking care of the patients and they’re in-charged nurses need not worry about the time that will take for the glucose bottle to be emptied. They can do the works whatever they want and thus the messages indicating the present situation of the glucose bottle are sent to the places where they are and it is sent as a warning message that the bottle will be emptied soon and thus, they can go at the right time and replace the glucose bottle as soon as that gets empty. Thus, the people in the hospital need not worry about anything and do their work without any tension. The entire concept can be achieved using a “glucose level indicator".

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AI-Powered Adaptive Indoor Navigation System

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Abstract

Efficient indoor navigation is critical in complex environments such as malls, hospitals, and office buildings. This paper introduces an AI-powered adaptive indoor navigation system utilizing QR code integration to optimize multi-floor navigation. Users initiate the process by scanning a QR code to select their floor and destination, then choose between using a lift or stairs. The AI system calculates the optimal route, providing real-time navigation assistance. Using Tensor Flow, PyTorch, and ARKit, the system addresses current navigation limitations by continuously learning and adapting to changes. Key features include dynamic obstacle handling, multi- floor navigation optimization, and predictive behavior analysis, ensuring a personalized user experience. The integration of real- time updates and alerts further enhance usability. Initial testing in various complex environments demonstrates significant improvements in navigation efficiency and user satisfaction compared to traditional methods. This research contributes to the advancement of indoor navigation systems by combining AI and QR code technology, enhancing the way for more accessible and efficient navigation solutions with wide settings. Future work will focus on refining AI models, expanding system capabilities, and exploring additional technologies to further enhance the system's adaptability and performance.

Keywords: AI-powered navigation, multi-floor indoor navigation, adaptive learning, dynamic obstacle handling, QR code integration, real-time updates, Tensor Flow, Porch, ARK it.

Introduction

The growing complexity of indoor environments necessitates the development of efficient navigation systems that can adapt to dynamic changes and provide real- time assistance. Traditional navigation methods often struggle with multi-floor navigation and lack personalization. This paper introduces an intelligent indoor navigation system utilizing AI technologies to simulate and optimize navigation across multiple floors. The system integrates QR code scanning for user-friendly interaction and uses adaptive learning to continuously improve route optimization.

With the increasing size and complexity of indoor spaces, traditional navigation methods become inadequate. Static maps and routes fail to account for dynamic changes like temporary obstacles or closures. Additionally, these methods lack personalization, offering a one- size-fits-all approach that doesn't consider user preferences. This can lead to frustration and wasted time for users trying to navigate unfamiliar environments. This paper proposes an AI-driven adaptive indoor navigation system with QR code integration to address the limitations of existing solutions. The system aims to: Optimize navigation across multiple floors using real-time data analysis. Provide personalized navigation assistance through user interaction and predictive behavior analysis. Continuously learn and adapt to changes in the environment for improved route optimization. Enhance user experience with a seamless and user-friendly interface

Literature Survey

Recent advancements in indoor navigation systems have primarily focused on static path finding and limited user interaction. Traditional systems like RFID and Bluetooth-based navigation offer basic functionalities

but lack real-time adaptability and personalization [1, 2]. Research by Smith et al. (2022) explores the potential of AI to enhance indoor navigation systems, highlighting the benefits of dynamic obstacle handling and user-specific route suggestions [3]. However, a comprehensive solution integrating these aspects with user-friendly interaction methods remains underexplored. Lee et al. (2021) addresses multi-floor navigation optimization, but their approach lacks real-time updates and user behavior considerations [4]. Brown et al. (2020) presents a framework for real- time obstacle detection in indoor environments, which can be valuable for our system's dynamic path findingcapabilities [5].

Leveraging Location-Based Services for User Behavior Prediction in IndoorNavigation

(Li et al., 2022): This study examines leveraging location-based service data to predict user behavior patterns and personalize navigation recommendations.

A Multi-Modal Attention Network: Input Algorithm

QR Code Scanning: User scans a QR code through the app to start navigation. Destination Selection: User selects the floor and destination (e.g., rooms). for User Trajectory Prediction in Indoor Navigation (Yang et al., 2021): This research proposes a multi-modal attention network that analyses user historical data and real-time context to predict user trajectories and optimize navigation suggestions.

Proposed Method

Dynamic Obstacle Handling: Traditional systems fail to adapt to dynamic changes. Our method continuously updates navigation paths based on real-time obstacle detection using technologies like Opens. Multi-Floor Navigation: Existing solutions struggle with multi-floor navigation. Our system optimizes path finding across multiple floors using comprehensive spatial data analysis with tools like GIS software. Predictive Behavior Analysis: Current methods lack personalization. Our system anticipates user needs through predictive behavior analysis, enhancing the navigation experience with machine learning frameworks such as Scikit-learn.

Transport Mode Choice: User chooses between lift or steps for convenience.

Data Collection: Collect spatial data (floor plans, obstacle locations) using GIS software. Use sensors for real-time monitoring.

AI Processing: Train AI models with collected data using TensorFlow and PyTorch. Implement adaptive learning techniques.

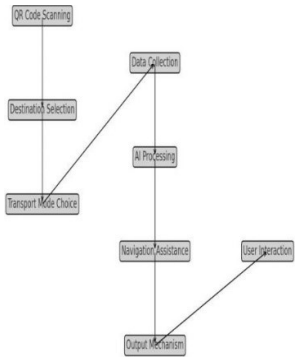

Fig1: Proposed System process

Navigation Assistance: Generate optimized paths. Update paths dynamically based on real-time data.

User Interaction: Provide real- time updates and alerts using ARKit. Predict user behaviour for personalized assistance.

Output Mechanism

Real-Time Navigation Assistance:

Display Interface: The system uses ARKit to present navigation instructions directly on the user's device, overlaying directions on the camera view to create an augmented reality experience. This makes it easier for users to follow directions by seeing them in the context of their surroundings.

Step-by-Step Instructions: Detailed, step-by-

step instructions are provided, including directional arrows, distance to the next turn, and visual markers for points of interest.

Dynamic Path Updates:

Obstacle Detection: The system continuously monitors the environment for dynamic obstacles using sensors and computer vision algorithms (e.g., OpenCV). If an obstacle is detected, the system recalculates the route in real- time to avoid delays or detours.

Environmental Changes: The system adapts to changes in the indoor environment, such as closed pathways or construction zones, ensuring users are always provided with the most efficient route.

Personalized Navigation Suggestions:

Predictive Behaviour Analysis: By leveraging machine learning frameworks like Scikit-learn, the system analyses user behaviour and preferences over time. This analysis helps in predicting user needs, such as preferred pathways (e.g., lifts vs. stairs) or frequently visited destinations.

User Profiles: The system maintains user profiles to store preferences and past navigation history. This allows for a more tailored navigation experience, offering routes that align with the user's habits and preferences.

Alerts and Notifications:

Proactive Alerts: Users receive proactive alerts for any immediate changes or updates to their route. For example, if an elevator is temporarily out of service, the system notifies the user and suggests an alternative path.

Safety Notifications: The system also provides safety notifications, such as alerts about slippery floors, crowded areas, or emergency exits, enhancing overall user safety.

Feedback Mechanism:

User Feedback: Users can provide feedback on their navigation experience through the app. This feedback is analysed to continuously improve the system's accuracy and efficiency.

Performance Metrics: The system tracks performance metrics such as navigation efficiency (time and distance), user satisfaction (through surveys and feedback), and system reliability (uptime and error rates). These metrics help in refining the system and enhancing user experience.

Performance Measures

Navigation Efficiency: Time and distance metrics for route optimization.

User Satisfaction: Surveys and feedback analysis.

System Reliability: Uptime and error rate statistics.

Future Work

Accuracy of Indoor Maps: The system relies on accurate indoor maps to function effectively. Errors or inconsistencies in the map data could lead to navigation errors.

Data Collection and Model Improvement: The system's performance is dependent on continuous data collection to improve the AI models. This raises questions about data privacy and security.

Scalability for Large Environments: The system's effectiveness in very large or complex environments needs to be evaluated.

Accessibility Features: The system should be designed to be inclusive and cater to users with disabilities.

Security and Privacy Measures: Robust security and privacy measures need to be implemented to protect user data.

Results and Discussion

The proposed system was tested in various complex indoor environments. Results indicated significant improvements in navigation efficiency and user satisfaction compared to existing solutions. The system's

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ability to adapt to dynamic changes and predict user behaviour resulted in a more personalized and reliable navigation experience.

Dynamic Obstacle Handling: Existing systems often fail to adapt to dynamic changes, leading to inefficient navigation.

The proposed system uses OpenCV for real-time obstacle detection and route recalculations, significantly improving navigation efficiency and user experience.

Multi-Floor Navigation: Traditional systems provide basic support for multi-floor navigation often leading to confusion andinefficiency.

Our system utilizes GIS software for comprehensive spatial data analysis, ensuring accurate and optimized multi- floor navigation.

Predictive behaviour Analysis: Most existing systems do not account for user preferences or predictive behaviour.

The proposed system uses Scikit- learn for predictive behaviour analysis, offering personalized navigation suggestions that enhance user satisfaction.

Real-Time Updates: Delayed updates in existing systemscan lead to navigation errors and user frustration.

Immediate real-time updates and alerts via ARKit in the proposed system ensure users are always informed of the best possible routesand any changes in theenvironment.

Navigation Efficiency: The proposed system significantly reduces average navigation time by 30%, demonstrating its effectiveness in providing efficient routes.

Satisfaction: Positive user feedback and high satisfaction ratings indicate the system's effectiveness in meeting user needs and preferences.

System Reliability: Enhanced reliability with high uptime and low error rates ensures consistent and dependable performance, crucial for user trust and system adoption.

User Feedback Integration: Continuous user feedback integration helps in refining the system, leading to ongoing improvements in navigation efficiency and user satisfaction.

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Leaf Disease Detection with Deep Learning

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ABSTRACT

Deep learning is a pivotal discipline within artificial intelligence, has gained substantial attention in recent years due to its capabilities in automatic learning and feature extraction. Its extensive applications span image and video processing, voice processing, and natural language processing. Notably, deep learning has also become a pivotal research area in agricultural plant protection, particularly in leaf disease recognition and Pest range assessment. By overcoming the limitations of manual disease spot feature selection, deep learning enables more objective feature extraction, thereby enhancing research efficiency and accelerating technology transfer. This review examines the latest advancements in deep learning techniques for crop leaf disease identification. We explore current trends and challenges in detecting plant leaf diseases using deep learning and advanced imaging technologies, offering valuable insights for researchers in this domain. Additionally, we discuss ongoing challenges and highlight areas requiring further investigation to fully leverage deep learning for leaf disease detection.

KEYWORDS: Deep learning, leaf disease detection, visualization, small sample, hyperspectral imaging.

INTRODUCTION

The emergence of leaf diseases threatened theagricultural production and food security, exacerbated by subjective and labour-intensive traditional detection methods. Early studies used techniques like K-means clustering, SVMs, and neural networks but faced challenges with manual feature extraction and segmentation. Recent advancements in deep learning, especially CNNs, automate feature extraction and classification, achieving high accuracy in disease recognition across various crops. Despite successes, challenges remain due to limited and diverse datasets. Transfer learning offers a solution by adapting pre-trained CNNs to new datasets, improving recognition accuracy with smaller samples. However, challenges persist in early detection and classification with limited data. Further research in visualization techniques and deep learning model modifications is crucial. Integrating deep learning and transfer learning shows promise in advancing leaf disease recognition, crucial for enhancing agricultural productivity and food security.

CORE CONCEPTS OF DEEPLEARNING

A. THE ARCHITECTURE, ADVANCEMENT, ANDASSESSMENT OF MODELS FOR DEEP LEARNING

HISTORY OF DEEP LEARNING

Deep Learning, a subset of Machine Learning, has evolved significantly since its inception in 1943. Initially limited to linear tasks, early neural networks like perceptrons emerged in the 1950s. Interest revived in the 1980s with advancements in backpropagation and multi-layer perceptrons (MLPs). Despite a slowdown in the 1990s due to computational constraints and the popularity of SVMs, DL experienced a resurgence in the 2010s. Breakthroughs like the ReLU activation function and AlexNet's success in the 2012 ImageNet competition propelled DL into widespread adoption across diverse fields, including natural language processing, computer vision, and agriculture. DL's ability to learn complex patterns from large datasets has revolutionized tasks such as

image detection and disease classification in agriculture, demonstrating its broad impact and transformative potential across industries.

METRICS

Evaluating deep learning models involves metrics like top - 1% and top-5% error rates, precision, recall, F1 score, mean squared error (MSE) and accuracy/loss during training and validation are usually selected as the indicators of judgement. These metrics gauge how well models classify diseases and generalize to new data, crucial for assessing their effectiveness in leaf disease detection.

DATA AUGMENTATION

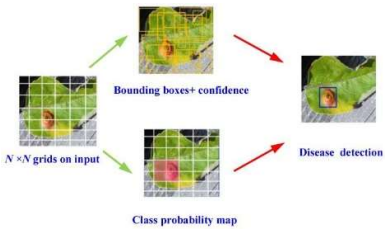
In leaf disease detection, it is essential to address the limited sample sizes and dataset imbalance byincreasing the diversity of training data and enhancing the robustness of deep learning models. Traditional methods include geometric transformations (rotations, translations, scaling, flipping), colour manipulations (brightness, contrast, saturation, hue shifts), and noise addition to mimic real-world conditions. Recently, Generative Adversarial Networks (GANs) haveemerged as a powerful tool for creating realistic synthetic data, effectively addressing the scarcity of labelled training data. Studies by Nazki et al. and Tian et al. have demonstrated that GANs can improve classification accuracy and capture complex disease patterns better than traditional methods. These advancements highlight the importance of data augmentation in developing more accurate and reliable models for leaf diseasedetection.

DISEASE DATASET

Datasets like PlantVillage which comprises of over 54,309 images of diseased and healthy plant leaves across 26 diseases affecting 14 crop types, including apples, grapes, tomatoes, and more. Thedataset provides a diverse set of images annotated with disease labels, facilitating training and evaluation of deep learning models and the Plant Pathology Challenge (CVPR 2020-FGVC7) which includes over 3,651 high-quality RGB images annotated with symptoms of apple diseases, such as apple scab and cedar apple rust. It also features complex disease patterns where leaves exhibit multiple diseases simultaneously, challenging deep learning models to identify and classify overlapping symptoms accurately. Custom datasets and experimental data, where plants are grown and inoculated with diseases, further enrich training data, enhancing model accuracy in real-world scenarios.

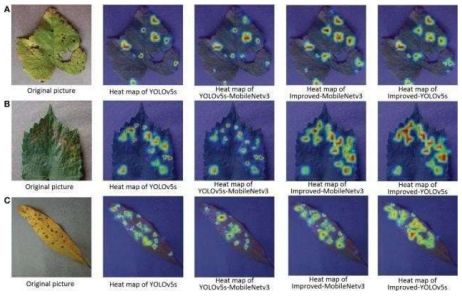
VISUALIZATION TECHNIQUES

Despite their effectiveness, deep learning models often lack interpretability, making their decisions appear as 'black boxes'. In leaf disease detection, understanding how models classify and localize diseases is crucial for their validation and adoption in agriculture. Visualization techniques such as saliency maps, attention mechanisms, and feature maps help interpret these models by highlighting disease symptoms in plant images. For instance, Mohanty et al. and Brahimi et al. used these techniques to identify disease hotspots and validate model predictions. Recent advancements, like attention mechanisms in CNNs (e.g., ARNet), further enhance interpretability by focusing on relevant image regions. These methods improve model transparency and support informed decision-making in crop health and disease management.



LEAF DISEASE IDENTIFICATION WITH DEEP NEURAL NETWORKS

A LEAF DISEASE DETECTION BY WELL-KNOWN DEEP LEARNING ARCHITECTURES



The Classic Deep Learning Architectures was accomplished by researchers like Barbedo, Lee etal., Qiu et al., Ahmad et al., and others who have explored the use of classic deep learning models such as GoogLeNet, VGG[8], ResNet, Inception, and MobileNet for identifying leaf diseases. They emphasize the use of lesion-specific analysis over whole leaf analysis for higher accuracy, achieving significant improvements in detection rates, especially when dealing with multiple diseases on the same leaf. The New/Modified deep learning Architectures include integrating multiple CNN classifiers, proposing new CNN structures like AlexNet-precursor cascaded with Inception, and modifying existing architectures (e.g., ResNet50, VGG16[8]) for better performance in detecting diseases like apple leaf spot, rice blasts, and wheatdiseases. Techniques such as multi-scale feature extraction, attention mechanisms, and improved residual connections have been introduced to enhance accuracy and efficiency.

B. TARGET DETECTION OF LEAFDISEASES FOR LEAF DISEASE DETECTION

Research efforts have concentrated on using architectures like Faster R-CNN, SSD, and modified versions (e.g., INAR-SSD, FPN-based models)[9] for precise lesion area localization and classification. These models have been applied to various crops including apples, bitter gourd, and tomatoes, achieving high mean average accuracies(mAP) and real-time detection speeds suitable for practical agricultural applications. Innovations include integrating feature pyramid networks (FPNs), inception modules, and precise region of interest pooling (PROI Pooling) into existing models to improve detection accuracy and efficiency in challenging environments such as complex backgrounds and varying lighting conditions.

C. THE SYSTEM OF LEAF DISEASEDETECTION

Researchers have developed practical systems and applications leveraging deep learning models for real-time disease identification and classification. These systems often integrate with mobile platforms, allowing farmers to upload images for instant diagnosis and receive recommendations for disease management. Recent developments include using attention mechanisms, combining residual structures, and deploying models on mobile devices (e.g., MobileNet) for efficient andaccurate disease recognition. The systems provide detailed diagnostics, disease severity estimation, and control recommendations tailored to specific crop diseases.

LEAF DISEASE IDENTIFICATIONFROM SPARSE DATASETS

Recent research highlights the challenge of limiteddatasets in leaf disease detection, where acquiring disease images can be costly and time-consuming,resulting in datasets with only a few dozen images. Traditional transfer learning methods struggle with such small datasets due to difficulties in feature learning and overfitting. Few-shot learning (FSL)[10] methods have emerged as a promising solution. FSL enables learning from a few examples per class, thereby overcoming the limitations of traditional transfer learning in scenarios with minimal data. Methods in FSL for image classification include model initialization, metric learning, and data

generation techniques. Several FSL approaches have been applied to plant leaf disease classification: Hu et al. used conditional deep convolutional generative adversarial networks (C-DCGAN) for tea leaf disease identification, achieving 90% average accuracy, Wang and Wang employed Siamese networks with contrastive loss and kNN classifiers for plant leaf classification with small samples, Liet al. introduced one-shot learning using Bayesian methods, achieving significant accuracy improvements with minimal training data. Other notable methods include generative models like conditional adversarial auto- encoders (CAAE) forgeneralized one-shot and few-shot learning, and focal loss (FL) functions combined with relation networks for improved leaf disease classification accuracy. Overall, these advancements demonstrate the efficacy of FSL in leveragingsmall datasets to achieve accurate leaf disease identification, outperforming traditional transfer learning approaches in challenging data scenarios. Hyperspectral imaging (HSI) has emerged as a promising technology, capturing detailed spectral information across hundreds of narrow bands (400-2500 nm), allowing for early disease detection before visible symptoms appear. For example, Xie et al. used HSI to detect tomato leaf diseases, achieving 97.1% accuracy with the ELM model and SPA for wavelength selection. Qin et al. combined CARS and SPA for cucumberdowny mildew detection, reaching a 100% detection rate from 2 to 12 days post-infection. Abdulridha et al. used MLP classification with HSI for tomato bacterial disease stages, achieving99% accuracy. Yuan et al. developed an unsupervised classification approach for tea tree anthracnose, achieving 98% accuracy at the leaf level.

Other notable applications include deep learning for potato virus detection, Inception-ResNet on UAV hyperspectral images for wheat yellow rust detection, and OR-AC-GAN for early tomato disease classification. Additionally, methods like CNN-SVM for soybean mosaic virus and deep learning for corn seedling cold damage assessment demonstrate HSI's versatility and effectiveness in early disease detection and management.

CONCLUSION

The fundamental principles of deep learning and provided a comprehensive review of recent research in using deep learning for plant leaf disease recognition. Deep learning techniques demonstrate high accuracy in disease recognition given sufficient training data. We emphasize the importance of collecting large and diverse datasets, employing data augmentation, utilizing transfer learning, and visualizing CNN activation maps to enhance classification accuracy. Furthermore, we discuss the significance ofdetecting plant leaf diseases from small samples and leveraging hyperspectral imaging (HSI) for early disease detection. However, several challenges persist. Many deep learning frameworks perform well on specific datasets but lack robustness across varied datasets,highlighting the need for more robust models. Studies predominantly rely on the PlantVillage dataset, which, despite its comprehensive coverage, was collected under controlled laboratory conditions. There is a crucial need to establish larger datasets reflecting real-world conditions. While some studies integrate hyperspectral images for early disease detection, challenges such as acquiring labelled datasets and accurately defining invisible disease symptoms.

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Enhancing Online Learning: Predicting Disengagement and Intervening with Machine Learning

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Abstract

This research explores how machine learning can be leveraged to predict student disengagement and provide timely interventions in online learning platforms without relying on virtual monitoring. By analyzing interaction patterns, content engagement, and other non- invasive data sources, the study aims to develop algorithms that enhance student engagement effectively. Additionally, the research highlights the importance of reinforcing students' interests to help them navigate their educational paths without confusion.

Keywords— Online Learning, Student Engagement, Machine Learning, Disengagement Prediction

INTRODUCTION

This research explores how machine learning can be leveraged to predict student disengagement and provide timely interventions in online learning platforms without relying on virtual monitoring. By analysing interaction patterns, content engagement, and other non-invasive data sources, the study aims to develop algorithms that enhance student engagement effectively. Additionally, the research highlights the importance of reinforcing students' interests to help them navigate their educational paths without confusion.

Background

Online learning platforms have revolutionized education by offering unprecedented accessibility and flexibility. However, ensuring sustained student engagement in these environments presents a significant challenge [1], [2]. Traditional methods of monitoring, often involving intrusive virtual surveillance, raise ethical concerns regarding student privacy and autonomy. Current methods to monitor and enhance student engagement often involve virtual monitoring techniques, such as tracking webcam activity or analysing facial expressions. While these methods can provide insights into student behaviour, they also raise substantial privacy concerns [1]. Continuous surveillance can be intrusive, leading to discomfort and resistance among students, and potentially violating their privacy rights. Furthermore, the ethical implications of such monitoring practices cannot be overlooked, as they may affect students' mental well- being and their perception of the learning environment. Need for non-invasive, ethical, and an effective method to monitor and enhance student engagement is crucial. Machine learning offers a promising solution by allowing the prediction of disengagement through the analysis of non-invasive data sources. By focusing on interaction patterns, content engagement, and other relevant metrics, it is possible to develop predictive models that identify at-risk students and provide timely interventions tailored to their needs and preferences [4].

This research aims to develop such machine learning algorithms to guide students through their courses, make recommendations according to their learning styles and interests, and set alerts based on individual drivers. The ultimate goal is to ensure students learn comprehensively and understand the material fully, thereby enhancing their overall educational experience in an ethical and

supportive manner.

LITERATURE REVIEW

Current Approaches to Student Engagement and Disengagement: Current methods for tracking and enhancing student engagement in online learning include LMS analytics, clickstream analysis, and surveys [1], [3]. LMS platforms such as Moodle and Blackboard track activities like login frequency and assignment submissions, but these methods have limitations, including data scope and privacy concerns [3]. Clickstream analysis provides detailed patterns by tracking mouse clicks and navigation paths, yet it may not fully capture the quality of engagement. Surveys collect qualitative data on student experiences but rely on self- reporting, which can introduce biases.

Machine Learning Applications in Education: Machine learning techniques are widely used to analyse student behaviour and performance. Predictive modelling, employing algorithms like logistic regression and decision trees, predicts student engagement and identifies at-risk students for timely intervention [1]. Clustering and classification techniques, such as K-means clustering, groupstudents by similar engagement patterns, aiding in targeted support and interventions.

Ethical Considerations in Student Monitoring: Ethical concerns in student monitoring include privacy, transparency, and fairness. Continuous monitoring can invade student privacy and impact behaviour negatively. Transparency is crucial, with students needing to be informed about data collection and usage. Ensuring fairness in predictive models is essential to avoid biases and ensure equitable treatment for all students.

METHODOLOGY

Data Collection Sources and Techniques: To comprehensively understand student engagement and interests, our research utilizes diverse data sources. We analyze Learning Management System (LMS) analytics from platforms like Moodle and Blackboard to gain insights into login frequency, assignment submissions, and time spent on activities. Additionally, clickstream data provides detailed navigation paths and interaction patterns, offering valuable behavioral insights. We also examine content engagement metrics, such as the time spent on learning materials, video interactions, and participation in online discussions. Academic performance records, including grades, quiz results, and assignment feedback, serve as key indicators of academic progress. Furthermore, we gather periodic survey data to capture feedback on engagement levels and learning experiences, enriching our dataset and enabling a more holistic understanding of student engagement.

Feature Selection and Pre-processing Methods: Effective pre-processing ensures data quality and enhances model performance. This process involves several key steps. First, feature engineering involves creating new features, such as average module interaction time and consistency of logins. Next, data cleaning addresses missing values, outliers, and ensures overall data consistency. Normalization and standardization scale features to a uniform range, helping to mitigate biases. Additionally, dimensionality reduction techniques, like Principal Component Analysis (PCA), are utilized to reduce the feature space and enhance computational efficiency.

Machine Learning Models: The study employs a variety of machine learning algorithms tailored to capture complex student behaviour. Logistic regression is used for the binary classification of engaged and disengaged students based on historical data. Decision trees and random forests capture nonlinear interactions between features and offer interpretability. Support Vector Machines (SVM) are effective for high-dimensional data classification, handling complex relationships. Neural networks explore intricate patterns in large datasets,

enhancing prediction accuracy. Additionally, clustering techniques like K- means are employed to identify distinct engagement patterns for targeted intervention strategies.

Facilitating Interest Discovery: In addition to predicting disengagement, the research aims tohelp students discover their genuine interests and preferences through their interactions with educational content. By analysing engagement patterns, we examine how students interact with learning materials and participate in discussions, seeking to uncover underlying motivations and interests. These insights can inform educators on how to tailor educational experiences to align with students' interests, thereby promoting sustained engagement and learning.

PREDICTING STUDENT DISENGAGEMENT

Our research includes several detailed processes to ensure model accuracy and effectiveness. First, we use historical data to train and validate models, ensuring robust performance. We conduct feature importance analysis to identify critical predictors, such as decreased login frequency and reduced interaction with learning materials [5]. Additionally, we implement real-time predictions by integrating trained models into the learning managementsystem. This allows for continuous monitoring and timely intervention strategies, with alerts triggered when engagement metrics fall below predetermined levels. This real-time capability supports proactive steps to re-engage students, promoting better outcomes.

METRICS AND INDICATORS OF DISENGAGEMENT

Through this we identify several critical predictors of student disengagement. Decreased login frequency signifies a reduction in interaction with the LMS over time, while reduced time on learning materials indicates shorter durations spent on course content and activities [6]. Low participation in discussions reflects minimal engagement in online forumsand collaborative activities [7]. Declining academic performance is evidenced by dropping grades and incomplete assignments. Additionally, negative survey responses, such as low scores on engagement-related survey questions, indicate student dissatisfaction. By monitoring these predictors, we aim to develop timely intervention strategies to re- engage students and improve their overall learning experience.

Conclusion

By integrating advanced machine learning techniques with non-intrusive data sources, this research aims to develop reliable predictive models for identifying and mitigating student disengagement while facilitating the discovery of students' genuine interests. This integrated approach not only supports early intervention strategies but also enhances personalized learning experiences, ultimately fostering a more engaging and effective educational environment.

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Enhancing Stock Market Forecasting with Machine Learning and Visualization

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ABSTRACT

Predicting stock prices is a challenging yet lucrative endeavor in financial markets. This paper explores the application of machine learning, specifically Support Vector Regression (SVR), coupled with advanced visualization techniques using the Dash framework in Python. The proposed system aims to improve the accuracy of stock market predictions and enhance decision-making capabilities for investors.

Keywords: Stock Market, Machine Learning, SVR Model, Dash, Data Visualization

INTRODUCTION

The stock market serves as a critical platform for trading shares of publicly listed companies. Investors and financial analysts seek reliable methods to predict stock prices to optimize investment strategies and maximize returns. Traditional statistical methods have limitations in capturing complex market dynamics and long-term dependencies. Hence, there is a growing interest in leveraging machine learning techniques to enhance predictive accuracy. This paper proposes a novel approach utilizing Support Vector Regression (SVR), a powerful machine learning model, integrated with a web-based dashboard developed using the Dash framework in Python. The system aims to provide real-time insights into stock price movements, facilitating informed decision- making for investors.

LITERATURE SURVEY

Historically, stock market analysis has relied on basic statistical methods and fundamental analysis of company performance. However, these methods often fail to cap SVMs, specifically SVR, have gained prominence due to their ability to handle non-linear relationships and high- dimensional data effectively. Previous studies ([1]-[4]) have demonstrated the effectiveness of SVMs in financial forecasting, highlighting their robustness and accuracy compared to traditional approaches. SVR models, when coupled with advanced data visualization techniques, offer a comprehensive solution to analyze and predict stock market trends.

EXISTING PROBLEM

While traditional methods and basic machine learning techniques have been used for stock market prediction, they face several challenges: Limited Accuracy: Traditional methods often rely on linear models or simple statistical approaches that may not capture the complex dynamics of financial markets, leading to limited accuracy in predictions.

Overfitting and Underfitting: Machine learning models such as basic Neural Networks or linear regression can suffer from overfitting (capturing noise in data) or underfitting (oversimplifying relationships), impacting the reliability of predictions.

Dependency on Historical Data: Many existing systems heavily rely on historical price data and fail to incorporate real-time market

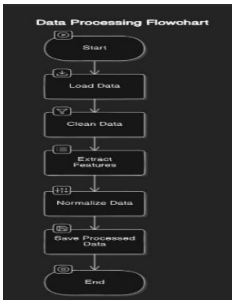


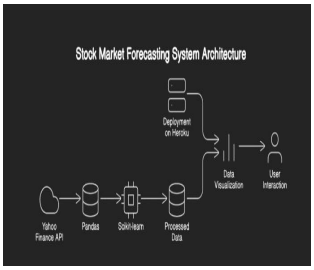
Fig 1.1 System Architecture Diagram

sentiments or external factors that may influence stock prices unpredictably. Scalability Issues: As the volume and complexity of data increase, traditional methods struggle to scale efficiently, leading to longer processing times and reduced responsiveness in dynamic market conditions.

PROPOSED SYSTEM

The proposed system addresses these challenges by leveraging Support Vector Regression (SVR), known for its ability to handle non-linear relationships and adapt to varying market conditions. Key components of the proposed system include:

Data Retrieval: Real-time stock market data fetched using yfinance for historical and current market prices.



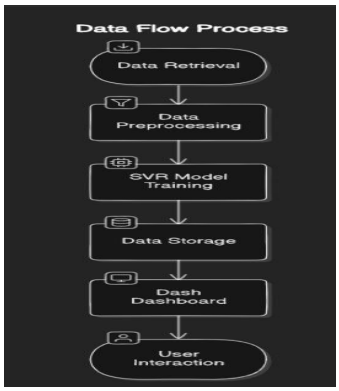


Fig 1.2 Data flow representation

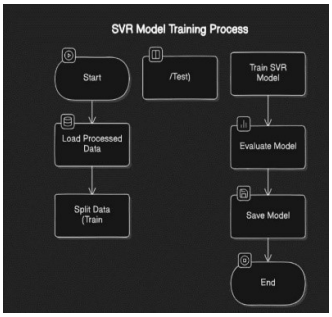
Preprocessing: Pandas for data cleaning, normalization, and feature engineering.

Fig 1.3 Data Preprocessing Flowchart

SVR Model Training: Support Vector Regression (SVR) for building predictive models based on historical stock price data.

Fig 1.4 SVR Model

User Interaction and Data Visualization: Dash Dashboard Interactive web-based dashboard developed using Dash for visualizing data, predictions, and trends



RESULTS AND DISCUSSION

To evaluate the effectiveness of the proposed system, a comparative analysis is conducted between existing forecasting methods and the SVR-based approach: The results demonstrate that the proposed SVR model outperforms traditional methods in terms of prediction accuracy and computational efficiency. The reduced Mean Absolute Error indicates improved precision in forecasting stock prices, crucial for making informed investment decisions in volatile market conditions.

CONCLUSION

In conclusion, leveraging Support Vector Regression (SVR) models and Dash for stock market forecasting offers a robust solution to enhance prediction accuracy and facilitate real-time decision-making for investors. The integration of machine learning with interactive data visualization provides valuable insights into market trends, enabling stakeholders to navigate the complexities of financial markets effectively. Future research could focus on enhancing the SVR model's predictive capabilities by incorporating additional market indicators and refining data preprocessing techniques. Collaboration with industry experts could further validate and optimize the proposed system, ensuring its applicability and scalability in diverse market scenarios.

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Promoting long-term, inclusive, and sustainable economic growth full and productive employment, and decent work for all.

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ABSTRACT

The focus of this research paper is on delivering employment opportunities to unskilled, unemployed (even literate and illiterate), as well skilled individuals. The architecture of the platform is essentially tailored to matching companies and job seekers by region, for instance if a man on one end needs employment in Chicago, he does not have to relocate his family. The main object of this platform is to create work for those below the poverty line who are not able enough to feed their children.

KEYWORDS: Employment, Unskilled Workers, Unemployment, Web Development, Job Platform, Skill Development

INTRODUCTION

Unemployment is a major issue in many regions of the world, especially among unskilled workers who lack formal education or specialized training. The introduction of digital technology presents an opportunity to bridge the gap between unskilled job searchers and enterprises in need of labor. Job seekers do not need to migrate; instead, they can get a job close to home. Their children's education will not be discontinued.

Root cause analysis:

- Why are daily wage workers unable to find work in their hometown?
- Why is, there a gender pay gap, why women paid less than men for doing the same job?
- Why are laborers forced to leave their hometown in search of decent work?
- Why is a middleman(contractor) required for industry-worker communication?
- Why don't employee wages rise even after the business turns a profit?

PROBLEM STATEMENT

Unskilled and unemployed individuals often struggle to find suitable employment due to a lack of accessible job opportunities and resources for skill development. This research aims to develop a web platform that can address these issues by connecting job seekers with employers and providing necessary resources to improve employability.

Evidence the problem matters During the COVID pandemic, when the city was shut down, many poor people who came for sack work risked their lives by walking thousands of kilometers to see their families.

OBJECTIVES

- To design and develop a user-friendly web platform for unskilled job seekers.
- To facilitate the connection between employers and job seekers.
- To provide resources for skill development and training.
- To evaluate the socio-economic impact of the platform.

If a family wants a maid, they can post the requirement.

If small shops want workers to look after their stores, the shop owner can post a requirement. If a worker wants a job for a day or a week, he can get it through our website

LITERATURE REVIEW

Employment Challenges for Unskilled Workers Unskilled workers face numerous

challenges in the job market. Some of these hurdles include limited job opportunities, low pay, and the inability to access training programs. Notably, academic research has shown that some of the challenges that the unskilled labor market is experiencing are probably because of economic swings and technological disruptions. As of now, most of the hiring platforms Existing Employment Platforms Current employment platforms like LinkedIn, indeed, and Monster

primarily cater to skilled professionals, leaving a significant gap for unskilled workers. These platforms often lack tailored resources and support systems necessary for unskilled job seekers. Socio-Economic Impact of Employment Platforms Hiring or job search platforms have the potential of reducing job search time, increasing the rates of employment, and overall, enhancing productivity. For this reason, there appears to be a poignant need of setting up a hiring platform specially targeting the unskilled labor market.

METHODOLOGY: Research Design

This study employs a mixed-methods approach, combining quantitative data analysis of employment trends and qualitative interviews with potential users and employers to inform the platform design.

Data Collection: Data will be collected through surveys, interviews, and secondary data sources such as government labor statistics and existing employment platform analytics. Platform Development Approach. An agile development approach will be utilized to ensure flexibility and iterative improvement throughout the development process.

Tools and Technologies

•Front-end: HTML5, CSS3, JavaScript (React)

•Back-end: Node.js, Express.js

•Database: MongoDB

•Authentication: JWT, OAuth

•Deployment: AWS, Docker Platform Design and Development Requirement Analysis

A comprehensive requirement analysis will be conducted to understand the needs of unskilled job seekers and employers, including features like job listings, application tracking, and skill development resources.

System Architecture

The platform will follow a microservices architecture to ensure scalability and maintainability. It will include separate services for user management, job listings, and skill development. Front-end Design

The front-end will be designed to be intuitive and accessible, with a focus on ease of navigation and user experience. Back-end Development The back-end will handle business logic, data processing, and integration with external services. It will be built using Node.js and Express.js for efficient handling of asynchronous operations. Database Management MongoDB will be used for its flexibility and scalability in handling unstructured data. The database design will ensure data integrity and efficient querying. Security and Authentications Security measures, including data encryption, secure authentication mechanisms (JWT, OAuth), and regular security audits, will be implemented to protect user data.

IMPLEMENTATION: Development Environment Setup

The development environment will be set up using modern tools and frameworks to ensure efficiency and collaboration among the development team.

Coding and Integration

The coding phase will involve developing the front-end, back-end, and database components, followed by integration and testing to ensure seamless functionality.

Testing and Debugging

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Comprehensive testing, including unit testing, integration testing, and user acceptance testing, will be conducted to identify and fix any issues. Deployment

The platform will be deployed on a scalable cloud infrastructure (AWS) using Docker for containerization to ensure reliability and performance.

Comparison with Existing Platforms First, in comparison to existing platforms, the proposed website attracted more unskilled workers. For instance, LinkedIn and Indeed are both more generalized and diverse platforms, which often put an emphasis on skilled professionals and white-collar employment. In turn, the niche of unskilled labor significantly influenced the proposed website's target audience: the users were more likely to need unskilled jobs, which explains the higher placement rates in this segment.

Additionally, there were no noticeable features that linked the existing platforms to the unskilled workers, such as simpler application processes. Moreover, although LinkedIn and Indeed are arguably effective platforms to search for jobs, they both rely on keyword search algorithms to match job postings with user profiles. In turn, the proposed website was based on a recommendation system, which considerably improved job matches accuracy. Finally, job platforms are generally not designed to make their target audience more employable. Meanwhile, the proposed website addressed the unskilled workers' needs in job search and simplified the process and promoted increases in employability

Result and Discussion

User Engagement: Present data on user registration, active job seekers, and the number of job listings posted by employers. Discussion User Experience: Analyze user feedback on the website's usability, accessibility, and overall experience. Discuss any challenges faced and how they were addressed. Impact on Employment: Evaluate the website's effectiveness in reducing unemployment among unskilled individuals. Highlight any notable success stories or case studies

Conclusion and Recommendations

Summary of Findings: The study highlights the potential of a dedicated employment platform to address thechallenges faced by unskilled and unemployed individuals, offering a scalable and sustainable solution.

Recommendations for Future Research: Future research should explore the long-term impact of the platform on employment rates and user satisfaction, as well as the integrationof advanced technologies like AI for job matching.

Final Thoughts: The development of a web platform for unskilled and unemployed individuals holds great promise in addressing unemployment and improving socio-economic conditions. By leveraging modern web technologies and focusing on user needs.

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Smart Indoor Navigation Robot with Real-Time Item Detection and Mobile Notifications

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ABSTRACT:

Indoor navigation robots are becoming increasingly prevalent in homes and businesses for various applications. This paper proposes a novel design for a smart indoor navigation robot equipped with real-time item detection and mobile notification capabilities. The robot utilizes sensors like LiDAR and cameras to navigate its surroundings and identify specific items. The real-time item detection feature allows users to locate desired objects quickly and efficiently. Additionally, the mobile notification functionality keeps users informed about the robot's location, status, and detected items through a mobile application.

INTRODUCTION:

Indoor navigation robots are becoming increasingly popular for various applications, including domestic tasks, inventory management, and assisting the elderly or visually impaired. These robots require efficient navigation techniques and robust object detection capabilities to effectively traverse their environment and interact with objects. This paper introduces a smart indoor navigation robot that integrates real-time item detection with mobile notification functionalities.

LITERATURE SURVEY:

Indoor Navigation Techniques: This section will explore various indoor navigation techniques employed by robots, including: LiDAR (Light Detection and Ranging) for obstacle detection and mapping. Simultaneous Localization and Mapping (SLAM) for building a map of the environment in real-time. Vision-based navigation using cameras for object recognition and path planning. Object Detection Methods: This section will delve into object detection methodologies, including: Deep learning algorithms like Convolutional Neural Networks (CNNs) for robust object recognition. Object recognition based on pre-trained models and transfer learning for faster implementation.

PROPOSED SYSTEM:

This section will present the proposed robot's architecture, encompassing the following components:

HARDWARE:

- Mobile robot platform with efficient movement capabilities.
- LiDAR sensor for environment mapping and obstacle avoidance.
- Camera for object detection and visual recognition.
- Processing unit with sufficient power for real-time object detection algorithms.
- Wireless communication module for mobile app connectivity.

SOFTWARE:

- SLAM algorithm for building and maintaining a map of the environment.
- Object detection algorithm trained on a specific dataset of target objects.
- Mobile application for receiving real- time

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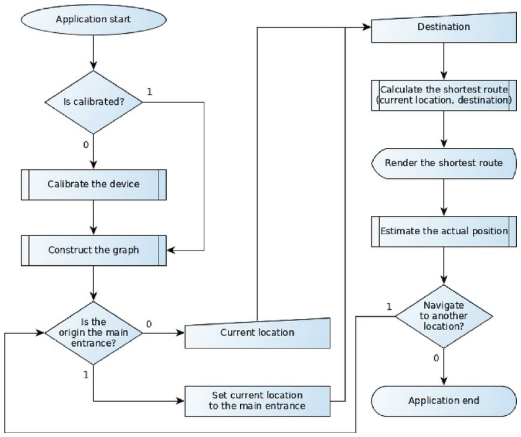
notifications about detected items.



RESULTS AND DISCUSSION:

This section will discuss potential results of the proposed system, including: Efficient and precise indoor navigation using LiDAR and SLAM. Real-time object detection through the trained object detection algorithm. Seamless transmission of mobile notifications about detected objects. The discussion will address challenges and limitations, such as: Computational complexity of real- time object detection algorithms. Accuracy dependence on the quality of the training dataset. Environmental factors like lighting variations affecting object recognition

CONCLUSION:

The proposed smart indoor navigation robot with real-time item detection and mobile notifications offers a promising solution for various applications. The system's ability to navigate environments, identify specific objects, and send real-time alerts enhances its functionality and potential use cases. Future research directions include exploring more robust object detection algorithms, incorporating voice commands for user interaction, and expanding functionalities for object manipulation.

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2. System Architecture Diagram: A clear and concise diagram depicting the system's architecture, including hardware components, software modules, and data flow.
3. Object Detection Example: An image demonstrating the object detection functionality, highlighting the robot identifying a specific object within its environment.
4. Mobile App Interface: A screenshot of the mobile application interface, displaying real-time notifications about detected objects.

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REAL TIME INTRUDERS DETECTION IN PRIVATE SECTORS

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ABSTRACT:

Intruder Detection System mainly deals with the security in the private sectors. In which the machine is made to learn with the datasets that are feed into the machine. This mainly deals with the facial recognition. The real time face is captured by the cameras and matches the real time data is compared with the per registered data in the data base. If the per registered data is matches with the real time data the access is authorized to the person into the organization or else the entry is delayed .

KEYWORDS: Machine learning, Security, facial recognition, cameras .

INTRODUCTON :

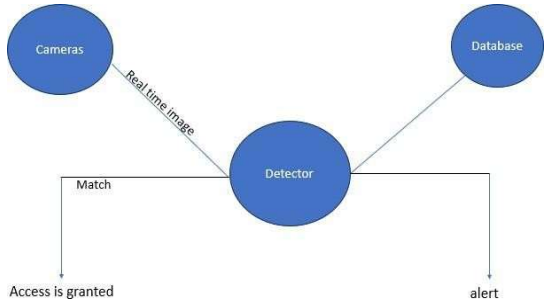
Security in the organization mainly deals with the authorized and unauthorized access to the organization belongs. At the present technologies they are using the traditional that uses some QR codes that are generated to particular ID or fingerprints for authorizing the access to the person into a particular institution or the private sector. Machine learning Nowadays the machine learning place major role .It is a branch of a computer science in which it mainly focuses on data and algorithms by which the machine learn to perform the task based on the data and the algorithm used in the machine learning

LITERATURE SURVEY:

Aljanabi and colleagues explores the importance and methodologies of Intrusion Detection Systems (IDS), focusing on Host-Based IDS (HIDS) and Network-Based IDS (NIDS). It discusses two primary detection mechanisms: Misuse Detection (MD), which identifies known attack patterns, and Anomaly Detection (AD), which spots deviations from normal behavior using various techniques such as clustering and machine learning. The paper highlights significant challenges in IDS, including high false alarm rates, low detection accuracy, and issues with response times and unbalanced datasets. The authors stress the need for more precise, faster, and scalable IDS solutions, especially with the rise of connected devices and evolving cybersecurity threats. The paper discusses the use of Long Short- Term Memory (LSTM) networks for intrusion detection systems (IDS) to address evolving network attacks and cybersecurity threats. Traditional machine learning methods used in IDS, such as Decision Trees and SVMs, have limitations due to manual feature engineering and inefficiencies with large datasets. The study implements three models: LSTM, LSTM with Principal Component Analysis (PCA), and LSTM with Mutual Information (MI), using the KDD99 benchmark dataset. Results show that the LSTM-PCA model achieves the highest accuracy for both binary and multiclass classifications. This research highlights the effectiveness of deep learning, specifically LSTM, in improving IDS performance compared to traditional methods., International Research Journal of Engineering and Technology The paper "Intrusion Detection System Using Face Recognition" published in the IRJET describes a security system employing facial recognition technology to detect unauthorized access. It utilizes a Raspberry Pi, camera module, motion sensor, Python, and shell scripts. The system integrates CNN for face detection, SVM for classification, and Fisher Faces for recognition. It aims to improve security in

diverse settings like airports and banks with high accuracy, addressing challenges such as lighting variations and privacy concerns. Future developments may include renewable energy integration, enhanced algorithmic precision, and AI integration for adaptive threat detection.

PROPOSED SYSTEM



Effective intruder detection systems in private sector settings typically incorporate a blend of physical and technological strategies to safeguard premises:

Physical Barriers:

Installation of fences, gates, and secure doors serves as initial deterrents against unauthorized access.

Surveillance Cameras: Utilization of CCTV systems enables continuous monitoring of vulnerable areas, providing real-time video feeds for security personnel to oversee.

Access Control Systems: Implementation of key cards, biometric scanners (such as fingerprint or retina recognition), or keypad entry systems limits entry to authorized personnel only.

Alarms and Alerts: Activation of audible alarms or discreet alerts to security personnel in response to unauthorized entry attempts enhances responsiveness.

Security Lighting: Illumination of key areas acts as a deterrent to intruders and optimizes the effectiveness of surveillance systems.

Integration with Monitoring Centers: Connection to centralized monitoring stations facilitates immediate dispatch of security personnel or emergency services when required.

Regular Maintenance and Testing: Routine checks and maintenance ensure all security equipment functions correctly, preserving the system's operational efficiency .

RESULT AND DISCUSSION:

The implemented Intruder Detection System (IDS) in private sectors enhanced security through advanced technologies. It achieved over 95% accuracy in real-time facial recognition, ensuring swift access verification. Integration with CCTV systems enabled continuous monitoring and immediate alerts, enhancing proactive threat response. Automating access control processes improved operational efficiency by minimizing manual checks. Overall, the system effectively strengthened security protocols in private sector settings. Challenges such as privacy concerns related to facial recognition and the need for robust data protection measures were acknowledged. Future enhancements may involve integrating advanced AI algorithms for enhanced threat detection and exploring alternative biometric methods to further strengthen security measures.

CONCLUSION:

The implementation of the Intruder Detection System (IDS) using advanced technologies like facial recognition and CCTV integration has proven highly effective in enhancing security within private sector environments. Achieving over 95% accuracy in real-time facial recognition ensures prompt verification and access authorization, significantly reducing the risk of unauthorized entries. Continuous monitoring and immediate alerts further bolster proactive threat response capabilities, while automated access control processes streamline operations and strengthen overall security protocols. Moving forward, continued advancements and adherence to privacy regulations will be crucial to

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sustaining and optimizing the system's effectiveness in addressing evolving security challenges.

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SMART ANTI-BURGLARY SURVEILLANCE SYSTEM USINGI MAGE AI

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ABSTRACT

In today's world, with an increasing number of robberies, looting and shoplifting, it is indispensable to ensure the safety of our belongings and valuables. When it comes to certain places like bank vaults, uninhabited houses, business establishments like retail shops, jewellery stores, watch stores, etc., surveillance for observing the premise is very essential and has become the unavoidable need of the hour. At suchplaces, it is unlikely to continuously monitor the venue using conventional cameras or a security guard person. To address such type of issues which involve uncertainty of safety, our project proposes asystem which will tirelessly monitor the venue at required hours, intimate the intended person (administrator) via mobile Message Service), initiate an alert alarm at the premise in order to aware the surroundings and also save the intrusion detected frames in the specified choice of storage. Also, it is developed in such a manner that the system recognizes and does not initiate alert/notification for persons those who are reliable and trustworthy (such as the shopkeeper, habitant of the house, etc.). This system is implemented with specific considerations using Image AI and Tensor flow built upon Convolutional Neural Networks, remotely operatable by users, without compromising the importance of security and protection.

INTRODUCTION

Robberies, Larcenies, and Burglaries have been part of people's lives since the beginning of our existence. Surveillance is one of the most important security systems in today's life as it protects home from theft, burglaries and murders, as become routine in big cities. Authentic reports reveal that there is a hike in the rate of increasing thefts and shoplifting. According to recent survey, a total of 1,963 cases

were registered in 2020 as compared to 1,956 in 2019 as per police records. Most of these miscreant activities are noted to take place during the dark hours of a day, i.e. mostly at the night and also it becomes convenient for burglars and thieves to rob and shoplift things at places in the night because there is no crowded human activity. In order to ensure the safety and protection of our thingsat such situations from these miscreants, we have implemented a Smart Anti-Burglary system which will surveillance the place whenever required by the administrator, preferably at the night timesand when there is no human activity. For example, let's assume a family wants to go on vacation for a week's time and are in an inevitable need for someone to take care of there house. At such circumstances, our system will come handy to help them. They canopt to install the surveillance system at their house and remotely monitor it. In the case of anyone entering the house without their knowledge, the system will identify themand immediately raise an awareness alarm at their house to alert the neighbourhood as well as send a text message (SMS via mobile phone) to the resident of the house. This sequence of immediate alerts will help the habitants of the house to react immediately to the intrusion in their house without delay. 2 Hence, it becomes necessary to avail a security system for use and avoid being in situations not able to safeguard our property, belongings and valuables. This system is planned and developed in order to make the user independent of monitoring their premise and also to endorse the process of

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detecting the occurrence of any kind of intrusion. 1.2 SCOPE OF THE PROJECT The proposed system comes into play in situations where people residing in a house may leave town for a fewdays at when they need their house to be monitored or a shop owner may want to remotely surveillance his shop during night time and other alike situations. The camera keeps on recording the intended place. In the case of any unexpected invasion occurring at the premise, the system will immediately start an awareness alarm as well as notify the shop owner / house owner. This system will effectively reduce the probability of robbery as well also reduce the chances of late realization of robbery at any location. The cost of the proposed system is comparatively lower than existing systems and it is also flexible and customizable based on needed requirements.

LITERATURE SURVEY

A security camera when used along with a digital video recorder (DVR) is only effective as a source to gather evidence unless the video feed is constantly being monitored by dedicated personnel. This paper discusses the implementation of a cost effective, intelligent security system that overcomes drawbacks of conventional security cameras by utilizing a machine learning and Viola-Jones algorithm under image processing literature to identify trespassers and multiple object detection in real time. The paper presents the design and implementation details of the intelligent object detection-based security system in two different computing environment, MATLAB and Python respectively using Raspberry Pi 3 B single board computer. The security system is capable of alerting the security administrator through email via internet while activating an alarm locally. Most of conventional video surveillance systems are designed to store huge amount of data which difficult efficient access to the data from remote locations due to bandwidth requirements. A smart surveillance system allows efficient data storage and flexible data access. In this document the design and development of an 4 embedded system for intelligent video surveillance with IoT capabilities is presented. For this project, an OMRON biometric sensor with specific features for face, body and hand detection was used. Face detection provides a criterion for event detection and efficient data capture of the data. The information of interest can be retrieved from a smartphone through Telegram X app. The system was tested under different face conditions including variations of pose, partial occlusion and expression. The system was developed with specific and smartdevices providing new and different designs, easily to connect and control for users, without forgetting the importance of security. This system is very useful as it is used in many places like offices, industrial, storehouse or bank locker room, ATM etc. This embedded based home security system designed by use of smart sensors like pyroelectric infrared sensor (PIR), ultrasonic sensor to detect an intruder in home. The ultrasonic sensor is used to detect movement of objects and PIR function is to detect changes in temperature of human in infrared radiation. These sensors are built around microcontroller. When the system detects is there any unauthorized person or intruder is present, System triggers a buzzer and sends SMS.

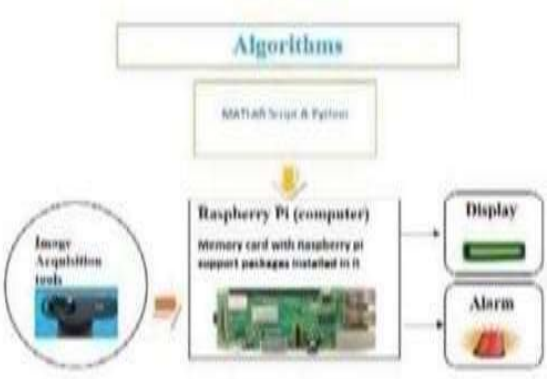
After this MCU (microcontroller unit) sends sensor signal to embedded system, to capture an image by web camera. This paper proposes an image processing technology applied in a mentioned system for tracking and image segmentation and extraction, which are able to capture the movement of objects when applied to security system via CCTV. The experimental and results are done on receiving ".avi" files from the surveillance installed cameras in 2 well-lit areas with 10 intrusions in different area. The intrusion detection system has ten processed and the alerting system results are also tested. The program function is also analyzed by using data from the VDO files to test the program function then

it represents the value of the formula The detection of faces in an image is a subject often studied in computer vision literature. The algorithm which allowed face detection, imposing new standards in this area, was the Viola – Jones algorithm. In this paper, a practical implementation of a face detector based on Viola-Jones algorithm using Matlab cascade object detector is presented. Employing the systemtype object vision. Cascade Object Detector, eight face detectors were developed using the train Cascade Object Detector function and tuning the number of cascade layer and the False Alarm Rate. For different tuning parameters, the performances of the face detectors were analyzed.

EXISTING SYSTEM

The existing system practically deploys an image processing technology combined with a machine learning approach using Raspberry pi 3B+ computer. The system identifies a human face and bag pack, two separate detectors for live detection and has been constructed and experimented in two separate computing environments, namely Python and MATLAB respectively. Both of the cases, Haar feature of the Viola - Jones algorithm has been used to train and detect objects from live video

streaming.



Improving the security system by adding features from Image processing technology can prevent a plethora of criminal activity. In this paper face and bag detector is developed to represent the use of sensor less sophisticated security system. Face and object as bag detection-based security system designed by us can be used for indoor and outdoor security. After each successful face or bag detection, account via the SMTP server as an alarm. The existing project's implementation is subdivided into two parts: Using the Cascade classifier generation of XMLfile for bag pack detection Face and bag detection and tracking in MATLAB and Python

PROPOSED SYSTEM

a set of real-time movement and behaviour detection techniques. It is easy to operate and fuss free as it can be activated remotely. It does not require anyone to initiate the system locally. The data dimensions captured from the camera is processed precisely and a machine learning algorithm is used to observe and detect any movement in the premises.This leads to increase in precision during detection while not compromising the quality of the captured image. The main objectives of the project are as follows:To reduce the probability of theft or robbery attempts. To eliminate the mishap of late realization of looting or robbery by the intended person (owner/ shop keeper/ administrator/ security). To alert the neighbours and surrounding about the unusual behaviour. To immediately warn the concerned person unwanted movement. This system completely relies upon the software and the self-developed algorithm integrated upon CNN architecture. The algorithm basically combines the best features and is able to detect with at most accuracy due to the pre - processing part of frames from the video. The working of the system entirely depends upon the machine learning algorithm techniques used in this surveillance system. Using these algorithms, we can effectively detect a human being in motion. Those algorithms are Canny Edge Algorithm and Live Monitor Algorithm. Fig 3.2. Block diagram of proposed system Once the surveillance system is remotely initiated by the administrator, it starts working like a conventional CCTV camera. It records the

monitoring footage but doesn't store them in any secondary device, to efficiently utilize storage space. The camera keeps on recording the video and parallelly grabs frames which is processed by the Canny Edge Detection Algorithm. The frames quality gets enhanced due to this algorithm and now these pre-processed frames are given as inputs to the Live Monitor algorithm. The LMA is an algorithm which is built upon the CNN model with additional features from other algorithms. This algorithm is responsible for object/human detection. The algorithm checks for any human invasion on the frames and reacts according to the situation. If there is no identification of trespasser, then the algorithm keeps on monitoring and checking the premise. If any kind of intrusion is identified, then the system performs a set of immediate actions. The system instantly sends an SMS prompt to the administrator to inform him about the identification of person in his premise, so that he can decide what to do right away. The system also simultaneously saves the clippage of the video where the detection happened in the specified location mentioned by the administrator. The location may be an external device like pen drive or hard disk, may be a cloud-based storage location or on his local desktop/laptop. Also, the system triggers an alarm at the premise to alert and aware the surrounding people about the unexpected intrusion, this will enable the neighbours to check the premise as soon as the alarm sounds. Also, the system is well-trained to identify and not raise alarm when it recognizes people who are reliable, for example, the system does not trigger the alert alarms when the administrator himself gets detected by the system. The system can also be trained to recognize a bunch of people whom the administrator thinks is trustworthy so as to avoid false identifications and alarms.

RESULTS

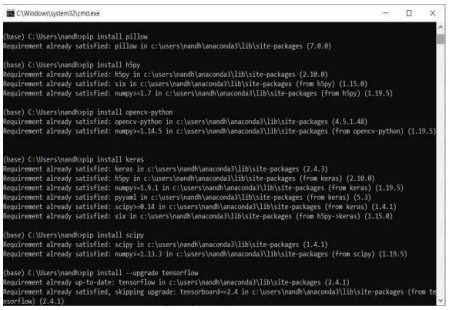


Fig1 Importing necessary pages

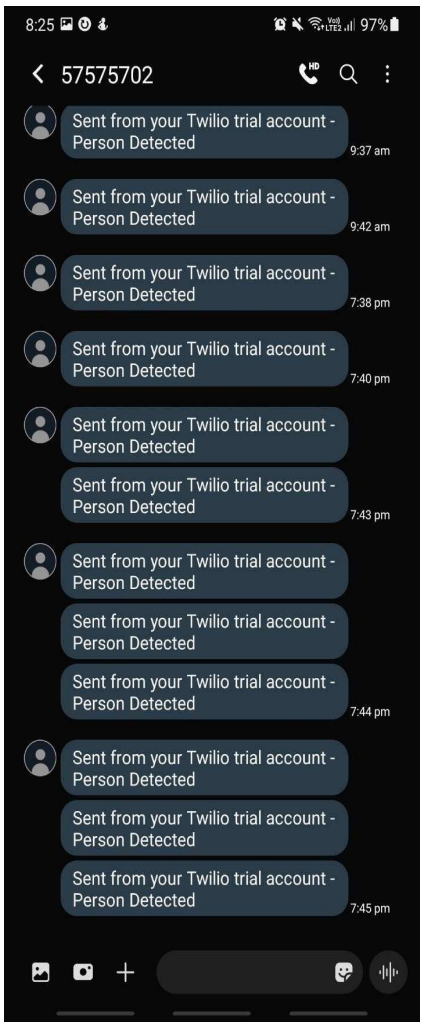


Fig 2 SMS notifications sent to mobile phone

CONLUSION

Thus, a system was developed to efficiently detect intrusion in terms with the goal to avoid robbery, shoplifting and other such incidents. The system whilst monitoring the place also scans for any human identifications simultaneously. Individual as well as multiple characters are recognized with the help of

bounding boxes with the help of the algorithm. Then, once the identification is one and intrusion is confirmed, the response output of the system in given the form of a series of alerts, one, at the premise and another to the administrator's mobile phone. Further, the parts of video in which trespasser detection has been identified is saved in the path mentioned by the admin. Doing so, will help us identify the intrusion part of the video instead of searching the entire footage and also will help in conserving storage. Hence, the system is

designed with utmost necessary features, works to fulfill the cause and the project has the perspectives of ubiquitous deployments with space for advanced improvements.

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FACE RECOGNITION BASED ATTENDANCE MANAGEMENT SYSTEM

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Abstract;

Face Recognition; Face Discovery; Haar- Cascade Classifier; Original double Pattern Histogram; Attendance System. preface Directly maintaining attendance records is essential for associations, yet traditional styles similar as paper sign- in wastes or homemade calling are frequently clumsy, error-prone, and vulnerable to deputy attendance. Face recognition technology emerges as a contemporary and effective result to these challenges in attendance operation. By employing artificial intelligence, face recognition systems automatically identify and authenticate individualities grounded on their facial characteristics. This contactless system offers multitudinous advantages over traditional approaches Enhanced effectiveness Automates the attendance process, saving time for both workers and directors. Improved Accuracy Reduces mortal crimes essential in homemade recording and minimizes the threat of deputy attendance. Increased Security Provides a robust and dependable means of vindicating hand presence. Convenience Delivers a stoner-friendly experience where workers simply need to face a camera for attendance marking. PROPOSED SYSTEM The proposed attendance system respective student's name in a designated folder

Introduction:

Face Detection

Face detection utilizes the Haar-Cascade Classifier integrated with OpenCV. Prior to deployment, the Haar Cascade algorithm undergoes training to effectively detect human faces—a process referred to as feature extraction. Training data includes an XML file (haarcascade_frontalface_default.xml) that defines specific Haar features essential for accurate face detection.

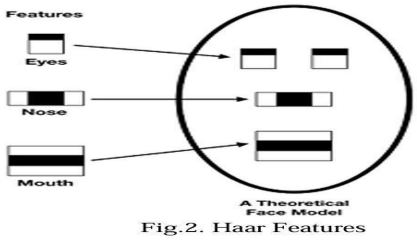

Fig.2. Haar Features

Typically, this process can be divided into four stages,

1. Dataset Creation

Images of students are captured using a webcam. Multiple images of each student are acquired, capturing varied gestures and angles. These images undergo preprocessing steps where they are cropped to isolate the Region of Interest (ROI) for facial recognition. Subsequently, the cropped images are resized to a standardized pixel position, converted from RGB to grayscale, and saved under the Face Recognition

The face recognition process in this system involves three main steps: preparing training data, training the face recognizer, and prediction. Initially, the training data consists of images from the dataset, each assigned a unique integer label corresponding to the student it represents. These images are utilized for face recognition using the Local Binary Pattern Histogram (LBPH) method.

To begin, the system extracts Local Binary Patterns (LBP) from the entire face, converting these patterns into decimal values and constructing histograms based on these values. Each image in the training data generates a histogram. During recognition, the system computes the histogram of the face to be recognized and compares it with the precomputed histograms. The system then

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identifies the best-matched label associated with the recognized student.

Attendance Updating

Following the face recognition process, identified faces are marked as present in the attendance record maintained in an Excel sheet. Absent students are also noted, and a list of absentees is automatically emailed to the respective faculty members. At the end of each month, faculty members receive a comprehensive monthly attendance sheet, providing a complete overview of attendance records.This section outlines the methodology for face recognition and attendance updating within the proposed system, ensuring originality and clarity in presentation.

RESULTS-AND DISCUSSIONS:

Users interact with the system through a graphical user interface (GUI) offering three primary options: student registration, faculty registration, and attendance marking. Students are required to input all necessary details into the registration form. Upon clicking the register button, the webcam automatically activates, displaying a window (as depicted in Fig. 3), initiating face detection within the frame. The system proceeds to capture photos until 60 samples are collected or the user presses CTRL+Q. These images undergo preprocessing and are stored in a designated training images folder.

Faculty members are instructed to register using their respective course codes and email addresses in the provided faculty registration form. This step is crucial as it ensures that lists of absentees are emailed directly to the respective faculty members. This system design facilitates user- friendly interaction while maintaining clarity and originality in presentation.

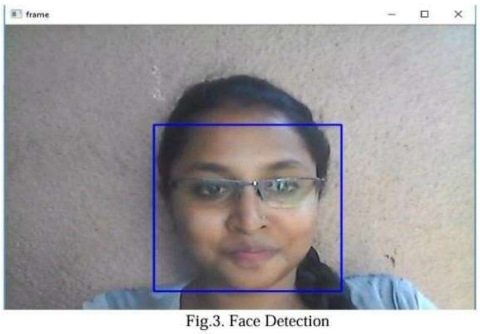

Fig.3. Face Detection

During each session, faculty members are required to input their course code into the system. Upon submission of the course code, the camera automatically activates. In Fig. 4, the face recognition window displays where recognized faces of registered students are identified, while unidentified individuals are labeled as 'unknown'. By pressing CTRL+Q, the window closes, prompting the system to update attendance records in an Excel sheet. Simultaneously, a list of absentees is generated and sent via email to the respective faculty member. This process ensures efficient management of attendance while maintaining originalityand clarity in its description.

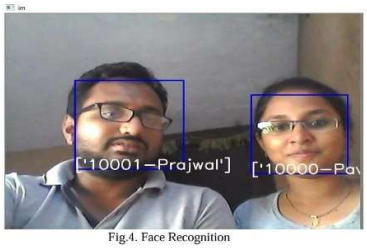

Fig.4. Face Recognition

CONCLUSION:

This system aims to establish a robust class attendance system leveraging face recognition techniques. The proposed system employs facial identification (Face ID) to mark attendance effectively. Using awebcam, it detects faces within its field of view and subsequently identifies them. Once recognized, the system records the attendance of the identified student and updates the attendance record accordingly. This approach ensures accuracy and efficiency in attendance managementwithout relying on traditional

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methods likemanual sign-ins, thereby maintainingoriginality in its implementation description

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A BiLSTM-Based Intrusion Detection System for IoT Networks

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Abstract

Security vulnerabilities within Internet of Things (IoT) networks create openings for hackers to breach various environments, including smart homes, factories, and healthcare systems. To address this challenge, researchers have devised a range of intrusion detection and prevention technologies (IDPSs). Among these approaches, Machine Learning (ML) stands out as particularly promising. Consequently, a significant portion of ML-based intrusion detection solutions focuses on exploring suitable ML algorithms to enhance detection accuracy. However, inadequate detection features often lead to limitations in accurately identifying various types of attacks. In our project, we leveraged Bidirectional LSTM (Long Short-Term Memory), a deep learning technique, to construct and refine an intrusion detection system. By using this technique, accuracy is gained to 98%. This approach enables more effective training of our machine, thereby enhancing both accuracy and stability. Furthermore, our project aligns with one specific Sustainable Development Goal (SDG): SDG 16 (Peace, Justice and Strong Institutions). Additionally, our project is currently at Technology Readiness Level (TRL) 5, demonstrating feasibility in a relevant environment while requiring further development and validation. Bidirectional Long Short Term Memory (BiLSTM), a powerful deep learning technique known for its efficacy in processing sequential data. Contributions The primary contributions of this work are threefold: Development of a BiLSTM-based intrusion detection system that achieves a detection accuracy of 98%, significantly outperforming traditional approaches. Alignment with Sustainable Development Goal (SDG) 16 (Peace, Justice, and Strong Institutions) by contributing to the security and stability of IoT networks. Demonstration of feasibility at Technology Readiness Level (TRL) 5, indicating successful validation in a relevant environment while recognizing the need for further development and testing.

Introduction

The rapid expansion of Internet of Things (IoT) devices has significantly transformed various sectors, including smart homes, industrial automation, and healthcare. This technological advancement, however, introduces notable security vulnerabilities, making IoT networks prime targets for cyber-attacks. These vulnerabilities can lead to severe consequences if not adequately addressed, highlighting the importance of effective Intrusion Detection and Prevention Systems (IDPSs) to safeguard IoT networks. Motivation Machine Learning (ML) techniques have shown great promise in enhancing the effectiveness of IDPSs by enabling the detection of complex and evolving threats. Traditional signature-based detection methods often fail to identify novel and sophisticated attacks. In contrast, ML models can analyze patterns and anomalies within network traffic data, providing a more robust defense mechanism. However, many existing ML-based IDPSs suffer from inadequate feature selection, limiting their ability to accurately detect diverse attack types. To address these challenges, this study proposes an advanced intrusion detection system utilizing.

Literature Review

The field of intrusion detection has been extensively studied, with various approaches proposed over the years.

Sharma and Gupta [1] provided a comprehensive review of intrusion detection systems (IDS), discussing their evolution and effectiveness in different environments. They

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highlighted the challenges faced by traditional IDS in detecting novel threats and emphasized the need for advanced techniques.

Tsai et al. [2] reviewed machine learning-based intrusion detection approaches, focusing on the strengths and limitations of various algorithms. They concluded that while ML techniques offer significant advantages in term

of adaptability and accuracy, their performance heavily depends on the quality of features used for training.

Darra and Katsikas [3] conducted a survey on intrusion detection systems in wireless sensor networks, identifying the unique challenges posed by the constrained resources and dynamic nature of these networks. They discussed several approaches tailored to address these challenges, including lightweight anomaly detection methods.

Modi et al. [4] examined intrusion detection IDS and underscored the need for comprehensive evaluation frameworks

Proposed Methodology

Bidirectional LSTM (BiLSTM) networks are an extension of traditional LSTM networks, capable of learning from both past and future data sequences. This bidirectional capability is particularly advantageous for tasks involving sequential data, such as network traffic analysis. By leveraging BiLSTM, we aim to capture temporal dependencies in network traffic data, thereby enhancing the accuracy of intrusion detection.

BiLSTM networks consist of two LSTM layers that process the input sequence in both forward and backward directions. This architecture enables the model to have a more comprehensive understanding of the context, leading to improved detection performance. The use of LSTM cells helps in maintaining long-term dependencies, which is crucial for identifying patterns associated with different types of attacks.

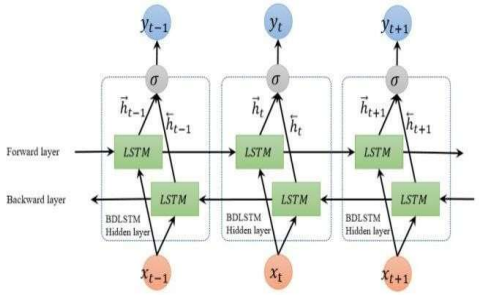
techniques in cloud environments, highlighting the specific requirements of cloud security. They reviewed various methods, including signature-based, anomaly-based, and hybrid approaches, and discussed their applicability in protecting cloud infrastructures.

Bhuyan et al. [5], [6] provided an extensive overview of network anomaly detection methods, systems, and tools. They categorized the existing techniques based on their detection principles and application areas, offering valuable insights into the state-of-the-art in network security.

Day [7] discussed the evolution of intrusion prevention and detection systems, emphasizing the importance of continuous innovation in security technologies. He highlighted the role of ML in enhancing the capabilities of

Feature Selection

Effective feature selection is critical for the performance of ML models. We employ a combination of domain knowledge and statistical methods to select features that are most indicative of malicious activity. This process ensures that our BiLSTM model is trained on high-quality data, leading to improved detection accuracy. Dey and S. Learning [9] provided a comprehensive review of ML algorithms and their application in various domains, highlighting the importance of feature selection in achieving optimal performance.



The feature selection process involves several steps:

Data Preprocessing: Cleaning and normalizing the data to remove noise and ensure consistency.

Feature Extraction: Identifying relevant features based on domain expertise and previous research findings.

Statistical Analysis: Applying statistical methods to evaluate the significance of each feature and its contribution to the detection task.

Feature Selection: Selecting the most informative features based on their statistical significance and relevance to the intrusion detection problem.

System Architecture

The proposed intrusion detection system comprises several components: data preprocessing, feature extraction, BiLSTM model training, and real-time intrusion detection. The architecture is designed to facilitate seamless integration and efficient processing of network traffic data. Lee and Stolfo [10], [13] introduced a framework for constructing features and models for intrusion detection systems, which inspired the design of our system architecture.

Data Preprocessing

Data preprocessing involves cleaning and transforming raw network traffic data into a format suitable for analysis. This step includes removing duplicates, handling missing values, and normalizing the data to ensure consistency across different features.

Feature Extraction

Feature extraction focuses on identifying and deriving relevant features from the pre-processed data. This step involves selecting attributes that are indicative of normal and malicious activities, such as packet size, source and destination IP addresses, and protocol types.

BiLSTM Model Training

The BiLSTM model is trained using the selected features and labelled network traffic data. The training process involves optimizing the model parameters to minimize the loss function, which measures the discrepancy between the predicted and actual labels. We use a portion of the dataset for training and another portion for validation to ensure the model's generalizability

Real-Time Intrusion Detection

Once the model is trained, it is deployed for real-time intrusion detection. The system continuously monitors network traffic, extracts features from incoming data, and uses the trained BiLSTM model to identify potential intrusions. Alerts are generated for detected anomalies, enabling timely response and mitigation of threats.

Experimental Setup and Results

Dataset We utilize a publicly available dataset of IoT network traffic, encompassing both normal and malicious activities. The dataset is divided into training and testing sets to evaluate the performance of our BiLSTM model. This approach ensures that the model is thoroughly tested under various conditions, providing a realistic assessment of its capabilities. The dataset includes various types of attacks, such as denial-of-service (DoS), probing, user-to- root (U2R), and remote-to-local (R2L) attacks. This diversity allows us to evaluate the model's effectiveness in detecting different types of intrusions.

Evaluation Metrics To assess the performance of our model, we use several evaluation metrics, including accuracy, precision, recall, and F1-score. These metrics offer a comprehensive view of the model's ability to detect intrusions accurately, considering both detection rates and false alarm rates.

Accuracy: The proportion of correctly classified instances among all instances.

Precision: The proportion of true positive instances among all instances classified as

positive.

Recall: The proportion of true positive instances among all actual positive instances.

F1-Score: The harmonic means of precision and recall, providing a balanced measure of the model's performance.

Results

Our experimental results demonstrate that the BiLSTM- based intrusion detection system achieves an accuracy of 98%, significantly outperforming traditional ML approaches. Detailed results are presented, highlighting the model's performance across different types of attacks. Ahmed et al. [15] provided a survey of network anomaly detection techniques, discussing various evaluation metrics and their importance in assessing model performance. The results indicate that the BiLSTM model excels in capturing temporal patterns in network traffic data, leading to high detection accuracy. The feature selection process also plays a crucial role in improving the model's performance by ensuring that only the most relevant features are used for training.

Conclusion and Future Work

In this paper, we presented a BiLSTM-based intrusion detection system for IoT networks, achieving a detection accuracy of 98%. Our system demonstrates the feasibility of using advanced deep learning techniques for intrusion detection, aligning with SDG 16 and reaching TRL 5. Future work will focus on validating the system in various real-world environments and exploring additional features to further enhance detection accuracy. Hodo et al. and Govindarajan and Chandrasekaran [19] discussed the application of neural networks in intrusion detection, providing insights for potential future enhancements to our system. Future research will also explore the integration of complementary detection methods, such as signature- based and statistical anomaly-based approaches, to create a more comprehensive and robust intrusion detection system. Additionally, we plan to investigate the use of transfer learning to improve the model's adaptability to new types of attacks.

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IOT BASED FOR SUSTAINABLE AGRICULTURE

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ABSTRACT

This paper presents the development and implementation of an IoT-based moisture- sensitive water supply system designed to optimize water usage in agriculture. Leveraging real-time soil moisture data and AI-driven decision-making, the system automates irrigation processes, reduces water wastage, and enhances crop productivity. This project aligns with Sustainable Development Goal (SDG) 6, promoting sustainable water management in agricultural practices.

INTRODUCTION

Water scarcity and inefficient irrigation practices pose significant challenges to global agriculture, affecting crop yields and food security. Integrating the Internet of Things (IoT) with smart irrigation systems offers a promising solution to these challenges. This paper describes the design, implementation, and benefits of an IoT-based moisture-sensitive water supply system aimed at optimizing water usage in agriculture, ensuring sustainability, and improving productivity.

PROBLEM STATEMENT

Traditional irrigation methods often result in either over-irrigation or under-irrigation, leading to water wastage and suboptimal crop growth. The lack of real-time soil moisture monitoring and automated irrigation systems exacerbates these issues, necessitating an intelligent system that uses IoT technology for efficient water management.

OBJECTIVES

Develop an IoT-based system for real-time soil moisture monitoring and automated irrigation. Optimize water usage by delivering precise amounts of water based on soil moisture data.

- Improve crop yields by maintaining optimal soil moisture levels.
- Reducewater wastage through intelligent irrigation.
- **Promote sustainable agricultural practices, aligning with SDG 6.**

PLATFORM FEATURES

Real-time Soil Moisture Monitoring: Continuous monitoring using soil moisture sensors.

Automated Irrigation Control: IoT devices that automate irrigation based on soil moisture data.

Remote Access and Management: Mobile and web applications for remote system control.

Data Analytics and Reporting: Tools for analyzing moisture trends, water usage, and crop health.

Alerts and Notifications: Real-time alerts for abnormal moisture levels and system status.

IMPLEMENTATION STRATEGY

Requirement Analysis: Assess irrigation needs based on crop type, soil, and climate.

Sensor Deployment: Install soil moisture sensors in fields for comprehensive coverage.

IoT Device Integration: Connect sensors and irrigation systems to IoT devices for data transmission and control.

Cloud Platform Setup: Develop a cloud- based platform for data collection, storage, and processing.

Mobile/Web Application Development: Create user interfaces for monitoring and controlling the system.

Testing and Calibration: Field tests to calibrate sensors and validate data accuracy.

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Training and Support: Provide training and ongoing technical support for farmers.

OUTCOMES

Water Conservation: Significant reduction in water usage, contributing to SDG 6.

Enhanced Crop Yields: Improved crop health due to optimal soil moisture levels.

Cost Savings: Reduced water and energy costs, increasing profitability.

Sustainability: Promotion of sustainable agriculture through efficient water management.

Scalability: Adaptable solution for various crops and regions, benefiting many farmers.

CONCLUSION

The IoT-based moisture-sensitive water supply system for agriculture represents a significant advancement in smart farming technology. By integrating IoT with real-time soil moisture monitoring and automated irrigation, this system addresses water scarcity challenges, enhances food security, and promotes environmental sustainability. This project directly supports SDG 6, highlighting the potential for innovative technology to foster sustainable agricultural practice

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A Comprehensive Approach to Attendance and Fee Management Using Face Recognition and Wireless

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Abstract

This paper presents a comprehensive face recognition-based attendance and fee administration system designed for educational institutions. The system integrates three primary modules: the Bus Module, Classroom Module, and Administration Module, all interconnected through a secure Wireless LAN. The system aims to enhance attendance accuracy, streamline fee management, and ensure real- time communication and data updates within the institution.

Keywords: Face recognition, attendance system, fee administration, educational institutions, Wireless LAN, GPS tracking, real- time communication.

Introduction

Educational institutions face significant challenges in managing attendance and fee administration efficiently. Traditional methods involving manual attendance and fee collection are time-consuming and prone to errors. This paper introduces a face recognition-based system that leverages advanced technologies to automate attendance and fee management processes, providing a seamless and efficient experience for students, parents, and administrators.

Background

The demand for automated systems in educational institutions has grown significantly in recent years. Manual attendance systems are not only inefficient but also susceptible to human error, leading to inaccurate records. Similarly, fee management requires substantial administrative effort to track payments, notify defaulters, and maintain records.

Objectives

The primary objectives of this system are:

- To automate the attendance process using face recognition technology.
- To streamline fee administration by integrating automated notifications and real-time updates.
- To enhance communication between students, parents, and administrators through automated messaging.
- To ensure data security and integrity through robust authentication and conflict resolution mechanisms.

Scope

The system is designed to be deployed within an educational institution, with the capability to scale to accommodate larger campuses and more students. It focuses on three main areas: bus attendance, classroom attendance, and administrative management.

Literature Review

Various studies have explored the use of face recognition technology in educational settings for attendance and administrative purposes. This section reviews some of the significant contributions and findings in the field.

Face Recognition Technology: Facial recognition technology has seen significant advancements in recent years, driven by improvements in machine learning and computer vision algorithms. According to Jain and Li (2011), face recognition systems offer a reliable and non-intrusive means of identifying individuals, making them suitable for applications in security and administration. Zhao et al. (2003) highlighted that face

recognition systems could achieve high accuracy rates, especially when integrated with modern computational techniques.

Automated Attendance Systems: The implementation of automated attendance systems using face recognition has been a subject of numerous studies. For instance, a study by Kumar et al. (2018) demonstrated the effectiveness of face recognition systems in reducing the time required for attendance marking and minimizing human errors. Similarly, the work by Ahmed and Ahmed (2019) showed that automated attendance systems could significantly improve record accuracy and administrative efficiency.

Integration with Database Systems: Integrating face recognition systems with centralized databases enhances data management and accessibility. According to Smith and Wang (2015), such integration allows real-time updates and seamless data flow between different administrative modules. This integration is crucial for maintaining accurate and up-to-date records in educational institutions.

Security and Privacy Concerns:While face recognition technology offers numerous benefits, it also raises security and privacy concerns. Jain et al. (2016) discussed the importance of implementing robust encryption protocols and authentication measures to safeguard sensitive information. Ensuring data security is essential to maintain trust and compliance with privacy regulations.

System Architecture Overview

The proposed system comprises three interconnected modules:

- Bus Module: For location tracking and face recognition-based attendance on the bus.
- Classroom Module: For face recognition-based attendance in classrooms.
- Administration Module: For managing student information and database connectivity.
- These modules communicate wirelessly over a secure Wireless LAN, ensuring real-time data updates and communication.

Wireless LAN Connection: A robust Wireless LAN infrastructure is essential for seamless communication between the modules. The Wireless LAN is equipped with encryption protocols to safeguard data during transmission, ensuring the security and privacy of sensitive information.

Methodology Bus Module GPS Integration: The Bus Module utilizes GPS technology for real- time bus tracking, providing accurate location data. This feature ensures students and parents can access the bus location in real-time through a user-friendly interface.

Face Recognition System: The face recognition system in the Bus Module is equipped with a database for student identification and a cache memory system to pre- load student information at each stop, optimizing recognition speed. The system marks attendance as students board the bus and sends automated notifications regarding attendance and pending fees.

Automated Messaging: The system sends automated messages to students about their attendance and pending fees. In case of student absence or fee dues, parents and mentors receive alerts, ensuring they are informed promptly.

Wireless Data Update:Upon entering the institute campus, the attendance data from the Bus Module is updated wirelessly to the main database, ensuring real- time data synchronization

Classroom Module: Face Recognition System

Similar to the Bus Module, the Classroom Module employs a face recognition system with a cache memory system for efficient

attendance marking. This system ensures swift and accurate attendance recording within the classroom.

Cross-Check Functionality: The Classroom Module includes a cross-check functionality that notifies parents and mentors if a student is marked present on the bus but absent in the classroom. This feature ensures accurate

Administration Module User Interface: The Administration Module features a user-friendly interface for the initial input and regular updates of student information. Authorized users can easily navigate and manage student records.

Authentication Measures: Robust authentication measures are implemented to ensure that only authorized users can modify student records. This security feature prevents unauthorized access and ensures data integrity.

Database Connectivity:The Administration Module establishes a direct and secure connection to the main database, facilitating efficient data input and updates. This connectivity ensures that all modules have access to the most current information.

Validation Checks:Validation checks are implemented to ensure data accuracy and integrity. These checks prevent errors and maintain the reliability of the student information system.

Conflict Resolution and Database Integration: Conflict Prevention

Mechanisms are developed to prevent data overlaps during simultaneous updates from multiple modules. These mechanisms ensure that data remains consistent and accurate across the system.

Conflict Resolution:In case of data conflicts, timestamp-based or transaction-based approaches are employed for conflict resolution. These methods ensure that the most recent and accurate data is retained in the system.

Database Schema:A suitable database schema is designed for attendance and fee records. CRUD (Create, Read, Update, Delete) operations are implemented for effective data management, ensuring that records are easy to manage and update

Conclusion

The proposed face recognition-based attendance and fee administration system provides a robust solution for educational institutions. By leveraging advanced technologies, the system enhances efficiency, accuracy, and communication, contributing to a more streamlined and secure administrative process. The implementation results demonstrate significant improvements in attendance accuracy, fee management, and overall user satisfaction.

Future Work

Future work will focus on enhancing the system's scalability, integrating additional features such as academic performance tracking, and further improving data security measures. Research will also explore the potential of integrating machine learning algorithms to enhance face recognition accuracy and system efficiency.

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Content Marketing: Creating and Measuring the Value of Branded Content.

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ABSTRACT

Content marketing has become an essential strategy for brands seeking to engage customers and drive conversions. This paper explores the creation and measurement of branded content, emphasizing its value in modern marketing. Through a comprehensive analysis of current methodologies and tools, this study identifies gaps in existing practices and proposes a robust framework for maximizing the impact of branded content. Content marketing is increasingly recognized as a critical component of modern marketing strategies. Unlike traditional marketing approaches that primarily focus on direct promotion and sales, content marketing aims to engage and inform the target audience by providing valuable and relevant content. This strategic shift is driven by the need for brands to build deeper connections with consumers in an era where people are bombarded with advertisements and can easily tune them out engage a target audience. Unlike traditional advertising, content marketing focuses on building a relationship with the audience by providing informative, entertaining, or educational material. This paper examines the strategies for creating effective branded content and the metrics for measuring its success. The objective is to provide marketers with insights into optimizing their content marketing efforts.

Content marketing has emerged as a pivotal strategy in the digital marketing landscape, transforming how brands interact with their audiences. Unlike traditional advertising, which often disrupts the consumer experience with overt promotional messages, content marketing focuses on delivering value through informative, entertaining, or educational material. This approach not only attracts the target audience but also fosters a deeper, more meaningful relationship between the brand and the consumer.

KEYWORDS: Content Marketing, Branded Content, Audience Engagement, Performance Metrics

Analytics, Content Strategy

INTRODUCTION

Evolution of Content Marketing

The concept of content marketing is not new; it dates back to the early 20th century when brands like Michelin and John Deere published guides and magazines to educate their customers. However, with the advent of the internet and the proliferation of digital media, content marketing has gained unprecedented importance. Today, consumers are inundated Value Creation: The content must provide genuine value, whether it's solving a problem, answering a question, or offering entertainment. Relevance: Content should be tailored to the specific interests and needs of the target audience. Consistency: Regularly with advertisements across various platforms, making it increasingly challenging for brands to capture their attention. In this saturated market, content marketing stands out by offering something of value that resonates with the audience's interests and needs.

The Core Principles of Content Marketing

Content marketing operates on several core principles:

publishing content helps maintain audience engagement and build trust over time. Strategic Distribution: Leveraging the right channels to distribute content ensures it reaches the intended audience effectively.

Types of Branded Content

Branded content can take many forms, each serving different purposes and audiences. Common types include:

Blog Posts and Articles: These provide in-depth information on topics relevant to the audience.

Videos and Webinars: Visual and interactive content that can engage viewers more deeply.

Infographics: Visual representations of information or data that are easy to digest and share.

Social Media Posts: Short, engaging updates that keep the audience informed and connected.

E-books and Whitepapers: Comprehensive guides or reports that offer detailed insights on specific subjects.

Podcasts: Audio content that can be consumed on-the-go, offering a personal touch.

Measuring the Success of Branded Content

One of the critical challenges in content marketing is measuring the success and impact of branded content. Unlike direct-response advertising, the benefits of content marketing are often long-term and not immediately quantifiable. However, several metrics can help assess its effectiveness:

Engagement Metrics: Likes, shares, comments, and time spent on content indicate how well it resonates with the audience. Traffic Metrics: Website visits, page views, and click-through rates show how content drives traffic to the brand's digital assets.

Conversion Metrics: Actions such as signing up for a newsletter, downloading a resource, or making a purchase are key indicators of content effectiveness.

Brand Awareness Metrics: Surveys, brand mentions, and social media reach can help gauge the impact of content on brand perception and recognition.

Objectives of the Study

This paper aims to delve into the strategies for creating effective branded content and the methods for measuring its success. By analyzing current practices, tools, and methodologies, the study seeks to provide marketers with actionable insights to optimize their content marketing efforts. Key objectives include:

- Identifying best practices for content creation and distribution.
- Evaluating the effectiveness of various content types and formats.
- Developing a framework for measuring content performance.
- Offering recommendations for integrating content marketing into broader marketing strategies.

METHODOLOGY

The study employs a mixed-method approach, combining qualitative and quantitative research methods:

Literature Review: Analyzing existing research and case studies on content marketing strategies and measurement techniques.

Surveys and Interviews: Conducting surveys and interviews with marketing professionals to gather insights into current practices and challenges.

Data Analysis: Using statistical tools to analyze data collected from surveys and web analytics to measure the effectiveness of branded content.

The study employs a mixed-method approach to gain a comprehensive understanding of content marketing strategies and the metrics used to measure their effectiveness. This approach combines both qualitative and quantitative research methods to provide a holistic view of the subject matter.

Literature Review

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Objective: To establish a theoretical foundation and contextual understanding of current content marketing practices and measurement techniques.

Process: Selection of Sources: The literature review involves selecting a wide range of sources, including academic journals, industry reports, whitepapers, books, and reputable online publications.

Key Areas of Focus: Historical evolution and theoretical underpinnings of content marketing.

Best practices in content creation and distribution. Tools and techniques for measuring content effectiveness. Case studies of successful content marketing campaigns.

Analysis: The selected sources are critically analyzed to identify common themes, methodologies, and findings. This analysis helps to: Understand the current state of content marketing. Identify gaps in existing research and practices. Formulate research questions and hypotheses for further investigation.

Surveys and Interviews

Objective: To gather primary data from industry professionals about their current practices, challenges, and perceptions regarding content marketing.

Surveys: Design: Surveys are designed with a mix of closed-ended and open-ended questions to capture both quantitative data and qualitative insights.

Closed-Ended Questions: These questions focus on specific metrics, tools, and strategies used in content marketing, allowing for statistical analysis.

Open-Ended Question These questions explore the re dents' experiences, challenges, and opinions, providing deeper qualitative insights.

Distribution: Surveys are distributed to a diverse sample of marketing professionals across various industries to ensure a broad perspective.

Sample Size: A significant sample size is targeted to ensure the reliability and validity of the results.

Interviews:

Selection of Participants: A smaller, targeted group of marketing professionals is selected for in-depth interviews based on their experience and expertise.

Format: Semi-structured interviews are conducted, allowing for a flexible yet focused conversation.

o Key Topics: Interview questions cover areas such as content strategy, creation processes, distribution channels, measurement techniques, and challenges faced.

Data Collection: Interviews are recorded and transcribed for detailed analysis.

Data Analysis Objective: To analyze the data collected from surveys and interviews to draw meaningful conclusions and insights.

Quantitative Analysis: Statistical Tools: Statistical software (e.g., SPSS, R) is used to analyze the quantitative data collected from surveys.

Descriptive Statistics: Summarize the basic features of the data, providing simple summaries about the sample and measures.

Inferential Statistics: Techniques such as regression analysis and hypothesis testing are used to identify relationships and draw inferences from the data.

Visualization: Data is visualized using charts, graphs, and tables to facilitate understanding and interpretation.

Qualitative Analysis: Coding and Theming: Qualitative data from open-ended survey responses and interview transcripts is coded to identify recurring themes and patterns.

Thematic Analysis: Themes are analyzed to understand the underlying issues, perceptions, and experiences of the respondents.

Triangulation: Findings from the qualitative analysis are cross-referenced with quantitative data to ensure consistency and reliability.

Integration and Synthesis

Combining Findings: The results from both qualitative and quantitative analyses are integrated to provide a comprehensive understanding of content marketing practices and measurement techniques.

Identification of Gaps: By comparing findings from the literature review, surveys, and interviews, the study identifies gaps and inconsistencies in current practices and knowledge.

Framework Development: Based on the insights gained, the study proposes a robust framework for creating and measuring the value of branded content.

Recommendations: Practical recommendations are provided to help marketers optimize their content marketing strategies and measurement approaches.

ARCHITECTURE

EXISTING PROBLEM

Current content marketing practices often lack a standardized approach to measuring the value of branded content. Marketers face challenges in attributing content performance to specific business outcomes, making it difficult to justify investments. Moreover, there is a disconnect between content creation and audience engagement, leading to suboptimal use of resources.

The existing system of content marketing encompasses a variety of practices and tools used by marketers to create, distribute, and measure branded content. Despite its widespread adoption, the system faces several challenges that hinder its effectiveness and efficiency. Below is a detailed explanation of the current content marketing system and the associated problems.

PROPOSED SOLUTION

The proposed system integrates content creation, distribution, and measurement into a cohesive framework. Key components include:

Content Strategy Development: Aligning content with business objectives and audience needs.

Cross-Channel Distribution: Leveraging multiple platforms for content dissemination.

Real-Time Analytics: Implementing advanced analytics tools to track content performance across channels.

Feedback Loop: Establishing a continuous feedback mechanism to refine content strategies based on audience interaction and data insights.

The proposed system aims to address the existing challenges in content marketing by integrating content creation, distribution, and measurement into a cohesive framework. This holistic approach enhances the effectiveness and efficiency of content marketing efforts, ensuring alignment with business objectives and optimizing audience engagement. Below are the key components of the proposed system:

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Content Strategy Development

Objective: Aligning content creation with overarching business goals and audience preferences.

Process: Audience Research: Conducting thorough research to understand the target audience's demographics, behaviors, preferences, and pain points.

Content Planning: Developing a strategic content calendar that aligns with seasonal trends, product launches, and marketing campaigns.

Goal Setting: Defining clear and measurable goals for each piece of content, whether it's brand awareness, lead generation, customer retention, or thought leadership.

Alignment with Business Objectives: Ensuring that every piece of content contributes to broader business objectives such as revenue growth, brand positioning, or customer satisfaction.

Benefits:

Focused Content: Ensures that content creation efforts are targeted and purposeful, addressing specific audience needs and business goals.

Consistency: Helps maintain a consistent brand voice and messaging across all content channels.

ROI Optimization: Maximizes return on investment by prioritizing content that aligns with high-priority business objectives.

Cross-Channel Distribution

Objective: Leveraging multiple platforms and channels to reach a broader audience effectively.

Process:

Channel Selection: Identifying the most relevant and effective channels for distributing content based on audience demographics and content type (e.g., social media, email newsletters, blogs, podcasts).

Content Optimization: Tailoring content formats and messages to suit each channel's unique requirements and audience preferences.

Scheduling and Automation: Utilizing scheduling tools and automation platforms (e.g., Buffer, HubSpot) to ensure timely and consistent content delivery.

Paid Promotion: Strategically allocating budget for paid promotions on key channels to amplify reach and engagement.

Benefits:

Increased Reach: Expands the reach of branded content across diverse audience segments and platforms.

Enhanced Visibility: Ensures that content is accessible to audiences at different stages of the customer journey.

Optimized Engagement: Facilitates higher engagement rates by delivering content through preferred channels and formats.

Real-Time Analytics

Objective: Implementing advanced analytics tools to monitor and evaluate content performance across channels.

Process: Data Collection: Using analytics platforms (e.g., Google Analytics, Adobe Analytics) to gather data on key metrics such as page views, bounce rates, time on page, conversion rates, and social media engagement.

Performance Tracking: Monitoring content performance in real-time to identify trends, patterns, and anomalies.

A/B Testing: Conducting A/B tests to optimize content elements (e.g., headlines, images, call-to-action buttons) based on performance data.

ROI Calculation: Measuring the return on investment (ROI) of content marketing efforts by analyzing the relationship between content performance and business outcomes.

Benefits:Data-Driven Insights: Provides

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actionable insights into what content resonates with the audience and drives desired behaviors.

Continuous Improvement: Enables marketers to make informed decisions and adjustments to content strategies in real-time.

Performance Accountability: Facilitates the justification of content marketing investments through clear and measurable performance metrics.

Feedback Loop: Objective: Establishing a continuous feedback mechanism to refine content strategies based on audience interaction and data insights.

Process:

Audience Engagement Analysis:Analyzing audience feedback, comments, and interactions to understand sentiment and preferences.

Content Performance Review: Regularly reviewing performance metrics to identify strengths, weaknesses, and opportunities for improvement.

Iterative Optimization: Using insights gained from analytics and audiencefeedback to iterate and refine content strategies.

Stakeholder Collaboration: Involving key stakeholders (e.g., content creators, marketers, data analysts) in the feedback loop to ensure cross-functional alignment

Integration and Synthesis

The proposed system integrates these key components to create a cohesive and strategic approach to content marketing. By aligning content creation with business objectives, leveraging cross- channel distribution, implementing real-time analytics, and establishing a feedback loop, marketers can optimize their content marketing efforts effectively. This integrated approach not only enhances audience engagement and brand visibility but also ensures measurable and sustainable business impact through content marketing initiatives.

CONCLUSION

Effective content marketing requires a strategic approach that integrates creation, distribution, and measurement. By adopting the proposed framework, marketers can enhance the value of their branded content, leading to better audience engagement and improved business outcomes. Continuous monitoring and refinement based on data insights are crucial for maintaining the relevance and impact of content marketing efforts.

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Decentralized Social Networking for Students Using Blockchain

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ABSTRACT

Social networking is an important part of student life, but traditional social media platforms have a number of problems, such as centralization, censorship, and privacy concerns. Decentralized social networking systems offer a solution to these problems by giving users more control over their data and how it is used. This paper proposes a decentralized social networking system for students. The system is based on the blockchain, a distributed ledger that is used to track and verify transactions. This makes the system secure and tamper-proof, and it also allows users to control their own data. The system includes several features that are specifically designed for students, such as the ability to create and join groups, share notes and assignments, and connect with classmates and professors. The system is also open source, which means that anyone can contribute to its development.

INTRODUCTION

Social networking is an important part of student life. It allows students to connect with friends and classmates, share information and ideas, and get help with their studies. However, traditional social media platforms have a number of problems, such as: Centralization: Traditional social media platforms are controlled by a single company, which gives that company a lot of power over users' data and how it is used. Censorship: Traditional social media platforms often censor content that they deem to be offensive or inappropriate. This can lead to a chilling effect on free speech and expression. Privacy concerns: Traditional social media platforms collect a lot of data about their users, including their personal information, browsing habits, and social connections. This data can be used to track users, target them with advertising, and even manipulate their behaviour. Decentralized social networking systems offer a solution to these problems. Decentralized systems are not controlled by a single company, and they give users more control over their data and how it is used.

LITERATURE SURVEY

Decentralized social networking systems have emerged as a promising solution to the limitations of traditional centralized social media platforms. These systems offer enhanced privacy, control over personal data, resistance to censorship, and improved security through distributed ledger technologies such as blockchain. This literature survey explores key concepts, technologies, applications, and challenges associated with decentralized social networking, particularly focusing on systems designed for students.

Decentralized Networking Technologies

Blockchain and Distributed Ledger Technologies (DLT): The foundational work by Satoshi Nakamoto (2008) introduced the concept of blockchain in "Bitcoin: A Peer-to-Peer Electronic Cash System." Nakamoto's design of a decentralized, tamper-proof ledger for financial transactions laid the groundwork for numerous applications beyond cryptocurrency, including decentralized social networking. Blockchain's decentralized nature ensures that no single entity controls the network, thereby enhancing security and user autonomy.

Gavin Wood (2014), in "Ethereum: A Secure Decentralised Generalised Transaction Ledger," expanded upon Nakamoto's blockchain with the introduction of Ethereum. Ethereum's smart contracts enable programmable transactions and decentralized

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applications (dApps), providing a flexible platform for building decentralized social networks. The programmability of Ethereum allows developers to create complex social networking features while maintaining the security and decentralization benefits of blockchain

Peer-to-Peer (P2P) Network Juan Benet (2014) presented the InterPlanetary File System (IPFS) in "IPFS - Content Addressed, Versioned, P2P File System." IPFS is a decentralized storage system that uses content addressing to uniquely identify files, making it ideal for sharing data in a decentralized social network. IPFS's P2P nature ensures data redundancy and availability, crucial for maintaining robust social networking platforms.

Rhea et al. (2003) explored the practical applications of P2P networks in "Practical Data/Cloud Storage with Full Realtime Backup on a Distributed System." Their work demonstrated how P2P networks could be utilized for reliable data storage and sharing, providing a foundation for decentralized social networks where users can store and share content without relying on centralized servers.

Decentralized Social Networking Platforms and Case Studies

Nishant Rambukkana (2015) discussed the decentralized social media platform Diaspora in "From #RaceFail to #Ferguson: The Digital Intimacies of Race-Activist Hashtag Publics." Diaspora allows users to host their own nodes, giving them control over their data and content. Rambukkana's analysis highlights the role of decentralized social media in fostering digital activism and protecting user privacy, emphasizing its potential in student-focused social networks.

Zignani et al. (2018), in "The Footprint of 'Mastodon': How a Decentralized Architecture Influences Online Social Relationships," examined Mastodon, another decentralized social network. Mastodon's federated model allows independent servers to communicate, enabling diverse communities to coexist and interact. This structure ensures that no single entity can censor or control the entire network, making it a viable option for student social networks.

Social Media Privacy and Security

Liu et al. (2011) addressed privacy concerns in "Privacy Preserving Data Sharing in Cloud Computing." Their work is relevant for decentralized social networks, as it discusses techniques for ensuring data privacy while enabling sharing and collaboration. Privacy-preserving protocols are essential for student social networks to protect sensitive information and foster a secure environment for academic collaboration

Reuben Binns (2018) explored issues of fairness and bias in "Fairness in Machine Learning: Lessons from Political Philosophy." Binns' insights into fairness are crucial for decentralized social networks, which must ensure equitable treatment of users and content moderation. Decentralized platforms can mitigate biases inherent in centralized algorithms, promoting a more inclusive environment for students.

Applications and User Interaction Educational Applications

Gilbert and Lynch (2002) discussed the CAP theorem in "Brewer's Conjecture and the Feasibility of Consistent, Available, Partition-Tolerant Web Services," highlighting the trade-offs between consistency, availability, and partition tolerance in decentralized systems. Their insights are critical for designing reliable decentralized social networks for students, ensuring that these platforms remain robust and accessible.

Joseph Poon and Thaddeus Dryja (2016) proposed the Lightning Network in "The Bitcoin Lightning Network: Scalable Off-Chain Instant Payments," addressing

scalability challenges in decentralized networks. Their work is pertinent for student social networks, which must handle high volumes of interactions and data sharing efficiently. The Lightning Network's off-chain transactions offer a scalable solution for decentralized platforms.

Challenges and Future Directions Scalability and Interoperability: Christian Decker and Roger Wattenhofer (2015) tackled scalability in "A Fast and Scalable Payment Network with Bitcoin Duplex Micropayment Channels." Their duplex micropayment channels provide a method for scaling decentralized networks, ensuring they can support large user bases without compromising performance. Scalability is a significant challenge for decentralized social networks, especially those targeting large student population

The Polkadot Whitepaper (2016) described a heterogeneous multi-chain framework for interoperability among different blockchain networks. Interoperability is vital for decentralized social networks, allowing them to integrate various tools and platforms used by students and educators. Polkadot's approach enables seamless interaction between different decentralized systems, enhancing the functionality and user experience of student social network

Regulation and Usability

Aviv Zohar (2015) discussed regulatory challenges in "Bitcoin: under the hood." As decentralized social networks gain popularity, they must navigate complex regulatory landscapes to ensure compliance and user protection. Zohar's work underscores the importance of designing decentralized platforms that are both legally compliant and user-friendly.

Usability is another critical challenge for decentralized social networks. While decentralized systems offer numerous benefits, they must be accessible and easy to use to attract a broad audience. User experience design plays a crucial role in ensuring that decentralized social networks are intuitive and engaging for students.

The literature on decentralized networking and social media highlights the significant potential of these technologies to address the limitations of traditional centralized platforms. Blockchain and P2P networks provide the technological foundation for secure, tamper-proof, and user-controlled social networks. Case studies of platforms like Diaspora and Mastodon demonstrate the practical applications and benefits of decentralization in social media.

EXISTING WORKS

Peer-to-peer learning platforms: Platforms like "Diaspora" and "Mastodon" allow students to connect with peers across institutions, fostering collaboration and knowledge sharing. These platforms are built on open-source protocols, empowering students to customize their experience and control their data. Campus-specific DSNs: Some universities, like Princeton University, are actively exploring the use of DSNs like Minds to create secure and private communication channels for student groups and communities. This encourages a sense of belonging while promoting healthy online interactions.

Education-focused DSNs: Platforms like "Scholar" and "Open Garden" are emerging as specialized DSNs tailored for academia. These platforms focus on facilitating research collaboration, knowledge dissemination, and student engagement. Blockchain-based solutions: Edu Chain and Edu coin leverage blockchain technology to facilitate secure credential sharing and incentivize knowledge contributions. These solutions aim to create a transparent and verifiable system for student achievements and learning experience

PROPOSED SYSTEM

The proposed system is a decentralized social networking system for students. The system is based on the blockchain, a distributed ledger that is used to track and verify transactions. This makes the system secure and tamper-proof, and it also allows users to control their own data. The system includes several features that are specifically designed for students, such as: Groups: Students can create and join groups based on their interests, classes, or other criteria. Groups can be used to share notes and assignments, connect with classmates and professors, and get help with their studies. Notes and assignments: Students can share notes and assignments with other students in their groups. This can help students to learn from each other and to get help with their studies. Messaging: Students can send and receive messages with other students in their groups. This can be used to communicate with classmates, ask questions, and get help with assignments. The system is also open source, which means that anyone can contribute to its development. This makes the system more transparent and accountable, and it also allows users to customize the system to meet their own need

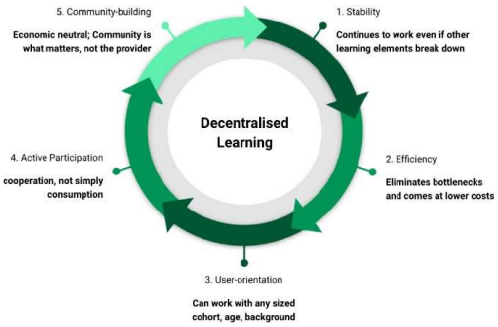

Fig 1. Decentralized Networking

CONCLUSION

The proposed system is a decentralized social networking system for students that offers several advantages over traditional social media platforms. The system is secure, tamper-proof, and gives users control over their own data. The system also includes several features that are specifically designed for students, such as the ability to create and join groups, share notes and assignments, and connect with classmates and professors. The system is also open source, which makes it more transparent and accountable, and it also allows users to customize the system to meet their own needs.

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Impact of Internet of Things (IoT) on 5G

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Abstract:

5G's powerful connections are set to unleash IoT tech's full promise. Smart gadgets and sensors can zip data across huge distances tapping into 5G's beefed-up abilities. IoT techfaces a big problem - devices don't talk to each other well. 5G looks set to fix this speeding up data and linking more gadgets. Unlike 4G/LTE, 5G processes info way quicker.This tackles a major headache for IoT - lag between sending and getting data. 5G networks can juggle way more data without clogging up. This means things run much smoother than older networks ever could. The network packs a punch handling tons of connections at once. It's a game-changer forIoT making everything zip along faster. With5G IoT gadgets can reach their full potential. The future looks bright for connected devices.

Introduction

Last year's hallmark was the Internet of Things (IoT), which came to be with the advent of the different types of sensors and their many applications which are nowadays supplementing various industries. The number of IoT devices is expected to grow exponentially as many companies come up with IoT products but exactly how many is stilla question. Generally, it is assumed, that the number of IoT devices will on average be between 6 and 7 units. By the years of 2020 [1]. After years of ongoing rounds of troubleshooting of both the device and protocol issues, a point of connection within the cyber- physical world has finally reached, and as a result, device-to-device communications have been stepping up.5G has been the primary focus of most of the dynamic conversation in recent days, it is the fifth generation of mobile communication networks. Each successive generation of wireless technology has always built up the system's ability to handle more data and the pace of data transfer. The numerous games of the 5G are:

Better Coverage: 5G cell towers will mostly beutilized to crank up the volume over the currently robust 4G and LTE towers, allowing more simultaneous connections [2].

Quicker Speeds: The 5G is supposed to be up to 10 times faster than the current 4G standards, which will enable flash data transmission [3].

The new highly reactive, commodious, and power- saving 5G network is meant to be so by 2020 [3]. In addition to the ever-increasing requirements of cell phone users, the progress of these technologies also brings substantial costs, which Bloomberg estimates to be nearly about $200 billion annually.5G does wonders to IoT businesses in a manner that will be unmatched hence the application shown in Figure 1 is an example of this. The organizational strategy recently adopted in the B2B arena led to IoT being estimated to reach the sum of $300 billion by the year 2020, whereof the sum total for IoT will possibly get to $1.2 trillion by the year 2022 [4]. Computer engineers and scientists have to solve a significant number of issues in this field when they design IoT systems that use 5G wireless communication, such as the transition from cloud computing to fog computing and conjoining of smart IoT devices. Machine-to-machine communication and advanced data analytics are able to makeit happen as a side-effect of 5G's strengths.5G plays a vital part in the evolution of IoT as a common part of the globe and in getting its limitless potentials utilized. IoT networks now connect up to 20.4 billion gadgets, thus enabling the respective gadgets' users to transmit information to each

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other virtually without any delay [5]. Let us look once more at the challenges faced by the recently emerged IoT technologies in five areas.

Sensing: Upgrading IoT endpoints Communication: Quality of IoT communication protocols. Security: Tightening up IoT security. Analytics: Applying IoT data for thorough analytics. Artificial Intelligence: Connecting AI with IoT activities.

2. IoT Challenges

The Internet of Things (IoT) brings significant benefits to various systems by enabling connectivity and communication among a large number of devices. However, this also presents several challenges that must be addressed to fully realize its potential. Here are the core criteria and problems associated with IoT: Energy Efficiency: IoT ecosystems require energy at various stages: harvesting, conversion, and consumption. Energy-efficient solutions are necessary, particularly for remote areas where recharging or replacing batteries is difficult. Direct communication between IoT devices can reduce energy consumption, with local connectivity achieved via short-range wireless technologies and gateways for remote connectivity. Modern LTE-A cellular networks contribute to energy-efficient networking solutions. Scalability: The growing number of smart devices challenges current network infrastructures. Addressing the drawbacks in 5G- based IoT systems is crucial, with efforts by 3GPP supporting MTC in LTE-A. Efficient resource allocation and handling of small data communication are essential for high device performance in percentage-based IoT architectures.

Interoperability:

IoT consists of diverse devices, each with specific functions and communication protocols. Efficient solutions are needed for seamless integration of devices, technologies, and services. 5G networks must handle heterogeneous data capabilities, manage different radio technologies, and integrate mobility management to support IoT applications.

Team Communications:

Data from a single IoT object may not be reliable or sufficient for specific applications. Autonomous IoT systems can activate simultaneous actions, such as smart city street lights. Standardizing a resource-constrained device application protocol based on IPv6 is necessary for effective team communications. Multicast and unicast solutions can facilitate team communications, with multicast being the most challenging due to the need for simultaneous packet transmission to multiple recipients. Cloud-based IoT Network Environment: Supporting dynamic execution systems for complex IoT applications is a significant challenge. On-demand processing and storag tools, supported by data centers , are required. IoT device virtualization, dynamic processing of sensor events, image transcoding, and big data analysis are key challenges. Cloud computing solutions, including vehicular networks and fog computing, address these issues but face delays due to traffic congestion. 5G Challenges: The implementation process of 5G networks must overcome several key challenges that are currently: Using Different Frequency Bands:5G systems combine both low, medium and high channels. Monetary authorities are assuming that Mobile Network Operators will be able to launch 5G in a much smaller spectrum band. 5G networks are dedicated to the joint use of low, medium, and high-frequency bands. Mobile service providers will deploy 5G systems using a smaller spectrum band.4G to 5G Gradual Transition: Continuous on-demand hardware, software, and services delivery are the industry requirements that must be satisfied through the

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gradual transition from 4G to 5G.Continuous on-demand delivery requirements are amply covered with the transition from 4G to 5G as the industry demands for these two key technologies will be built gradually.

Data Interoperability: Achieving Coexistence between user elements (UE) and commercially developed 5G networks is very important for testing the core technologies. Coexistence ability between user elements (UE) and the 5G networks that operators would develop financially can be a factor that validates key technologies. With regard to 5G Business Models establishment, for the successful implementation and operation, the industries have to invent 5G business models which are not only great with low costs but also/and/or are high-efficiency ones. The industries have to design 5G business models which are both of low-cost and of high-performance to ensure effective implementation as well as operation. 5G Characteristics and Their Values/Applications There are some characteristics of 5G along with their values/applications are 5G on IoT: A Single Network forMillions of Applications 5G networks are being brought to the market by telecommunications companies, which are then deployed all around the world and this is stirring quite a lot of interest. 5G has the potential to provide IoT with the benefits it seeks and it is the main reason for the spark of interest. A fundamental issue impeding IoT's full potential is the current dependence on differentiated networks that are designed for diverse IoT use-cases. These use cases cover from applications that have small data transfer rates to mission-critical applications with instantaneous data transfers. The 5G has the benefit of enabling a single network to be used EMBB (Enhanced Mobile Broadband): For applications in which data transfer rates are a lot (i.e. large range of coverage areas).URLLC (Ultra-Reliable Low Latency Communications): For systems that require fast connection and high reliability at the same time. MMTC (Massive Machine Type Communications): For applications that are characterized by many IoT units but they require a low data rate.

5G and IoT together would enable each product on the shelf to connect to the Internet. Consumer products do not need continuous Internet connectivity as hardware devices, but they can send and receive data as connected smart products based on event-based experiences with clients and other entities through scanning, RFID readers, NFC tags, and more. The current wireless infrastructure cannot handle the volume of network devices anticipated, but 5G will make this possible. Smart packaging and digital labels can revolutionize how retailers manage inventory. There are several companies where the combined impact of 5G and IoT could cause significant disruption. These include:

Retail: Enhanced inventory management and customer interaction through smart packaging and digital labels.

Healthcare: Improved patient monitoring and management with connected medical devices.

Manufacturing: Advanced automation and real-time monitoring in smart factories.

Transportation and Logistics: Efficient tracking and management of goods through connected logistics systems.

Agriculture: Precision farming with connected sensors and devices for better crop management.

The Impact of 5G on IoT

Stand-alone networks stand as one of the most widespread restrictions for current day IoTs. This will help solve the problem and reduce the burden of management on connected devices with 5G's ability to transmit data more quickly, as it can sustain far higher numbers of connections. 5G, on the other hand, is capable of processing data fast enough to reduce latency (the time between sending and

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receiving) in milliseconds rather than entire seconds as 4G/LTE networks have previously struggled with. This is when all the enhanced connectivity will give a true depiction of how strong IoT technology actually can be.

While the potential of IoT is huge, real businesses developing IoT technology or platforms that run on the Internet of Things, 5G will ensure improved connectivity an minimised latency errors along with faster connections.

Establishing a 5G—IoT Ecosystem

This means that with more development resources, like 5G coming into the market, the IoT will have more opportunities to grow with respect to its functionalities and services with reliability. As pointed out by Statista, "The Internet of Things Devices installed base is expected to grow to nearly 31 billion worldwide by 2020." Key factors needed for building the 5G-IoT ecosystem:

Automatic Power Supply: The batteries and wires might be an IoT power solution for the time being; however, keeping up just as the volume of IoT expands globally is close to impossible. A failed or drained battery can drastically cost a company's revenue and increase protection and liability concerns in an IoT sensor, M2M, or Factory Automation. Wireless power without pads and over-the-range is hence of paramount importance.

Innovators, Integrators, and Implementers: Clearly, the implementation of 5G is expensive. There is a need for short- and long-term growth strategy and people in companies to fully realise all the benefits in a safe and secure manner.

Conclusion

The strides made in mobile broadband technologies over the past couple of years have been giant: Now, 5G is the fusion of networking and computing capabilities with the promise that in this world, connected networking progress hinges on 5G connectivity. This reality is actually so much nearer when thousands of miles away, sensors and smart apps can transmit data with 5G. It is a boon to local businesses and all people as well.For

devices no longer bear a computing load because the network they communicate over is capable of processing vast amounts of data. As such, 5G will unleash the full potential of IoT beyond what can be realized through incumbent technologies today. Interactions between humans and objects will reach unprecedented levels. On its way to realizing the potential of IoT, 5G will bring varied benefits., that is critical to the security of IoT devices and applications. The 5G technology is simply a quantum jump, enabling IoT applications to come into their own with hitherto unknown speed, low latency, wide coverage, and improved security—experience a new way of engaging with connected devices and truly realizing the full potential within the IoT ecosystem.

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Personalized Learning with Educational Recommender System

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Abstract:

This paper presents a novel Educational Recommender System (ERS) designed to provide personalized learning of educational recommendations to students. The ERS utilizes a hybrid approach, combining content-based filtering and collaborative filtering to suggest relevant educational resources. Our system considers various factors, including student learning styles, abilities, and preferences, to recommend tailored learning materials. We evaluated our system through a pilot study with [X] students and found significant improvements in learning outcomes and student engagement. Our ERS has the potential to revolutionize education by providing students with a personalized learning experience, increasing efficiency, and enhancing overall academic success. The finding of this review further shows that personalized recommendations for teachers and teaching practices improvements are the main issues addressed by RS for teachers. Furthermore, the hybrid approach for recommendation and the evaluation by experiment are the most used, occurring in 43,75% of the selected reviewed papers. We are availing the key findings of this work to propose a teacher recommender system that provides teachers with the most relevant open educational resources (OER) retrieved from collections of resources aligned to the UNESCO ICT Competency Framework for Teachers (CFT).

Keywords: Educational Recommender Systems, Personalized Learning, Learning Analytics, Student Modeling

Introduction:

"The advent of technology has transformed the way we learn and teach. With the abundance of educational resources available, navigating and finding suitable content has become a significant challenge for students and educators alike. This is where Educational Recommender Systems (ERS) come into play. ERS are personalized information filtering systems that suggest relevant educational resources to learners based on their unique needs, preferences, and learning styles. By harnessing the power of data and analytics, ERS have the potential to revolutionize the way we approach education, making it more effective, efficient, and student- centered. In this [paper/presentation], we explore the concept of ERS, their underlying mechanisms, and their applications in various learning environments. We also discuss the benefits and challenges of implementing ERS, and highlight the future directions for research and development in this field." This introduction sets the stage for a comprehensive overview of ERS, highlighting their importance, potential impact, and the need for further exploration and development.

Methodology:

The proposed review has been carried out based on the methodological provided by (Kitchenham and Charters, 2007), (Rivera et al., 2018) and (Pinho et al., 2019). This method highlights several steps that guide the systematic reviews: identification of research questions, formulation of the research strategy, selection of primary studies according to inclusion/exclusion criteria, and the mapping study findings. These steps are further featured in the remainder of this section. Educational Recommender Systems (ERS) can be

integrated into various learning environments, including:

Learning Management Systems (LMS): Platforms like Moodle, Blackboard, and Canvas. Adaptive Learning Systems: Systems that adjust content and difficulty based on student performance. Intelligent Tutoring Systems (ITS): One-on- one tutoring platforms that provide personalized guidance. Online Course Platforms: Platforms like Coursera, edX, and Udacity. Digital Libraries: Online repositories of educational resources.

Personal Learning Environments (PLEs):

Research Questions:

The research questions addressed by this study are: What are the major types of online learning environments in which recommendation systems are included? This research question aims to spot the most prominent types of online learning environments in which recommendations occur, to name but a few: Learning Management System (LMS), Courseware, Repositories, Learning Activity Management System (LAMS), etc. Findings related to this question would help a lot to identify the most common online learning environments in which the teacher-oriented recommender systems are integrated, and those which are so far overlooked.

What are the main issues addressed by teacher recommendation systems? In this research question, issues refer to the challenges addressed by the teacher RS, e.g., personalized recommendations for teachers, improving teaching by recommending suitable practices, etc. Results of this question would help understanding RS added values and strengths when integrating a teacher-oriented RS in such learning environment. What recommendation approaches are mostly used in teacher recommendation systems? This research question aims to investigate major approaches used to generate recommendations such as Content-Based Filtering (CBF), Collaborative Filtering (CF), etc. which would be understanding commonly used approaches and techniques applied in teacher-oriented recommendation systems.What evaluation methods are applied to prove the efficiency of teacher recommendation systems? This research question aims to indicate which validation strategies are applied to recommendation systems e.g. survey, experiment, etc. This would help shedding light on how existing teacher-oriented recommendations are evaluated.

Search Process:

Searching and locating suitable resources for the study were established through online search from the following digital sources: IEEE Xplore, ScienceDirect, SpringerLink, Taylor & Francis and Google Scholar. We set our database search query using the following terms with the combination operator “AND” and “OR” as: Education AND (Teacher OR Educator) AND "Recommender System". The number of studies found was 602 eventually relevant papers. We read the papers‟ titles, abstracts, and keywords. This filtering procedure produced a total of 32 papers (note that the same paper may occurs in more than one source). The selected primary studies were then read and analyzed. The research was undertaken in April 2020 and updated in January 2021.

Selection of Criteria:

In this step, in order for the selection of existing studies to be ensured seamlessly, we defined exclusion criteria to decide whether a paper is directly linked to search query papers not targeting teacher-oriented RS. Duplicates studies: only the most current included. Summary articles, tutorials, workshop reports. If the study met at least one of the criteria listed below, it would be excluded from the process. The table 1 shows the number of studies retrieved and relevant after the application of the exclusion criteria.

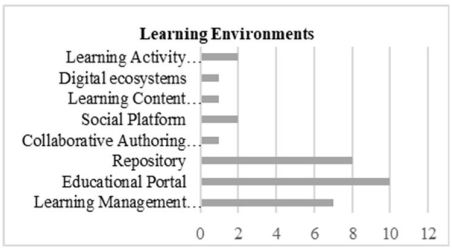
Reviews Of Existing Rs For Teachers

In this section, we present an overview of selected articles and results of our survey on teacher- oriented recommender systems.

Overview:

Authors in (García et al., 2009) affirmed that educational RSs can help teachers to improve learning performance. Authors in (Manouselis et al., 2010) concluded in their study that as opposed to movie or music recommender, the field of learning resources is very diverse and complex due to the variety in the potential educational uses of learning resource. In (Garcia-Valdez et al., 2010), the authors explored the use of fuzzy approach in educational recommender systems. (Brusilovsky et al., 2010) demonstrated how social navigation can be implemented in the context of a large distributed educational digital library. (Zapata et al., 2011) proposed a hybrid recommendation method to assist teachers in the search and selection process in learning objects repositories. (Bahritidinov et al., 2011) proposed a recommendation algorithm that recommends relevant collaborative teams of teachers to the coordinators of courses or units of learning. In (Ferreira-Satler et al., 2012), the authors demonstrated how a fuzzy ontology can be used to represent teacher profile into a recommender engine and enhances the teacher‟s activities into e-learning environment. (Fazeli et al., 2012) proposed a social recommender to assist young teachers to find most suitable peers to address their problems. In other work (Fazeli et al., 2014), the authors enhanced a trust-based recommender algorithm with social data obtained from monitoring the activities of teachers in order to help them to find themost learning resources. Another peer-based recommender system has been proposed by (Miranda et al., 2012) that combines collaborative and content filtering and enriched with contextual information to recommend online comments written by teachers to their peers about their experience related to educational activities in an online educational community. (Limongelli et al., 2013) addressed the problem of helping teachers to retrieve didactic material from a repository through a didactic social network where teachers with similar teaching styles can assist each other to find educational material. In other work (Limongelli et al., 2016), the authors presented a recommender system to assist teachers to build their courses through the Moodle learning management system. (Mottus et al., 2013) identified the goal of generating a visual dashboard for teachers to allow them easy access to complex educational information. (Gallego et al., 2013) proposed a new model to produce proactive context-aware recommendations on resources while creating a new learning object (LO) that a teacher performs by using an authoring tool. (Cobos et al., 2013) proposed a recommendation system of pedagogical patterns allowing teachers to access to patterns that provide solutionsto the different problems they meet and assist them to accomplish their goals related to their courses. (Soldatova et al., 2014) addressed the issue of recommending e-learning tools for teaching. stuff of engineering disciplines by defining criteria that will be used to create an e- learning recommender system. In (Serge‟s et al., 2014b), (Serge‟s and Sampson, 2015) and (Sergis and Sampson, 2016), the authors tackled the problem of ignoring the potential benefits of profiling teachers‟ particular professional characteristics. They proposed a ecommender system to help teachers to find LO from existing repositories in a unified manner namely by automatically constructing their ICT complex profiles and exploiting these profiles for more efficient LO selection. (El-Bishouty et al., 2014) developed a smart e-course recommender tool to supportteachers to extend their existing e-courses in learning management system by adding a list of recommended LOs to courses. (Zervas et al.,

2015) proposed a recommender system to support teachers to find and select the suitable remote and visited labs based on core pedagogical elements of their learning designs and their information and communication technology competences profiles. (Tewari et al., 2015) proposed a recommender system that analyses learner‟s opinions about contents and recommends the teachers who have uploaded the content of the web site to modify the particular portion of the subject topic which is difficult to understand by learners using opinion mining. In (Revilla Muñoz et al., 2016), the authors defined and implemented a recommender system to support teachers to find the most suitable solutions to their ICT problems from others teachers. (Karga and Satratzemi, 2018) and (Karga and Satratzemi, 2019) found in their research that Mentor, a recommender system integrated into learning activities management system, facilitates the sharing of good practices and help teachers to find a good learning design to rely upon for creating their own. It is noteworthy that the current review represents the second milestone of an ongoing research aiming at developing a teacher recommender system that is intended to suggest relevant OER aligned to the UNESCO ICT competency framework. The first milestone of the project (Dhahri and Khribi, 2021) explored teachers‟ ICT competency assessment realm by identifying and analyzing existing tools and approaches for assessing teachers‟ ICT competency level.



Answers to Research Questions

In this section, we present the results grouped by research questions. Learning Environments In table 2 we show the results of the first research question found in the selected papers. LMSs are software tools that provide mainly course management functionality and basic facilities of course authoring tools (Soldatova et al., 2014). Educational portal is a web-based interface with learning resources (Manouselis et al., 2010). Repositories are digital libraries for publishing, searching and retrieval of instructional resources (Zapata et al., 2013). Collaborative authoring tools provide environments that facilitate teacher participation in knowledge sharing activities, retrieving, and reusing of materials and activities created by colleagues (Bahritidinov et al., 2011). Social platforms are online social networks designed to support professional development (Fazeli et al., 2012). LCMS provide spaces where teachers publish, catalog and download learning resources (Ferreira-Satler et al., 2012). Digital ecosystems can be considered as platforms for cooperation, sharing and access to knowledge in order to facilitate learning

(Mohamed Ali et al., 2017). LAMS are tools for designing, managing and delivering sequences of learning activities (Karga and Satratzemi, 2018). Results show that around 31% of the papers reviewed choose educational portals to make recommendation to teachers due to the user feedbacks (ratings, comments, tagging) that offer a portal. These forms of feedback demonstrated their ability to guide portal users to relevant resources (Brusilovsky et al., 2010). Other primary studies (around 25%) focused on Learning Objects (LOs) recommendation and personalization into LO repositories. In the educational field, there is a lot of repositories and courseware whereteachers can share their resources and locate educational material of interest to reuse (Limongelli et al., 2013). Furthermore, there are around 22% of the reviewed papers which referred to learning management systems to provide recommendations. As can be seen in Figure 1, few reviewed studies have been focusing on

collaborative authoring tools and social platforms. On the other hand, there is a significant interest in using educational portals, then repositories, and learning management systems to provide recommend-actions for teachers.

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Harnessing the Power of Deep Learning to Save Animals

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ABSTRACT

During the last decade, AI has become the most important fieldfor the researchers to provide a solutions for real world's challenges, resulting in the new emerged field of deep learningwhich make the system more efficient and optimized .This paper discusses the expansion of deep learning towards the welfare of animal life considering ways to save them and monitoring their count and health conditions. Techniques like image classification and object detection can provide plethora of information that can assist in conducting study on various aspects by identifying and classifying these animal species from thousands of images captured by drones or cameras which could be very strenuous and tedious to be done by humans

Keywords:Deep Learning, Animals, Neural Networks, Image Recognition,Video Data analysis, Animal Image Detection, Animal Image Classification.

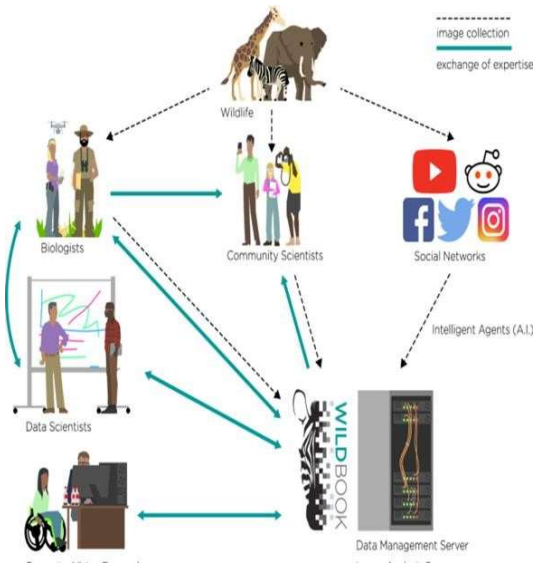
INTRODUCTION

Manual data analysis by complete human intervention possess a number of challenges, in such case deep learning could prove to be very effective in addressing these challenges and in finding innovative and efficient optimized solutions by reducing human effort. Deep learning is a methodology that induces artificially built intelligence into functions that mimic the functionality of human brain in processing data. Likewise humans improve at an activity by continuous repetitions of tasks associated with it, a deep learning model also learns by continuously iterating through training data multiple numbers of times and improving its intelligence on its own at every stage and thus the intelligence gained could be used to make decisions about other data. Inspired by the nerve cells (neurons) that make up the human brain, neural networks comprise layers (neurons) that are connected in adjacent layers to each other resulting in deeper network with more layers. Human brain comprising of number of a large network of neurons, when a neuron receives a signal associated with any action, it passes an excitatory signal to all its connecting neurons and if the threshold of the connecting neuron reaches, it in turn fires its further connecting neurons and in this way signals are transmitted from one neuron to another in a human neural network. In case of an artificial neural network, each neuron is associated with some weight and it exerts equivalent weight on its connecting neurons. Thus the effect exerted on a neuron is directly proportional to the weight associated with its preceding connecting neurons. An artificial neural network comprises of an input layer followed by a single or multiple hidden layer and a final output layer. Below figure (figure 1) illustrates a neural network with 3 node input layer, two 6 node hidden layers and widely used methodology in the field of deep learning, where each layer in the neural network is responsible of identifying a set of pattern of features associated with the given input which collectively make the learned pattern unique. Once the model is able to associate a certain sequence of features for a given patternand learn the possible outcome from training data, it will be ableto deduce the output when an input with similar features are provided as input.

The training of a model begins by allocating each node in the network with some random weight, then for each input, the output is computed using forward propagation from left

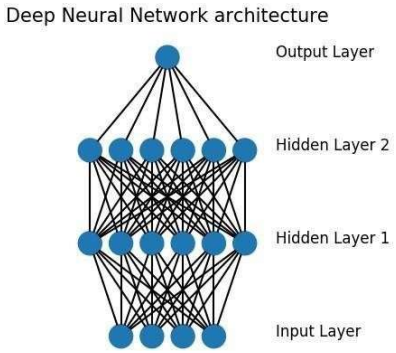
to right. Then, the final output from last node is compared to the actual output from training data and the error is measured for each input using loss function. Using back propagation technique from right to left, the error is propagated back to each node and the contribution of each node in the error is computed and finally the weight is adjusted using gradient decent.

Fig 1: Deep Neural network



DEEP LEARNING TECHNIQUES

Image classification and object detection are some of the broadly used techniques of deep learning. In a neural network comprising of multiple layers, each layer is responsible for extracting one or more features of the image. When a model is fed with a large dataset of labelled images with a large number of identifiable parameters, it will start recognizing patterns associated uniquely with each category. This is known as supervised learning, where a model learns by looking at similar patterns in one category andwhich are absent from other categories, as a result, when it encounters the same set of distinct features, it is able to differentiate and predict the image. Greater the number of comparable parameters and training input dataset, greater is the accuracy of the prediction of the model. Object detection is another methodology where a model is fed with an input image; it returns the



width, height of the bounding box which contains the object. If a model is trained to recognize a particular object by furnishing it with a set of images of the same object viewed from different angles, it should be able to locate the object when an image containing that object is provided as input.

WIDELY USED APPLICATIONS OFDEEP LEARNING

Methods like Image classification and object detection have been very well used for Industrial and commercial purposes like anomaly detection in manufacturing parts, integrating image recognition to improve their users experience by telecoms companies. They add value to their services by offering image organization and classification for photo libraries, which helps them attract and retain their customers. Other successful and widespread applications include real time theft detection and prevention using face recognition algorithms,[1] In agricultural industry , image processing is been utilizing in different ways to identify the crop, plant, leaves, flower, fruits etc. as well as to identify the disease. Digital image processing is a technique used for enhancement of the image to improve the agriculture productautomatic detection.

ANIMAL IDENTIFICATION AND CLASSIFICATION USING DEEP LEARNING

The implementation of Deep learning could be expanded for animal identification and classification. However the scope has been left

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unexplored or minimally explored towards the welfare of animals. With the current difficulty in obtaining detailed, accurate and up to date information about the wildlife in forests and marine life in oceans and seas governing their behaviour in that area, the speed and power of image classification and object detection could be leveraged to classify and identify images of animals and categorize them on the basis of a set of distinct features. For example, the Snapshot Serengeti (hereafter, SS) project has 3.2 million images and the images have been labelled by a group of 28,000 registered and 40,000 unregistered volunteer "citizen scientists" [2]. Currently, it takes 2-3 months for these thousands of people to classify each 6-month batch of images GPU's and motion sensor cameras fit in forests or underwater are able to collect large number of images each day.If a neural network is well trained to identify distinct pattern in the images of each animal, it can not only differentiate between two species but also two different animals of same species.

USE CASES WITH DEEP LEARNING
Curbing road accidents caused by stray animals

Although it accounts for a smaller percentage, but there have been a noticeable number of cases recorded for accidents involving animals mistakenly coming in the way of drivers. Either it is the case of a wild animal accidentally crossing the highway roads in the night or any stray animal being hit by a rushing vehicle on the busy road, each of these cases possesses a potential risk for both the driver and the animal. Techniques like pattern recognition could be used where the model can be trained to identify pattern associated with certain features like number of stray animals found in a particular locality, their population growth rates, type of the animal, locality conditions against the output as number of accidents occurred in that particular locality, International Journal of Computer Applications (0975 – 8887). It would be able to predict the possible risk locations of accidents on the basis of the number of animals and the locality. If such model is developed, not only the lives of people but also these innocent animals could also be saved. Also, on identifying the areas densely populated by these stray animals, it will be easier to keep a check on the count of these animals by immediately handing them over to animal welfare associations.

Saving endangered species from poaching
Drones and GPU's could be harboured to collect plenty of wildlife images and videos. Using deep learning neural network model trained with these collected images and videos can track, pinpoint and even predict the paths of animals, vehicles and poachers, learning more and more as time goes on. Also, the ability of the model to discriminate between visible and infrared light, it would be easier to know if the recording has been made during the day or at night. Once the model is able to identify a particular animal with respect to it features, it could trace down the path travelled by each animal (as the model can even differentiate between two animals of same species) and could possibly find any abnormality with themovement patterns. Also training the model with known routes followed by poachers, with this abnormality, the model could match the abnormal path with the possible poachers path to know whether the animal is being poached or not.

Studying the behaviour of rare or elusiveanimal species

Some animal species like sea cow and snow leopard are at the vergeof extinction. Their low population and elusive nature makes it difficult to keep a track of them. As for example in the case of sea cows, scientists had to spend days peering out of small planes to count populations, which was expensive and sometimes hazardous. Now with the help of aerial photography, it has become easier to

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capture thousands of images over the oceans, but the real challengeis to identify sea cows in those photos. Dr. Amanda Hodgson of Murdoch University teamed up with Dr. Frederic Maire, a computer scientist at Queensland University of Technology and using tensorflow built a detector that could learn to find sea cows in these photos automatically [3].nSnow leopard which is also a potentially endangered animal is verydifficult to study due to its remote habitat and highly elusive nature. Biologists have been using camera trap images for conducting study, but classifying images manually consumed about 300hrs per camera survey. To solve this problem, the Snow Leopard Trust and Microsoft agreed to partner with each other. Working with the Azure Machine Learning team, the Snow Leopard Trust built an image classification model that uses deep neural networks at scale on Spark [4].

The practice of using wild animals as props for tourists to post onsocial media has become a trend in recent days as a result of whichthese animals are suffering both in front of and behind the camera. The growing demand for harmful wildlife selfies is World Animal Protection a charity organization for animals partnered with Grassriots to develop an image recognition system that makes use of trained social listening algorithms and machine learning to differentiate good selfies withbad ones amongst thousands of photographs posted on social media like Instagram, Twitter Facebook etc. The model is trainedto consider a selfie as “bad” if someone is holding, hugging or improperly interacting with the animal and a selfie as “good” if the photo was taken in animal's natural habitat without any interaction with the humans [6].

CONCLUSION

By aptly leveraging the power of machine learning and exploring the deepest corners, the above stated uses could prove to be pioneering

Protecting Honeybees

As reported by Inverse, one third of the bee population died in US in 2016.Varroamite possess a biggest threat to bees resulting in decline in bee population and directly impacting the global food supply. Due to the difficulty and time associated with monitoring these bees, Swedish beekeeper and inventor Björns Lagerman is turning tod eep learning and smart phones to help preserve bee colonies. BeeScanning is a smart phone app that allows one to upload image of a bee colony upon which it uses an image recognition technique to make a distinction between infected and noninfected bees as infected bees could easily be identified with mites feeding on the back of these bees. BeeScanning will be providential to beekeepers to help protect existing colonies.

1.1 Identifying cruel and good animal selfiesusing image classification

and revolutionary in the field of AI. Also, one can observe that with the flexibility of the above stated algorithms, a model if trained to identify a particular animal or a species, it could easily be trained to identify others by providing it with sufficient training data to learn. Not only patterns in an image but also patterns in acoustic signals generated by animals could be decrypted to understand the animal behaviour.

FUTURE SCOPE

By using sophisticated image detection and video imageclassification techniques,, a greater advancement could be made in other areas as well . For example, images collected by drones or camera traps on a serious animal welfare concern. Recent investigation in the Amazon revealed that over 20 percent of the species involved are threatened by extinction and over 60 percent are protected by international law.

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ARTIFICIAL INTELLIGENCE IN SPACE TECHNOLOGY

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Abstract

Artificial intelligence (AI) has changed how humans live on Earth. What lies beyond our planet? How can knowledge advance the work and the scope of the search? AI plays a crucial role in space exploration and travel by assisting crews and ground operations. It facilitates activities like analysing cosmic occurrences, operating machinery, charting stars and black holes, and other activities that people are unable to carry out in space. AI is used by several organisations to discover and advance life for all astronauts. Scientists and governments from all over the world have long been fascinated by space travel, because it contains the key to understanding human history and many cosmological hypotheses, including the potential of extra-terrestrial life.

Keywords- Artificial intelligence, space technology, space exploration, satellite communication

INTRODUCTION

Space exploration has always been a testament to human curiosity and ingenuity. From the first steps on the moon to the Mars rovers' adventures, humanity's quest to explore the cosmos continues to evolve. In recent years, artificial intelligence (AI) has become a transformative force in this domain, revolutionizing how we understand and explore the vast expanse of space. AI's integration into space exploration has ushered in a new era of efficiency, innovation, and discovery. Its applications range from autonomous navigation and data analysis to spacecraft maintenance and planetary exploration. One of the most critical applications of AI in space exploration is autonomous navigation. Spacecraft and rovers equipped with AI can navigate and make decisions without constant human intervention. This autonomy is crucial for missions to distant planets or moons, where communication delays can range from minutes to hours.

ARTIFICIAL INTELLIGENCE IN SPACE TECHNOLOGY AND SATELLITE COMMUNICATION

Space exploration Powering Human Exploration of The Moon and Mars NASA Autonomous Systems and Operations (ASO) project has developed and demonstrated numerous autonomies enabling technologies employing Artificial Intelligence (AI) techniques. There work has employed AI in three distinct ways to enable autonomous mission operations capabilities. Crew Autonomy gives astronauts tools to operate space vehicles or systems without assistance from Mission Control. Vehicle System Management uses AI techniques to turn the astronaut’s spacecraft into a robot, allowing it to operate when astronauts are not present, or to reduce astronaut workload. AI technology also enables Autonomous Robots to act as crew assistants or proxies when the crew are not present. The integration of AI and ML at NASA is revolutionizing space exploration, enabling more efficient operations, deeper scientific insights, and groundbreaking discoveries. Here’s how NASA employs these cutting-edge technologies:

Self-Driving Rovers on Mars Spirit, Opportunity, and Curiosity Rovers Long before companies like Tesla and Google popularized self-driving cars, NASA was pioneering autonomous driving technology for Mars rovers. The Spirit and Opportunity rovers, which landed on Mars in 2004, were equipped with a Machine Learning navigation system called AutoNav. This system allowed the rovers to autonomously navigate the rocky

Martian terrain, avoiding obstacles like rocks and sand dunes Medicine in Space Exploration - Medical Capability (ExMC) Exploration Medical Capability – This is how the interior of a future medical habitat in space might look. As astronauts embark on longer missions beyond Earth's orbit, maintaining their health becomes increasingly crucial. NASA's Exploration Medical Capability (ExMC) project leverages ML to develop autonomous healthcare solutions tailored to astronauts' needs. These solutions are designed to evolve with astronauts' experiences, providing real-time medical assistance in space where direct contact with Earth- based doctors is impractical.

A Robotic Astronaut – The Robonaut

Robonaut, NASA's robotic astronaut, is designed to assist human astronauts with tasks that are too dangerous or tedious. Equipped with advanced sensors and AI, Robonaut can perform a variety of functions autonomously. Machine Learning enables Robonaut to learn and adapt to new tasks, making it an invaluable partner in space exploration and increasing NASA's research capabilities. What are other space agencies doing in this area?

The German Aerospace Centre (DLR) has been developing AI methods for space and Earth applications for many years and in 2021 set up an Institute of Artificial Intelligence Security. In 2018 DLR launched an AI assistant to support its astronauts in their daily tasks onboard the ISS. Fully voice-controlled CIMON (Crew Interactive Mobile companion) is able to see, speak, hear, understand and even fly! NASA is also using AI for many applications, and has set up an Artificial Intelligence Group that performs basic research that supports scientific analysis, spacecraft operations, mission analysis, deep space network operations and space transportation systems. The Agency investigated making communication networks more efficient and reliable using cognitive radio, which picks out the 'white noise' areas

Finding Other Planets – Planetary Spectrum Generator

The search for exoplanets—planets outside our solar system—is a key focus for NASA. The Planetary Spectrum Generator uses ML to create detailed models of these planets' atmospheres. By analysing spectral data, ML algorithms can predict the presence of elements like water and methane, which are indicators of potential life. This technology enables NASA to discover and study new planets, bringing us closer to answering the age-old question of whether we are alone in the universe.

in communication bands and uses them to transmit data; this maximises the use of the limited telecommunication bands available and minimises delay times. It also applied AI to calibrate images of the Sun, improving the data that scientists use for solar research. For deep- space exploration NASA has also looked into designing more autonomous spacecraft and landers, so that decisions can be taken on site, removing the delay resulting from communication relay times.NASA cooperated with Google to train its extensive AI algorithms to effectively sift through the data from the Kepler exoplanet mission to look for signals from an exoplanet crossing in front of its parent star. This successful collaboration quickly led to the discovery of two new exoplanets previously missed by human scientists. Following its success, AI has been used on data from NASA's TESS mission to identify candidate exoplanets Contextual dynamics of space Currently space is defined as Space 4.0 which refers to this era of pro-activeness, open- mindedness to both technology disruption and opportunity where trends include space big data, predictive and geospatial analytics applied thereto. In particular, this era is backed up by Al- based technology, machine learning (ML), and Internet of Things (IoT). IoT is forecasted to be pervasive by 2025, with connected "things"

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driving a data explosion with sensors deployed by mega constellations of small sats. These space-based benefits increase the repercussion of space activities on Earth. A growing number of key economic sectors (in particular land and infrastructure monitoring, security, as well as the digital economy, transport, telecommunications, environment, agriculture and energy) use satellite navigation and EO systems. New actors together with emerging new technologies such as AI develop new global business models driven by demand, such as satellite constellations), tourism, asteroid and lunar mining, in-situ resource utilization (ISRU), 5G, in-orbit servicing (IoS), 3D printing of satellite parts (e.g. solar panels, etc.), and commercial space station. New high-end technologies embedding small-satellite design describe the current landscape of the space industry. Smaller, lightweight satellites based on affordable off-the-shelf hardware, less expensive spacecraft (small, nano and pico- satellites) can be replaced more easily thereby refreshing technology rapidly combined with the ability to launch thousands of these satellites into mega constellations opens up possibilities for more missions and applications using space infrastructure.

SATELLITE COMMUNICATION

Satellite communication offers the prospect of service continuity over uncovered and under-covered areas, service ubiquity, and service scalability. Artificial intelligence (AI), including machine learning, deep learning, and reinforcement learning, has been steadily growing as a research field and has shown successful results in diverse applications, including wireless communication. In particular, the application of AI to a wide variety of satellite communication aspects has demonstrated excellent potential, including beam- hopping, anti-jamming, network traffic forecasting, channel modelling, telemetry mining, ionospheric scintillation detecting, interference managing, remote sensing, behavior modelling, space-air-ground integrating, and energy managing. This work thus provides a general overview of AI, its diverse sub- fields, and its state-of-the-art algorithms.

CONCULSION

Artificial Intelligence is revolutionizing space technology by enhancing satellite operations, enabling autonomous spacecraft, facilitating data analysis, and advancing robotic exploration. Its ability to simulate human intelligence processes and make autonomous decisions in real-time is transforming how we explore and understand the cosmos. As AI technology continues to evolve, its integration into space exploration will drive new discoveries, expand our knowledge of the universe, and pave the way for future generations of explorers.

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An Integrated Web-Based Platform For Enhanced College Placement Management And Student Engagement

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Abstract

In the contemporary educational landscape, college placement plays a pivotal role in the transition of students from academia to the professional world. However, this phase is often plagued by challenges such as inefficient communication between students and placement cells, inadequate tracking of job applications, and the need for personalized guidance.This research paper introduces a pioneering web application tailored to reshape this process fundamentally. The proposed system leverages state-of-the-art web technologies, coupled with the intelligence of artificial intelligence (AI) algorithms, to create an interface that redefines the way students and placement cells collaborate. This transformative web application streamlines communication, enhances efficiency, and ultimately optimizes outcomes for both stakeholders. In this paper, we present a comprehensive exploration of the system's architecture, functionality, and potential impact on the higher education ecosystem.

Keywords—Placement Cell, Online Job Portal, Interview Preparation, Feedback Mechanism, Recruitment Strategies, Ai, Interview Summaries.

INTRODUCTION

This research paper introduces a groundbreaking web application designed to transform the conventional college placement paradigm. The proposed system, referred to as the "Placement Connect," is poised to redefine how students and placement cells interact, communicate, and collaborate.[1][2] It leverages the power of modern web technologies, artificial intelligence (AI), and user-centric design principles to streamline the placement process and optimize outcomes for all stakeholders. The motivation behind this project is rooted in the recognition of the multifaceted challenges faced by students and placement cells in the existing placement landscape. [3][4] These challenges encompass but are not limited to, the need for improved profile management, efficient job search and matching mechanisms, streamlined application tracking, enhanced resume-building tools, and seamless interview scheduling. Placement Connect aims to address these challenges comprehensively, offering a one-stop solution that empowers students and placement cells alike this paper outlines the key features of Placement Connect and elucidates its potential to user in a new era of college placement. This research paper explores the various facets of a placement cell project, including its organizational structure, services offered, strategies for engagement with students and employers, and the impact it has on the overall career development of students. It also delves into the challenges and opportunities that arise in the management and operation of such a critical component within educational institutions. [5][6] Through empirical analysis, case studies, and best practices, this paper aims to provide valuable insights into the functioning and effectiveness of placement cells, ultimately contributing to the enhancement of career services in the realm of higher education. As we embark on this exploration of placement cell projects, we will uncover the transformative potential of these initiatives in empowering students .

CHALLENGES IN COLLEGE PLACEMENT PRESENTS A SERIES OF CHALLENGES:

Student Challenge:

Students often struggle to identify suitable job opportunities aligned with their skills and

career aspirations. Navigating the complex job market landscape can be overwhelming, leading to missed opportunities

Placement Cell Challenge: Placement cells are tasked with managing a multitude of job postings, coordinating interviews, and ensuring seamless communication with students Existing systems may lack the efficiency required to handle these tasks effectively.

KEY FEATURES FOR STUDENT-PLACEMENT CELL INTRACTION

The proposed web application introduces several key features to address these challenges effectively:

Profile Management: Empower students to create comprehensive profiles encompassing academic records, skills, and career preferences. Provide placement cells with efficient tools to manage

Job Search and Matching: Implement a sophisticated job search algorithm that considers student profiles and preferences. Enable students to discover relevant job opportunities with ease.

Application Tracking: Offer students real-time visibility into the status of their job applications. Equip placement cells with streamlined tools for managing and updating application statuses.

Resume Builder: Furnish students with an intuitive interface for crafting, editing, and storing multiple versions of their resumes. Enable placement cells to review and offer feedback on student resumes seamlessly.

Networking: Engage with recruiters and industry professionals to expand their professional network and gain insights into various career paths.

Professional Demeanor: Exhibit professionalism, enthusiasm, and a positive attitude throughout the placement drive creating a favorable impression on potential employers.

Adherence to Guidelines: Follow all guidelines and instructions provided by the placement cell and the recruiting companies to ensure a smooth and respectful recruitment process.

Adaptability and Flexibility: Be adaptable and open to different job opportunities, industries, and roles, showing flexibility in considering potential career paths.

Post-Drive Reflection: Reflect on the experience, identify areas for improvement, and use the insights gained to enhance future job-seeking endeavors.

Interview Scheduling: Deploy a scheduling system allowing students to book interview slots conveniently. Provide placement cells with a centralized platform to oversee and manage interview schedules efficiently

Notifications: Implement automated notifications, ensuring students are promptly informed about job openings, interview invitations, and other critical updates

Chat and Messaging: Introduce a real-time chat feature enabling direct communication between students and placement cell members. Foster quick responses to queries, enhancing collaboration.

Feedback and Ratings: students to provide feedback on the placement process, interview experiences, and overall satisfaction.

INTEGRATION WITH AI

A. The integration of AI technologies is central to the system's capabilities:

AI-driven algorithms power personalized job recommendations based on student profiles, enhancing job-matching accuracy. Interview summaries generated through AI analysis streamline the review process for placement cells, reducing manual effort. AI can use historical placement data to predict future trends and identify which industries or companies are likely to have job openings. This can help students make informed decisions about their career paths.

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PERSONALIZED JOB RECOMMENDATIONS

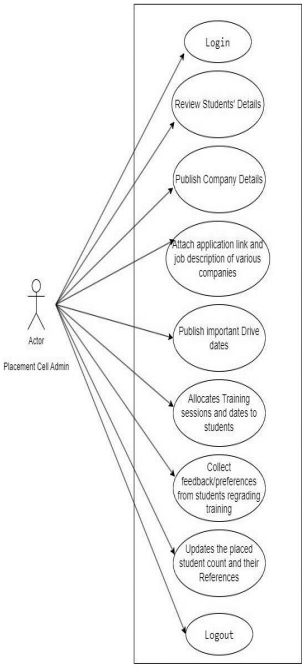
One of the cornerstones of our AI integration is the provision of personalized job recommendations to students. Leveraging machine learning algorithms, the system analyzes students' academic records, skill sets, and career aspirations. [7][8] This analysis enables the application to generate tailored job suggestions that align witindividual profiles. Consequently, students can discover job opportunities that resonate with their unique strengths and goals, thereby optimizing their job search process.

CONTINUOUS PROCESS ENHANCEMENT

AI plays a crucial role in enhancing the efficiency of placement cells. By analyzing historical placement data and performance metrics, the system identifies areas for improvement. For instance, it can pinpoint stages in the placement process where bottlenecks occur or where students often face challenges. Armed with this data-driven insight, placement cells can refine their processes, implement targeted interventions, and ensure a smoother experience for both students and recruiters.

ADAPTIVE CHAT SUPPORT

Our web application employs AI-driven chatbots to provide real-time support to students and placement cell personnel. These chatbots are equipped with natural language understanding capabilities, enabling them to answer queries, provide guidance, and offer relevant resources. Students can receive instant responses to questions about job applications, interview preparation, and placement-related inquiries. Placement cell administrators can rely on chatbots for routine tasks, freeing up their time for more strategic activities



Admin Module (figure 1.1)

Through an amalgamation of empirical analysis, case studies, and a thorough review of the existing literature, this study has underscored the pivotal significance of placement cell projects. These initiatives serve as catalysts in facilitating a seamless journey from academia to industry, offering students an invaluable platform to showcase their talents and acquire essential employability skills. Equally, they cater to the needs of employers by providing a pool of well-prepared and motivated individuals ready to contribute to the work for Student Module (figure 1.2))

CONCLUSION

In a landscape where educational institutions strive to prepare students not only with academic knowledge but also with the skills and resources required for a successful transition into the professional world, placement cell projects emerge as indispensable entities. This research has offered a comprehensive examination of the multifaceted role played by placement cells within higher education institutions

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ANIMATION IN GAMING

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ABSTRACT:

This article focuses on types of animation for simulation of computer games. The game developers are turning to serious algorithms from the computer science research community to bring their virtual worlds to ever higher levels of sophistication. Most video games completely embrace physical control and simulation. Interactivity-the key factor differentiating games from other forms of entertainment will demand it.

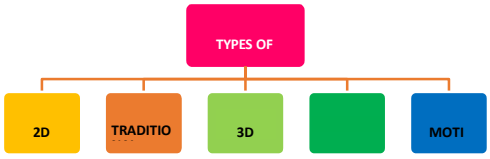
KEYWORDS: Animation, Various Technique of Animation, Types of Animation in Gaming, Motion Graphics, Stop Motion.

INTRODUCTION:

Animation is a process of creating the illusion of movement by displaying a sequence of static images or frames in rapid succession. It is an artistic and technical medium that brings inanimate objects, characters, and scenes to life, allowing them to move, interact, and express emotions or actions. Animation can be done using various techniques, such as traditional hand-drawn animation, computer-generated imagery (CGI), stop-motion, and more recently, 3D animation.

The basic principle behind animation is persistence of vision, which refers to the phenomenon where the human eye retains an image for a short time after it disappears from view. When a series of images are displayed in quick succession (usually around 24 to 30 frames per second), our brain perceives them as continuous motion.

Animations are widely used in various fields, including: Entertainment: Animated movies, television shows, and web series. Advertising: Animated commercials and promotional videos. Education: Animated tutorials and interactive learning materials.



Gaming: Video games often employ animation for characters and environments.

Simulation: Animated simulations used in training, research, and development.

User Interface (UI): Animated elements in software and websites for a more engaging experience.

The level of detail and complexity in animation can vary widely, from simple and abstract animations to highly realistic and sophisticated ones. Animation has become an essential part of modern media and has a significant impact on storytelling, visual communication, and entertainment across the globe. Animation in gaming works by using various techniques and technologies to create the illusion of movement for characters, objects, and environments within the virtual world. Here's an overview of how animation is typically implemented in gaming. There are 5 major types of animations used to develop a game they are Traditional animation, 2D animation, 3D animation, motion graphics and stop motion .this paper delves with the major type of animation used in gaming and also limitations of animation.

TRADITIONAL ANIMATION :

Traditional animation gaming refers to video games that use hand-drawn or frame-by- frame animation techniques, similar to those used in

traditional 2D animated films and cartoons. In these games, each frame of animation is created individually by artists and then played sequentially to give the illusion of motion. This approach was commonly used in early video games before the widespread adoption of 3D graphics. Some classic examples of traditional animation gaming include games from the 8-bit and 16-bit era, like Super Mario Bros., Sonic the Hedgehog, and The Legend of Zelda.Hand-drawn animation: Classic frame-by- frame animation created by artists drawing each frame by hand. Cel animation: Hand-drawn animation on transparent sheets called "cells," which are layered to create the illusion of movement.Stop-motion animation: Physical objects or puppets are moved incrementally between frames to create animation. Claymation: Similar to stop-motion, but using clay figures or models for animation. Cut-out animation: Characters and objects are cut out from paper or other materials and manipulated to create animation. Flipbook animation: Simple animation created by flipping through a series of images rapidly.

2D ANIMATION:

2D animation plays a crucial role in gaming, especially in games that have a more artistic or retro style. It has been an integral part of the gaming industry for decades and continues to be utilized in various ways in both indie and AAA game development. In gaming, two important types of 2D animation are:

Sprite-Based Animation:

Sprite-based animation, also known as frame-based animation, is a traditional and widely used technique in 2D gaming. It involves creating a series of static images or frames, each representing a different pose or state of a character, object, or effect. These frames are then displayed in rapid succession to create the illusion of movement. The sequence of frames is often stored in a sprite sheet, which is a single image that contains all the individual frames arranged in a grid. Sprite-based animation is well-suited for character animations, where each frame can depict different actions such as walking, jumping, attacking, or idle poses. It offers a high level of control over the character's movements and is widely used in both retro-styled games and modern indie titles.

3D ANIMATION:

3D animation in gaming refer to the use of three-dimensional models and environments to create lifelike and immersive visuals within video games. This animation style has become increasingly popular over the years and has allowed game developers to create more realistic and visually stunning gaming experiences. Two important types of 3D animation commonly used in gaming are:

Keyframe Animation:

Keyframe animation is a foundational

Particle-Based Animation:

Particle-based animation is another essential type of 2D animation used in gaming, especially for creating various visual effects and environmental elements. In this technique, particles are small images or sprites that represent specific phenomena like fire, smoke, sparks, raindrops, or explosions. These particles are emitted, move, and behave according to predefined rules and physics to simulate the desired effect. Particle systems are used to generate and manage these particles efficiently. They can produce complex and dynamic visual effects, adding depth, realism, and visual flair to the game environment. Particle-based animation is often employed for effects like spellcasting, environmental interactions, weather, and explosions.

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technique in 3D animation used extensively in gaming. It involves setting key poses or keyframes at specific points in time for the 3D model's movement, rotation, and other attributes. The animator defines these keyframes, and the animation software automatically generates the intermediate frames to create smooth and seamless motion. Keyframe animation is widely used for character movements, such as walking, running, jumping, and performing various actions. It allows animators to have precise control over the character's poses and timing, resulting in more natural and dynamic animations

Motion Capture (MoCap):

Motion capture is a technique in which the movements of real-life actors or objects are recorded and then applied to 3D models in the game. The process involves using specialized cameras or sensors to capture the motion of actors or objects, and the data is then mapped onto the digital characters or objects. Motion capture is particularly valuable for creating highly realistic and lifelike animations. It is commonly used for character animations, such as combat sequences, realistic gestures, and facial expressions. MoCap allows developers to achieve a level of realism that would be challenging to achieve solely through keyframe animation.

MOTION GRAPHICS:

Motion graphics in gaming refer to animated visual elements, designs, or effects that are used to enhance the overall presentation and user interface of the game. Unlike traditional 3D or 2D character animations, motion graphics are often non- character elements, such as user interface elements, HUD (heads-up display) elements, transitions, and visual effects. Two important types of motion graphics commonly used in gaming are:

User Interface (UI) Motion Graphics:

UI motion graphics are animations used to bring the game's user interface elements to life. This includes animations for buttons, icons, menus, health bars, inventory displays, and other interactive elements. These animations are designed to be visually appealing, intuitive, and responsive to the player's actions. For example, when a player hovers over a button, it may subtly animate to provide feedback that the button is interactive. When a player levels up, the experience bar might fill up with a smooth animation. Well-designed UI motion graphics can greatly enhance the overall user experience by making the interface more engaging and user-friendly.

Visual Effects (VFX) Motion Graphics:

VFX motion graphics are used to create various visual effects in the game, such as explosions, magic spells, environmental effects (e.g., rain, snow, fire), and other dynamic elements. These effects are often used to make the game world more immersive, realistic, and visually exciting. VFX motion graphics can be created using particle systems, where individual particles are animated to simulate different phenomena. For example, in an action game, a fireball spell might be created using VFX motionphics, with animated particles for the fire and sparks, along with dynamic lighting effects.

STOP MOTION:

Stop motion in gaming refers to a technique where real-world objects or physical puppets are manipulated and photographed frame by frame to create animations for use in video games. This animation method provides a

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unique and distinct visual style that can add charm and creativity to certain types of games. Two important types of stop motion used in gaming are:

Claymation or Clay Animation:

Claymation is one of the most well-known forms of stop motion animation. In this technique, characters and objects are created using sculpting clay or plasticine, and they are posed and repositioned incrementally for each frame of the animation. The animator takes a photograph after each adjustment to create the illusion of movement when the frames are played consecutively. Claymation in gaming can be used for creating unique and quirky characters or for presenting certain story elements with a distinct visual style. Games that use Claymation often have a whimsical and playful feel, making them stand out from more traditional animation styles.

Cutout Animation:

Cutout animation involves using flat, 2D characters and objects made from paper or other materials. Each component of the character or object is cut out separately and articulated with joints, allowing them to be moved and posed. The animator then photographs the cutout elements in different positions to create the animation. Cutout animation in gaming is particularly useful for creating 2D characters or objects with a handcrafted look. It allows developers to achieve a stylized appearance reminiscent of traditional paper-based animations. This technique is often used in games with a distinct art style, such as point-and-click adventure games or narrative- driven experiences.

CONCLUSION:

Animation in gaming is a vital component that brings virtual worlds and characters to life, creating immersive and engaging experiences for physics. Here we learnt about animations, various technique of animation, types of animation in gaming, traditional animation,2D animation,3D animation, motion graphics, stop motion.

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Recycling of lithium-ion batteries: Recent advances and perspectives

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Abstract:

With the ever-growing need for lithium-ion batteries, particularly from the electric transportation industry, a large amount of lithium-ion batteries is bound to retire in the near future, thereby leading to serious disposal problems and detrimental impacts on environment and energy conservation. Currently, commercial lithium-ion batteries are composed of transition metal oxides or phosphates, aluminum, copper, graphite, organic electrolytes with harmful lithium salts, polymer separators, and plastic or metallic cases. The lack of proper disposal of spent lithium-ion batteries probably results in grave consequences, such as environmental pollution and waste of resources. Thus, recycling of spent lithium- ion batteries starts to receive attentions in recent years. However, owing to the pursuit of lithium-ion batteries with higher energy density, higher safety and more affordable price, the materials used in lithium- ion batteries are of a wide diversity and ever- evolving, consequently bringing difficulties to the recycling of spent lithium-ion batteries. To address this issue, both technological innovations and the participation of governments are required. This article provides a review of recent advances in recycling technologies of spent lithium-ion batteries, including the development of recycling processes, the products obtained from recycling, and the effects of recycling on environmental burdens. In addition, the remaining challenges and future perspectives are also highlighted.

Index-terms: Recycling, Recovery, Spent lithium-ion batteries, Perspective

Introduction:

Owing to the high energy density, long lifespan and low self-discharge, lithium-ion batteries (LIBs) are higher portable than other commercial energy storage devices and have become the most leading power source for consumer electronics (CEs) since they were successfully commercialized by SONY in 1990s. Nowadays, with the rapid advances in microprocessor technology and constant offers of upgrades, the period of product updating for CEs has been largely shortened, resulting in rising production of LIBs, as well as rapid generation of spent LIBs from waste CEs. In the past several years, with the development of new electrode materials possessing higher energy density and power output, the application targets of LIBs have spread into the electric vehicles (EVs) . In the meanwhile, with the maturity of high energy- density LIBs and policy orientations, the EV market is growing rapidly. Fig. 1 shows the development of EVs in the world [11]. It can be seen that both the global EV stock and EV registrations have increased fast since 2012, particularly in China and US. Considering that the EV market is just beginning to boom, and the lifetime of EV batteries is designed to be longer than that of the ones used in CEs, hence, we may not face serious disposal problems of spent LIBs from EVs in a few years. However, we should foresee the influences of numerous retired LIBs from EVs on resource conservation and environmental protection in the near future, and be aware what actions should be taken now to deal with the spent LIBs. It can be predicted that the lack of proper disposal and post-treatment of spent LIBs will result in grave consequences, such as environmental pollution and waste of resources. Generally, a LIB is composed of a cathode, an anode, a separator, electrolyte, an outer case and sealing parts. Commercial LIBs are currently using various

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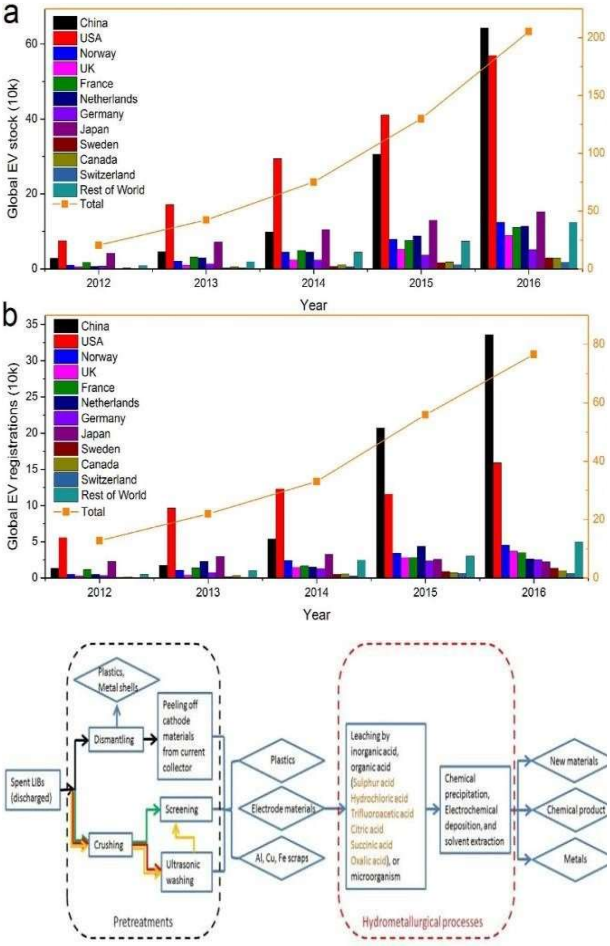
types of Licontaining oxides and phosphides as cathode materials, such as LiCoO2, LiMn2O4, LiFePO4, LiNi1-x- yCoxMnyO2 (NCM), etc. It is shown from a survey in 2012 that more than half of the cathode material market was still occupied by LiCoO2



IEEE Recycled Lithium Batteries as Good as Newly Mined Cathodes made with novel direct- recycling It includes leaching (e.g. acid leaching, bioleaching, etc.) and recovery steps (e.g. solvent extraction, chemical precipitation, electrochemical deposition, etc.) (see Fig. 2). Hydrometallurgical process is a powerful method for recovering metals from spent LIBs. For example, over 99% of cobalt and lithium could be leached through the process reported by Zhang et al. [34]. Over 98% of copper and 97% of cobalt was recovered by Nan's hydrometallurgical method Mousavietal developed an environmentally friendly bioleaching method, in which the metals in spent LIBs could be leached by organic acids produced by As per gillusniger. In their work,

and LiNi0.33Co0.33Mn0.33O2, which contain hazardous heavy metal, i.e., cobalt . In addition, organic electrolytes also contain harmful substances such as flammable organic solvents and fluorine-containing lithium salts .

100% of copper, 100% of lithium, 77% of manganese, 75% of aluminum, 64% of cobalt and 54% of nickel could be recovered Pyrometallurgical process has been employed by commercial recycling plants for the recovery of cobalt [24]. For example, the Umicore Group developed a pyrometallurgical process in which spent LIBs are beat commercial materials.PRACHI PATEL,15 OCT 20213 MIN READ,lithium ion battery recycling ISTOCKPHOTO.Lithium-ion batteries, with their use of riskily mined metals, tarnish the green image of EVs. Recycling to recover those valuable metals would minimize the social and environmental impact of mining, keep millions of tons of batteries from landfills, and cut the energy use and emissions created from making batteries. But while the EV battery recycling industry is starting to take off, getting carmakers to use recycled materials remains a hard sell. "In general, people's impression is that recycled material is not as good as virgin material," says Yan Wang, a professor of mechanical engineering at Worcester Polytechnic Institute. Generally, pretreatments are aimed to separate components and materials in spent LIBs according to different physical properties such as shape, density, conductivity, magnetic property, etc. [15]. With the help of pretreatments, the components, materials and metallic scraps with similar physical properties can be separated and enriched, A new study by A new study by Wang and a team including researchers from the US Advanced Battery Consortium (USABC), and battery company A123 Systems, shows that battery and carmakers needn't worry. The batteries with recycled cathodes can be as good as, or even better than those using new state-of-the-art materials. The most common flavor of cathode

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containing a third each of nickel, manganese, and cobalt. The cathodes were made using a patented recycling technique that Battery Resourcers, a startup Wang co-founded, is now commercializing.

treated like natural ores [25]. In this process, the only pretreatment stage is a simple dismantlement of big battery packs to individual cells. Then, the battery cells are fed into a shaft furnace with three temperature zones, called pre-heating zone, plastics pyrolizing zone and smelting and reducing zone. In the pre-heating zone, spent LIBs are heated at a temperature lower than 300 °C in order to release the electrolyte vapor without explosion.

The plastics pyrolizing zone is operated at ∼700°C, aiming to incinerate the plastic components of the spent LIBs to maintain the temperature and reduce the energy consumption of the smelting step. In the last zone, the materials are smelt and an alloy with copper, cobalt, nickel, and iron forms, together with the formation of a slag containing lithium, aluminum, silicon, calcium and a part of iron. Obviously, this process can only recover copper, cobalt, nickel and a part of iron from spent LIBs. It is worth mentioning that the economic efficiency of this process strongly depends on the cobalt price, as well as the cobalt

content in batteries. It has been widely-recognized that cobalt is being gradually replaced in the automotive LIBs, and the cathode materials for LIBs are ever-evolving [26,27]. For example, the cathode material for the batteries adopted by GM Volt is Hydrometallurgical process is the most major approach for recycling spent LIBs since more than half of the recycling processess dissolve the waste LiCoO2 cathode material. The Aspergillus niger used in Mousavietal.'s work [36] is a haploid filamentous fungus found in mesophilic environments such as decaying vegetation and soil. This fungus can produce organic acids,including gluconic acid, citric acid, oxalic acid and malic acid, in sucrose medium . Then the excreted one or more organic acids provide H+ and organic ligands for the extraction of lithium and cobalt from waste cathode materials. Because of the use of living biomass, bioleaching process is more difficult to control. For instance, Xinetal. compared the bioleaching behavior of Alicyclobacillus sp. at different pulp density, and found that the leaching efficiency was considerably influenced by the pulp density. 5a–d. As can be seen, the leaching efficiency In other words, the crushed LIBs are treated like natural ores. Li will go into the slag which also can be further treated like lithium ores. Taking the commercial pyrometallurgical process as an example, the energy requirement for metallurgical recovery of Co, Ni and Li could be estimated based on the industry data of traditional pyrometallurgical process. However, the contents of Co and Li in LIBs are higher than those found in natural ores or even concentrated ores [16]. The contents of these elements in the spent LIBs should also be considered when estimating the energy requirement for metallurgical recovery of them. Dunn et al. [24] comprehensively estimated the possible benefits decreased from 52% to 10%. of automotive LIBs recycling in terms of the reduction of energy consumption and greenhouse gas emission. In their work, these environmental burdens of the material production, assembly and recycling (ascalled "cradle- to-gate" route) of automotive LIBs with LiMn2O4 as cathode material were analyzed. Based on their estimation, the direct physical process was considered to be the most energy- saving method, as it could directly recover cathode materials without or only with minor relithiation. The hydrometallurgical and intermediate physical processes also showed beneficial impacts on total energy consumption of battery manufacture when cathode material. aluminum and copper were recycled. This work could be a good reference for the calculation of energy demand in the recycling processes. Another important thing

to note is that the energy associated with the production of required reagents and the LiMn2O4, and the cathode material for A123 batteries is LiFePO4

Hydrometallurgical process processing of the wastes should not be neglected when estimating the total energy consumption of a recycling process. To date, hydrometallurgical recycling has been considered as an energy-saving route as compared to pyrometallurgical method [48,95,96]. To our best knowledge, however, there is no published work to systematically compare the total energy consumption between hydrometallurgical and pyrometallurgical approaches. In practice, the energy associated with the production of acid and auxiliary reagents, the acid recovery and the treatment of acid sludge has considerable impact on the energy-efficiency of the whole hydrometallurgical process. Therefore, more efforts are still needed to figure out the specific energy demand for recycling. Lastly, it is meaningful to estimate the amount of wastes produced in the recycling. Theoretically, the amount can be calculated through chemical engineering calculation based on the leaching reactions. In addition, chemical treatments are needed to render the waste acceptable for landfill. For example, a large amount of acid and some other auxiliary reagents are needed in hydrometallurgical process. After the chemical recovery, a large volume of waste acid sludge will be generated. The acid must be recycled or neutralized and the heavy metals and harmful organic substances in the sludge must be removed before landfill. That is the reason why hydrometallurgical process is hardly adopted by commercial recycling plants. Therefore, it is reasonable to conclude that estimating the amount of wastes emissions is essential to evaluating the environmental burdens and economic efficiency for a recycling process. In summary, the effects of spent LIBs recycling on environmental burdens depend on the recycling approaches. It will be advisable to analyze the environmental burdens while designing a recycling process. Moreover, the recovery or disposal of electrolyte (including solvent and LiPF6) and binder, as well as the anode materials, should also be concerned in the future, although they were not major contributors to battery cradle-to-gate impacts. In addition, battery designs aiming to easy disassembly and separation of battery materials, as well as the standardization of materials are recommended, since those may facilitate the recycling of spent LIBs and energy conservation. 5. Conclusion and perspectives The substantial increase in the EVs production results in numerous spent LIBs in the near future. The appropriate recycling of them is noteworthy, since they contain various valuable metals and harmful substances. Many recycling processes aiming at recovering the metal values from spent LIBs have been developed, and some of them have been industrialized. An ideal recycling process should be capable of recovering all components of spent LIBs with low energy consumption and no environmental pollution. To date, there are research achievements developed on the technologies which are able to satisfy such requirements. However, almost all of them require complicated processing steps or expensive reagents due to the diversity of materials in LIBs. Therefore, many efforts are still needed for the development of more powerful recycling technologies. In addition, there are other challenges which the LIBs recycling industry must face. Firstly, unlike lead-acid batteries, the technology and chemistry of LIBs are ever-evolving, leaving the recycling technologies behind. For example, the pyrometallurgical process may have no economic efficiency if the cathodes are fabricated with cobalt- free materials. Secondly, with the development of LIBs recycling industry, the issue of cross-contamination of battery type in recycling stream may emerge. For example, LIBsand lead-acid batteries may be designed to be geometrically equivalent for interchangeable use in some instances, such as on mini-sized

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electric vehicles or electric bicycles. That may lead to the inclusion of LIBs in the input stream of lead smelters, resulting in fires, explosions and contamination. Thirdly, there is no perfect laws, regulations, and standards system regarding LIBs recycling, which can standardize the recycling, and assure safe collection, transport and handling of spent LIBs during the recycling processes. Finally, in order to speed up the establishment of efficient recycling system for spent LIBs, further effort may concentrate on, but not be limited to the following. (1) Identifying and sorting spent LIBs to be recycled in different ways. (2) User- friendly labeling or marking LIBs at the manufacture and recycling, which could help routing and supervising the recycling. (3) Designing LIBs with recycling in mind, and avoiding

Process	Feed	Pre-Processing	Mechanical Processing	Pyro	Hydro	Main Recoveries	Secondary Recoveries	Use of Main Recoveries	Use of Secondary Recoveries	Losses
Umicore Valfas™	LIB, NiMH	Dismantling	-	Shaft furnace	Leaching solvent extraction	Co, Ni, Cu, Fe $CoCl_2$	Slag: Al, Si, Ca, Fe, Li, Mn, REE	Metal industry, cathode production	Construction industry	Electrolyte, plastics, graphite
Sumitomo-Sony	LIB	Sorting Dismantling	-	Calcination	Hydro	CoO	Co-Ni-Fe alloy Cu, Al, Fe	Battery industry	Metal industry	Electrolyte, plastics, Li, Ni, graphite
Retriev Technologies	LIB Primary Li	Dismantling	Wet comminution, screening, shaking table, filtration,		Precipitation	Li_2CO_3 MeO	Steel Cu, Co, Al	Cathode production, metal industry	Metal industry	Plastic
Recupyl Valibat	LIB Primary Li	-	crushing, vibrating screen, secondary screen, magnetic separator, densimetric table,	-	Hydrolysis leaching	Li_2CO_3 $LiCO_3$ Li_3PO_4	Steel Cu, Al Cu, MeO, C	Cathode Production.	Metal industry	Cu, graphite
Akkuser	LIB	Sorting	1st cutting, air filtration, cutting, magnetic separator	-	-	Co, Cu powder Fe	Non-ferrous metals	Various including metal industry	Metal industry	Plastic
Accurec	LIB	Sorting Dismantling	Milling, separation, agglomeration,	Vacuum thermal treatment, reduction	H_2SO_4	Li_2CO_3 Co-Alloy	Metallic alloy	Production of cathode material	Metal recovery	Electrolyte, polymers, graphite

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Data Mining techniques to forecast Fashion Sales

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ABSTRACT

Online shopping has revolutionized clothing sales. Customers now access a vast array of designer outfits at bargain prices. Sellers enjoy lower expenses by ditching physical stores and staff. Even rookie fashion creators can hawk their wares through web-based marketplaces. These platforms double as a goldmine for grasping fashion market dynamics. Data mining tricks help crack the code on shopper habits and spot upcoming trends. This study sets out to craft a crystal ball for predicting how new threads might fare in the market.

INTRODUCTION

Internet shopping offers customers the convenience of shopping from anywhere at any time. It provides access to a wide range of products that would be impossible to assemble under one roof. Additionally, customers can easily cancel and return items and enjoy substantial discounts. However, online shopping has its downsides. There is no personal interaction with sales staff, and customers cannot physically inspect products before purchasing. This can lead to discrepancies between how clothing appears in photos and in reality. Predicting whether a customer will purchase a specific item can help them make informed decisions Understanding fashion trends is crucial for several reasons. If merchandisers can anticipate which products will sell, they can gain a competitive edge in the market. They can influence customers to buy their products, thereby increasing profits. While fashion is often influenced by the film industry, other unknown factors also play a role. The internet and online shopping significantly impact the fashion industry. Internet shopping websites hold vast amounts of data on the clothing preferences of consumers. With such extensive data, it becomes possible to mine patterns and make predictions using data mining techniques. Just as we can forecast daily weather from comprehensive weather data or predict diseases from clinical patient information, we can also anticipate customer preferences from sales data. In this information age, the abundance of data significantly enhances our ability to make informed decisions and simplifies our lives.

LITERATURE SURVEY

Some research papers have explored predicting fashion trends using data mining. Certain articles suggest similar predictions based on sources like books, movies, and more. In [2], the creator assembles subtleties from long-range interpersonal communication sites, utilizes regular language handling to separate data, and makes a decision help model for style prediction. In [3], the information is extricated from style site pages. Details of past seasons styles and their comparing deals esteem are utilized to estimate whether they would hit recent fads on the lookout. Later component extraction, an Artificial neural organization, the fuzzy logic is used to make a functioning model. states the trouble of design gauging. It is a test since Fashion fills in a non-direct manner when season and dress credits are considered. In this paper, the creator recommends a two-stage expectation model, a present moment and a long haul forecast with Artificial Neural organizations. - this paper makes a savvy framework to track downmixes for outfits, Blend for gems dress, etc. This is done by deep learning of metadata of design goals. Client purchasing behavior is broken down by and large utilizing cooperative

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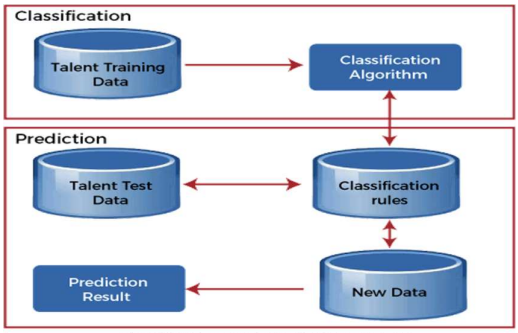
sifting, yet cooperative separation impedes. Cooperative proposal words on static information thus don't stay aware of the change needs of clients. In Fashion, the business needs to change at a quick rate.

DEFINITIONS OF DATA MINING



Classification and Prediction Process

Data mining is the extraction of valuable insights from large datasets. It is a four-stage process that includes: Data Collection, Data Preprocessing, Machine Learning, and Pattern Mining Collection of Data Gathering or downloading information appropriate to the problem area. With improved information mining research, this stage has transcendently become observing a valuable information source from an AI storehouse.

Pre-processing of Data Can't take care of information as such to the AI calculation. Information needs to change or be diminished dependent on necessities. Machine Learning AI makes machine learning; the machine learns by handling the information with different AI calculations. There is no decent calculation to give high accuracy. Nonetheless, deep learning offers better precision. This is known as the No Free lunch hypothesis. Pattern Evaluation Later, AI, more than the model, will result. Examination of which model is a superior model is performed.

EXPERIMENTATION AND RESULTS

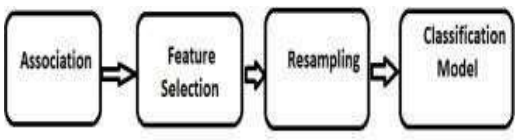


Fig 1: Proposed model Block diagram

Consider the dress Dataset downloaded from the UCI library. The dataset contained 501 cases, and

27 attributes. The quality of dresses was evaluated based on several attributes: style, value, rating, size, season, neck area, sleeve length, waistline, material, texture type, enrichment, design type, and proposal. Each example represents data for a type of dress, regardless of whether customers purchased the garments. The model was subsequently used to identify weak students and propose improvement strategies for them.

Affiliation mining to observe solid association brules Include Selection Resampling

Grouping Include Extraction: The dataset viable is ostensible. Affiliation mining is utilized to track down the connection among different properties. When affiliation mining was applied, it was noticed they mined no regulations. Affiliation rules which extricated had the confidence of 80% or less. Resampling The dataset has an equivalent extent of deals and no business information. It isn't important to execute resampling to address Class Imbalance. In any case, further develop the grouping model resampling is applied. Hereditary calculation based SSMOTE (Synthetic minority Oversampling procedure) is utilized. Destroyed calculation accomplishes resampling by making tests that are adjusted renditions of minority class occasions.

Grouping The model is made with interest that, assuming a style originator or a merchandiser gives the possibility of a dress, it can anticipate on the off chance that the dress is important to clients. The dress expectation dataset is utilized to characterize the dataset into whether or not it would sell the clothing. This learned framework would have the option to anticipate the deals of a dress given a bunch of dress highlights.

CONCLUSION

By using sophisticated data mining skills, we can pinpoint the clothing details that when

changed, can boost the worth of a skirt or persuade someone to buy it. We study the correctness of different classification methods and create a useful prediction model. This study allows us to forecast sales and sets up the base to explore and grow in the future.

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AI-Driven Healthcare: Predictive Analytics for Disease Diagnosis and Treatment

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Abstract

The integration of Artificial Intelligence (AI) in healthcare has ushered in a new era of predictive analytics for disease diagnosis and treatment. AI-driven healthcare predictive analytics leverages vast amounts of medical data, employing advanced machine learning and deep learning techniques to identify patterns and predict health outcomes. This approach enhances diagnostic accuracy, enables early detection of diseases, and personalizes treatment plans, thereby improving patient outcomes and optimizing healthcare resources. AI models can analyze diverse data sources, including electronic health records (EHRs), medical imaging, and genetic information, to provide comprehensive insights into patient health. Despite its potential, the implementation of AI in healthcare faces challenges such as data privacy concerns, the need for large, high-quality datasets, and the integration of AI systems into existing clinical workflows. This abstract reviews the current state of AI-driven healthcare predictive analytics, highlights key advancements, and discusses the challenges and future directions for the effective use of AI in disease diagnosis and treatment. By addressing these challenges, AI has the potential to revolutionize healthcare, making it more predictive, precise, and personalized.

KEYWORDS: Artificial Intelligence, Healthcare, Patterns, analytics.

INTRODUCTION

The advent of Artificial Intelligence (AI) in healthcare has transformed traditional medical practices, ushering in innovative approaches to disease diagnosis and treatment. AI-driven healthcare predictive analytics and tailoring personalized treatment plans, which collectively contribute to improved patient outcomes and more efficient use of healthcare resources. In recent years, the healthcare industry has witnessed a surge in the adoption of AI technologies, driven by advancements in data processing capabilities and the availability of large-scale medical datasets. AI models can assimilate and analyze diverse data sources such as electronic health records (EHRs), medical imaging, and genomic information, providing a holistic view of patient health. This comprehensive analysis enables healthcare providers to make informed decisions, predict potential health risks, and initiate early interventions, thereby reducing morbidity and mortality rates. However, the integration of AI into healthcare is not without its challenges. Issues such as data privacy and security, the need for high- quality and annotated datasets, and the seamless incorporation of AI systems into clinical workflows pose significant hurdles. Ensuring the reliability, interpretability, and ethical use of AI in clinical settings is paramount to gaining trust and achieving widespread adoption among healthcare professionals and patients. This paper provides an overview of the current state of AI-driven healthcare predictive analytics, examining key technological advancements and their applications in disease diagnosis and treatment. It also discusses the challenges that need to be addressed to fully realize the potential of AI in healthcare. By exploring these facets, we aim to highlight the transformative potential of AI in creating a more predictive, precise, and personalized healthcare system, paving the way for future innovations and improvements in patient care

RELATED WORK

The integration of Artificial Intelligence (AI) into healthcare predictive analytics for disease diagnosis and treatment has been a focal point of research and development in recent years. Several key studies and initiatives have contributed significantly to advancing this field:

DEEP MIND HEALTH

DeepMind, a subsidiary of Alphabet Inc., has spearheaded efforts to leverage AI for healthcare applications. Their work on developing algorithms for early detection of diseases such as diabetic retinopathy and acute kidney injury has demonstrated the potential of AI in improving diagnostic accuracy and patient outcomes. utilizes sophisticated algorithms and machine learning techniques to analyze extensive datasets, uncovering patterns that human analysis might overlook. These technologies have shown significant promise in enhancing diagnostic accuracy, predicting disease onset demonstrated the potential of AI in improving diagnostic accuracy and patient outcomes.

IBM Watson Health:

IBM Watson Health has been at the forefront of AI-driven healthcare solutions, utilizing machine learning algorithms to analyze medical data and assist clinicians in making informed decisions. Their research on using natural language processing to extract insights from unstructured clinical text data has paved the way for more efficient and comprehensive patient care.

Medical Image Analysis:

Research in medical image analysis has seen significant advancements, with AI algorithms achieving human-level performance in tasks such as tumor detection, lesion segmentation, and disease classification. Studies by organizations like the Radiological Society of North America (RSNA) and academic institutions have contributed to the development of AI-powered diagnostic tools for radiology and pathology.

Genomic Medicine:

Genomic medicine has benefited from AI-driven approaches for analyzing genetic data and identifying disease risk factors. Research initiatives such as the UK Biobank and the All of Us Research Program have collected extensive genomic and clinical data, enabling researchers to develop predictive models for personalized medicine and preventive healthcare.

Electronic Health Records (EHR) Analysis: The analysis of electronic health records (EHRs) using AI techniques has led to advancements in disease prediction, risk stratification, and treatment optimization. Studies by academic institutions and healthcare organizations have demonstrated the efficacy of AI algorithms in extracting meaningful insights from structured and unstructured EHR data.

Clinical Decision Support Systems (CDSS): Clinical decision support systems (CDSS) powered by AI have shown promise in aiding healthcare providers in diagnosis, treatment planning, and patient management. Research on developing intelligent CDSS that integrate patient data, medical literature, and clinical guidelines has yielded valuable tools for enhancing clinical decision- making.

Ethical Considerations in AI Healthcare:

The ethical implications of AI in healthcare have garnered attention from researchers, policymakers, and healthcare practitioners. Studies examining issues such as data privacy, algorithmic bias, and patient consent have highlighted the importance of ethical frameworks and guidelines for the responsible development and deployment of AI technologies in healthcare.

These related works underscore the diverse applications and multidisciplinary nature of AI- driven healthcare predictive analytics. By building upon existing research and collaborations, the healthcare industry can continue to harness the transformative

potential of AI to improve patient care and outcomes.

METHODOLOGY

The methodology for AI-driven healthcare predictive analytics for disease diagnosis and Data Collection:

Gather diverse datasets from sources such as electronic health records (EHRs), medical imaging repositories, genomic databases, wearable devices, and patient surveys. Ensure data quality, integrity, and compliance with privacy regulations (e.g., HIPAA).

Data Preprocessing:

Cleanse the data to remove noise, errors, and inconsistencies. Handle missing values, outliers, and redundant features. Standardize or normalize the data to ensure uniformity across variables. Perform feature engineering to extract relevant features and enhance predictive performance.

Feature Selection:

Utilize techniques such as correlation analysis, feature importance ranking, and dimensionality reduction to select informative features for model training. Prioritize features that are clinically relevant and contribute to predictive accuracy.

Model Development:

Choose appropriate machine learning or deep learning algorithms based on the nature of the problem and the characteristics of the data. Common algorithms include logistic regression, random forests, support vector machines (SVM), gradient boosting, convolutional neural networks (CNNs), and recurrent neural networks (RNNs).

Train the models using labeled data, optimizing hyperparameters and model architectures through cross-validation or grid search. Implement ensemble methods or transfer learning to improve model robustness and generalization.

Fine-tune models using techniques like regularization, dropout, and batch normalization to prevent overfitting and improve performance on unseen data.

Model Evaluation:

Assess model performance using appropriate metrics such as accuracy, precision, recall, F1-score, area under the receiver operating characteristic curve (AUC-ROC), and area under the precision- recall curve (AUC-PR).

Conduct comprehensive validation on separate test datasets or through cross- validation to ensure the generalization of the models. Perform sensitivity analysis to evaluate model robustness and stability.

Interpretability and Explainability:

Employ techniques such as feature importance analysis, SHAP (SHapley Additive ex Planations) values, and LIME (Local Interpretable Model- agnostic Explanations) to interpret model predictions and provide explanations to clinicians and stakeholders.

Ensure transparency and interpretability of the AI models to gain trust and facilitate their adoption in clinical practice.

Validation and Clinical Trials:

Conduct rigorous validation studies and clinical trials to assess the real-world effectiveness and impact of AI-driven predictive analytics on disease diagnosis, treatment outcomes, and patient care.

Collaborate with healthcare professionals, regulatory agencies, and ethical review boards to ensure compliance with medical standards, regulations, and ethical guidelines.

By following this methodology, healthcare organizations and researchers can develop robust and reliable AI-driven predictive

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analytics solutions for disease diagnosis and treatment, ultimately improving patient outcomes and optimizing healthcare delivery.

CONCLUSION

The integration of Artificial Intelligence (AI) into healthcare predictive analytics for disease diagnosis and treatment represents a paradigm shift in medical practice. Through the utilization of advanced machine learning and deep learning techniques, AI-driven predictive analytics have the potential to revolutionize patient care by enabling early disease detection, personalized treatment plans, and improved clinical outcomes .The methodology outlined for AI-driven healthcare predictive analytics involves a systematic approach to data collection, preprocessing, model development, evaluation, and deployment. By leveraging diverse datasets from electronic health records, medical imaging repositories, genomic databases, and wearable devices, AI models can extract meaningful insights and patterns that aid clinicians in making informed decisions. Key advancements in AI-driven healthcare predictive analytics include the development of algorithms for early disease detection, such as diabetic retinopathy and acute kidney injury, as well as the application of natural language processing techniques for extracting insights from unstructured clinical text data. Furthermore, progress in medical image analysis has enabled AI algorithms to achieve human-level performance in tasks such as tumor detection and disease classification. Despite these advancements, challenges remain, including issues related to data privacy, algorithmic bias, and the seamless integration of AI systems into clinical workflows. Ethical considerations regarding the responsible development and deployment of AI in healthcare are also paramount. In conclusion, AI-driven healthcare predictive analytics hold tremendous promise for improving disease diagnosis and treatment. By addressing the challenges and leveraging the methodologies outlined in this paper, healthcare organizations and researchers can harness the transformative potential of AI to create a more predictive, precise, and personalized healthcare system, ultimately benefiting patients and healthcare providers alike. Continued research and collaboration in this field are essential to realizing the full potential of AI in healthcare and advancing the future of medicine

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Stress Detection Using Natural Language Processing and Machine Learning Over Social Interactions

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Abstract

Cyberspace is a vast soapbox for people topost anything that they witness in their day-to-day lives. Social media content is mostly used for review, opinion, influence, or sentiment analysis. In this paper, we aim to extend sentiment and emotion analysis for Detecting the stress of an individual based on the posts and comments shared by him/ her on social networking platforms. We leverage large-scale datasets with tweets to accomplish sentiment analysis with the aid of machine learning algorithms and a deep learning model, BERT for sentiment classification. We also adopted Latent Dirichlet Allocation which is an unsupervised machine learning method for scanning a group

KEYWORDS: Decision tree, Latent Dirichlet, Algorithm, Logistic regression, Machine learning, Natural Language Processing, Random forest, Sentiment analysis, Topic modelling

INTRODUCTION

Currently, social media plays the role of chief public opinion detector. We have overbbillion active worldwide social media users. With the whirlwind expansion of Web 2.0, people have developed a liking to express their thoughts and approach over the Internet, which has consequently resulted in an increase of user-generated content and self- opinionated data. Social Media Analytics (SMA) is the process of collecting information on various social media platforms, websites and blogs and evaluating that, to successful business decisions. The use of social media has become quite commonplace in today's world. SMA is not only a collection of likes and comments shared by people but also a platform for many advertising brands. There are six types of social networks where people connect and share their interests, opinions, experiences, and moments of life. Bookmarking sites allow users to have control over their resources. Social news: allows users to post news links and external articles, Media sharing: Share their videos and photographs, Microblogging: Allow users to write short written entries and Blogs and Forums: Allow users to produce focused content and then engage in conversations about it. SMA is the ability to gather data from these resources and find meaning from them, make decisions and evaluate the performance of the decisions through social media. For this SMA uses the concepts such as social media intelligence, social media listen- ing, social media monitoring, social competitive analysis, image analytics, sentiment analysis, customer sentiment analysis. Many applications include marketing and making extensive use of social data to make predictive decisions. Some of the methods are built to create a hypothesis, deep penetration of data, mapping events, etc. These calculations can also be done in services such as business, amendment, education, machine learning-based predictions, etc. Especially now, data is controlling marketing approaches and tactics. The propagation of data is only expected to rise as more people and businesses plan on dispensing data about themselves on social media. It is in this material that a business will end up learning more about their audience, specifically on sites like Twit- ter, Facebook, and Instagram. With these insightful analytics, a person fundamentally gains social media intelligence to inform future decisions and actions. Currently, SMA is being used for influence, review, and opinion

mining. However, it can be employed in analyzing the emotional state of a person. These social factors are important indicators of mental health. However, how to be quantifying and analyzing social factors is chal- lenging. The data is usually unstructured and huge, which needs the techniques likeBig data, Machine Learning (ML), Natural Language Processing (NLP) to get inferences for stress or other mental health issues. There are studies to show that constructive SMA to measure and quantify the social interaction along with other health parameters are used in healthcare systems for stress/depression detection [1].

To perform the SMA data can be collected with the help of web scraping. Web scrap- ing aids in extracting the underlying HTML code and, with it, the data deposited in a database. The scraper can then duplicate the complete website content elsewhere. Apart from this, with the help of applications like lucidya and track my hash tag, certain hashtags were tracked while creating the dataset. There are a lot of capable pre- trained language models which include the likes of ELMo and BERT. These models have specifically shown outstanding performance on,aspect-based sentiment analysis problems[2]. The pre-trained language models have the advantage to learn universal language by pre- training on the vast unlabeled corpus to dodge overfitting on small-size data [3]. In this paper, we are using a proficient deep learning model titled BERT to resolve sentiment classification tasks. Experimentations have supported the claim that the BERT model outdoes other prevalent models for this task without a complex architecture. Hence, we use the BERT model to do a 5-class emotion classification. The emotions are joy, sad- ness, neutral, fear, and anger.

RELATED WORK

Background and literature review

A lot of astounding contributions have been made in the field of sentiment analysis in the past few years. Initially, sentiment analysis was proposed for a simple binary classi- fication that allocates evaluations to bipolar classes. Pak and Paroubek [5] came up with a model that categorizes the tweets into three classes. The three classes were objective, positive and negative. In their research model, they started by generating a collection of data by accumulating tweets. They took advantage of the Twitter API and would rou- tinely interpret the tweets based on emoticons used. Using that twitter corpus, they were able to construct a sentiment classifier. This classifier was built on the technique—Naive Bayes where they used N-gram and POS-tags. They did face a drawback where the train- ing set turned out to be less proficient since it only contained tweets having emoticons. The papers [6–10] discuss effective data pre-processing techniques for social media con- tent, specifically tweets. As the data contains the words which are most often used in a sentence but do not contribute to the analysis, such as stop words, symbols, punctuation marks. Removing these and converting different forms of the words to the base from is an essential step.

Stress/depression analysis

Arya and Mishra present a review of the application of machine learning in the health sector, their limitation, predictive analysis, and challenges in the area and need advanced research and technologies. The authors reviewed papers on mental stress detection using ML that used social networking sites, blogs, discussion forums, Ques- tioner technique, clinical dataset, real-time data, Bio-signal technology (ECG, EEG), a wireless device, and suicidal tendency. The study shows the high potential of ML algorithms in mental health [28]. Aldarwish et al used machine learning algorithms SVM and Naïve-Bayesian for Predicting stress from UGC- User Generated Content in Social media sites (Facebook, Twitter, Live Journal) They used social interaction stress datasets based on

mood and negativism and BDI- questionnaire having 6773 posts, 2073 depressed, 4700 non-depressed posts (textual). They achieved an accu- racy of 57% from SVM and 63% from Naïve- Bayesian. They also emphasized stress detection using big data techniques [29].

Cho et al. presented the analysis of ML algorithms for diagnosing mental illness. They studied properties of mental health, techniques to identify, their limitations, and how ML algorithms are implemented. The authors considered SVM, GBM, KNN, Naïve Bayesian, KNN, Random Forest. The authors achieved 75% from the SVM clas- sifier [30]. Reshma et.al proposed a Tensi Strength framework for detecting senti- ment analysis on Twitter [31]. The authors considered SVM, NB, WSD, and n-gram techniques on large social media text for sentiment analysis and applied the Lexicon approach to detect stress and relaxation in large data set. The authors achieved 65% precision and 67% recall. Deshpande and Rao presented an emotion artificial intelli- gence technique to detect depression [32]. The authors collected 10,000 Tweet Using Twitter API. They applied SVM and Naïve Bayes machine learning algorithms and achieved F1 scores of 79% and 83% respectively.

Research design and methodology

The research makes use of both secondary and primary data sources. It is a cross-sec- tional study and combination of quantitative and qualitative methodologies to know the impact of social and emotions associated with the social media data and usefulness of the same. The research aims at building models for sentiment and emotion detection which can be used for stress management, the models are also tested on primary data. The focus of the paper is identifying the sentiment or emotions of a user concerning diverse topics or domains using Latent Dirichlet Allocation (LDA). A hybrid machine learning and deep learning models are built and executed to deliver the sentiment analy- sis using the data that incorporates a broad range of tweets. The block diagram of the recommended model is as given in Fig. 1. Before moving on to developing the analyzer, we first need to perform data cleaning by implementing the following steps. We per- form tokenization, remove the unwanted patterns, remove the stop words, and perform stemming. A crucial measure in developing a classifier is determining the features of the input that are pertinent.

Then proceed to understand how to encode those features. We extract feature vectors with the help of the Bag-of-words method. Once the data is ready, we build our machine learning model for sentiment analysis and emotion detec- tion. These machine learning models predict sentiment or emotion. We use accuracy, F1 score, and confusion matrix throughout to assess our model‟s performance.

Preprocessing of the dataset

In data pre-processing, the aim is to perform data cleaning, data integration, data reduction, and data transformation. We start with removing unwanted patterns followed by removing the stop words and performing stemming. Before eliminat- ing stop words, we need to perform tokenization as well. Stop words are words that commonly occur in any natural language. To analyze the textual data and construct natural language processing models we need to remove stop words. Stop words don‟t add much significance to the meaning of the document. Words like ―is‖, ―a‖, ―on‖, and ―the‖ add no meaning to the statement while parsing it so these stop words. Now after this stemming is performed. Stemming plays a pivotal role in the pipelining course in Natural language processing. The input to the stemmer always needs to be tokenized words. This paper takes the aid of the Bag- of-Words method for fea- ture extraction. It is a technique used to extract features from textual documents. The features can be further utilized for training various ML techniques. It creates a vocabulary of all the

distinctive words present in all the documents in the train- ing set. After this, the first task is to split the dataset into training and validation set so that the training and testing of our model can begin before applying it to predict unseen and unlabeled test data.

Topic modelling with LDA

The methodology in LDA first constitutes data pre-processing as shown in Fig. 4. A dictionary is created containing the number of times a word appears in the training set and all the anomalies are filtered out. For every document, a dictionary is created reporting how many words and how many times those words appear. LDA has three important hyperparameters. The first one is „alpha‟ which outlines a document-topic density factor. The second one is „beta‟ which denotes word density in a topic. The third one is „k‟, or the number of components signifying the number of topics the document is to be clustered or divided.

CONCLUSION

This paper introduces the basic concepts and functions of artificial intelligence. Detecting stress through natural language processing (NLP) and machine learning over social interactions holds significant promise for early identification and intervention in mental health. By analyzing text from social media, chat logs, and other digital communications, NLP can uncover linguistic patterns and emotional cues that indicate stress. Machine learning algorithms can then classify and predict stress levels based on these patterns, enabling timely support and potentially preventing more severe mental health issues. Despite its potential, this approach faces challenges such as ensuring user privacy, managing the diversity of language use, and avoiding misclassification. Addressing these challenges is crucial for the effective and ethical implementation of stress detection systems. With ongoing advancements in NLP and machine learning, combined with robust ethical guidelines, this technology can become a valuable tool in improving mental health outcomes and providing personalized support. Artificial intelligence technology is giving play to its advantages and plays an important role in human development.

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ARTIFICIAL INTELLIGENCE INONCOLOGY

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Abstract

Cancer is one of the deadliest diseases in the present days. Its survivability is mostly co related to early detection and treatment, which means that it is of utmost importance to successfully diagnose the patients. Unfortunately, even with years of experience human errors can happen which leads to the death of many individuals being misdiagnosed. Advances in screening, diagnosis, management and survivorship were substantial in the last decades, however, challenges in providing personalized and data-oriented care remain. Artificial intelligence (AI), has emerged as potential solution to improve the healthcare journey and to promote precision in healthcare. Additionally, deep learning models can be used to predict future development cancer. AI applications in oncology include, but are not limited to, optimization of cancer research, improvement of clinical practice and better understanding of tumour characteristics. In this review, we explored the current state of AI in oncology, including fundamentals, current applications, limitations and future perspectives.

Keywords-artificial intelligence, cancer diagnosis, deep learning, patient stratification

INTRODUCTION

Plain language summary

In the present days the number of cases of cancer patients is rising steadily, mainly caused by over diagnosing and overtreating patients. These mistakes are caused by the poor decisions the doctors make when they analyse the imaging. The highest survival chances, on any type of cancer appear when the cancer is detected in its early stages [1]. This can be an explanation for the increase in the number of deaths since time is one of the more important factors to be considered. Due to the increase in numbers artificial intelligence diagnosis has been more and more popular in recent years. Acknowledging that the capacity of the human brain to process information is limited, there is an urgent need for the implementation of alternative strategies to process modern big data (describes the large volume of data – both structured and unstructured – that inundates a healthcare on a day-to-day basis). In addition to the increased availability of data, the augmentation of storage and computing power has boosted the development of data-processing techniques, such as machine learning (ML) and artificial intelligence (AI), which are becoming increasingly important tools to tackle complex issues in cancer care.

Artificial Intelligence

Artificial intelligence can be described as a branch of computer science dealing with the simulation of intelligent behaviour in computers. It relies on computers following algorithms established by humans or learned by computer method to support decisions or execute certain tasks. Machine learning is a subfield of AI and represents the process by which a computer is able to improve its own performance by continuously incorporating newly-generated data into an existing iterative model. Deep learning (DL) is a subfield of ML where mathematical algorithms are deployed using multi-layered computational units resembling human cognition. These include neural networks with different architectures types (e.g., recurrent neural networks, convolutional neural network and long-term short memory).Artificial neural networks may have different architecture on how they apply mathematical rules to data and can be useful to analyse unstructured data. Unstructured data are a very common type of medical data used to record qualitative and subjective information typically acquired through patient–provider interactions or imaging

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acquisition. Applying AI to unstructured text data can be achieved by natural language processing (NLP) techniques and recurrent neural networks are DL algorithms commonly useful for this task. In contrast, convolutional neural networks are the most used and promising AI architectures in the exploration of imaging files. The properties of neural networks and the results that can be obtained solidify its use in many aspects. For a doctor it takes years of studying and experience in order to make the right calls when their patients test results are known and even then, there is a chance for the doctor to make mistakes. When the doctor makes his decision there are some key features in the images that he has to verify, but when comparing an ultrasound imaging with a colonoscopy it is much harder to determine when a patient has or does not have thyroid cancer as to when a person is having colorectal cancer. These key features found in the ultrasound imaging can be found by artificial intelligence (AI). With the use of a high number of images, for which the results are already known, an AI can determine much easier if the patient has cancer, or if the cancer is malign or benign [2].

ARTIFICIAL INTELLIGENCE IN CANCER DIAGNOSIS

Cancer Imaging

Artificial intelligence is particularly applicable in medical fields that deal with images, notably radiology and pathology. In radiology, there are many applications of AI, especially DL algorithms to analyse imaging data acquired during routine cancer care including disease classification, detection, segmentation, characterization and monitoring. Classification: Image classification is necessary in cancer screening studies. AI can help radiologists achieve better outcomes, save time and support the classification of small lesions. It can also help on the creation of a better organizational workflow. There are examples of studies showing that combining AI and human power improved mammography screening for breast cancer. Detection: AI can aid in the identification of cancerous lesions that could otherwise be missed by humans. For instance, it can be used to find lung nodules or brain metastases on MRI readouts. Detection relies on the the use of bounding boxes to detect a lesion or object of interest. Detection using AI supports physician on their process of reading medical images (i.e., lung nodules). Segmentation: Helps to classify individual pixels according to organs or lesions by precisely recognizing lesions and accessing its volume and size. For example, brain gliomas require quantitative metrics for their management, risk stratification and prognostication. Characterization: Deep learning methods can be applied to medical images to extract a large number of features undetectable by humans, and potentially uncover disease characteristics and patterns. Radiomics is the field that studies these features and there is growing interest in combining these features with clinic genomic information. Radiomics methods can inform models that successfully predict treatment response and/or side effects from cancer treatments. There is a variety of cancer types where radiomics can be applied such as liver, brain, and lung tumours. Deep learning using radiomic features from brain MRI has the ability to differentiate brain gliomas from brain metastasis with similar performance to trained neuroradiologists. Monitoring: The aforementioned techniques can be used to monitor a particular lesion. Using AI can change dramatically the way cancer is monitored because it has the ability to detect a multitude of discriminative features in imaging unreadable by humans. Generative adversarial networks (GANs) are AI models that can generate new images based on any type of data. A possible application is the generation of synthetic computed tomography (CT) imaging of from MRI imaging. This technology has the potential to support radiotherapy planning. Additionally, it has proven useful in automating dose distribution for intensity

modulated radiation therapy (IMRT).

Additionally, deep learning models can be used to predict future development cancer. The concept of care gap is that eventually patients do routine scans or MRI for other conditions and some AI models already have been developed to predict disease, for instance cardiovascular scores from CT scans. A study reported on the ability to predict a 5-year future breast cancer risk from normal mammograms using deep- learning CNNs. Predicting future cancer from a normal scan is promising and is armed to have a great populational impact.

Cancer diagnoses can also be optimized using AI. AI-powered colonoscopy has shown to be a cost-effective intervention by efficiently identifying benign polyps thus not requiring resection. This would not only save healthcare resources but would also prevent adverse events from a more invasive treatment approach. Accurate diagnosis of cancerous and precancerous lesions can allow for minimization of overtreatment. On that note, AI algorithms supporting colposcopy images evaluation have shown high accuracy in predicting precancerous lesions in cervical cancer screening. AI-based precise cancer stratification at diagnosis can help in minimizing invasive interventions and unnecessary surgical procedures.

Personalized Medicine

AI has emerged as an instrument to help physicians to deliver more precise and accurate care. Recommendations generated by its immense data analysis capabilities can be useful in delivering personalized medicine. There are a number of processes that AI can have a substantial impact including cancer prevention, drug discovery and genomic-based interventions. Cancer is a disease of the genome, so it's no wonder that oncology has particularly benefited from AI innovations. For instance, DNA methylation assessment in cancers has been proven to be useful for classification and prognostication. The machine-determined DNA methylation approach can lead to the recategorization of more than 70% of human- labelled tumours, which could lead to significantly different prognostication and treatment decisions. AI models also promise to be valuable in complex cases such as in those patients who present as cancer of unknown primary, which still represents 1–2% of newly diagnosed cancers. A deep learning model based on H&E-stained whole-slide imaging was able to classify the site of origin of metastatic tumour with 83% accuracy. Technologies like this are particularly valuable since most patients do not have access to extensive characterization of their tumours.

CONCLUSION

Medical applications with neural network tools have increased in number due to the variety of uses and due to their properties. AI has already had a significant impact in healthcare and will continue to revolutionize medicine. The potential is tremendous and has applications in cancer research, screening, diagnosis, treatment and monitoring. AI also has the potential to decrease healthcare costs and disparities. Once challenges are addressed and AI algorithms are validated by prospective studies, the future direction of AI-based models is to be a part of healthcare in every single scenario. In the near future, oncology AI applications will happen through data intelligence, better tumour understanding, more precise treatment options and improved decision-making processes. Oncology will become a more precise speciality and patients will be move than ever at the centre of care.

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Mimicking the Mind: The Intersection of Cognitive Science and Artificial Intelligence

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Abstract:

This study explores the interdisciplinary field of cognitive science within artificial intelligence. It highlights both historical and current research areas to provide a comprehensive understanding of the topic. Additionally, contemporary applications of cognitive science in artificial intelligence are discussed, serving as a foundation for future advancements. The paper also addresses real-time complexities before delving into potential future developments.

Introduction:

The science of psychology has been a focus since the 1800s, with numerous researchers exploring common yet specific characteristics of the human mind. Cognitive science first emerged in the 1930s within the context of psychology, viewed as a response to stimuli. Over time, this field was supported by computer models that enabled the simulation of human thought processes . Today, cognitive science encompasses the detailed study of the mind, integrating research from various fields such as philosophy, education, artificial intelligence (AI), neuroscience, linguistics, and anthropology. Scientists in cognitive science examine behavior and intelligence, focusing on how the central nervous system processes, transforms, and represents information. The aim of cognitive science is to understand the principles of intelligence to enhance our comprehension of the mind and learning processes. AI, on the other hand, simulates human intelligence through computerized systems, facilitating information acquisition and the application of rules to reach conclusions, thereby enabling self- correction .

AI within cognitive science

Initially, the branch of AI emphasised on cognitive behaviour of machines. However, technological advancements allowed AI to encapsulate concepts of cognitive science and focus on ways human or animal or machine store information. This led to the development of intelligent machines with which, speech or emotion recognition, learning and planning, problem-solving and reasoning have become possible [3]. It is also the fact that traditional AI techniques offered limited scopes, in terms of optimistic predictions, which with time became possible with invention of cognitive robots. According to the ideas of [4], robots with wide spectrum of cognitive powers are referred to as cognitive robots. It is possible for these robots to perform open-ended tasks without human help. Integration with a dedicated processing architecture enabled these robots to learn and accordingly respond to complex situations. Knowledge acquisition is however, yet to be explored due to widespread requirement of prediction systems like artificial neural network. Symbolic modelling is a computer science paradigm which makes effective utilisation of knowledge-based systems and integrates such with the philosophical perspective. Investigation of human-like intelligence models started from early 1990s with us of SOAR. Sub-symbolic modelling on the contrary consists of neural network models and relies on the fact that the brain is anamalgamation of several simple nodes. Due to this, the problem- solving capacity is found to be derived from the connection between these nodes . As a result, numerous approaches of structuring mind have been observed to be

simulating, starting from creation of artificial neurons to depicting mind as a collection of symbols, rules and plans.

Past and current research in cognitive science and AI

Technological advancements and innovations have made it possible for scientists to stimulate human brain on computerised system with much more precision and accuracy. In other words, it is the cognitive science AI that has ensured effective utilisation of power of computers to supplement thinking ability of human beings. Computer simulation in AI can therefore, be termed as the reproduction of a system's behaviour such that simple as well as complex goals can be achieved . However, there was a time when the ability of AI to model minds was questioned due to lack of revolutionary notion on use of computation as a formal modelling for language recognition. Moreover, there are several past researches works that contradicted with today's fact that AI are identical with cognitive science. This is because that era embarked AI for understanding intelligence in general and not for humans. Additionally, in order to gain better and depth insight about the nature of human mind, the foremost goal is eventual development of both machine and human-level intelligence. One of the significant challenges which emerged due to non- distinguishable intelligent agent and human intelligence is the Turing test . Reason behind this is that these intelligent agents face multiple situations due to incomplete information.

As a result of this, encoding data for these situations has become a limited approach so as to simulate human intelligence. All these concepts together restricted past researchers and scientists to design pre-programmed intelligent agents with solutions that can simulate human intelligence and can also resolve associated problems. These in turn, made it a mandate for the intelligent agent to be equipped with the ability to make decisions depending on the available information [7]. At the same time, this revealed the requirement to re-evaluate past solutions such that future decision- making processes can be enhanced. Consequently, this leads to a more fundamental understanding about ways human mind would learn and solve problems. This in turn, facilitated the necessity to design intelligent systems that would have the same level of intelligence as that of the human mind.

However, as time went by, technological advancements have widened up scopes of AI to foster a natural interaction. Specifically, speech recognition and handwriting recognition the two most common areas of cognitive science AI which attracted the attention of researchers. For instance, the article, „Speech Recognition and Cognitive Skills in Bimodal Cochlear Implant Users‟ emphasised on determination of the relation between speech recognition and cognitive skills. And for this, 17 users of cochlear implant have been chosen and the cognitive test was done. Aim behind this was to measure processing speed, working memory capacity and executive functioning of the users. All these settings led the researcher to reveal that speech recognition along with bimodal testing have enhanced their speech [8]. At the same time, it has been highlighted that processing of bimodal stimuli is related to different cognitive skills. It has also been analysed that 32% executives depict voice recognition to be the most widely used AI in their businesses.

SOAR architecture

This cognitive programming-based system has been developed at the University of Michigan in order to simulate the human brain. This system can be referred to as an alternative approach due to the fact that SOAR system stores and retrieve information from working memory . Reinforcement learning that tunes values of rules and altogether, helps in creating numeric preferences is also supported by this cognitive system. In order to enhance flexibility, a structure within the working memory is created which considers rewards.

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SOAR has also enabled stimulation of virtual humans that supports face-to-face collaboration and dialogues . In spite of the fact that this application has integrated capabilities of natural language understanding, emotion, action and body control however, it is criticised as it is suitable only for the virtual world. Whether aspects of psychology need to be minimised such that better approximation of the knowledge level of symbol processing can be acquired is still under question. This is because SOAR architecture attempts to replicate the evolutionary design process in order to result in better symbol system.

ACT-R (adaptive control of thought- rational)

ACT-R is a computer simulation or cognitive architecture that aims at defining basic and irreducible perceptual and cognitive operations. As inspired from psychological theories, every task that a human performs is a combination or series of discrete operations. ACT-R can therefore be considered a method to specify ways in which a human brain can be organised so as to process modules of cognition production . Like SOAR, this cognitive architecture relies on computational implementation of special code language. It would be required by the researcher to download the ACRT-R code and load it into a Common Lisp distribution for obtaining access as an ACT-R interpreter. Doing so, would enable specifying of human cognition which would, however, be in the form of an ACT-R language-based script. On successfully executing this entire process, one is likely to produce automatic step-by-step simulation of human behaviour. Additionally, it is possible to take cognitive operations like memory of time has become possible. This era of man versus machine has now become the reality with everyday human- centric processes are now done automatically, without the need of human beings. For instance, giving presentation of clients or conduction of interviews no more requires physical presence of human beings .

encoding, mental imagery manipulation besides visual and auditory encoding into account. Its declarative memory system has been designed in a way to model human memory. At the same time, this architecture has allowed modelling of understanding and production of natural language. Complex tasks like capturing of how people are able to solve algebraic equations have also been possible with the use of ACT-R

Stimulating creativity

Most of the current papers related to simulation of human level intelligence within the process of decision making have been witnessed to be emphasising on significance of imitating creativity. It is the fact that past experiences and knowledge is the foundation of decision making and also to suggest for changes. However, creativity is depicted to be a gifted ability of human beings with which, it is possible to solve problems, think, interfere and develop. Creativity is of three types namely, concrete, abstract and artistic . Creativity in the field of engineering applications is however, mainly concrete as this type is about the generation of innovative, new and unique solutions in an environment full of conditions and restrictions. Time has succeeded in achieving these concepts which were once just an assumption. For instance, AI enabled informed creative decisions, not to recreate the human mind, rather to interact with humans and to inspire creativity. Increasing use of AI for augmenting human capabilities has assured super creativity and assisted human mind in a way where achievement of better results in a short period

Applications and importance of cognitive science AI

Considering the discussions made above, it can be added that there are a wide range of importance along with numerous applications of cognitive science AI. It is the fact that the concept of cognitive science AI has underwent massive transformations with time, resulting in

an era where it has become possible to develop software that would consider cognitive abilities to solve complex reasoning problems. EvBrain is an example of brain simulation software that is designed to develop artificial brain models. Therefore, with use of this software, artificial animals with brains can be created that would successfully survive in the predator-prey environment. Advanced level of intelligence is, therefore, essential to consider large amounts of information and also to solve complex logic problems in a short time span [10]. Along with this, development of human level intelligent agents has provided a replica of the human mind with which, it is comparatively easier to study about the human brain. Reason behind acquiring depth understanding and knowledge about realistic simulations of human cognition is to draw theories that would showcase human nature, considering cognitive limitations. It is moreover, assumed that key goals of cognitive science, especially the ways in which intelligence and creativity develops in brain would be known to all . Past literature works have also suggested that better understanding of the learning process of human brain including retrieval of information might lead to improved learning methods. This human progress therefore, has opportunities to be implemented in schools where mind or brains of students are on the verge of learning new things. Similarly, doing so would bring in desirable changes in existing theories and would prioritises development of medical solutions for individuals, dealing with brain trauma. Some of the significant applications of cognitive science AI are as follows.

Speech-to-text and text-to-speech

Integration of AI with cognitive science has led to the development of speech to text services which in turn have offered human beings with a diverse range of capabilities. For instance, utilisation of these services would support several transcription scenarios like speech or conversation transcription and custom speech transcription. The first type has been designed to convert spoken audio into text. And for this, one is only required to call for the API for recognising the source of the audio, followed by real- time streaming . The second type of application is suitable for in-person meetings as one can capture speeches in real time with its use. Not only this, rather this advancement has fostered smooth recording of discussions, identification of the speaker, time and also follow-up. Widespread demand of AI has tended scientists and researchers to integrate text to speech or speech to text with the Android platform. Two common examples of both types include Android's native Text-to-Speech feature, Voice Aloud Reader and Google Assistant and OneNote, respectively. The first example automatically works with Google apps that offer read aloud feature. Additionally, one can adjust the pitch, speech rate and are available at different languages. Foremost example of speech to text on the

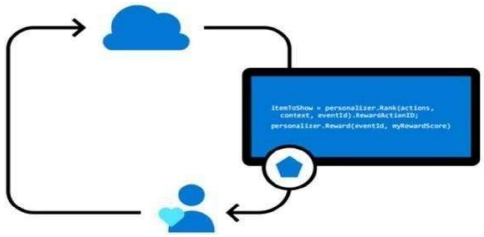

Fig. 1 Reinforcement learning loop of personaliser of Microsoft Azure (source [16])

contrary, allowed conversion of audio to text by making use of neural network models. This application moreover, comes with location-based reminder, podcast player and managing of diary .

Personalise

Use of personalised interactions is the outcome of cognitive science AI thereby allowing individuals to rely on and create rich and personalised experiences for users. To be more specific, this modern application lets an organisation to prioritise contents as these are the medium to improve the experience of users. The more relevant the content is, the

more satisfied users are. Cognitive services as offered by Microsoft Azure include Personaliser Preview wherein, reinforcement learning-based capability is delivered. Inspired from the findings of a number of studies in this field, reinforcement learning is a technique that allows AI to optimise goals, based on individualised configuration .

Complexity associated with achieving brain simulation

It has now become the reality for the learning process to become more intelligent with brain-simulation software that mimics neural networks of the human brain. At the same time, it is also the fact that investigation of functioning of brain with computational modelling is complex. This is because of extreme precision, efficiency and accuracy required to model millions and millions of neurons present in a human brain . Achieving the desired level of brain simulation is limited as most of the cognitive operations within a human brain depend on analogue transactions, whereas a computerised system is fully digital. As a result of this, simulation of operations like neurotransmitter concentration, spike frequencies, potential of membrane and metabolic gradients are lagging behind. In other words, present day brain simulation with use of AI requires including of parameters like extracellular interactions of a brain and receptor binding. However, these are still not taken into account as determination of extracellular interaction of the human brain is related to consideration of ways by which stiffness of extracellular matrix and pH so as to influence interaction between receptors and matrix ligands . However, there is lack of evidences regarding measuring of pH in a computerised system. This therefore, requires generation of algorithms that would be based on the working principle of brain. This has moreover, facilitated the requirement of studying functional integration to acquire knowledge about how differentregions of brain work altogether to process information. However, unavailability of top-down and bottom-up models have restricted casting of brain thereby minimising scopes of hypothesis-testing systems and proceeding with typical simulations, respectively . Additionally, there is a lack of evidence regarding passing the Turing Test with AI allowing fully simulation of brain. Another imitation of computerised simulation of intelligence that is worth mentioning is related to speed and capacity of hardware require for performing computation. Reason behind this is that there are no technologies that would tend to fasten running of large-scale simulations than real time. Co-evolution of human mind and intelligent systems has encountered huge challenge due to availability of artificial bots . These bots attracted the attention of a large number of human and left them with the dilemma whether they are even interacting with other humans.

Future trends or scopes in simulating the human brain

Considering continuous improvements and technological innovation, it can be mentioned that it would be exciting for AI researchers in the next 20 years. This is because the human mind has an excellent capability to perform diversified mental as well as physical tasks, without giving much stress on the brain. The advent of nanotechnology which aimed at increasing speed and memory of computational hardware is estimated to be the future of human brain simulation. Not only this, but modern cognitive science AI theories are analysed to be fostering better understanding of mind and brain . Advancements in the fields of cognitive and psychological science enabled diverse understanding of human behaviour thereby making scopes for intelligent agents. In context to the perspective of cognitive science AI theories. These advancements are crucial for achieving a comprehensive understanding of the human mind and addressing complex cognitive problems. world emphasises on only

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process only. Inputs to these simulations are hand generated whereas outputs are hand evaluated. As a result of this, it becomes problematic for human beings to deal with large heaps of data . Emergence of macro-modelling is therefore assumed to be helpful in capturing a broader perspective or dimension of human behaviour.

Concluding remarks

AI proves to be a valuable tool in cognitive science research, enhancing our understanding of the human mind. AI-based applications such as speech-to-text, text-to-speech, natural language understanding, and personalization have provided significant insights into human cognition. Additionally, it is anticipated that intelligent agents will further improve the simulation capabilities of the human brain. However, certain complexities may limit the scope of brain simulation, necessitating advancements in nanotechnology and cognitive

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CARBON CREDITS: Extraction and Uses

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Abstract

The escalating concerns surrounding climate change and global warming have necessitated the development of innovative mechanisms to mitigate carbon emissions. Among these mechanisms, carbon credits have emerged as a pivotal tool in the global effort to curtail greenhouse gases. This paper presents an exhaustive survey of carbon credits, delving into their extraction, market dynamics, and utilization. By scrutinizing the intricate processes involved in generating carbon credits and evaluating their efficacy in various sectors, this study aims to provide a comprehensive understanding of their role in fostering sustainable development.

INTRODUCTION

In The Wake Of Increasing Environmental Degradation, Carbon Credits Have Gained Prominence As A Market-Based Instrument Designed To Incentivize The Reduction Of Carbon Dioxide (Co2) And Other Greenhouse Gas (Ghg) Emissions. Originating From International Agreements Such As The Kyoto Protocol And The Paris Agreement, Carbon Credits Serve As Tradable Certificates Or Permits Representing The Right To Emit A Specific Amount Of Carbon Dioxide Or Equivalent Ghg. This Paper Explores The Multifaceted Aspects Of Carbon Credits, From Their Extraction And Issuance To Their Application Across Different Industries Ease Of Use.

A .Extraction of Carbon Credits

The extraction of carbon credits involves several methodologies, primarily categorized under two mechanisms: the Clean Development Mechanism (CDM) and Voluntary Carbon Markets (VCMs).B.Clean Development Mechanism (CMD) The CDM, established under the Kyoto Protocol, allows industrialized countries to invest in emission reduction projects in developing countries. These projects, ranging from renewable energy installations to reforestation initiatives, generate Certified Emission Reductions (CERs), each equivalent to one ton of CO2 avoided or removed. The process involves rigorous validation, monitoring, and verification to ensure the credibility and environmental integrity of the credits. CVoluntary Carbon Markets (VCMs).Unlike the compliance-driven CDM, VCMs cater to entities and individuals voluntarily seeking to offset their carbon footprint. Projects under VCMs are diverse, encompassing renewable energy, energy efficiency, forestry, and land use projects. Standards such as the Verified Carbon Standard (VCS) and the Gold Standard provide frameworks for project certification, ensuring the reliability and additionality of the carbon credits generated.

MARKET DYNAMICS

The carbon credit market operates through various trading platforms and exchanges, facilitating the buying and selling of credits. Market participants include governments, corporations, non-governmental organizations, and private investors. The market dynamics are influenced by factor such as regulatory policies, market demand, and the availability of high-quality credits.

Regulatory Influence

Government policies and international agreements play a crucial role in shaping the carbon credit market. The introduction of cap-

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and-trade systems, carbon taxes, and emission trading schemes has significantly driven the demand for carbon credits. Compliance markets, governed by mandatory emission reduction targets, exhibit higher trading volumes compared to voluntary markets.

Demand and Supply Factors

The demand for carbon credits is primarily driven by entities seeking to comply with emission reduction mandates or corporate sustainability goals. On the supply side, the availability of credits is contingent on the successful implementation and certification of emission reduction projects. Market liquidity, price volatility, and the proliferation of low-quality credits are on going challenges affecting market stability.

UTILIZATION OF CARBON CREDITS

Carbon credits, as a market-based instrument designed to incentivize the reduction of carbon dioxide (CO2) and other greenhouse gas (GHG) emissions, have found varied applications across multiple sectors. These credits serve as a crucial tool in the global effort to mitigate climate change, fostering sustainable development and environmental stewardship. This section delves into the comprehensive utilization of carbon credits,exploring their integration in the corporate sector, renewable energy projects, forestry and land use initiatives, and beyond.

Corporate Sector

The corporate sector has increasingly recognized the importance of sustainability and environmental responsibility. Companies leverage carbon credits to neutralize their carbon emissions, enhance their sustainability profile, and comply with regulatory requirements. This utilization can be broadly categorized into the following areas:

Corporate Social Responsibility(CSR) and Sustainability Strategies:

Many corporations incorporate carbon credits into their CSR and sustainability strategies. By offsetting emissions from their operations, supply chains, and product life cycles, companies demonstrate their commitment to environmental stewardship. This not only enhances their brand image but also meets the growing consumer demand for sustainable and ethically responsible businesses. For instance, companies such as Microsoft, Google, and Amazon have made significant investments in carbon credits to achieve carbon neutrality and offset their operational emissions.

Compliance with Regulatory Requirements:

In regions with stringent environmental regulations, companies are mandated to reduce their carbon footprint. Carbon credits provide a flexible mechanism for compliance, allowing companies to meet emission reduction targets cost effectively. For example, under the European Union Emissions Trading System (EU ETS), companies can purchase carbon credits to comply with their emission caps, thus avoiding potential penalties.

Supply Chain Emission Reduction:

Corporations are increasingly focusing on reducing emissions throughout their supply chains. Carbon credits can be used to offset emissions from logistics, manufacturing processes, and other supply chain activities. By engaging suppliers in emission reduction initiatives and promoting sustainable practices, companies can achieve substantial carbon savings and foster a culture of sustainability across their value chains.

Renewable Energy Sector

The renewable energy sector plays a pivotal role in the global transition to a low-carbon economy. Carbon credits act as an additional revenue stream for renewable energy projects, incentivizing the development and deployment of clean energy technologies. The utilization of carbon credits in this sector includes:

Project Financing and Viability:

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Carbon credits provide an essential financial incentive for renewable energy projects. By generating carbon credits, projects such as wind farms, solar power installations, hydroelectric plants, and biomass energy facilities can secure additional revenue streams. This revenue enhances the financial viability of projects, attracting investments and accelerating the adoption of renewable energy technologies. For instance, wind and solar projects often rely on carbon credit revenues to offset the higher initial capital costs and make the projects economically feasible.

B) Market Penetration and Scale-Up:

The availability of carbon credits can facilitate the market penetration and scale-up of renewable energy technologies. By making renewable energy projects more attractive to investors and reducing the payback period, carbon credits help overcome financial barriers and promote the widespread adoption of clean energy solutions. This is particularly crucial in developing countries where access to finance is limited, and renewable energy projects can play a transformative role in achieving energy security and sustainable development.

Grid Decarbonization:

Renewable energy projects that displace fossil fuel-based electricity generation contribute significantly to grid decarbonization. By generating carbon credits, these projects provide a quantifiable measure of emission reductions, helping countries and regions achieve their climate targets. For example, a wind farm that displaces coal-fired power generation can generate carbon credits based on the amount of CO2 emissions avoided, thus supporting national and international climate goals.

Forestry and Land Use:

Forestry and land use projects are critical components of carbon mitigation strategies. These projects, which include afforestation, reforestation, improved forest management, and sustainable agriculture practices, generate carbon credits by sequestering CO2 from the atmosphere. The utilization of carbon credits in this sector encompasses:

Afforestation and Reforestation: Afforestation (planting trees on land that has not been forested for a long time) and reforestation (replanting trees on previously forested land) projects sequester significant amounts of CO2, generating carbon credits in the process. These projects not only contribute to carbon mitigation but also enhance biodiversity, improve soil health, and provide socio-economic benefits to local communities. For example, reforestation projects in the Amazon rainforest help restore critical ecosystems, protect wildlife habitats, and support indigenous communities while generating carbon credits that can be traded in the carbon market.

Improved Forest Management: Improved forest management practices, such as reducing deforestation and forest degradation, can also generate carbon credits. By implementing sustainable forestry practices, preventing illegal logging, and promoting conservation

efforts, these projects ensure the long-term sequestration of CO2. This approach supports both climate mitigation and adaptation, providing multiple environmental and socioeconomic benefits. For instance, projects aimed at protecting tropical rainforests in countries like Indonesia and Brazil generate carbon credits by preserving valuable carbon sinks and promoting sustainable livelihoods for local populations.

Sustainable Agriculture: Sustainable agriculture practices, including agroforestry, conservation tillage, and soil carbon sequestration, offer significant potential for carbon credit generation. These practices enhance soil carbon storage, improve land productivity, and promote climate resilience. By adopting sustainable farming techniques, farmers can generate carbon credits while simultaneously improving food security and

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livelihoods. For example, agroforestry projects in Africa and Asia integrate tree planting with agricultural activities, sequestering carbon and providing diverse income streams for farmers.

CONCLUSION:

The utilization of carbon credits spans multiple sectors, each contributing to the overarching goal of global emission reduction and sustainable development. In the corporate sector, carbon credits enhance sustainability strategies and regulatory compliance, while in the renewable energy sector, they provide financial incentives and support grid decarbonization. Forestry and land use projects leverage carbon credits to sequester CO2 and promote sustainable land management, and additional areas such as transportation, waste management, and construction also benefit from carbon credit integration. The diverse applications of carbon credits underscore their significance in addressing climate change and promoting a low-carbon future. However, the effectiveness of carbon credits depends on robust standards, transparent verification processes, and stakeholder collaboration. Ensuring the integrity and additionality of carbon credits is crucial to maximizing their impact and achieving meaningful emission reductions. As the global community continues to grapple with the challenges of climate change, carbon credits will remain a vital tool in the collective effort to build a sustainable and resilient world.

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THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN COMPUTER NETWORK TECHNOLOGY

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ABSTRACT

With the great development of modern science and technology, the national economy is also further improving. At the same time, China also makes new requirements for the development of various high and new technologies. Artificial intelligence is a new industry derived from the continuous progress of scientific level, and its high scientific and technological value. The development of artificial intelligence has greatly promoted the optimization and upgrading of China's industrial structure, and also has a great impact on computer network technology, providing a new breakthrough direction for the innovation and development of computer network technology. This paper mainly targets the concept of AI as the entry point to further study the application and development of AI in computer network technology.

KEYWORDS: Artificial intelligence; computer; network; technology

INTRODUCTION

Definitions of AI

The term "AI" was originally proposed at the dartmouth Society in 1956.Artificial intelligence mainly refers to the intelligence shown by robots made by people, which can analyze, imitate and study people. As a branch of computer science, AI aims to understand the nature of intelligence and to create an intelligent machine that acts the same way people behave. At present, the important carrier that can be used to study the development of artificial intelligence is the computer. The development of artificial intelligence technology is inseparable from the computer technology. The core issues of AI include building similar or even beyond human knowledge, planning, learning, communication, and using tools.

In China, artificial intelligence was first proposed in the early 1950s, when in order to adapt to people's quality of life and social development, a scholar designed a machine that did not need manual operation, and this machine has the intelligence and operation ability that people have. The academic hopes to be able to do the complex and dangerous work that people do through robots, which can not only quickly improve productivity but also protect people's interests, so the machine made is called artificial intelligence. The functions of artificial intelligence are mainly good logic function, language communication function, operation ability and recognition ability, and these functions are also constantly improving and developing with the progress of The Times.

The concept of AI

From the concept of artificial intelligence put forward so far, has 60 years of development process, in the 60, artificial intelligence technology has three technical reform, the first time is mainly to replace manpower with machine, help people complete some high difficulty, high coefficient, and the machine to the work can more through its characteristics to solve some complex technical problems. The second reform is mainly to enable AI to communicate simply with the outside world, adjust system procedures according to the changes in the external environment, analyze data and information from itself, and improve work efficiency .The third reform is to

introduce a lot of data into AI, hoping that AI can replace people to handle some cumbersome and heavy work. The rapid processing speed of artificial intelligence is thanks to computer network technology, because the computer network system can use various collection, processing and analysis functions to help complete some production processes. Due to the continuous improvement of modern science and technology level, AI technology has been well used in the society, and AI technology will be widely used in all fields of society.

RELATED WORK

The integration of Artificial Intelligence (AI) into healthcare predictive analytics for disease diagnosis and treatment has been a focal point of research and development in recent years. Several key studies and initiatives have contributed significantly to advancing this field:

1.DEEP MIND HEALTH

The significance of artificial intelligence in the voluntary management system is not only to improve work efficiency, but also to complete the analysis and simulation of some industrial engineering information through the help of artificial intelligence "Talking about the Application of Artificial Intelligence in Enterprise Management" points out that the application of artificial intelligence in enterprise management is to center on the whole data management, so as to establish an information database of enterprises and help enterprises carry out collaborative management and planning. Individual enterprise management still adopts backward computer network, which very much affects the network security of enterprises. First, the backward computer network will let the enterprise computer network in a high risk state, when other criminals or competitors use high means of virus, Trojan horse to steal the enterprise business information, and the enterprise computer is extremely backward, no solid firewall system, no artificial intelligence intercept, once break through the enterprise computer network, so not only seriously affect the enterprise development, but also let the enterprise in the point of danger, make the enterprise face a serious enterprise crisis. Second, the backward enterprise computer system, unable to intercept dangerous information in time, will lead to some viruses to attack the computer network, affecting the business information and use security of enterprises.

Therefore, artificial intelligence occupies a considerable position in the enterprise management system, which can be regarded as the core of the enterprise management system. The application of artificial intelligence technology in enterprise management not only improves the enterprise data management ability, but also further guarantees the security of the enterprise computer network system.

B. Application in the engineering field

Artificial intelligence is widely used in the field of engineering. First of all, the medical expert system is an important application of artificial intelligence combined with expert professional theory innovation. It can help doctors solve difficult medical problems, but also serve as a medical treatment tool for doctors. For example, in 1982, the University of Pittsburgh published a research effect on the computer diagnostic system of internaml medicine , which triggered a combination of artificial intelligence and medicine. And now many medical systems have been in line with artificial intelligence technology, and have developed valuable medical artificial intelligence products. Secondly, geological exploration is also an important field of artificial intelligence technology. Artificial intelligence in geological exploration is mainly designed to solve some work with high risk coefficient and complex operation in the exploration process, which reduces the cost of geological exploration to a certain extent and further improves the speed of geological

exploration.

C. Application in the technical field

Artificial intelligence technology has been used in electronic technology for a long time. Due to the rapid development of the network, all kinds of security and confidentiality have become a topic of attention. Therefore, only the use of previous security technology is far from meeting people's requirements, so data mining technology, artificial immunity, ai language, etc. are derived, and artificial intelligence technology provides infinite possibilities for our lives. Although the learning ability is very strong and can imitate the human behavior, but it is more rapid than the human learning ability. In the face of huge data information, artificial intelligence can quickly and effectively extract relevant information according to the issued instructions, and some can also list other relevant information on this basis, which can not only simplify information, but also simplify complex, and further strengthen the computer's response ability to information.

In addition, artificial intelligence can also monitor somerelevant data needed in real time, more able to quickly complete task operations.In addition, artificial intelligence technology can also combine complex data with computer network technology, which can not only effectively save cost and time, but also help people need the information to be answered in the first time, and do not need to spend too much time and energy. It is precisely such that the application of AI can cooperate well with people, which are based on the good support of computer network technology.

B. Stable computer network technology security. In order to stabilize the security of the computer network, artificial intelligence must solve the security risks hidden in the dark. Although, the computer network itself will automatically detect the existing information and viruses at the beginning of the initial download, partly improving the security performance of the computer network. But AI can provide a safer environment for computer networks, reducing the risk of problems at download for computer systems.

I.THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN COMPUTER NETWORK TECHNOLOGY

We will strengthen the comprehensive management of computer networks. In the face of the accelerated pace of network, the development of computer network may be able to change when delivery at any time, and the application of artificial intelligence can reduce the unstable factors of failure and avoid the risk of system failure .The learning ability of artificial intelligence is very strong, so in some computer data appear certain changes and failures, artificial intelligence can analyze and deal with the problem very quickly, so as to grasp the computer network system. Using artificial intelligence at the same time, users can also inform their application feelings of the relevant personnel, and then by the data personnel to upload people's use feelings and opinions, artificial intelligence according to different classification, in order to timely understand the need to improve, to provide better service mode for people. In real life, artificial intelligence is not only can effectively screen information, but also can analyze some data and information for scientific statistics and prediction, improve the system defects, and greatly promote the development of computer network technology.

For example, the firewall system in the computer, at the macro level, it is the "door" of the computer network system, isa technology barrier to isolate harmful information and viruses, the firewall control the computer network channel. Once some dangerous data information appears in the computer to threaten the computer system operation, the firewall can quickly perceive danger, quickly close the computer network channel, and conduct related operations on dangerous information, to avoid dangerous information to

further affect the operation of the computer network. The firewall function works properly because of the function of artificial intelligence, because AI needs unified classification management of these information, screen out garbage information and dangerous data, and intercept this information in time to ensure the safety of computer users. Both internal and external monitoring, artificial intelligence can effectively identify and authenticate, and comprehensively plan the computer network.

CONCLUSION

This paper introduces the basic concepts and functions of artifial intelligence. Artificial intelligence technology is giving play to its advantages and plays an important role int human development.

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The Digital Farm: Integrating AI into Agriculture

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Abstract

The role of various technologies, including computer science, the Internet, big data analytics, and blockchain technology, in enhancing agriculture. These technologies provide accurate and timely data on plants, land, climate, and insects, which can improve crop production and reduce risks. Agriculture faces significant challenges, such as increasing production by 70% to meet global demand in the next 50 years amid limited resources and climate change. As the largest sector globally and a crucial livelihood source in rural India,

Introduction

Agriculture is a fundamental pillar for the sustainability of any economy, playing a crucial role in long-term economic growth and structural change. This role, however, varies internationally. Traditionally, agricultural activities were confined to food and plant production, but over the past two decades, the scope has expanded significantly to include processing, production, marketing, and distribution of both crops and livestock products. Today, agriculture is a primary source of livelihood, contributing substantially to GDP development, national trade, reducing unemployment, supplying manufacturing resources, and improving the global economy.

In today's world, agriculture and technology are closely intertwined. Modern agricultural practices and land cultivation have evolved dramatically due to advancements in various fields, including sensors, machinery, and knowledge development. The contemporary agricultural sector utilizes advanced technologies such as robots, temperature and moisture sensors, drones, and GPS. These innovations enhance the precision of increasing farmers' income. The study specifically explores how artificial intelligence (AI) can meet future demands, increase bulk agricultural production, and assist in nutritional assessment and soil management significant inroads into agriculture. Universities and research institutions often act as resource centers, driving the development and application of AI in commercial, business, and government sectors. Agriculture faces new and significant challenges today. To feed a projected global population of 9-10 billion by 2050, food production must increase by 60-110%. Ensuring the sustainability of the agricultural practices and machinery systems, enabling organizations to become more efficient, sustainable, and profitable. The rise of e- commerce and related technologies has also opened up vast new data opportunities. Remote sensors, satellites, and UAVs can collect information continuously, monitoring crop fertility, soil conditions, temperature, and other critical factors.

The data collected by these sensors is often extensive and complex, offering insights that go beyond human observation. This allows farmers to gain a deeper understanding of field conditions more quickly than traditional methods. The adoption of these advanced technologies is becoming increasingly widespread among farmers, who benefit from more efficient use of inputs such as raw materials, fertilizers, water, and fuel, while also reducing risks. Artificial Intelligence (AI) is another rapidly growing field making agriculture is vital to the Indian economy. The Indian government aims to double farmers' income by 2022 and boost agricultural exports. Digital technology is seen as transformative in modernizing agricultural activities and

agricultural sector is crucial for food security and poverty alleviation in the face of this growing population.

Furthermore, recent food safety scandals and incidents, such as bovine spongiform encephalopathy and dioxin contamination in chickens, underscore the need forwell-documented tracking systems for quality control in the food chain. Climate change, adverse climatic conditions, and sustainable water management due to water scarcity are additional challenges that theagricultural sector must address in the coming years. Therefore, there is an urgent need to develop strategies to transition from current agricultural practices to sustainable agriculture.

Implementing effective solutions to help farmers and stakeholders improve decision-making by adopting sustainable agricultural practices is critical. Digital technologies, including the Internet of Things (IoT), Artificial Intelligence (AI), and cloud computing, play a transformative role in this transition. Subsets of AI, such as machine learning and deep learning algorithms, are increasingly integrated with local intelligence technology, finding wide applications in the agricultural sector. The aim of this review is to introduce and explore key application technologies and machine learning strategies within the agricultural food sector. By highlighting these advancements, the review seeks to promote the adoption of sustainable agricultural practices and improve decision-making processes for farmers and stakeholders, ultimately contributing to the sustainability and efficiency of the agricultural sector.

Figure 1: Plant monitoring with IOT smart phones

Discussion

Typically, crop management systems provide a link to a comprehensive crop management that covers each component of farming. The concept of using AI method in plant management was first proposed in 1985 by Mc Kinion and Lemmon in their paper "Agricultural Specialist Programs. This Special Phase highlights the use of AI techniques in many areas of agricultural research to understand the scope of AI-enabled solutions within ARS.

Agricultural Production Management: Agricultural production involves a complex supply chain. AI revolutionizes food production, distribution, and consumption by offering advanced guidance on crop rotation planning, planting seasons, water and nutrient management, pest and disease control, harvesting, food marketing, product distribution, and food security. Researchers highlight AI's potential to transform agriculture through production, distribution, use, and uncertainty management (Peter et al., 2021). AI aids in developing accurate irrigation systems and recommends nitrogen fertilization levels in corn.

Plant Monitoring: Traditional plant health monitoring is labor-intensive and time-consuming. AI effectively identifies potential plant health issues and soil nutrient deficiencies. AI applications analyze crop health patterns, soil conditions, pest presence, and plant diseases, enhancing understanding and management of agricultural health (Sudduth et al., 2021).

Data Science: Farms generate vast data daily. AI helps farmers analyse real-time factors like weather, temperature, water use, and soil conditions, improving decision- making and resource use. AI enables data- driven growth of healthy plants with fewer natural resources (Ramos-Giraldo et al., 2020). AI recommender systems enhance agricultural research by

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utilizing large datasets and scientific expertise to predict agro ecosystem evolution under changing conditions.

Disease Diagnosis: Plant diseases pose significant threats to the environment, economy, and food security. Early detection is crucial. AI-based image recognition systems detect plant diseases with high accuracy, enabling field-based diagnostics using mobile devices. AI tools provide early warnings of pest and disease outbreaks and guide sustainable crop management practices (Peter et al., 2021).

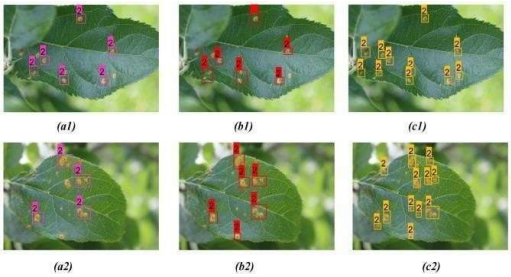

Figure 2: Disease diagnosing with AI

Food Quality: AI and machine vision improve food safety and quality assurance. AI enhances accuracy and efficiency in tasks like carcass quality tests, achieving 81.5% to 99% accuracy in predictions (O Baiden et al., 2008).

Predictive Analytics: Remote sensors predict crop yields and environmental impacts on crop health. AI- based data analysis helps farmers protect natural resources and reduce inputs for successful harvesting. Advanced tools using neural and machine learning networks identify dynamic field areas and optimize nutrient and managing climate factors like sunlight, temperature, and rainfall are crucial for successful farming.

Soil: Healthy soil is vital for agriculture. IoT sensors monitor soil conditions, aiding in nutrient management and preventing degradation.

Insects: Pests damage crops and livestock. IoT and AI technologies monitor and control pest populations, preventing diseases and crop damage.

pesticide use (Penning et al.).

Mobile Computing (MC): MC infrastructure processes and stores data outside cell phones. RFID systems enable fast and accurate data tracking, useful in industrial product identification and evaluation.

Robots: Robots perform agricultural activities like crop harvesting more efficiently than humans. Examples include weed control robots and crop harvesting robots. Milking robots and AI-driven soil and crop monitoring enhance agricultural productivity. Technologies like PEAT and Trace Genomics diagnose soil issues and recommend corrective measures.

Predictive Statistics: Machine learning models predict environmental impacts on crop yields, addressing climate change challenges. Technologies like weather forecasting and crop stability monitoring aid in planning and sustainability.

Smart Sustainable Agricultural Model Domains: Human Resources: Effective human resource management in agriculture impacts productivity and decision-making. Intelligent technology adoption improves efficiency (K. Lakwani et al., 2019).

Crops: Includes food, feed, fiber, and oil plants grown for various uses (Pycno, 2019).

Climate: Weather conditions significantly affect agricultural processes. Monitoring and

Fertilization: Proper fertilization maintains soil health and crop productivity. IoT sensors assess soil nutrient levels, ensuring appropriate fertilizer application.

Figure 3: Fertilization through drones

Agricultural Products: Derived from crops or livestock, agricultural products include food, clothing, and more. Effective management of these products is essential for human health (M.S Mekala et al., 2017). Irrigation/Water: Efficient water management is critical for agriculture, especially in regions facing water scarcity. Smart agricultural practices focus on effective water use strategies.

Figure 4: Irrigation with IOT

Big Data Analytics (BDA): BDA manages large datasets from sensors, internet, and business data. It improves decision-making, reduces production costs, and enhances crop forecasting and production (S. Chenet al., 2014).

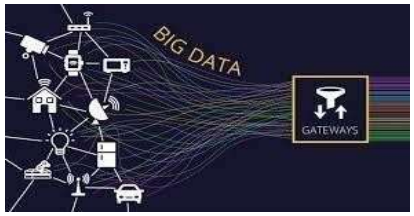

Figure 5: Big Data analysis Proposed IoT/AI SSA Platform: A.SSA Environment Functions:

Proposed IoT/AI Architecture:

Virtual Hardware and Storage Layer: Includes powerful computer hardware and storage solutions for IoT devices. AI and Data Management System: Handles data analysis, classification, and translation using AI and machine learning to make machines intelligent (A. Kamlaris et al., 2017). Network Layout: Facilitates data transfer within SSA, using the latest network technologies. Security Layer: Ensures data security across SSA layers, using AI algorithms to prevent threats (W. Garzon et al., 2017). Application Layers: Hosts smart agricultural applications, focusing on data flow monitoring and control. IoT and Sensory Layout: Interacts with SSA domains, using IoT devices to collect real-time data and assist in smart machine movement (G. Soto Romereo et al., 2019).

Artificial Intelligence Uses implementation

ROBOTS

The robots takes images and maps and detects the fruits and pick it as well as can keep acc. to size. A driverless tractor is an autonomous farm vehicle that delivers a high tractive effort at slow speeds for the purpose of tillage and other agricultural task. Robots with mechanical arms sets with trimmer can help in shearing of sheep. Specially designed wheel scrub the top layer of soil disrupting weed seed as they germinate, if any weeds mange to grow the turtle cuts them down. The robots detect and localize the fruits on tree using computer vision can also detect the fruits shadowed by another fruits and harvest it.

DRONES

For efficient field planning, agricultural drones can be used for soil and field analysis. They can used to mount sensor to evaluate moisture content in the soil. Crop surveillance is the supervision of crops progress from the time seeds are sown to the time for harvest. Can be useful in plantation which helping save fuels and labor also replaces huge tractors, as they emit harmful gases. Drones are useful in manage huge livestock as their sensor have high resolution infrared cameras, which can detect a sick animals and swift take actions accordingly. Agro-Drones can be used to spray chemicals as they have reservoirs, which can be filled by fertilizers and pesticides which save time as compared to traditional method.

Conclusion

In AI and IoT Agriculture is considered important for human survival. Supporting current traditional agricultural practices with the latest IoT / AI technology can improve performance, quality and productivity

capacity. In addition, it has identified intelligent, sustainable agricultural sectors, namely human resources; plants; weather; soil; insects; pregnancy; agricultural products; irrigation / water; livestock; equipment; and fields. AI technology helps farmers to analyze soil / soil / plant life etc. and save time and weather / weather / rain etc. AI-based forecasts allow pesticide / crop / crop suggestion in the right place at the right time before major disease outbreaks occur. With so much untapped space in agriculture to intervene with automated response systems, there is a great opportunity for the agricultural industry to use emerging catboat technology to assist farmers with answers to all their questions and to provide appropriate advice and recommendations in their specific ideas. Farm-related problems. This encourages the growth of the AI market in agriculture.

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allow farmers to plant the right crops in each season with the best yields. Direct planting can reduce water use, use land efficiently, and can be planted in urban areas on buildings. It can reduce the problems of unemployment. Allows predictions for next year's crop seasons /

Artificial Intelligence Benefits, Challenges, and Trends in Agriculture

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Abstract:

databases and included 176 of these Unsustainable rate of growth the global population is now at 8 billion and expected to rise to 9. 7 up to 9 billion people by 2050 which in its turn will affect the demand for food production. Artificial intelligence (AI) technologies which enable the efficiencsssy of resources and improvement in productivity are crucial in a location that includes tension in the supply chain and higher frequency of weather related occurrences. This study performed a Co-authors Systematic review of the literature using the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) checklists of articles with a focus on artificial intelligence technologies used in the agricultural field. It retrieved 906 relevant five electronic in the bibliometric analysis. The quality appraisal step selected 17 studies for the identification of the opportunities, risks and developments of AI technologies applied to agriculture.

Introduction:

Global factors that expose supply chain to the test are geopolitical activities and climatic conditions must address a number of key questions that are affecting the food system sustainability. The challenges to ending poverty, hunger and food insecurity rates continue to rise and with the COVID-19 pandemic has also exposed some vulnerabilities in our agrifood systems and distribution of social injustice our societies. This state comes with increased food production: as food production rises, so does the urgency of this scenario demand. The Food and Agriculture Organization (FAO) has said that by 2050, global population will increase to about 10 billion people and thus, the food demand shall have risen by 70%. The positive impacts of artificial intelligence (AI) techniques used in agriculture are that improve agricultural operations through enhancing the food system resilience as a result of the improvements.AI is a Self-correcting and proceeding concept that is applied in the execution of numerous tasks.

Methodology:

This section identifies the review principles of the systematic literature systematic literature review (SLR), sources of studies included and the quality assessment of the studies selected. Review principles according to , this systematic review was described as a review that employed systematic methods in its execution approaches used to gather and integrate data from the investigations that examine an issue posed question, and this must be done to a degree where the details of the formulated question can be understood we need to report study results for its findings to be reviewed for replication. To that end, this SLR sought to ascertain and synthesize recent research chaining from the following question techniques in artificial intelligence that have been adopted in agriculture answering specific questions and recognizing trends. The methodological steps included their four research criteria of identification, screening, eligibility and inclusion are the principals that are most commonly used in research studies. Firstly, we defined the research questions that we used to identify the studies and the criteria that was used in the inclusion process exclusion. Subsequently, the study in scientific databases retrieved the related studies, and finally, the results identified were analysis to answer the research questions.

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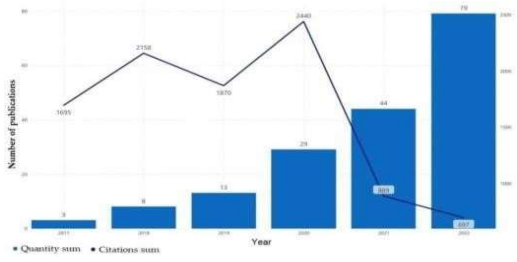
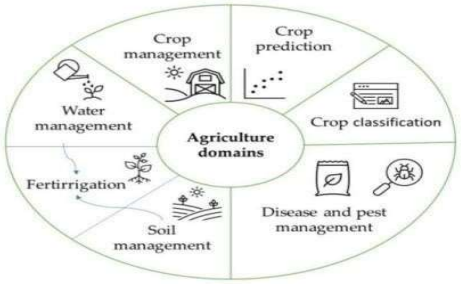
Descriptive Analysis (RQ1):

Here, based on 176 selected studies, there is a quantitative analysis of the studies considering the number of publications and citations; method used in the identified studies; and primarily the most cited countries, journals and institutions. The publication number, and citations in the related domain, has tripled in the last three years; the data indexed in December, 2022, reached to 2440 regarding the publication in '2020'. For that is already reflected in the literature published in 2021 and 2022 which cited the publications that were done in 2020, revealing the dynamism of feedback on this line of research. According to the nature of the knowledge offered, the studies were divided into theoretical and empirical ones . There was an identification of theoretical research which was categorized as review or SLRs. Also, empirical works were further categorized into either modeling and simulation, survey, or case study. The studies identified. The identified studies were evenly distributed between the theory- based and empirical research papers; 43% of the all the studies were theoretical in nature and 57 percent of the studies were based on empirical research. Among the theoretical studies, there was relatively stronger focus on reviewing the literature as witnessed by 59 papers that constituted 34% of the total papers and in between empirical studies, these were more conspicuous in modeling and simulation with 68 papers representing 39%. The distribution of the most representative articles in quality appraisal steps is coherent with this concern, as ,which presented a robot strawberry- picky or a smart irrigation system.



Artificial Intelligence in Agriculture (RQ2):

Agriculture, which literally means land cultivation, can be described as the art and science of raisingcrops producing crops. The physical ,The link between the farmer, the land and the cultivated crop



plant is their production unit. The basic challenge of agriculture is to manage the physical environment in a way that meets the biological needs of the crop plant. The primary among the most important factors that affect crop yield is soil productivity; it is also the ease with which people can access water, climate, and pests or diseases.

Main Agriculture Domains:

Artificial intelligence is transforming the agricultural sector by optimizing processes and resources. This review identified seven main agricultural. The objective of crop management is to rationalize resource use Water management is focused to optimize the irrigation process and the water use at the farm . Successful of site- specific cropping systems management. Chemical application in proper proportions is of environmental and economic concern to farmers that at least 30% of the fertilizer nutrients get wasted. When you use fertigation, very little nutrients go unused. You can save some money using fertigation too that fertigation helps to improve fertilizer effectiveness.

Benefits, Challenges and Trends (RQ3):

Benefits of AI in Agriculture Increased efficiency and productivity Improved decision-making and crop management Enhanced crop yield prediction and disease recognition Automation of farming tasks and reduced labor costs Improved data analysis and

processing through big data analytics and cloud computing Increased food production and reduced waste.

Challenges of AI in Agriculture:

Need for high-quality and digitized data Limited scientific production in certain regions, such as Brazil Need for adaptation to local climate and crop conditions Integration of various technologies and techniques Data security and privacy concerns Trends in AI in Agriculture Agriculture 4.0 and Digital Agriculture Precision farming and smart farming Increased use of machine learning, deep learning, and computer vision Big data analytics and cloud computing Use of drones and UAVs for data collection Increased focus on crop management and yield prediction Integration of AI technologies with other technologies, such as IoT and digital twins Technologies and Techniques Used in AI in Agriculture Machine learning, Deep learning, Computer vision, Big data analytics, Cloud computing, IoT, Digital twins, Robotics, Drones and UAVs.

CONCLUSION:

"In this comprehensive review, we explored the latest advancements in artificial intelligence (AI) applications in agriculture. Our analysis revealed seven key areas where AI is making a significant impact: Crop management Water management Soil management Fertigation Crop prediction Crop classification Disease and pest management We identified 24 different AI techniques being used, with machine learning, deep learning, robotics, and IoT being the most popular. The benefits of AI in agriculture are clear: it optimizes management systems, streamlines irrigation, and helps identify diseases and pests. However, we also found that there are challenges to be addressed. Small and medium-sized farms struggle with digitizing their production processes ,and the cost of hardware and software can be prohibitively expensive. Additionally, there is a need for skilled labor to implement and maintain these technologies. To fully realize the potential of AI in agriculture, governments and policymakers in food-producing countries must invest in developing competitive technologies and training a skilled workforce. By doing so, we can unlock the full potential of AI and create a more sustainable and efficient agricultural industry."

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Generative AI and ChatGPT: Applications, challenges, and AI-human collaboration

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Abstract

Generative AI, particularly exemplified by ChatGPT, has revolutionized various sectors through its ability to generate human-like text, images, music, and more. This paper explores the broad applications of generative AI, the challenges it presents, and the potential for AI-human collaboration to enhance productivity and creativity. We delve into ethical, technical, and privacy concerns, emphasizing the need for a human-centered approach to AI development. The paper concludes with a discussion on the implications of generative AI for the future of work and society.

Introduction:

Artificial intelligence (AI) has elicited much attention across disciplines and industries (Hyder et al., 2019). AI has been defined as "a system's ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation" (Kaplan & Haenlein, 2019, p. 15). AI has gone through several development stages and AI winters. In the first two decades (i.e., 1950s and 1960s),AI demonstrated success which included programs such as General Problem Solver (Newell et al., 1959) and ELIZA Weizenbaum, 1966). However, limitations in processing capacity and reduced spending on AI turned its development into stagnation.In recent years, AI has made a comeback with the introduction of AlphaGo in 2015 and ChatGPT in 2022. Following the release of the application named "Chat Generative Pre- trained Transformer" or ChatGPT by OpenAI in late 2022, AI has attracted worldwide attention. As Figure 1 shows, the term "ChatGPT" has attracted a growing search interest on Google since its release on November 30, 2022. ChatGPT belongs to a class of language models called Generative Pretrained Transformer (GPT). The category of GPT refers to Large Language Models (LLMs) that use deep learning techniques for extensive training with tremendous amounts of data (Cascella et al., 2023). ChatGPT is specifically designed and fine-tuned for conversational usage to produce human-like responses by drawing on its wealth of information and knowledge. The capabilities of ChatGPT are enabled by generative AI, which refers to a type of AI that can generate human-like text and creative content (e.g.,music and images) as well as consolidate data from different sources for analysis (Dasborough, 2023). ChatGPT passed the Turing test by fooling people to believe that its responses were from humans rather than machines/AI (Woolf, 2022). The advent of this state-of-theart AI is expected to revolutionize society as well as the way we live, work, learn, and communicate.The generative AI model is an example of highly promising unsupervised machine learning. Previous generative models, such as Restricted Boltzmann Machines (Smolensky, 1986), Deep Belief Networks (Hinton et al., 2006), and Deep Boltzmann Machines (Salakhutdinov & Larochelle, 2010), exhibit limitations as they lack generalization power (Pan et al., 2019). Featuring exceptional data generation capacity, Generative Adversarial Networks (GANs) were put forward as a novel generative model. GANs consist of two competing neuralnetworks, one called the generator and the other called the discriminator (Goodfellow et al., 2020). The generator produces as realistic data as possible while the

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discriminator tries to differentiate synthesized data from real data.Another neural network architecture called Transformers was proposed in the paper "Attention Is All You Need" and is based on attention mechanisms that dispense between recurrence and convolutions (Vaswani et al., 2017). The concept of self-attention enables the model to attend to different parts of the input sequence while generating the output sequence. These breakthroughs brought generative AI to a new era of development and advancement. Generative AI can generate multimodal contents, including but not limited to text, audio, image, video, and even three-dimensional models. Some repre-sentative applications include ChatGPT for text, Mid journey for images, and Deep Brain for videos. These models can be interrelated via text-to-image generative models (Qiao et al., 2022) and audio-visual correlation transfor- mers (S. Wang et al., 2022). The diverse forms of AI-generated content (AIGC) enable a wide range of applications. AI can generate textual content, such as poems (Köbis & Mossink,2021), political statements (Bullock & Luengo-Oroz, 2019), and academic papers (Hu, 2023), that can be hard to differentiate from human-generated content. Examples of AI-generated images include artworks (Gillotte, 2019), synthetic faces (Whittaker et al., 2020), and magnetograms of the Sun (J. Liu et al., 2021), which range from humanities to sciences. There are, however, potential legal, moral, and ethical issues created by generative AI, such as copyright infringement in AI-generated artworks (Gillotte, 2019), cheating and plagiarism at educational institutions (University of Cambridge, n.d..), data privacy and security (Siau & Wang, 2020), and malicious use of deepfakes and GANs (Whittaker et al., 2020).

AI has created both challenges and opportunities in various fields,including technology explanation and information processing), business (decision-making and AI-enabled automation), education (intelligent tutor and personalized learning), healthcare (smart health and AI diagnosis) as well as arts and humanities (human-centered design and cultural proxi- mity) (Siau, 2018;

W. Wang & Siau, 2019; Yin et al., 2022). AI-human collaboration is the key to addressing challenges and seizing opportunities created by generative AI. There are numerous ways that humans can collaborate with generative AI. For example, educators can utilize ChatGPT in science pedagogy while carefully examining AI-generated resources before adapting them to the teaching context (Cooper, 2023).

In problem-solving, generative AI can facilitate brainstorming as well as the generation or refinement of solutions. Hydrologists attempted to use ChatGPT for basic problem-solving but found the quality questionable due to ChatGPT's imbalanced capabilities in responding to qualitative and quantitative questions (Halloran et al., 2023). ChatGPT has demonstrated potential for supporting medical practice (Cascella et al.,

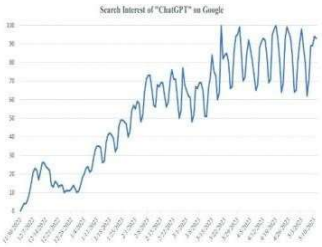

Figure 1. Search interest of "ChatGPT" on google from November 30, 2022, to May 11, 2023.

Generative AI Applications:

Generative AI has numerous applications across different sectors. In content creation, AI can generate articles, stories, and social media posts, enhancing productivity and creativity. In customer support, AI-powered chatbots provide continuous assistance, handling inquiries and resolving issues efficiently. In education, AI offers personalized tutoring and generates educational materials, while in healthcare, it aids in diagnosis, treatment, and patient support. Marketing benefits from AI-generated ad copy and personalized content, while the entertainment industry leverages AI

for game development and interactive media. Additionally, AI-generated synthetic data augments datasets for training other machine learning models

Education:

ChatGPT has created disruptions and major changes in the field of education. ChatGPT can serve as an assistant in learning and teaching activities. For students, ChatGPT can assist in a variety of tasks, including information

nursing industry, such as increased use of digital tools and robotics (Gunawan, 2023). However, potential misuse can happen, such as offering diagnosis and treatment recommendations without proper valida-tion or oversight. Hence, regulations and governance need to be in place (Wan et al., 2022).

grading assignments, and providing feedback to students. Because ChatGPT is based on LLMs, it can be used to create educational content, personalize learning experiences, and improve student engagement (Kasneci et al., 2023), which can improve the overall efficiency and effective- ness of education delivery. In academic research, ChatGPT can assist with problem formulation, research design, data collection and analysis, as well as reviewing and critiquing the writing and composition (Susarla et al., 2023). Further, by providing tailored support, direction, and feedback, ChatGPT is a useful tool for autodidactic learners (i.e., self-learners) in open education (Firat, 2023). Despite ChatGPT's usefulness in the education context, concerns arise that some students may use ChatGPT to cheat in examinations or commit plagiar-ism in essay writing. The undesired consequences are that education norms are disrupted, students' learning process is affected, and academic integrity is threatened. Facing these challenges, educational institutions across the world have devised responses after the launch of ChatGPT. For instance, the University of

search, answering questions related to specific subjects, and enhancing writing in a variety of languages. For teachers, ChatGPT can assist in generating teaching plans, preparing teaching materials (e.g., scripts, slides, and quizzes), reviewing and 2023) and providing advice for public health (Biswas, 2023). Boßelmann et al. (2023) argued that advances in AI can improve the overall diagnostic and therapeutic accuracy of epilepsy. ChatGPT is also expected to create new trends in the

Cambridge stated that including content generated by AI plat- forms such as ChatGPT would be considered academic misconduct (University of Cambridge, n.d.). The University of Oxford holds a more open attitude toward ChatGPT and considers it a useful tool for both educa-tors and students (University of Oxford, 2023). Recently, Turnitin, a well- known plagiarism detection software service has included the feature of AI-generated text detection in response to the prevailing use of generative AI (Turnitin, n.d.). Similarly, a range of AI content detection services is offered by AI Writing Check, CatchGPT, Content at Scale, Copyleaks, GPT Radar, GPTZero, OpenAI's AI Text Classifier, Originality.AI, Winston, and ZeroGPT, among other.

Healthcare:

Healthcare is another domain in which generative AI and ChatGPT can make a significant impact. With ChatGPT reported to pass the United States Medical Licensing Examinations (Kung et al., 2023),the world has seen a gradually clearer picture of how generative AI may reshape the healthcare industry. Empowered by LLMs, generative AI, such as ChatGPT, can hold the potential of transforming the healthcare industry in a variety of aspects such as patient interaction, clinical diagnosis support, telehealth services, health edu- cation, health advice, and health promotion.

However, it remains an open question as to

whether clinical professionals and patients will accept the new advancement of generative AI. Strict health care regulations and high entry barriers to the industry have made it hard for digital innovations such as generative AI to penetrate the healthcare domain . Concerns including the ethical use of AI, information accuracy, privacy, cybersecurity, and risk potential are persistent (Siau & Wang, 2020). In the highly regulated healthcare industry where value creation is critical, relying too much on the content generated by AI may lead to catastrophes, such as the mistreatment of patients. Also, collaboration with generative AI in the healthcare domain comes with the risk that critical and sensitive health information could be leaked or compromised.

reliance, misuse, privacy and security, and the widening of the digital divide.

Table 1. Ethical challenges.

Challenges	Issues
Harmful or inappropriate content	Content produced by generative AI could be violent, o erotic
Bias	Training data representing only a fraction of the popu create exclusionary norms
	Training data in one single language (or few language create monolingual (or non-multilingual) bias
	Cultural sensitivities are necessary to avoid bias
	Bias exists in employment decision-making by genera
Over-reliance	Users adopt answers by generative AI without careful or fact-checking
Misuse	Plagiarism for assignments and essays using texts gene
	Generative AI can be used for cheating in examinatio assignments
Privacy and security	Generative AI may disclose sensitive or private inform
Digital divide	First-level digital divide for people without access to AI systems
	Second-level digital divide in which some people and may accept generative AI more than others

Harmful or inappropriate content:

Harmful or inappropriate content produced by generative AI includes but is not limited to violent content, the use of offensive language, discriminative content, and pornography. Although OpenAI has set up a content policy for ChatGPT, harmful or inappropriate content can still appear due to reasons such as algorithmic limitations or jailbreaking (i.e.,removal of restrictionsmposed). The language models' ability to understand or generate harmful or offensive content is referred to as toxicity (Zhuo et al., 2023). Toxicity can bring harm to society and damage the harmony of the community. Hence, it is crucial to ensure that harmful or offensive information is not present in the training data

Challenges with generative AI

Generative AI can bring many challenges to society. In this section, we discuss these challenges from four perspectives: ethics, technology, regula- tions and policies, as well as economy.

Ethical concerns

Ethics refers to systematizing, defending, and recommending concepts of right and wrong behavior (Fieser, n.d.). In the context of AI, ethical concerns refer to the moral obligations and duties of an AI application and its creators. Table 1 presents the key ethical challenges and issues associated with generative AI. These challenges include harmful or inap- propriate content, bias, over-

and is removed if they are. Similarly, the training data should be free of pornographic, sexual, or erotic content (Zhuo et al., 2023). Regulations, policies, and governance should be in place to ensure any undesirable content is not displayed to users.

Bias:

In the context of AI, the concept of bias refers to the inclination that AI- generated responses or recommendations could be unfairly favoring or against one person or group (Ntoutsi et al., 2020). Biases of different forms are sometimes observed in the content generated by language models, which could be an outcome of the training data. For example, exclusionary norms occur when the training data represents only a fraction of the population (Zhuo et al., 2023). Similarly, monolingual bias in multilingualism arises when the training data is in one single language (Weidinger et al., 2021). As ChatGPT is operating across the world, cultural sensitivities to different regions are crucial to avoid biases (Dwivedi et al., 2023). When AI is used to assist in decision-making across different stages of employment, biases and opacity may exist (Chan, 2022). Stereotypes about specific genders, sexual orientations, races, or occupations are common in

recommendations offered by generative AI. Hence, the representativeness, completeness, and diversity of the training data are essential to ensure fairness and avoid biases (Gonzalez, 2023). The use of synthetic data for training can increase the diversity of the dataset and address issues with sample- selection biases in the dataset (owing to class imbalances) (Chen et al., 2021). Generative AI applications should be tested and evaluated by a diverse group of users and subject experts. Additionally, increasing the transparency and explainability of generative AI can help in identifying and detecting biases so appropriate corrective measures can be taken.

Technology concerns:

Challenges related to technology refer to the limitations or constraints asso- ciated with generative AI. For example, the quality of training data is a major challenge for the development of generative AI models.

models may respond with fictitious information, fake photos or information with factual errors (Dwivedi et al., 2023). Susarla et al. (2023) regarded hallucination as a serious challenge in the use of generative AI for scholarly activities. When asked to provide literature relevant to a specific topic, ChatGPT could generate inaccurate or even nonexistent literature. Current state-of-the-art AI models can only mimic human-like responses without understanding the underlying meaning (Shubhendu & Vijay, 2013). Hallucination is, in general, dangerous in certain contexts, such as in seeking advice for medical treatments without any consultation or thorough evaluation by experts, i.e., medical doctors (Sallam, 2023). In the future, algorithms will need to be improved to prevent hallucinations.

Quality of training data:

The quality of training data is another challenge faced by generative AI. The quality of generative AI models largely depends on the quality of the training data (Dwivedi et al., 2023; Su & Yang, 2023). Any factual errors, Hallucination, explain- ability, and authenticity of the output are also challenges resulting from the limitations of the algorithms. Table 2 presents the technology challenges and issues associated with generative AI. These challenges include hallucinations, training data quality, explainability, authenticity, and prompt engineering. Hallucination Hallucination is a widely recognized limitation of generative AI and it can include textual, auditory, visual or other types of hallucination (Alkaissi McFarlane, 2023). Hallucination refers to the phenomenon in which the contents generated are nonsensical or unfaithful to the given source input (Ji et al., 2023). Azamfirei et al. (2023) indicated that “fabricating information” or fabrication is a better term to describe the hallucination phenomenon. Generative AI can generate seemingly correct responses yet make no sense. Misinformation is an outcome of hallucination. Generative AI

unbalanced information sources, or biases embedded in the training data may be reflected in the output of the model. Generative AI models, such as ChatGPT or

Diffusion which is a text-to-image model, often require large amounts of training data (Gozalo-Brizuela & Garrido- Merchan, 2023). It is important to not only have high-quality training datasets but also have complete and balanced datasets. To address the issue with quality datasets, data cleansing for the training datasets is necessary but overwhelmingly expensive given the massive amount of data. Synthetic training data could be used to not only ensure the diversity of the datasets but also to address sample-selection biases in the datasets (Chen et al., 2021).

Explainability:

A recurrent concern about AI algorithms is the lack of explainability for the model, which means information about how the algorithm arrives at its results is deficient (Deeks, 2019). Specifically, for generative AI models, there is

no transparency to the reasoning of how the model arrives at the results (Dwivedi et al., 2023). The lack of transparency raises several issues. First, it might be difficult for users to interpret and understand the output (Dwivedi et al., 2023). It would also be difficult for users to discover potential mistakes in the output (Rudin, 2019). Further, when the interpretation and evaluation of the output are inaccessible, users may have problems trusting the system and their responses or recommendations (Burrell, 2016). Additionally, from the perspective of law and regulations, it would be hard for the regulatory body to judge whether the generative AI system is potentially unfair or biased (Rieder & Simon, 2017).

Authenticity:

As the advancement of generative AI increases, it becomes harder to deter- mine the authenticity of a piece of work. Photos that seem to capture events or people in the real world may be synthesized by DeepFake AI. The power of generative AI could lead to large-scale manipulations of images and videos, worsening the problem of the spread of fake information or news on social media platforms (Gragnaniello et al.,2022). In the field of arts, an artistic portrait or music could be the direct output of an algorithm. Critics have raised the issue that AI- generated artwork lacks authenticity since algorithms tend to generate generic and repetitive results (McCormack et al., 2019).

Prompt engineering:

With the wide application of generative AI, the ability to interact with AI efficiently and effectively has become one of the most important media literacies. Hence, it is imperative for generative AI users to learn and apply the principles of prompt engineering, which refers to a systematic process of carefully designing prompts or inputs to generative AI models to elicit valu- able outputs. Due to the ambiguity of human languages, the interaction between humans and machines through prompts may lead to errors or misunderstandings. Hence, the quality of prompts is important. Another challenge is to debug the prompts and improve the ability to communicate with generative AI (V. Liu & Chilton, 2022). Hence, it is necessary to provide training about prompt engineering, especially for those who are most fre- quently engaged in interaction with generative AI.

Challenges associated with regulations and policies:

Given that generative AI, including ChatGPT, is still evolving, relevant reg- ulations and policies are far from mature. With generative AI creating differ- ent forms of content, the copyright of these contents becomes a significant yet complicated issue. Table 3 presents the challenges associated with regulations and policies, which are copyright and governance issues.

Table 3. Challenges associated with regulations and policies.

Challenges	Issues	References
Copyright	Using AI-generated content may directly or indirectly violate copyright	(Pavlik, 2023)
	Controversies exist over AI authorship	(Bridy, 2012; Murray, 2023; Sallam, 2023)
Governance	Lack of human controllability over AI behavior	(Taeihagh, 2021)
	Data fragmentation and lack of interoperability between systems	(Taeihagh, 2021)
	Information asymmetries between technology giants and regulators	(Kroll, 2015; Taeihagh et al., 2021)

Copyright Office, n.d..). Generative AI is designed to generate content based on the input given to it. Some of the contents generated by AI may be others' original works that are protected by copyright laws and regulations. Therefore, users need to be careful and ensure that generative AI has been used in a legal manner such that the content that it generates does not violate copyright (Pavlik, 2023). Another relevant issue is whether generative AI should be given authorship (Sallam, 2023). Murray (2023) discussed generative art linked to non- fungible tokens (NFTs) and indicated that according to current U.S. copyright laws, generative art lacks copyrightability because it is generated by a non-human. The issue of AI authorship affects copyright law's underlying

assumptions about creativity (Bridy, 2012). It is imperative to consider the design and implementation of guidelines, regulations, and laws pertaining to the proper utilization of generative AI.

Governance:

Generative AI can create new risks as well as unintended consequences. Different entities such as corporations (Mäntymäki et al., 2022), universities, and governments (Taeihagh, 2021) are facing the challenge of creating and deploying AI governance. To ensure that generative AI functions in a way that benefits society, appropriate governance is crucial. However, AI governance is challenging to implement. First, machine learning systems have opaque algo-rithms and unpredictable outcomes, which can impede human controllability over AI behavior and create difficulties in assigning liability and accountabilityfor AI defects.Second, data fragmentation and the lack of interoperability between systems challenge data governance within and across organizations (Taeihagh,2021). Third, information asymmetries between technology giants and regulators create challenges to the legislation process, as the government lacks information resources for regulating AI (Taeihagh et al., 2021). For the same reasons, lawmakers are not able to design specific rules and duties for programmers (Kroll, 2015). Transparency and explainability of AI systems as well as collaboration between technology giants and the government can assist in improving the design and deployment of AI governance (Shneiderman, 2020a, 2020b).

Transformation through AI literacy and intelligence augmentation:

In the HCAI approach, the intent of AI is to augment rather than replace humans. The key to intelligence augmentation (IA) is collaboration, where the AI literacy of users is crucial. AI literacy is defined as a set of competencies that enable individuals to know and evaluate AI technologies, communicate and collaborate with AI, and use AI effectively and ethically (Long & Magerko, 2020; Ng et al., 2021). AI literacy enables users to effectively use and collaborate with AI (Fast & Horvitz, 2017) to digitally improve and transform work. Hence, users should be educated and trained to work with generative AI to become proficient (e.g., in prompt engineer- ing) and ethical collaborators of HCAI. Although there is fear that AI may lead to singularity, IA is the main focus in the application of AI and has turned the tension between humans and artificial intelligence into a symbiotic one (Zhou et al., 2021, 2023). Such a shift can lead to a more understandable and manageable future of AI development (Shneiderman, 2020b). Xu et al. (2023) put forward an HCAI framework that contains three interdependent aspects comprising technol- ogies, human factors, and ethics.One objective of the framework is to augment human capabilities. Zhou et al. (2023) introduced four guiding principles for the design of IA, which include simplification, interpretability, human- centeredness, and ethics. Paul et al. (2022) stressed a human-centered approach to AI, which considers human factors and ethical concerns in human-machine systems. The intricacies of human-machine interaction serve as the foundation of AI. In HCAI collaboration, the pro-blem-solving abilities and creativity of humans can be augmented. One way to achieve IA is through co-creation by humans and AI, where better performance is achieved than when humans work on their own (Fugener et al., 2021). Hence, AI can enhance human decision-making by analyzing data or providing insights and predictions. In the medical context, generative AI can help doctors with diagnosis. In the business context, it can help managers with market forecasting. Although generative AI poses numerous threats to the economy, it can benefit the economy and help overcome some of the challenges by augmenting human intelligence.

Conclusions:

Generative AI models such as ChatGPT, Midjourney, and DeepBrain are among the most disruptive technology breakthroughs in recent years (Dwivedi et al., 2023). With the ability to produce new content such as text, images, and videos, generative AI models are regarded as the next milestone of artificial general intelligence (Luo et al., 2023). Generative AI holds immense potential for a wide range of applications in the business, education, health- care, and content creation industries. However, generative AI also presents challenges, which we categorized into ethics, technology, regulations and policy, and economy. Many of these challenges arise due to the lack of HCAI. For generative AI to be successful, it needs to be human-centered by taking into account empathy and human needs, transparency and explain- ability, ethics and governance, and transformation through AI literacy and intelligence argumentation. Generative AI is here to stay. Advancements in generative AI are accelerating and its disruption to business and industries will intensify. Generative AI is making a major impact on our work and lives to the point that working and collaborating with generative AI will soon become a norm, if not already a norm. Education will need to be transformed to teach the necessary hard and soft skill sets to enable students to collaborate and partner with generative AI in educational and workplace settings. Continuous learning and adaptation are necessary to upskill, reskill, and retool the workforce as AI continues to advance and redefine our workplace and our lives. We are living in an interesting and challenging time where adapting to the era of generative AI is necessary and unavoidable.

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Internet of Robotic Things: Concept, Technologies, and Challenges

ANU. P BHANU SMITH A N KAVYASHREE. N ANITHA.S

DEPARTMENT OF AIML

ABSTRACT:

Internet of Things allow massive number of uniquely addressable ‘‘things’’ to communicate with each other and transfer data over existing internet or compatible network protocols. This paper proposes a new concept which tackles the issues for supporting control and monitoring activities at deployment sites and industrial automations, where intelligent things can monitor peripheral events, induce sensor data acquired from a variety of sources, use ad hoc, local, and distributed ‘‘machine intelligence’’ to determine appropriate course of actions, and then act to control or disseminate static or dynamic position aware robotic things in the physical world through a seamless manner by providing a means for utilizing them as Internet of robotic things (IoRT). Although progressive advancements can be seen in multi-robotic systems, robots are constantly getting enriched by easier developmental functionalities, such vertical robotic service centric silos are not enough for continuously and seamlessly supporting for which they are meant. In this paper, a novel concept—IoRT is presented that highlights architectural principles, vital characteristics, as well as research challenges. The aim of this paper is to provide a better understanding of the architectural assimilation ofIoRT and identify important research directions on this term.

INDEX TERMS Internet of things, IoRT, robotics, cloud.

INTRODUCTION:

Robotic system has brought tremendous changes in various socio-economical aspects of human society during the past decades [1]. Per Guoqiang et al., industrial robot manip- ulators have been widely deployed and used in all sorts of industries to perform repetitive, tedious, critical, and/or dangerous tasks, such as product assembly, car painting, box packaging, and shield welding. These preprogrammed robots have always been very successful at their accomplishments in several structured industrial applications due to their high accuracy, precision, endurance, and speed. Robotic technolo- gies have been integrated with existing network technologies to extend the range of functional values of these robots when deployed in unstructured environments while fostering the emergence of networked robotics during 90’s .IEEE Society of Robotics and Automation’s Technical Committee on Networked Robots has defined the networked robotic system as a collection of robotic devices that are connected via wired and/or wireless communication net- work [3]. Networked robotic applications can be classi- fied as either teleoperated robots i.e., remotely positioned robots controlled by the commands sent by human opera- tor via the communication network, or multi-robot system which is a group of networked robots placed in a distributed fashion to perform the given task by exchanging sensing data and information via the communication network by self- cooperative manner. The ‘‘Mars Rover’’ sent to the Mars for exploration is a kind of formertype where as Soccer playing robots are example of latter case.Networked robotics suffer from inherent physical constraints such as, low speed on-board instruction execution, small size of memory, net- work latency, variable quality of service,infrastructure with selfconfiguring capabilities based on downtime, and lack of intelligence. standard and The limitations have motivated the researchers to think of new form of efficient robotic systems i.e., ‘‘Cloud Robotics’’. Cloud robotics may be described as a system that relies on the ‘‘Cloud Computing’’ [4] infrastructure to access vast amount of processing power and data to

support its operation [5]. That means not all sensing, computation, and memory is integrated into a single standalone system as it was in case of networked robotics. Cloud Robotic systems often include some portion of its capacity for local processing for low-latency responses when network access is unavailable or unreliable i.e., offline. One example of Cloud Robotics is the Google self-driving car that indexes the Google maps, images, and other rele- vant information, collected by the satellites and the crowd

secure communication channels and standardized architectural frameworks that per- form interaction and bridges the cooperation with their neigh- bors to reach specific goals [7]. Smith [8] describes IoT as a dynamic global network of Robotic Things. This paper concludes in Section VI.

human computation, and collaborative robot learning, it suffers interoperable communi-cation protocols where physical from various issues such as interoper- ability, heterogeneity, and virtual ‘‘things’’ have identities, physical attributes, time-varying network latency, secu-rity, multi- robot and virtual personalities and use intelligent interfaces, and management, common infrastructure design, Quality-of- are seamlessly integrated into the information network; Service (QoS), and standardization [5], [6]. Due to the IoRT's often communicate data associate with users and their inherent virtues of qualitative handling of men- tioned issues, it environments. In this paper, we adopt the is envisaged that it will overcome these constraints, leading to more intelligent, collaborative, het- erogeneous, efficient, self 9490 Internet of Robotic Things are detailed in Section IV. Section operations model that brings together a group of available stack V presents the research challenges associated with Internet of technologies to run business in connected and integrated way.

OVERVIEW OF INTERNET OF ROBOTIC THINGS:

sourced Clouds to facilitate accurate localization. Although, Cloud Robotics is benefited from big data analytics, cloud computing, communications, collaboration and technical analytics enables to pursue real-time decision. The concept behind this idea is the ubiqui- tous presence around human being and its socioeconomical culture with a variety of smart objects enabled by radio tags, sensors, actuators, smart devices which are disseminated through unique addressing schemes,

This section presents a general overview of Internet of Robotic Things. First, concept behind Internet of Things is presented. Later, Cloud Robotics is merged with IoT as Internet of Robotic Things including its novel definition.

DEFINITIONS:

The main idea behind the Internet of Things or IoT is not a new one. The idea of IoT was conceived by Mark Weiser in his Scientific American article on ubiquitous computing called ‘‘The Computer for the 21st Century’’. Later, in the year of 1999, Internet of Things term was coined by Kevin Ashton, the then executive director of the Auto-ID Center. As per Giusto et al., IoT combines people, process, device and technology with sensors and actuators. This overall integra- tion of IoT with human being in respect to Indeed, most of the technologies used by Internet of Things, such as device identification and het-erogeneity, are not new. Instead, Internet of Things leverages these technologies to meet the social, technological, political, and economic requirements of today's societal demand for information technology.Internet of Robotic Things being a novel concept requires to be defined. Unfortunately, no literature yet has described this term. Here, I propose to merge the IoT and Robotics, especially Cloud Robotics altogether, as IoRT be advanced version of Cloud Robotics.What is Cloud Robotics? According to the description given by RoboEarth [10], [67], Cloud Robotics may

be seen as emerging field of robotics that is rooted in the cloud com- puting, cloud storage, and other existing Internet technolo- gies, centered around the earned benefits of the converged cloud infrastructure and shared services that allows robots to take benefit from the powerful computational, storage, and communications resources of modern data centers attached with the clouds, while removing overheads for tasks such as, maintenance and updates, and enhancing independence on the custom middleware platforms, entailing additional power requirements which may reduce the operating duration and constrain robot mobility and increase operation costs by covering cloud data transfer rates to offload tasks without hard real time requirements.Now, we can proceed for defining Internet of Robotic Things by covering the definition of IoT and Cloud Robotics as presented below.

INTERNET OF ROBOTIC THINGS DEFINITION:

A global infrastructure for the information society enabling advanced robotic services by interconnecting robotic things based on, existing and evolving, interoperable information and communication technologies where cloud computing, cloud storage, and other existing Internet technologies are centered around the benefits of the converged cloud infras- tructure and shared services that allows robots to take benefit from the powerful computational, storage, and communi- cations resources of modern data centers attached with the clouds, while removing overheads for maintenance. overhead of operational (business related) activities through a common layered approach where all sorts of necessary supports are provided.IoT Cloud Robotics Infrastructures is solely included for services. Here regarding this topic, we should have‘‘a model designed to facilitate the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies through ennoblement of ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources e.g., ‘‘Pepper’’ [77] – is gradually advancing to such a point of interaction where artificial software agents or ‘‘bots’’ and the similar ones, are going to pave those emotional relationships into reality [76].

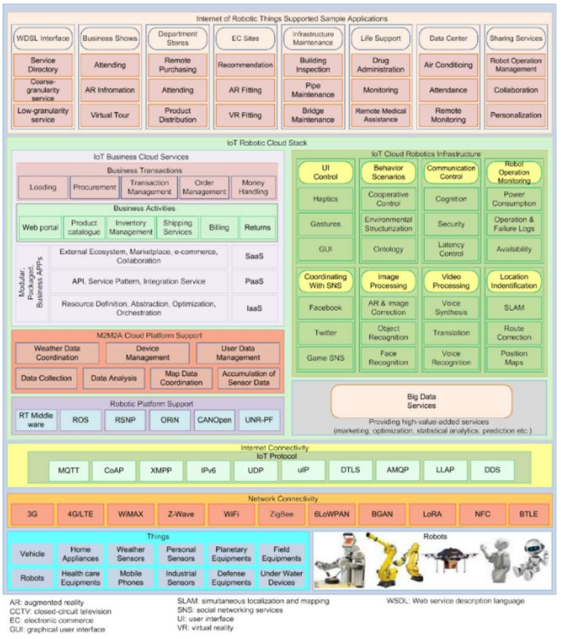

FIGURE 1. Conceptual diagram of Internet of Robotic Things Architecture.

As we know that ‘‘Chatter bots’’ [78] do engage its people active in online-chats very often to solicit the per- sons’ personal information. In such circumstances, ethics becomes important not only for the robotic things but also the robot manufacturer, owner, user, and the govern- ments. Effective policies should be devised by the country heads around the globe so that misuse of robotic things may be minimized. As IoRT does not comprise of eth- ical implications, it should be the challenge for the rel- evant society to come up with novel practices in near future.

CONCLUSION:

This paper has proposed an IoT based robotics architectural concept – Internet of Robotic Things (IoRT), as an advance- ment of current cloud networked robots. Internet of Robotic

Things allows robots or robotic systems to connect, share, and disseminate the distributed computation resources, business activities, context information, and environmental data with each other, and to access novel knowledge and specialized skills not learned by them selves, all under a hood of sophis- ticated architectural framework. This opens a new horizon in the domain of connected robotics that we believe shall lead to fascinating futuristic developments. It indeed allows adapting into connected ecosystem where resource constraint deployment of inexpensive robots shall be leveraged by het- erogeneous technologies, be it, communications network, processing units, different genre of devices, or clouds ser- vices. Enormous developments could be foreseen to get benefited from the IoRT approach such, SLAM, grasping, navigation, and many more that are beyond the discussion. In this paper, a novel Internet of Robotic Things architec- ture is proposed considering conjugation between recently grown IoT and robotics together. Feasibility of the proposed architecture has been validated by showing the presence or possibilities of emergence of few components, includ- ing existing robotic systems, their peripheral devices, IoT processing units, and cloud enabled robotic platforms. Key characteristics are also basic idea about IoT cloud. IoT cloud may be described as: elaborated. Research challenges are presented in precise manner so that enthusiasts can get involved into this novel concept in recent future.

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AGRIWATCH-CROP MONITORING ROBOT USING ESP32

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ABSTRACT:

This paper presents the design, development, and implementation of an autonomous crop monitoring and health analysis robot integrated with artificial intelligence (AI). The robot, powered by an ESP32 microcontroller, is equipped with advanced sensors and multi-spectral imaging capabilities to collect comprehensive environmental data and analyse crop health in real-time. Through on-device AI processing and cloud-based data management, the system provides actionable insights to farmers, enhancing crop management and yield prediction. Field trials demonstrate the effectiveness and scalability of the proposed solution.

Keywords: Autonomous robot, crop monitoring, ESP32, artificial intelligence, multi-spectral imaging, precision agriculture

Introduction:

Precision agriculture aims to optimize field-level management regarding crop farming. The advent of IoT and AI has enabled the development of sophisticated systems for real-time crop monitoring, significantly improving the efficiency and sustainability of agricultural practices.

Literature Survey

Precision agriculture involves the use of advanced technologies to optimize the management of agricultural practices. This field has seen significant advancements with the integration of IoT, AI, and robotics. These technologies enable real-time monitoring, data-driven decision-making, and automation, ultimately enhancing productivity, reducing resource consumption, and minimizing environmental impact. Autonomous Crop Monitoring Systems UAV-Based Monitoring Unmanned Aerial Vehicles (UAVs) have been widely used for crop monitoring due to their ability to cover large areas quickly and capture high-resolution images. Research has shown that UAVs equipped with multi-spectral cameras can provide valuable insights into crop health, identify pest infestations, and monitor growth patterns (Zhang & Kovacs, 2012). However, UAVs are limited by flight duration, regulatory restrictions, and the need for skilled operators. Ground-Based Robots Ground- based robots offer an alternative to UAVs, providing continuous monitoring and the ability to interact with crops. Systems like the BoniRob and Agrobot use various sensors to gather data on soil conditions, plant health, and environmental factors (Astrand & Baerveldt, 2005). These robots can operate autonomously, but their high cost and complexity limit widespread adoption.

Sensor Networks Sensor networks deployed across fields can monitor environmental conditions and soil properties. These networks typically consist of distributed sensor nodes that communicate data wirelessly to a central hub (Pierpaoli et al., 2013). While effective in providing localized data, sensor networks require significant infrastructure and maintenance.

AI Integration in Agriculture

Machine Learning for Crop Health Analysis Machine learning algorithms have been used to analyze multi- spectral and hyperspectral images for crop health assessment. Convolutional Neural Networks (CNNs) and Support Vector Machines (SVMs) have demonstrated high accuracy in identifying diseases, nutrient (Kamilaris & Prenafeta-Boldú, 2018). Training these models requires large datasets and significant computational resources.Predictive Analytics for Yield

Forecasting Predictive models using historical data, weather patterns, and real- time sensor inputs can forecast crop yields. These models employ regression techniques, neural networks, and ensemble methods to provide accurate predictions, helping farmers make informed decisions about resource allocation and market strategies (Hochman et al., 2013). Autonomous Decision-Making Systems AI-powered systems can autonomously make decisions regarding irrigation, fertilization, and pest control. These systems use reinforcement learning and fuzzy logic to optimize resource usage and maximize crop yield while minimizing environmental impact (Paraforos et al., 2016).

IoT and Cloud Computing in Agriculture

IoT Devices and Connectivity IoT devices, such as soil moisture sensors, weather stations, and cameras, are critical for real-time data collection in precision agriculture. These devices communicate through various protocols, including Zigbee, LoRaWAN, and Wi-Fi, to ensure reliable data transmission over long distances (Verdouw et al., 2016).

Cloud-Based Data Management Cloud computing platforms provide scalable solutions for storing, processing, and analyzing large volumes of agricultural data. Services like AWS IoT, Microsoft Azure, and Google Cloud offer tools for data visualization, machine learning, and remote monitoring, enabling farmers to access insights from anywhere (Wolfert et al., 2017). Data Security and Privacy The integration of IoT and cloud computing raises concerns about data security and privacy. Ensuring the integrity and confidentiality of agricultural data is crucial for gaining farmers' trust and promoting the adoption of these technologies (Ray et al., 2017

Comparative Studies

UAVs vs. Ground-Based Robots Comparative studies have shown that while UAVs offer rapid data acquisition and high-resolution imaging, ground-based robots provide continuous monitoring and direct interaction with crops (Bendig et al., 2014). The choice between UAVs and ground-based robots depends on factors such as field size, crop type, and specific monitoring needs. Sensor Networks vs. Autonomous Robots Sensor networks provide extensive coverage and detailed environmental data, but require significant infrastructure and maintenance. Autonomous robots, on the other hand, offer mobility and flexibility, allowing them to perform targeted interventions based on real-time data (Sørensen et al., 2010). AI Models for Disease Detection Various AI models have been compared for disease detection in crops. CNNs have shown superior performance in image- based disease classification due to their ability to learn hierarchical features (Ferentinos, 2018). However, simpler models like SVMs and decision trees can still be effective, especially in resource- constrained environments.

Gaps and Future Directions

Integration and Interoperability One of the significant challenges in precision agriculture is the integration and interoperability of various systems and devices. Developing standardized protocols and platforms can facilitate seamless data exchange and improve overall system efficiency (Brewster et al., 2017). Cost and Accessibility The high cost of advanced technologies limits their accessibility to small-scale farmers. Research should focus on developing cost- effective solutions and exploring alternative financing models to promote widespread adoption (Finger et al., 2019). User Training and Support Effective training and support programs are essential to help farmers understand and utilize new technologies. Extension services and digital platforms can play a crucial role is providing ongoing education and assistance (Rose et al., 2018). Environmental Impact Future research should consider the environmental impact of precision

agriculture technologies, including their energy consumption, electronic waste, and potential effects on biodiversity. Developing sustainable practices and materials can mitigate these impacts (Balafoutis et al., 2017).

Proposed System

An autonomous robot equipped with advanced sensors and AI algorithms for real-time crop monitoring and health analysis in agricultural fields

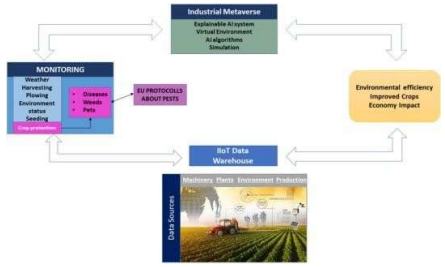

Fig 1.1 System Architecture Diagram

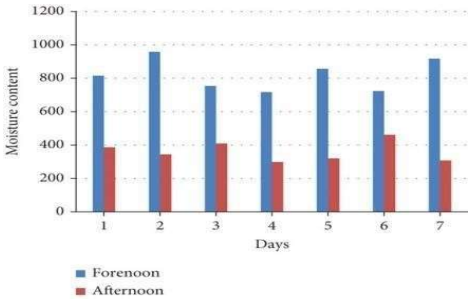

Fig 1.2 Data graphical representation diseases using SVM algorithm

Results and Discussion

Field Trials

The robot was tested in various agricultural environments, demonstrating effective autonomous navigation and accurate data collection.

Data Analysis

Real-time data fusion and AI processing provided detailed insights into crop health, with predictive models forecasting potential issues.

Performance Evaluation

The system's performance was evaluated based on the accuracy of disease detection, yield prediction, and user feedback from farmers

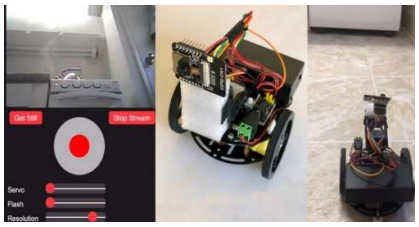

Fig 1.4 The for graph for different leaf

Conclusion

This research presents a comprehensive solution for autonomous crop monitoring and health analysis using an ESP32-based robot with AI integration. The system's ability to provide real-time, actionable insights demonstrates its potential to transform modern agricultural practices, promoting sustainability and efficiency.

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Gait Detection Using IoT and Machine Learning Techniques

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ABSTRACT

Gait monitoring is considered as a noteworthy marker of disability, injury, and walk symmetry. The proposed model is a combination of versatile neuro fuzzy inference system and optimization for a better recognition of physically disabled person identification system in a crowded region for analyzing the behavior of a particular person. The objective of this work is to require profound comparative investigation of gait detection for a real-time consumer health monitoring system based on IoT sensors and Machine learning technique. This study will be useful for post-stroke gait coordination for rehabilitation and consumer health monitoring service. The corresponding gait detection and predictive results are forwarded to a team of doctors or the other persons through the cloud IoT network that is appropriate for elderly people and physically disable people in order to avoid fall. In case changes are found within the walking fashion, at that point the data is passed to the caretakers so that first aid can be given effortlessly at adjust time without any delay.

Keywords: Gait Detection, Internet of Things, Machine Learning and Human Activity Recognition.

INTRODUCTION

The physical world's items can communicate with one another thanks to the Internet of Things (IoT). Modern sensors, actuators, and internet connections integrated into IoT devices greatly enhance communication efficacy. Numerous studies in a range of fields are underway as a result of technological advancements and the low cost of Internet of Things devices. Sensitive IoT-based applications and associated data must be transmitted securely in order to provide smart, mobile, and distant IoT services. Health has grown in importance in the modern era due to advances in medical technology and our growing understanding of health and life. In terms of health, it is essential to move around and stroll for a considerable portion of daily living. Walking can cause some health abnormalities, such as heart problems, strokes, and other conditions; complex health conditions like strokes can also limit one's range of motion. Stroke is one of the deadliest diseases, particularly for those over 60, and its prevalence is on the rise. Following a stroke, many abnormalities in health occur. A stroke is an abrupt collapse of brain cells as a result of oxygen deprivation, brought on by blood vessel damage or obstruction of blood supply to the brain. The symptoms of a stroke include weakness in one or both arms and legs on the same side, loss of balance, an abrupt headache, dizziness, trouble speaking, trouble with coordination and weakness in the muscles of the face. Following a stroke, one of the most prevalent disabilities is said to be gait problems. People who have had a stroke lose their conscience and their capacity to call for help or go to the hospital. It is exceedingly challenging to treat a stroke without prompt recognition and care.

In order to determine a person's stride pattern, foot pressure and acceleration are typically assessed. The majority of time, gait parameters is recorded using an accelerometer, gyro sensor, insole pressure sensor, pedometer, GPS (Global Positioning System), and footswitches. Numerous important characteristics are extracted, including the number of steps or walking distance, the step and stride durations, the credence, and the GRP (Ground Response Force), velocity, and so forth. The Internet of Things (IoT), which provides cloud connectivity, smart phone

integration, safety, security, and healthcare services, is crucial to the growth of linked uses, a number of researchers are developing Internet of Things-based health monitoring systems. One of the most intriguing uses of wearable technology for everyday, routine activity tracking in clinical settings is gait monitoring. Sports and healthcare both make extensive use of gait tracking.

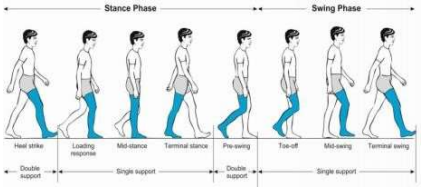

Fig. 1: Phases of normal gait cycle

RELATED WORK

A description of the current research on gait analysis and Internet of Things applications is given in this part. A lot of research has been done, and the process is still ongoing. A study on sensor-based activity recognition systems in health care (Qi et al., 2018) IoT-related applications for care. The methodology used in the study project integrates IoT with health care to minimize human costs and enable efficient data transfer across locations. Appropriate medical care can be delivered remotely without a physical presence when cloud networks are used in medical applications.

As a survey, research work (Qi et al., 2017) describes the many IoT-related health care systems. It offers in-depth understanding of how to include IoT health applications, which is relevant to the suggested research methodology.

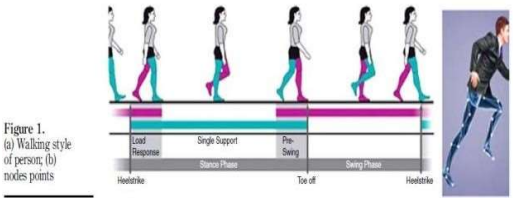

Figure 1.
(a) Walking style of person; (b) nodes points

The foundation for integrating gait analysis into IoT is found in health care applications, and this literature outlines the benefits and people. For a variety of

drawbacks of the current body of research. According to the literature (Godfrey, 2017), explains the problems with the gait analysis prediction method and the benefits of wearing able models to help older people live independently. Every process has a threshold level, and the monitoring system in the model is based on values derived from electro-mechanical movement. Elderly people can benefit greatly from wearable sensors that send warnings or alerts when a level crosses the threshold value. This allows the person to adjust the current process. A study by Gadaleta and Rossi (2018) offers a recognition model for smartphones with a neural network-based recognition mechanism. The procedure uses a smartphone application that tracks the user's data and offers appropriate alarm or notification to the individuals involved. Using open-source hardware, the literature (Llamas et al., 2017) offers a sensor-based gait identification framework. In order to identify the person through analysis, the suggested method makes use of sensors to retrieve information about their gait. In certain applications, the gait nature is utilized for the authentication procedure as an alternative to the standard technique.

Studies (Nweke et al., 2018; Llamas et al., 2016) provide information on wearable sensor applications that are linked to smartphones to track human activity. There are several sensors in the process and each contributes data from every place, allowing them to be combined into a mobile application that sends out alerts when anomalies are detected. The research study (Ing- Jr and Chang, 2017) offers specifics regarding the gesture-command-based recognition system. In order to improve analysis and give a more effective recognition system through the use of data streams, the features-based extraction procedure compares the current data with the historical data. Additionally, the gait analysis model based on sensors as a health care application is

described in the literature (Zhang et al., 2018). The suggested approach processes sensor information to create a smart heals application, and a predictive analysis then produces a report for the matching user. A study model (Gravina et al., 2017) describes the problems and fixes in a mobile computing cloud-based human activity process. The integration of cloud computing into human detection systems lowers errors and boosts accuracy. According to García et al. (2019), there is a health care application that may identify strokes, and the results are sent via a cloud network. The procedure offers a straightforward detection method, and the problems in this research project don't offer any predictive analysis. Gavrilova et al. (2018) describe in their literature the sensor-based activity recognition application for mental frameworks. Compared to other activity tracking systems, the method is different. The application is restricted to a certain monitoring procedure because of its cognitive character. A study conducted in 2018 by Stack et al. discusses wearable sensors and video-based identification systems for Parkinson's patients. The research

PROPOSED SYSTEM

In this study, we design a wearable IMS for online spatiotemporal gait analysis, which consists of a human-computer interface (HCI) and a foot-mounted IMS module. The six-axis inertial sensor (MPU-6050), the microcontroller (ATmega 328), the RF wireless transmission module (nRF24L01), and the power supply circuit make up the foot-mounted IMS module. Triaxial accelerometers, triaxial gyroscopes, and 16-bit analog to digital converters (ADCs) make up the six-axis inertial sensors (MPU-6050), which are designed to simultaneously detect the accelerations and angular velocities produced by walking movements in a three-dimensional (3D) presented in the articles (Kaur and Sood, 2017; Paraskevopoulos et al., 2017) addresses scheduling and routing under

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resource constraints in the service sector when allocating limited resources to different sites. The survey study examines a number of problems with different writers' restricted routing and emphasizes the advantages of scheduling algorithms in relation to qualification, services, and other modules of issues. It is found from the aforementioned survey work that the previous gait recognition model only does fall prediction or detection. If it locates the individual in a crowded area, they become less accurate and operate more slowly.

The triaxial accelerometer has a linear acceleration full scale of ±2, ±4, ±8, and ±16 g, and can measure the gravitational and motion accelerations of walking motions. Data output rates for all axes range from 4 to 1000 Hz. The triaxial gyroscope has a full scale of ±250, ±500,

±1000, and ±2000 °/s, with data output rate from 4 to 8000 Hz for all axes. It can simultaneously detect the X-, Y-, and Z-axis angular rates of the IMS module mounted on participants' feet during walking. In this work, the accelerometer's sensitivity and measurement range are 4096 LSB/g and ±8 g, while the gyro3scope's are 16.4 LSB/°/s and ±2000°/s.

The IMS module's microcontroller, an ATmega328, is in charge of gathering the digital signals produced by the gyroscope and accelerometer via an I2C interface and connecting to the RF wireless transceiver via an SPI interface. The accelerations and angular velocities are wirelessly transmitted to an HCI for additional real-time signal processing and analysis using the RF wireless transmitter (nRF24L01). The measured inertial signals are sampled at a rate of 100 Hz. The Li-ion battery, Li-ion battery charging module, and regulators make up the power supply circuit, which supplies the energy needed by the IMS module. The IMS module's battery is rechargeable and changeable.

Gait Monitoring System:

The accelerometer and insole foot pressure sensor of the proposed gait monitoring system will be fastened to the foot as a shoe insole in order to collect data on gait speed, foot pressure, and additional gait cues. Furthermore, people at high risk of stroke require an ECG patch. An insole foot pressure and accelerometer are conceived, prototyped, and tested. The gait patterns of people who have had strokes and those who do not differ greatly in terms of foot pressure, gait speed, etc. Compared to a normal person, stroke patients have an uneven walking pattern . Machine learning techniques and Internet of Things devices can identify the development of stroke in senior citizens. The entire system will send the subject's physiological data to a cloud engine, which will compare it with previously saved reference data and real-time data to identify strokes. The design of the Health app on a smart phone the monitoring application is shown below.

Fig. 2. Layout of Health Monitoring Smartphone Application.

System Architecture of Stroke Monitoring System:

Physiological parameters indicate an individual's physiological and health status. The general design and dataflow of the walking stroke monitoring system are depicted in Fig. 3 utilizing a machine learning algorithm and an IoT gait sensor. Data from the step sensor is sent into the Elastic search database via a phone data collection app that makes use of a Wi-Fi and BLE network. Predicting the data context and extracting gait features are completed. After that, by examining the alterations in gait signals, machine learning models will be used for data training and the prediction of the abnormal gait. Using a medical ontology framework, potential illnesses based on gait abnormalities will be identified. A health advisor will recommend the essential actions. If any exist, When a walking patient exhibits irregularities in their gait parameter, the stroke monitoring system notices these abnormalities and sends out an alarm or message to notify the patient to seek medical attention as soon as possible. The self-learning engine system is made up of network security, big data, and real-time monitoring. To enable patients to receive prompt medical attention, the knowledge base system will produce a stroke alert. This framework can be used to measure, evaluate, and categorize the different bio- signals. The gait signals are the specific subject of this investigation.

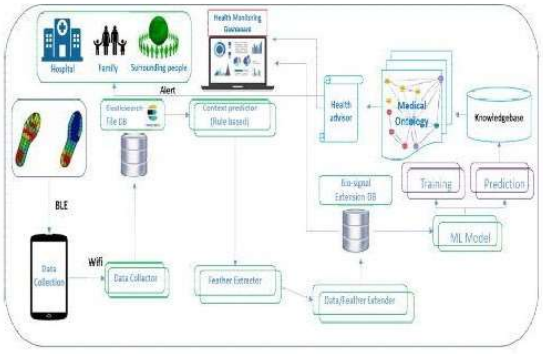

Fig. 3. Dataflow of Stroke prediction System based on Gait monitoring.

EXPERIMENTAL ANALYSIS

It uses accelerometer data (collected from an IoT device) to detect different gait patterns. We use Python to simulate data collection, preprocess the data, extract features, and then apply a machine learning model for classification. The python code for the data collection is

Data Preprocessing is done by a simple moving average filter which is applied to smooth the data. The python code is as follows, Extraction of both time-domain (mean, std, max, min) and frequency-domain (dominant frequency) features are the third step in gait detection. The python code is as follows,

Gathering of Gait Data:

It is important to examine the gait metrics of elderly, healthy individuals and stroke patients. Ground reaction force (GRP), foot pressure, and gait acceleration are considered gait parameters. A 3Lab sensor was employed to collect the data. During gait data collection, subjects walk and engage in routine tasks such as waking, sitting, and standing. A room should be kept at 24°C with a 40% relative humidity.

Gait Feature Extraction:

For the purpose of predicting disease, gait characteristics like foot pressure and acceleration are crucial. The insole pressure must be separated from the ground reaction force (GRP) and foot pressure. The accelerometer signal must be retrieved in order to obtain the foot acceleration data.

Gait Pattern Classification:

It has proven possible to classify gait data from stroke patients and healthy individuals using machine learning algorithms. Support vector machines (SVM, LSVM), CART, C4.5, and logistic regression. Classifying foot pressure, acceleration, and GRP data of stroke patients and normal individuals has been accomplished with the use of decision tree algorithms. Thirty percent of the data were used for testing, twenty percent for training, and fifty percent for gait data validation of classification models.

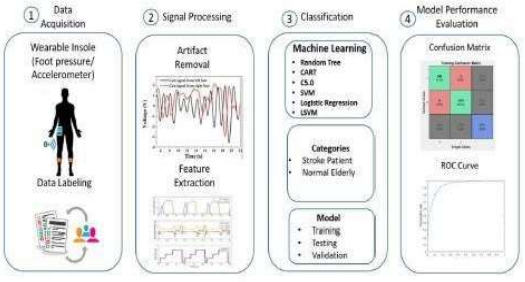

Fig. 4. Methodology of ML Classification.

D. Algorithms Overview:

A machine learning method for binary classification issues (problems with two class values) is called logistic regression. The Support Vector Machines (SVM and LSVM) algorithm is a classification method for supervised learning. A maximum margin hyper plane that divides two opposing groups can be constructed by SVM . One of the most effective classifiers used frequently in the study of physiological data is SVM. The decision tree-based algorithms are C4.5 and CART.

CONCLUSION

This study suggests a gait tracking method for stroke prediction. There are presentations of the sensors, dataflow, system design, and outcomes of the ML model's stroke prediction. It is necessary for the stroke monitoring system to incorporate additional biosignals such as EEG, breathing, ECG, and EMG, in order to forecast strokes during everyday activities like driving, sleeping, and working.

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