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A. 5G and Beyond 5G Network / Drone Technology

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C. Industrial loT

D. Electric Vehicles (EVs) and Smart Car

E. VLSI Design & Embedded System/ Applications of AI & Machine Learning

F. E-Paper Technology, Nano Technology for Future Electronics.

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1. Digital Revolution Unleashed: How IoT Empowers Industry 4.0

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Abstract— This paper highlights how the Internet of Things (IoT) revolutionizes tradiional factories into smart ones in Industry 4.0. By connecting devices, sensors, and software, smart factories optimize production, prevent machine failures through predictive maintenance, and enhance energy efficiency. IoT ensures real-time insights into energy consumption, improves workplace safety by identifying hazards, and enables efficient supply chain management. The review covers IoT applications like predictive maintenance, asset tracking, inventory management, quality control, production monitoring, energy efficiency, and supply chain optimization in smart factories, offering insights for quality improvement and process optimization

Introduction

"Digital Revolution Unleashed: How IoT Empowers Industry 4.0" delves into the transformative impact of the Internet of Things (IoT) on traditional factories, ushering them into the era of Industry 4.0. This paper explores the step-by-step procedure of implementing Industrial Internet of Things (IIoT) protocols, emphasizing their profound impact on various facets of industry. By interconnecting devices, sensors, and software, smart factories optimize production, prevent machine failures through predictive maintenance, and enhance overall efficiency. The review discusses applications of IoT in smart factories, including predictive maintenance, asset tracking, inventory management, quality control, and energy efficiency. The paper aims to provide valuable insights for enhancing quality control and optimizing part production processes in the dynamic landscape of Industry 4.0.

I. IIOT and Industry 4.0

2.1 What is IoT?

The Internet of Things (IoT) is a network of physical objects, commonly referred to as "things," that are equipped with sensors, software, and other technologies, allowing them to connect and share data with other devices and systems through the internet. These objects can range from everyday household items like smart thermostats and wearable devices to complex industrial tools used in manufacturing processes. IoT enables these objects to communicate and interact with each other, gather and analyze data, and automate tasks, leading to increased efficiency, convenience, and innovation in various industries and applications

2.2 What is Industry 4.0?

Industry 4.0 can be defined as the integration of intelligent digital technologies into manufacturing and industrial processes. It encompasses a set of technologies that include industrial IoT networks, AI, Big Data, robotics, and automation. Industry 4.0 allows for smart manufacturing and the creation of intelligent factories. It aims to enhance productivity, efficiency, and flexibility while enabling more intelligent decision-making and customization in manufacturing and supply chain operations.

2.3 What is IIoT?

The industrial internet of things (IoT) refers to the extension and use of the internet of things (IoT) in industrial sectors and applications. With a strong focus on machine-to-machine (M2M) communication, big data, and machine learning, the IIoT enables industries and enterprises to have better efficiency and reliability in their operations. The lloT encompasses industrial applications, including robotics, medical devices, and software-defined production processes.

The IloT goes beyond the normal consumer devices and internetworking of physical devices usually associated with the IoT. What makes it distinct is the intersection of information technology (IT) and operational technology (OT).

OT refers to the networking of operational processes and industrial control systems (ICSs), including human machine interfaces (HMIs), supervisory control and data acquisition (SCADA) systems, distributed control systems (DCSs), and programmable logic controllers (PLCs).

II. Industrial Revolution - From Industry 1.0 to Industry 4.0

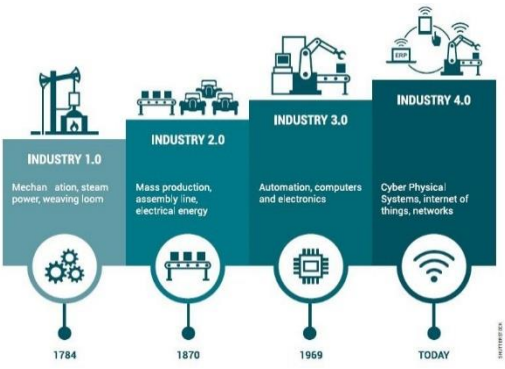

Fig. 1.1 Industrial Revolution

3.1 1st Industrial Revolution

The First Industrial Revolution began in the 18th century through the use of steam power and mechanization of production. What before produced threads on simple spinning wheels, the mechanized version achieved eight times the volume in the same time. Steam power was already known. The use of it for industrial purposes was the greatest breakthrough for increasing human productivity. Instead of weaving looms powered by muscle, steam-engines could be used for power. Developments such as the steamship or (some 100 years later) the steam-powered locomotive brought about further massive changes because humans and goods could move great distances in fewer hours.

3.2 2nd Industrial Revolution

The beginning of 20th century marked the start of the second industrial revolution – Industry 2.0. The main contributor to this revolution was the development of machines running on electrical energy. Electrical energy was already being used as a primary source of power. Electrical machines were more efficient to operate and maintain, both in terms of cost and effort unlike the water and steam-based machines which were comparatively inefficient and resource hungry. The first assembly line was also built during this era, further streamlining the process of mass production. Mass production of goods using assembly line became a standard practice.

3.3 3rd Industrial Revolution

The Third Industrial Revolution began in the ’70s in the 20th century through partial automation using memory-programmable controls and computers. Since the introduction of these technologies, we are now able to automate an entire production process without human assistance. Known examples of this are robots that perform programmed sequences without human intervention.

3.4 4th Industrial Revolution

Industry 4.0. It refers to the concept of factories in which machines are augmented with wireless connectivity and sensors, connected to a system that can visualize the entire production line and make decisions on its own. In essence, industry 4.0 describes the trend towards automation and data exchange in manufacturing technologies and processes which include cyber-physical systems (CPS), the internet of things (IoT), industrial internet of things (IIOT), cloud computing cognitive computing and artificial intelligence

III. How IoT Empowers Industry 4.0

Fig. 1.2 IoT Empact on Industry 4.0

1. IoT is responsible for the super-fast evolution of industry 4.0, where everything is connected within a common network and the operations are mostly automated, thus eliminating the need for much human intervention. Real-time data monitoring improves the decision-making process, and predictability helps reduce the chances of future hazards in the industry, accompanying management of the assets for future workability. The main stages of IoT and industry 4.0 evolution are:

    i. Getting things connected

    ii. Generating insights

    iii. Optimizing operations and processes

    iv. Innovation

2. Let's understand step by step how IIoT Works in Industry 4.0.

Fig. 1.3 various type of Sensors

Suppose Sensors are connected in industry, IoT relies on a network of sensors to collect real-time data from machines, equipment, and the environment. These sensors monitor parameters like temperature, pressure, humidity, and machine performance, providing valuable insights into the operational status of equipment.

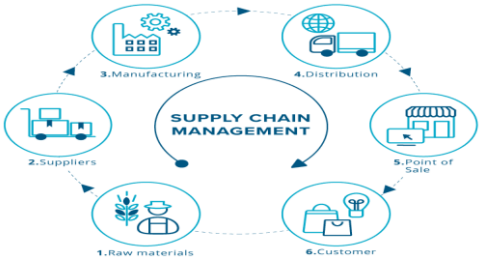

Fig. 1.4 Supply Chain Optimization

Supply Chain Optimization: IoT facilitates the integration of sensors throughout the supply chain, offering real-time visibility into the movement and condition of goods. This allows for better inventory management, predictive maintenance, and overall optimization of the supply chain.

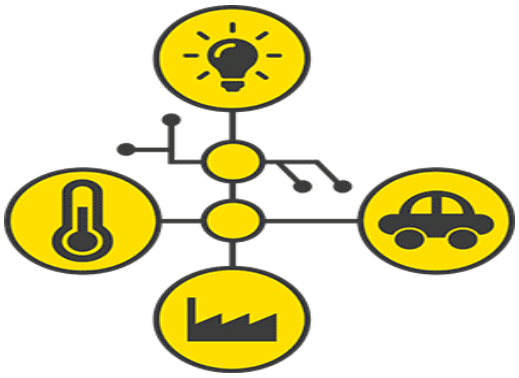

Fig. 1.5 Process Monitoring and Control

Process Monitoring and Control: In Industry 4.0, IoT-enabled devices enhance process monitoring and control by continuously collecting and analyzing data. This data-driven approach allows for better decision-making, improved efficiency, and the ability to quickly respond to changes or anomalies in the production process.

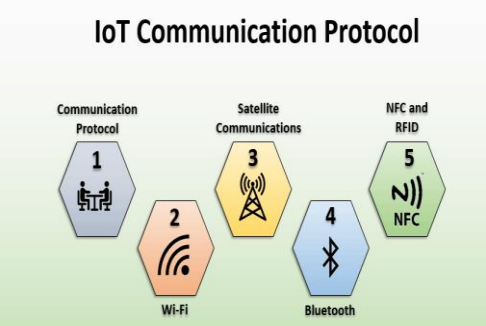

Fig. 1.6 IoT Protocols

IoT Protocols (PAN, Bluetooth, Wi-Fi): Various communication protocols like Personal Area Network (PAN), Bluetooth, and Wi-Fi play crucial roles in connecting IoT devices. PAN technologies, like Zigbee, are suitable for short-range communication within a factory, while Bluetooth and Wi-Fi enable broader connectivity. These protocols ensure seamless communication between devices, enabling them to work together efficiently

Fig. 1.7 Cloud Connectivity

Cloud Connectivity: IoT devices communicate with cloud platforms to store, process, and analyze the massive amounts of data they generate. Cloud connectivity allows for centralized data storage, accessibility, and advanced analytics. This enables businesses to make informed decisions, implement predictive maintenance, and optimize overall operations

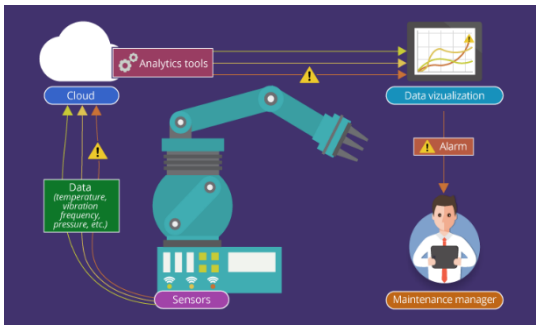

Fig. 1.8 Control System

Control Systems: Through IoT, control systems can be remotely accessed and managed. This enables operators to monitor and control industrial processes in real-time, even from a distance. Automation and control mechanisms can be fine-tuned based on the data received from IoT devices, enhancing overall operational efficiency.

In summary, the integration of IoT in Industry 4.0 transforms traditional industries into smart, connected systems. Through sensors, supply chain optimization, process monitoring, and communication protocols, IoT enhances data-driven decision-making, efficiency, and responsiveness, ultimately leading to more agile and competitive industrial operations

3.5 How IIoT protocols important in Industries?

IIoT protocols play a crucial role in industries by facilitating communication among various devices, enabling the exchange of data and commands. Without these protocols, hardware would be rendered useless, as they are essential for extracting valuable information, as well as allowing users to interact with and control devices effectively. In essence, IIoT protocols form the backbone of the technology stack, ensuring seamless connectivity and functionality in industrial settings.

IIoT protocols:

Bluetooth:

1. Bluetooth Low Energy (BLE): Efficient for low-power devices, commonly used in IoT applications like wearables and smart home devices.
2. Classic Bluetooth (BR/EDR): Used for higher data rate applications such as audio streaming

Wi-Fi:

1. MQTT over Wi-Fi: MQTT is a lightweight and widely used protocol for IoT communication, often implemented over Wi-Fi networks for higher bandwidth applications.
2. HTTP/HTTPS: Commonly used for web-based communication in IoT applications, leveraging Wi-Fi connectivity.

PAN (Personal Area Network):

1. Zigbee: A low-power, short-range communication protocol suitable for creating personal area networks, often used in smart home and industrial automation.
2. Z-Wave: Similar to Zigbee, Z-Wave is designed for low-power, short-range communication in smart home devices.

Other Protocols:

1. CoAP (Constrained Application Protocol): Designed for resource-constrained devices and networks, suitable for IoT applications.
2. OPC UA (Unified Architecture): Commonly used in industrial IoT (IIoT) for secure and reliable communication between industrial devices.
3. LoRaWAN (Long Range Wide Area Network): Ideal for long-range, low-power communication in IoT applications like smart agriculture and smart cities.

IV. M2M COMMUNICATION IN IIOT

M2M development was crucial to IIoT realization. M2M is essentially point-to-point communication with fixed lines implementing different protocols among devices of specific application and same type. M2M devices accede to requests for enclosed data or automatically

transmits the same. These can be various kinds of temperature sensors and motion detectors. An adequately complex monitored machine may employ the M2M module as a modem enabling data transmission. However, the machine with a simple circuit and switch may not show adequately intelligent behavior, which then is placed in a slave role controlled by the M2M module.

M2M gateway offers interconnection of M2M devices and forwards data gathered from a communications network. The communications network serves as the infrastructure for realizing communication between the M2M gateway and M2M end-user application or server. For this purpose, cellular network, telephone lines, and communication satellites can be used as shown in below Figure 2. Programmable Logic Controllers (PLCs) now control M2M communication systems. PLCs are a vital component of supervisory control and data acquisition (SCADA), a supervisory control system created to manage automated, big-scale industrial operations. Standard M2M systems are proprietary and detached from the internet with no provision for broader services, applications, and analytics. M2M systems are thus termed "siloed" or single-use/dedicated technology and do excellent work at controlling a specific industrial process. They, however, cannot share data with a business enterprise's ERP, PLM, or SCM systems.

element14 has partnered with many different suppliers like Schneider, Siemens, Mitsubishi, Honeywell, ABB, MulticomPro and more, who produce such broad portfolio of products like PLC's, HMIs, IIoT Gateways, M2M Gateways etc., to meet several requirements in IIoT& M2M Communication in Industrial Automation & Control System.

V. ADVANTAGES OF IIOT

Industrial IoT is merely a subset of modern technologies that are used to improve business processes. In other words, the use of Industrial IoT is effectively limited only by the problems that we need it to solve. Nonetheless, here are some of the primary use cases of Industrial IoT that have led to its widespread adoption around the world.

1. Improved Operational Efficiency:

Industrial IoT brings greater integration between processes, allowing for more frequent, clearer communication channels. This brings about reduced lag-time for seamless and more efficient production chains. Automated processes with IIoT-enabled machine to machine communication also reduces the need for operator intervention, allowing engineers to instead focus on optimizations and improvements

2. Faster Improvement Cycles:

Real-time and historical data from edge IIoT devices allows process supervisors to respond to

operational demands, such as promptly dealing with supply bottlenecks or under-utilized resources. Data also allows businesses to make informed decisions about future development plans, further accelerating process or product improvement cycles.

3. Reduced Operational Down Time:

The same data from Industrial IoT devices is also heavily used for monitoring the conditions and performance of vehicles and industrial equipment. In this manner, maintenance can occur predictively and in a timely manner, which reduces operational down time while avoiding collateral damage associated with complete component failures.

4. Enhanced Industrial Safety:

Workplace safety is another key area that Industrial IOT strives to improve. By using automated intercommunication and fail-safe sensors, we can ensure that high risk tasks are followed according to procedure, or are automatically aborted if a risk of human injury is detected. Dangerous processes are also quickly being automated to remove the need for operator intervention (and thus human error) as well.

VI. INDUSTRY 4.0 CHALLENGES

Anything that comes with a lot of benefits also has a few challenges. Industry 4.0 challenges include incorporating new technology or process into the organization. Besides, there are some other real-time challenges, such as:

1. Data Security: The first and foremost challenge is to ensure data security. There is a constant threat of cybercrime for many businesses regarding customer data. Switching to the cloud means moving out of their comfort zone – which makes them vulnerable. Data security is the primary concern of cloud-based technologies and Industrial 4.0 technologies.
2. Trained Human Resources: To adopt new technology, the frontline executives need training. Investing in new technology like Industry 4.0 doesn't indicate that you should rely on IT management to maintain systems. Instead, you can benefit from the frequent workforce training and constant guidance that the service provider conducts.
3. Team Support: Having team support is highly crucial when moving to new technology. The new model may be challenging to accept and adopt. You must set clear expectations, state the purpose and the benefits of this investment, and be transparent with the team throughout the implementation.
4. Leveraging Data: Another Industry 4.0 challenge is to leverage information and data and make informed decisions. You need training, knowledge, and documentation to understand the pattern to use data and improve, change, or grow a business.

CONCLUSION

In conclusion, the integration of IoT in Industry 4.0 marks a transformative era, reshaping traditional industrial landscapes into dynamic, interconnected ecosystems. This technological synergy, characterized by advanced sensors, seamless communication protocols, and cloud connectivity, empowers industries to achieve unprecedented levels of efficiency, automation, and data-driven decision-making. As we navigate this fourth industrial revolution, the convergence of IoT and Industry 4.0 not only enhances productivity but also lays the foundation for sustainable, agile, and intelligent manufacturing processes. The ongoing commitment to innovation in this space promises a future where industries continually evolve, adapt, and thrive in the era of connected intelligence.

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2. GREEN TECHNOLOGY - ELECTRIC VEHICLES

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ABSTRACT

Transport is a fundamental requirement of modern life, but the traditional combustion engine is quickly becoming outdated. Petrol or diesel vehicles are highly polluting and are being quickly replaced by fully electric vehicles. Fully electric vehicles (EV) have zero tailpipe emissions and are much better for the environment. The running cost of an electric vehicle is much lower than an equivalent petrol or diesel vehicle. Despite of All those advantages, people not prefer the electrical vehicle because the primary reason why people don't prefer electric vehicles is because of the unavailability of charging stations. Charging stations, unlike petrol bunks, aren't available everywhere. There always exists a fear as to what might happen if the vehicle runs out of battery. People are worried about more straightforward and faster commuting methods in our country rather than saving the Earth from the ill effects caused by pollution. The project mainly deals with a simple solution to make charging stations more accessible. The solution involves using public electricity and solar panels for the easy and hassle-free charging of Electric Vehicles. This paper consists of a scaled down prototype.

A technology that is environmentally friendly in its production, supply chain or usage is referred to as Green Technology or Green Tech for short. Green tech is an umbrella term that continuously develops products, system or equipment's which are less taxing to the natural environment and its resources which limit and diminishes the negative effect of human exercises. The world we live in has a limited amount of natural resources which are referred as Non-Renewable resources or the resources which can be depleted during the course of time. Human activities caused many to already perish from the face of the Earth. According to the estimate Global Footprint Network in 2018, humans are consuming natural resources 1.7% faster than the Earth can replenish. Therefore, the need of the hour is that we as a society should invest in Green Tech as they are: `

a) Less taxing to the natural environment thus reduces the resources depletion.

b) Emission of greenhouse gases (GHG) (CO2, CH4, N2O) is considerably less or zero.

c) Usage of renewable resources (wind, solar) is

encouraged.

Keywords – EV, Petrol Vehicle, Diesel Vehicle, Emission of greenhouse gases, Emission of greenhouse gases

INTRODUCTION

India is one of the top ten automotive markets in the world today and having highly increasing middle-class population with buying potential and the steady economic growth. But petrol price has increased more than 50% in 13 different steps in last two years. Here comes the potential need for alternative technologies in automobiles such as electric vehicles (EV) in India. Although the initial investment is around 1.5 times than conventional IC engine, but time has come when cost of environment is now more of concern than the cost of vehicle. National governments are focusing on R&D and consumer incentives, whereas city governments are supporting infrastructure deployment locally through publicprivate partnerships and other programs. The Global EV Outlook (GEO) finds that global EV sale has increased more than double between 2011 and 2012, exceeding the 100,000 sales milestones. A universal charging station charges vehicles of different companies with different batteries with varying charging capabilities, increasing the demand for EVs and ensuring reliability. The easiest way to acknowledge this concept is that the charging mechanism takes to play by simply altering the Current and Voltage to deliver a specific power required by the battery for fast charging. The controllers perform controlled power delivery. This model is a scaled-down version of the actual, with the systems working exactly.

The setup is continuously monitored and made sure it is a foolproof setup with no chances of electricity being stolen. The device is an IOT based programmable, secure interface providing customers with a plugin for charge when in need. Solar Energy is a sustainable energy source and is an infinite and clean energy source that is free and ecofriendly. So, it is very efficient & free from environmental pollution. The alarming situation of global warming leads to the full adoption of the renewable energy-based transportation system. However, their sustainable deployment at a mass level has been a challenging task. To overcome the above predicament, charging electric vehicles using distributed solar energy would be an excellent solution, resulting in net-zero emissions. Solar power would allow us to move to a green initiative swiftly. The latest technology involving fast charging and better run will result in the increasing usage of electric vehicles. There always lies a hunch in everyone's mind about what might happen if the vehicle runs out of battery. This indirectly leads to choosing a conventional vehicle rather than going pollution-free because the needs are satisfied. In 2020, India was the fifth-largest auto market, with 3.03 million units sold in the passenger and commercial vehicles categories. It was the seventh largest manufacturer of commercial vehicles in 2019.

This chart shows how much carbon dioxide

is produced in a given year. • These figures are based on 'production' emissions (i.e., emissions from the burning of fossil fuels within a country's borders). • These figures look specifically at carbon dioxide emissions – not total greenhouse gas emissions. • Annual emissions can be primarily influenced by population size – we present the per capita figures above.

This chart shows how much carbon dioxide is produced in a given year. • These figures are based on 'production' emissions (i.e., emissions from the burning of fossil fuels within a country's borders).

Fuel/Data	Petrol	Diesel	Electricity
Cost/Liter	Rs. 75	Rs. 60	Rs. 5.75
Consumption	67 Ltr.	83 Ltr.	870 kWh
Range/month	1333 Km	1667 Km	3623 Km
Range/day	44 Km	56 Km	121 Km
Range/year	16000 Km	20000 Km	43478 Km

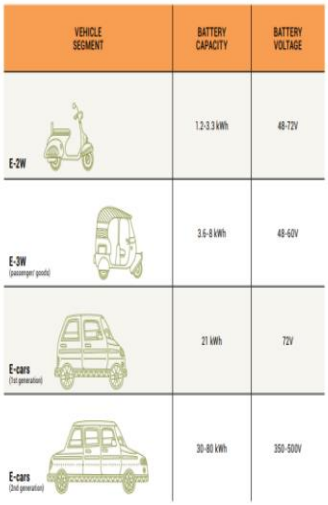

Figure 1

Historical Overview of EVs Modernization

The history of vehicles is varied and long. The first self-propelled car was built and designed by Niclas-Josef Cugnot and M. Brezin in 1769. The first vehicle was based on a steam-power motor carriage that could speed up to 6km/hr -Besides, the steam engine did not last long in the history of the car due to its low-speed constraints and fuel quality. So its history was estimated from 1770 to 1920 -The need to increase the speed of cars created new possibilities to improve the performance of the vehicle. In 1807, Francois Isaac de Rivaz invented the ICE to solve the mobility issue. A mixture of hydrogen and oxygen was used in the ICE to generate propulsion. Several engineers developed ICE systems during this period, but their designs were unsuccessful. This is because of the lack of quality fuel that humanity was experiencing to satisfy internal combustion. Luckily, the advent of EV solved this issue at the beginning of the 1800s It is stated in that EVs started in 1834. In 1859, the first oil was discovered. Therefore, ICEs have been successful from 1885 up until these days. This success is for how much longer than EVs, which are the future. Furthermore, EVs have a long history across generations**.**

Early Age of EV

The first small-scale electrical cars were developed in 1828-1835. This was the future thinking of the community of innovators from Hungary, the Netherlands and the USA. Nevertheless, during this period, people were using horses and buggies as the principal mobility mode. In 1830-1832, Robert Anderson had an idea to design the first crude EV, and Thomas Davenport developed the first battery EV in 1834. This took more than three decades, and electric cars became practicable only in the 1870s or later. The story noticed that this type of EV, in 1884, was built and produced massively by an English inventor, Thomas Parker. During the same century, it was observed in several cities, the first EVs worldwide.

In April 1881, Gustave Trouve, a French inventor, developed the first human-carry EV. Morrison's vehicle was slightly more than an electrical wagon. Therefore, their interest in William's invention sparked EV. This leads to an interesting observation made in 1896 that most early EVs were advertised exactly as carriages. Baker EVs were first produced in 1899. Therefore, EVs gained popularity due to their usage and being environmentally friendly compared to other automobiles.

Development and Implementation of EVs

It presents various benefits that can be used to justify the development and implementation of EVs. The efficient operation of an EV requires intense coordination of different components to produce a mechanical movement. Apart from the main advantages of EVs, as detailed in Fig. 1, high- performance is the principal advantage of EVs that can make the ICE counterparts obsolete shortly. The drawbacks of the electric car can be resolved effectively by the improved technology, which makes the EV the future vehicle. Some relevant advantages of electric cars are high driving response, lower driving and maintenance cost, high torque and power, highly safe, single-speed transmission, and effective traction control.

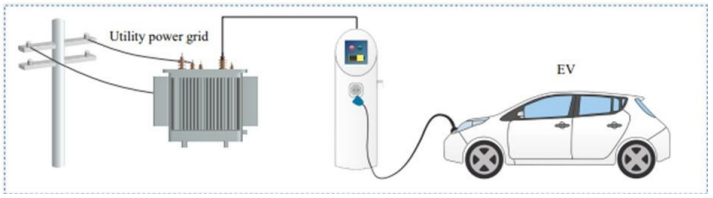

Figure (a)

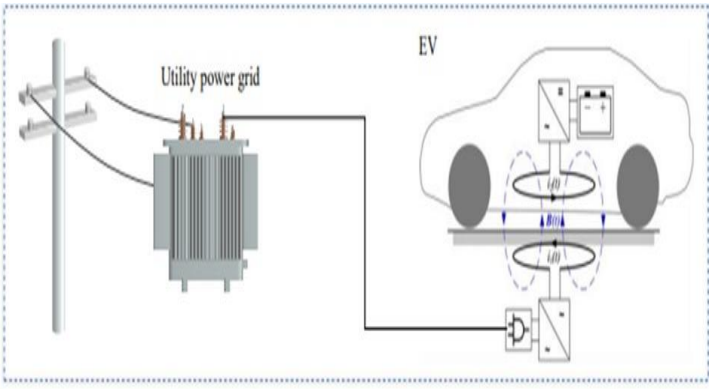

Figure (b)

Figure 2

Electric Motor

The electric motor is the engine of the propulsion system of EVs. Several types of electric motors are used for this purpose. Table 1 classifies different motors used to guarantee the propulsion system of EVs' fallibility. The propulsion system can be based on a single motor or multi-motor drive that can operate with or without gears. The propulsion system design of EV motors, as detailed in Table 1 and specified in Fig. 3, requires an acceptable characteristics relationship between torque and speed, cost-effectiveness, excellent reliability, high efficiency over broad torque.

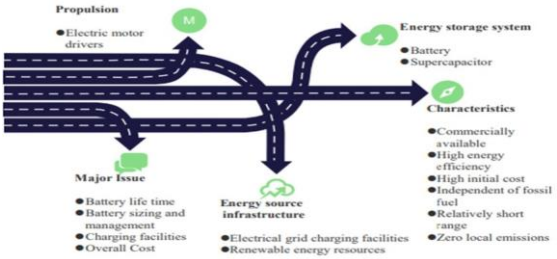

Figure 3

and speed ranges and power ratings. In addition, the EV electric motor needs a higher current density electric machine with the highest standard operation requirements compared to the traditional motor operating at the same power rating. The electric machines of the EV propulsion system can operate either in alternative current (AC) or direct current (DC) based on specified design requirements. Among the AC motors detailed in Table 1, the induction motor, despite being the workhorse of modern industry, is challenging to control the speed of induction motor; thus, it is classified to be the last in the list of matching the requirement of EV's propulsion system. Therefore, a vector-controlled induction motor is used. However, this system presents a lower efficiency at light loads, which is not acceptable for EV propulsion requirements. Therefore, the permanent magnet (PM) brushless DC motors type is the first. These motors have the best power density and torque vs speed characteristics, less maintenance, long life, low electromagnetic interference and quiet operation. Therefore, the AC PM synchronous motor and switched reluctance motor are classified as the second and the third However, DC motors possess several drawbacks, especially regarding electric noise, speed range, power density and operating life. This makes the DC motors less competitive than the induction motor.

Energy Storage System

The energy storage system (ESS) of EVs holds a significant part of electric car performance. The ESS requirements for an excellent rendition of system mobility must be safe in all operating conditions with an incredible life cycle, calendar life or self-discharge, high energy and power den.

Table 2 -

Current type	Model	Technology
Sinusoidal fed AC	Induction Motor	1. Wound 2. Squirrel cage
	Synchronous (PMSM)	1. Surface 2. Interior
Rectangular fed AC	PM Brushless DC	1. Surface 2. Interior
	Reluctance motor	
DC fed	Self-excited	1. Shunt 2. Series
	Separately excited	1. PM excited 2. Field excited

Figure 4

The power sources of electric cars are based on electrochemical energy storage, well known as batteries. The energy storage system (ESS) of EVs also uses electric energy storage. This ESS is called a supercapacitor or ultracapacitor with electrical double-layer capacitors. The battery pack plays a significant role in the design and performance of EVs. About 11 types of batteries can be used in electric car applications, and any battery can be used as a power supply for EV. This has been observed in several EVs developed wide-world. Nevertheless, a battery must meet all requirements for EVs. Table 2 presents the most popular energy storage (ES) technologies in EVs and hybrid electric vehicles (HEV). It also describes their advantages, drawbacks, and essential features for the V2G system. These ES are lead-acid, lithium-ion, nickel-

metal hybrid, and ultracapacitors. The lithium-ion batteries are used in different applications and possess several types, including lithium cobalt oxide, lithium iron phosphate, lithium manganese oxide, lithium nickel cobalt aluminium oxide and lithium nickel manganese cobalt oxide.

CONCLUSION:

The following setup worked effectively and effortlessly with no errors or unwanted functions. The charging of the battery took place, and the time taken with the energy consumption was recorded. There lies no flaws or wastage of electricity as the whole system is monitored throughout the process. Power fluctuations are absent, and the voltage is maintained and regulated with the Integrated circuits and the microprocessor, which play a significant role in ensuring regulated voltage and current flow. This prototype still requires various modifications to make it secure and steal proof. The safety of the battery, the transaction details with specific unit consumption worked without a hitch. The capability of fast charging with both the sources, solar and 220 V power grid energy, must be adapted to shorten the time required for charging. The entire system is a scaled-down model as all the tests carried out were for a small Li-Ion battery of 12V and 10Ah. The charging time was approximately 2 hours 30 mins with adapter and 1 hour 15 mins with solar charging. The device now works with limited sequence and instructions, and delivers power through the switching circuit taken care of by the relay. In conclusion, the switching ON and OFF of the device is secure, and following a set of protocols for the interface between the phone and the EVCS prototype.

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A Review paper on Water Vending Machine

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Abstract: - **The technologies like AI and IoT has changed the human life. Human life is easier now than before. Physical objects connected with smart sensors provide data to make people's life easier. Water vending machine is such type of machine which works like an ATM machine. Water pollution is a big problem in our society. Water vending machine can be a good solution for on this problem. It will provide the best quality of water to peoples in emergency situations. It will also be helpful to reduce the plastic bottle waste.**

Keywords—Water Vending Machine; Water Quality Standard; database; AI; IoT; NodeMCU.

I. INTRODUCTION

Water Vending Machine means any self-service device that upon insertion of money or tokens or upon receipt of payment by other means, dispenses unit servings of water in bulk into a container, without the necessity of refilling the machine between each operation.

The vending machine for drinking water is cheaper than buying it in convenience stores or from a store. It can be found in various locations, such as villages, dorms, and communities. There are many types of vending machines that sell drinking water, and this is a growing business. There are so many different kinds of drinking water vending machines that it can be hard to keep track of all of them. Due to the increasing number of companies that produce and sell drinking water, there is a lack of consistency in the quality of water.

Today's consumers are more accustomed to vending machines that sell drinking water. Compared to the price of buying it at a convenience store or store, this item is cheaper at a vending machine. It can be found in various locations, such as villages, dorms, and communities.

As companies expand their product offerings, they are also looking for ways to improve the quality of their products. Unfortunately, there are not always standards.

for the quality of drinking water. This can lead to illnesses such as dysentery, typhoid, and hepatitis.

Contaminated water can lead to illnesses such as typhoid, dysentery, and food poisoning. Today's consumers are more accustomed to using vending machines that dispense water, and this type of product has become more popular.

II. LITERATURE REVIEW

[1] The setup of a digital system to provide the drinking water from water vending machine is the goal of this project. the system is designed to research and develop a system that can assess the safety and Improve quality of drinking water. The four main elements used by the system for evaluation are pH, water temperature, level measurement and coin detection.

The system is using a controller that has a ESP8266 controller chip, it is main controller in the system. Another microcontroller is being used in this machine i.e., Arduino mega. the module is used to detect coins i.e., ESP32 CAM module.

[2] The quick expansion of the Internet of Things (IoT) and machine learning transforms the world of humans into a smart one. Smart sensors help to make people's lives easier and advanced. In this paper we used different sensors for different applications like level sensor, temperature sensor, and Arduino to do this.

[3] This paper provides us the survey taken on water vending machine in eight locations in Parit Raja was all investigated, one of the main reasons why consumers are willing to pay more for higher-quality drinking water is because of their increased cautions of the quality of tap water. Is the water being in good condition and is in that condition that we can drink it and it does not cause any harm and cause diseases. They are highly confident in the safety, and mineral content of this sort of drinking water because they believe that filtered water quality includes that which is commercially accessible in the market, such as mineral and bottled drinking water, as well as from the drinking water vending machine.

[4] Most of the vending machines nowadays are automated ones since they simplify a variety of tasks and increase their efficiency. The self-service drinking water machine is presented in this work. This machine can serve the customer with a wide range of inputs and outputs. This device resembles a vending machine. The machine is coin-operated. It offers drinking water and only takes coins as input, such as Rs.1, Rs.2, and Rs. 5 in any order. The primary goals of this system are to prevent water waste and environmental degradation by using a water control valve.

[5] In everyday life, boiled water with a set temperature and amount released is frequently used—for example,

when preparing milk with powdered newborn formula. However, there is only one type of fixed-temperature hot, warm, or ice water that can be provided by the water vending machines available on the market. In addition, the the water cannot be automatically stopped when the water fills the cup or bottle where water is being to be stored or used to the level of overflow.

[6] Many vending machines featuring a variety of product options and number selections have been produced in the last few years. They can be separated into categories such as snack, chocolate, food, and glucose water dispensers, among many other types of liquid dispensing vending machines. The main goal is to raise awareness of alteration usage of water among those who reside in areas without access to pharmacists.

[7] Vending machines are among the increasingly convenient things that have emerged in this world because of growth in society. Thus, using a PLC as the bottom machine and King view as the upper computer monitoring screen, this study constructs a basic vending machine control system. The basic vending machine assumes that the currency has been entered and computes and displays the amount of money. The user can choose the things he wants to buy on his own by using the selection button indication, which provides information about the goods that can be sold based on the amount of money. The user hits the button associated with the chosen good to initiate the vending machine after the amount deposited is sufficient to purchase drinks.

III. METHODOLOGY

A. Principle of System

The Drinking Water Vending Machine will be working under the Embedded system and machine learning by a controller included ESP32 CAM Module, ESP8266, Arduino sending data to Firebase for creating a database in Real-time. The system can be noticed about water quality in real-time on its OLED display and it can also display the quality of water on the LCD display, the input is given by 4x4 matrix keyboard. After the payment, the water wending machine will be asked to user how much amount of water you want, the user will give input through matrix keyboard and to it the water will be supplied to the user.

Types of components we in water vending machine that are: - 1). ESP8266 controller, 2). Arduino mega, 3). ESP32 Cam Module. 4). OLED Display, 5). LCD Display, 6). 4x4 Matrix Keyboard, 7). GSM Module, 8). Temperature sensor, 9). pH Sensor, 10). Motor. 11). Power Supply.

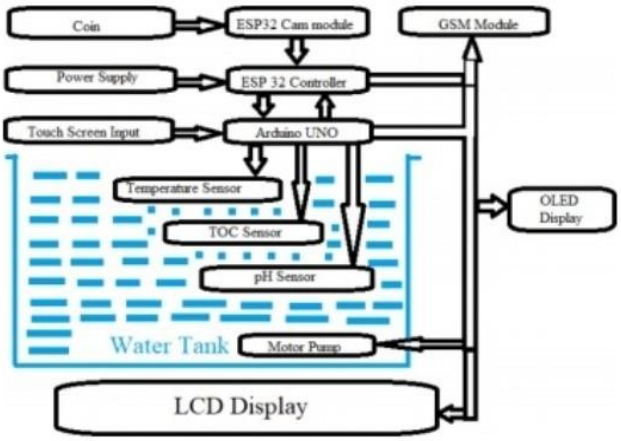

Figure a. Block Diagram of Water Vending Machine

B. Components used-

1. Arduino mega

The Arduino Mega is a microcontroller board with the ATmega2560 IC. It runs at a clock speed of 16 MHz, it has 54 digital I/O pins and 16 analog inputs, and 15 PWM outputs. It has 256 KB of Flash memory for code storage and 8 KB of SRAM, and 4 KB of EEPROM, it provides ample resources for programming and data storage. The board supports various communication interfaces, including UART, SPI, and I2C, enhancing connectivity options. Its USB connection facilitates easy interfacing with computers. Operating at 5V and compatible with a range of shields, the Arduino Mega is a preferred choice for projects demanding numerous I/O pins and expanded memory, making it suitable for applications in robotics, automation, and beyond.
Arduino mega is the main controller used for this project.

Figure b. Arduino mega

2. ESP8266 Microcontroller

The ESP8266 is a popular Wi-Fi module widely used in the field of embedded systems and Internet of Things (IoT) projects. It is Developed by Espressif Systems, this compact module integrates a 32-bit ESP8266 microcontroller with a comprehensive Wi-Fi stack,

allowing seamless connectivity to wireless networks. Operating at 80 MHz or higher, the ESP8266 provides ample processing power for various applications. It comes with GPIO (General-Purpose Input/Output) pins for versatile digital and analog interfacing. The module's ability to function as a standalone microcontroller or as a Wi-Fi-enabled device, coupled with its low cost and energy efficiency, has contributed to its popularity among hobbyists and professionals alike. Additionally, the ESP8266 can be programmed using the Its compact form factor and feature-rich capabilities make it an ideal choice for IoT projects, smart home devices, and other applications requiring wireless connectivity.

ESP8266 is used in this project for wi-fi access and cloud access.

Figure c. ESP8266 microcontroller

3. ESP32 CAM module

The ESP32-CAM module is a compact and versatile development board that integrates the ESP32-S module and a camera. The ESP32-CAM boasts the powerful ESP32 dual-core microcontroller, providing ample processing power for a variety of tasks. The module supports a range of communication interfaces, including Wi-Fi, making it suitable for IoT projects and applications involving remote monitoring or surveillance. With the ability to function as a standalone device or connect to other microcontrollers, the ESP32-CAM offers flexibility for different project requirements. Its compact form factor, affordable price, and feature-rich capabilities make the ESP32-CAM a popular choice for projects involving image capture, streaming, and IoT applications.

ESP32 CAM module is used to detect coin value, whether this coin is real or not etc…

Figure d. ESP32 CAM module

4. OLED display

OLED (Organic Light-Emitting Diode) display is a cutting-edge technology that emits light when an electric current is applied to organic compounds. Unlike traditional LCDs, OLEDs don't need a backlight, resulting in thinner and flexible displays. They offer advantages like flexibility, wide viewing angles, high contrast ratios, fast response times, and energy efficiency. OLEDs are widely used in smartphones, TVs, and wearable devices.

The values of water quality, water pH and temperature of water will be shown on OLED display.

Figure e. OLED display

5. LCD display-

LCD (Liquid Crystal Display) technology utilizes liquid crystals between layers of glass or plastic to control light and generate images. It requires a backlight, with LED and CCFL being common types. LCDs are widely used in devices like TVs and smartphones for their flat and thin display, but they have limitations such as restricted viewing angles.

The input which will be given by the user will be shown on LCD display.

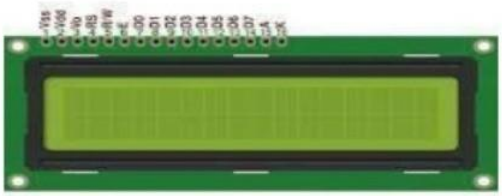

Figure f. LCD display

6. Temperature sensor

This Temperature sensor is used to measure the temperature around what we prepared for example we Build a water vending machine, and this machine is where we can apply like a railway station so what is temperature around the railway station can we apply the water vending machine, so it is used to read the temperature of environment. Temperature sensor is measured air temperature liquid or the temperature of solid matter.

Different types of temperature sensor such as RTD, Thermocouples. RTD stands for Resistance temperature detector it measures Measure temperature by correlating the resistance of a metal with temperature.
Thermocouples Generate a voltage proportional to temperature.
In simple word the temperature sensor is converted the physical signal to electric signal that can be displayed as a temperature reading. It will check temperature of water.

figure g. Temperature sensor

7. Analog Turbidity Sensor: -

Turbidity is a measurement of how cloudy the water is in a river. Anything that makes water cloudy will increase turbidity. It is very important for measured the turbidity to drink the river water. High turbidity, depending on the season, can have negative effects on a lake or river.
It is measured as Nephelometric turbidity units (NTU). A wide range to measure a turbidity is 0 to 1000 NTUs. The WHO (World Health Organization) establishes that the turbidity of drinking water shouldn't be more than 5 NTU and should ideally be below NTU.

It will purify the water in the water vending machine.
The turbidity sensor is used in water vending machine, Rivers, lake wastewater and effluent measurements, control instrumentation for settling ponds, sediment transport research, and laboratory measurements.

Figure h. Analog turbidity sensor

8.Level Sensor

To get required quantity of water in the primary tank there will be a tap in between secondary tank and primary tank. For Rs.1, Rs.2 and Rs.5 coin, there will be separate time allotted for tap to be on and allow water of required quantity to the primary tank. Some different types of level sensor are as follows –

1. Capacitance sensor
2. Ultrasonic sensor
3. Radar sensor
4. Pressure sensor
5. Optical sensor

Level sensors are widely used in various industries for measuring the level of liquid or solid.
. The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place, while point-level sensors only indicate whether the substance is above or below the sensing point. Generally, the latter detect levels that are excessively high or low.

It will measure the level of water in water vending machine.

Figure i.. types of level sensors

9.Surface sensor: -

This sensor is at outlet of drinking water machine. It will open the water outlet when water container is present below it. With this technique we will minimize the wastage of water.

10. pH Sensor: -

pH sensor is one of the most important sensors for measuring the pH and it is used in water quality monitoring. This sensor is use for measured the alkaline and acidity in water and other solution.

In the pH scale the standard pH range is 0-14. When a substance has a pH value of 7 this is considered pH neutral. pH value represents below 7 the pH value is considered more acidic. The pH value above 7 represent higher alkaline. For example, toothpaste usually has a pH of 8-9. On the other hand, stomach acid has a pH of 2.

Figure j. pH sensor

V. Conclusions

Drinking Water Vending Machine aimed to

1) Study and design checking system for drinking quality of drinking water vending machine.

2) Develop drinking water vending machines to have the standard and safety in drinking. The system can automatically purify the water. The system can be alerted the quality of drinking water in Real-Time, the system designed by the automation system included Microcontroller for sending data to its displays. The system can show the temperature of water. The system can be able to provide hot and cold water as per user requirement.

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4. Electric vehicle and Smart Car

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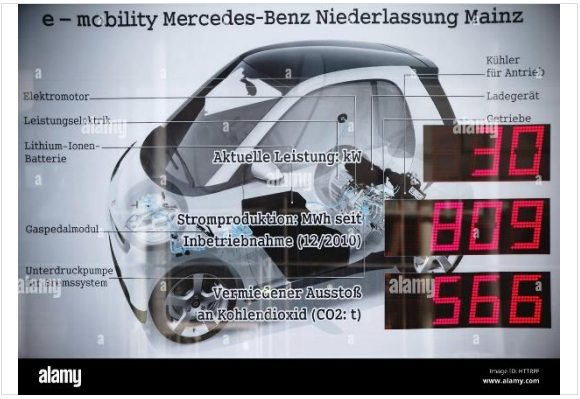
Abstract –

The intersection of electric vehicles (EVs) and smart cars is reshaping the automotive landscape, introducing a new era characterized by sustainable mobility and intelligent connectivity. This paper delves into the intricate symbiosis between these two domains, exploring how their integration not only addresses environmental concerns but also revolutionizes the driving experience. By analyzing the technological intricacies, market dynamics, and societal implications, this study aims to provide a comprehensive understanding of the synergistic potential of EVs and smart cars in shaping the future of transportation.

Introduction-

the rise of electric vehicles and smart cars signifies a pivotal min the evolution transportation, responding to the urgent need for cleaner and more efficient mobility solutions. Electric vehicles contribute to the reduction of greenhouse gas emissions, while smart cars leverage cutting-edge technologies to enhance safety, convenience, and overall driving experience. This paper provides an overview of the key technologies underpinning EVs and smart cars, emphasizing the interconnectedness of these innovations. As society increasingly embraces sustainable and connected mobility, understanding the symbiotic relationship between electric and smart technologies becomes imperative.



Electric Vehicle: -

An electric vehicle (EV) is a vehicle that uses one or more electric motors for propulsion. It can be powered by a collector system, with electricity from extravehicular sources, or it can be powered autonomously by a battery (sometimes charged by solar panels, or by converting fuel to electricity using fuel cells or a generator(Often known as a hybrid)). EVs include but are not limited to road and rail vehicles, and broadly can also include electric boat and underwater vessels (submersibles, and technically also diesel- and turbo-electric submarines), electric aircraft and electric spacecraft .

Types of Electric Vehicles:

a. **Battery Electric Vehicles (BEVs):** - Pure electric vehicles that run entirely on electric power stored in batteries. - No internal combustion engine, and no tailpipe emissions.

b. **Plug-in Hybrid Electric Vehicles (PHEVs):** - Combine an internal combustion engine with a rechargeable battery. - Can operate on electric power alone or switch to the internal combustion engine when needed.

c. **Hybrid Electric Vehicles (HEVs):** - Use a combination of an internal combustion engine and an electric motor. - The electric motor assists the engine, but the vehicle cannot run solely on electric power.

d. **Fuel Cell Electric Vehicles (FCEVs):** - Use hydrogen fuel cells to produce electricity, powering an electric motor. - Emit only water vapour and heat as by-products.

Major Components of an Electric Vehicle:

a. **Electric Motor:** - Converts electrical energy from the battery into mechanical energy to drive the vehicle.

b. **Battery:** - Stores electrical energy for powering the electric motor. - Lithium-ion batteries are commonly used due to their high energy density.

c. **Power Electronics:** - Convert and control the flow of electrical energy between the battery and the electric motor.

d. **Charging System:** - Includes onboard chargers for AC charging and DC fast chargers for rapid charging.

e. **Controller:** - Manages the flow of electricity between the battery and the motor, ensuring efficient performance.

Benefits of Electric Vehicle: -

Environmental Benefits:
Reduced Emissions: EVs produce zero tailpipe emissions, contributing to improved air quality and reduced greenhouse gas emissions, especially when charged using renewable energy sources.
Higher Efficiency: Electric motors are generally more efficient than internal combustion engines, leading to better energy conversion and reduced energy waste during operation.

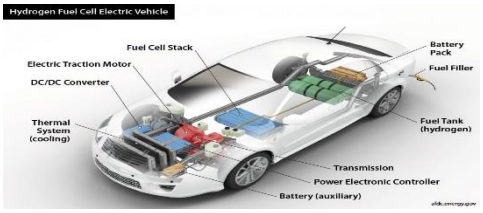
Reduced Operating Costs:
Lower Fuel Costs: Electricity is often cheaper than gasoline or diesel on a per-mile basis, resulting in lower fueling costs for EV owners.

Government Incentives:
Tax Credits and Rebates: Many governments around the world offer financial incentives to encourage the adoption of electric vehicles, such as tax credits, rebates, and reduced registration fees.

electric vehicles towards Smart Car:

Smart Electric vehicle -

An electric smart car primarily relies on electricity for power, eliminating the need for traditional fuel like gasoline. it is equipped with an electric motor and a battery pack, and when charged, the vehicle can run purely on electric power. this not only reduces dependence on fossil fuels but also contributes to lower carbon emissions, making it an environmentally friendly option. challenges of implementing electric vehicles.



Features of Smart Electric Vehicle:

For the most part, the vehicle leaves the assembly line with much of the capability that is required to gather data for an IoT solution. Each sensor, module and control system is able to report its status via an on-board connector, such as the ODBII connector on most passenger vehicles. The first addition to enable communication is to be able to take the data that is produced and bring it into your IoT application**.**

Passcode Protected Engine Access System:

This sub-project provides security for the user. The user will be prompted to carry a key with an embedded keypad and will be allowed to enter the password. On the successful entry, the user will be provided access to the engine or motor. If the user enters an invalid password, the engine would not start, hence will not be provided the engine or motor access. This microcontroller based security project can be used in both diesel and electric cars.

Cruise Control

In that case of long drives on highways, constant speed might be required for charge optimization. Thus, without accessing the accelerator the digital-switches are used for speed control. Various switches are used for various speeds. The motor runs at a particular speed until we apply the brake or any other alteration done to the dynamics of the vehicle. Pulse Width Modulation (PWM) method is used to vary the speed by varying the duty cycle of the converter.

This project will definitely help in long drives. Addition of sufficient features would improve its reliability further. Incorporating artificial intelligence where a car can automatically vary the speed in continuous iterations may be one among the aforementioned.

Battery Monitoring System:

A battery management system for an electric vehicle is a low-cost electronic system which takes care of the rechargeable battery by protecting it from operating outside its safe operating area, monitoring its state, preventing its leakage and keeping a check on the occurrence of defects.

Hence, a common man can afford to purchase such a system to maintain his car's battery, as the overall cost of manufacturing and production is minimal.

Autonomous Driving:

Advanced driver-assistance systems (ADAS) provide features like adaptive cruise control, lane-keeping assistance, and automatic emergency braking.

Some smart EVs may offer semi-autonomous driving capabilities, such as self-parking and highway autopilot.

Infotainment Systems:

Touchscreen Displays: Large touchscreen interfaces for navigation, entertainment, and vehicle control.
Voice Recognition: Allows drivers to control various functions using voice commands.
Smartphone Integration: Integration with mobile devices for seamless connectivity and control.

Energy Management

Battery Management: Allows owners to monitor the battery status, temperature, and charging status remotely.
Some smart EVs feature systems to optimize battery performance and longevity.

Charging Solutions

EVs may offer smart charging features, allowing users to schedule and optimize charging times for

cost savings or to take advantage of renewable energy sources.
Integration with navigation systems to find nearby charging stations.

Cyber security
Security Features: Robust cybersecurity measures to protect against potential hacking or unauthorized access to the vehicle's systems.

Customizable Settings
Personalization: Smart EVs often allow drivers to customize settings such as seat positions, climate control preferences, and ambient lighting.

Intelligent Navigation: Uses historical and real-time data to provide predictive routing based on traffic conditions, charging station availability, and user preferences.

Connectivity:
Smart cars often have the ability to connect to the internet, allowing for features such as real-time navigation, traffic updates, and remote vehicle monitoring.

Sensors and Cameras
Advanced sensors and cameras are employed for various purposes, such as collision avoidance, lane departure warnings, and parking assistance.

Challenges for Smart Electric Vehicle

Range Limitations
While advancements in battery technology are improving the range of electric vehicles, some consumers may still be concerned about the range compared to traditional vehicles, especially for long-distance travel.

Charging Speed
The time required for a full charge can be longer compared to refueling a traditional vehicle with gasoline. While fast-charging stations are addressing this issue, further improvements are needed for widespread acceptance.
Energy Source Impact:
The environmental benefits of smart EVs depend on the energy source used for electricity generation. If the electricity comes from fossil fuels, the overall impact on greenhouse gas emissions may be less significant.

Cybersecurity Risks:
The increased connectivity in smart EVs introduces cybersecurity risks, including the potential for hacking and unauthorized access. Ensuring robust cybersecurity measures is essential to protect user data and vehicle systems.

Technological Fragmentation:
The rapid evolution of technology in the automotive industry may lead to fragmentation, making it challenging for interoperability between different smart EV systems and platforms.

Conclusion:
In conclusion, electric smart vehicles represent a transformative shift in the automotive industry, offering a promising solution to address environmental concerns, enhance energy efficiency, and introduce advanced technologies for a smarter driving experience. The combination of electric propulsion and smart features opens up new possibilities, but it also presents various challenges that need to be addressed for widespread adoption. Here are key points to consider.

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5. E-PAPER TECHNOLOGY AND NANOTECHNOLOGY

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Abstract-*In this paper we explain about E-paper technology and Nanotechnology. E-paper technology made up of flexible material, requiring ultra-low power consumption, cheap tomanufacture and most importantly, easy and convenient to read, e-paper of the future are just around the corner, with the promise to hold libraries on a chip and replace most printed newspapers before the end of decades. Electronics paper (E-PAPER) is a portable. Nano-technology can be defined as science and engineering involved in the design, synthesis, characterization, and application of material and devices whose smallest functional organization in the at least one dimension is one the nano-meter scale or a one billionth of a meter nanotechnology and nano-engineering stand to produce significant scientific and technological advance in diverse fealds including medicine & physiology*

Keywords- ARM, Electronic paper, E-ink, Invention, printing, print Media Nano technology, Nano material drugdelivery.

I. INTRODUCTION

Electronic paper, e-paper or electronic ink display is a display technology designed to mimic the appearance of ordinary ink on paper.

Unlike a conventional flat panel display, which uses a backlight to illuminate its pixels, electronic paper reflects light like ordinary paper. It is capable of holding text and images indefinitely without drawing electricity, while allowing the image to be changed later. To build e-paper, several different technologies exist, some using plastic substrate andelectronics so that the display is flexible. E- paper has the potential to be more comfortable to read than conventional display. This is due to the stable

Nanotechnology and Nano engineering stand to produce significant scientific and technological advances in diverse fields including medicine and physiology. In a broad sense, they can be defined as the science and engineering involved in the design, syntheses, characterization, and application of materials and devices whose smallest functional organization in at least one dimension is on the nanometer scale, ranging from a few to several hundred nanometers. A nanometer is onebillionth of a meter or three orders of magnitude smaller then a micron, roughly the size scale of a molecule itself.

II. PROPOSED SYSTEM

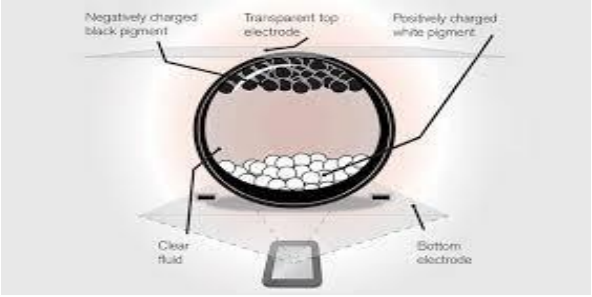


Fig.E-Paper Technology

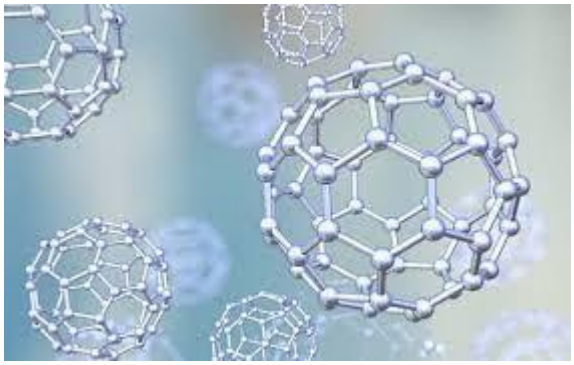
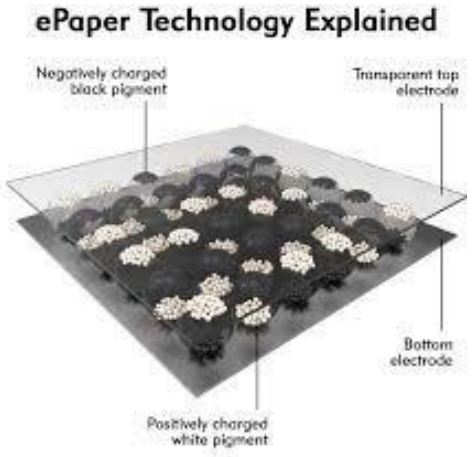


Fig. Nano technology

III. TECHNOLOGY BEHIND E-PAPER

The E-Paper is also called Electronic Paper or Electronic ink Display. The first E-Paper was developed in 1974's by Nicholas K Sheridon at Xerox's Palo Alto research centre. The first E-Paper is Gyricon, it is based on a thin sheet of flexible plastic containing a layer of tiny plastic beads each encapsulated in oil and it rotate freely. Gyricon consisted of polyethylene spheres between 75 and 106 micrometersacross. Each sphere is a Janus particle composed of negatively charged black plastic on one side and positively charged white plastic on the other. An E-Paper has two different parts front plane and back plane. The front plane consists of E-Ink and backplane consist of electronic circuits. To form an E-ink electronic display the ink is printed onto a plastic film that is laminated to a layer of circuit. Other form of E-ink with improve properties compared to Gyricon is Electrophoretic. When current is applied, allthe black particles will migrate to one side, andall the white to the other. Switch the field, and the capsule will change color. This enables switching between all black particles and all White particles on the transparent front electrode of the cell or microcapsule. This is how the high contrast ratio of electrophoretic display is created.



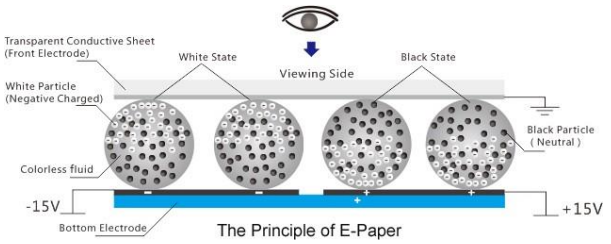
TECHNOLOGY BEHIND NANO-TECHNOLOGY

Nanotechnology involves manipulating materials at the nanoscale, typically at dimensions less than 100 nanometers. Key technologies include scanning probemicroscopy for imaging and manipulation, molecular self-assembly for creating structures, and various lithography techniques for patterning at the nanoscale. Additionally, advancements in nanomaterial synthesis, quantum dots, and nanoelectronics contribute to the field's progress. It's a multidisciplinary area combining physics, chemistry, biology, and engineering to explore novel properties and applications at the nanoscale.

WORKING OF E-PAPER

E-paper comprises two different parts, the first is electronic ink, sometimes referred to as the ‘frontplane’, and the second is the electronics required to generate the pattern of text and images on the E-ink page, called the ‘backplane’. Over the years, a number of methods for creating e-ink has been developed. The Gyricon E-ink developed in the 70s byNick Sheridon of Xerox is based on a thin sheet of flexible plastic containing a layer of tiny plastic beads, each encapsulated in a little pocket of oil and thus able to freely rotate within the plastic sheet. Each hemisphere of a bead has a different color and a different electrical charge. When an electric field is applied by the backbone, the beads rotate, creating a two colored pattern. This method of creating E-ink was dubbed Bichromal front plane. Another such technology is electrophoretic front plane developed by the E-ink Corporation. Electrophoretic front plane consists of millions of tiny microcapsules, each approximately 100 microns in diameter (about as wide as a human hair). Each microcapsule is filled with a clear fluid containing positively charged white particles and negatively charged black particles. When a negative electric field is applied, the while particles move to the bottom of the capsule and are thus hidden from view. When a positive electric filed is applied, the black particles migrate to the top and the white particles move to the bottom generating black text or a picture. The brightness and

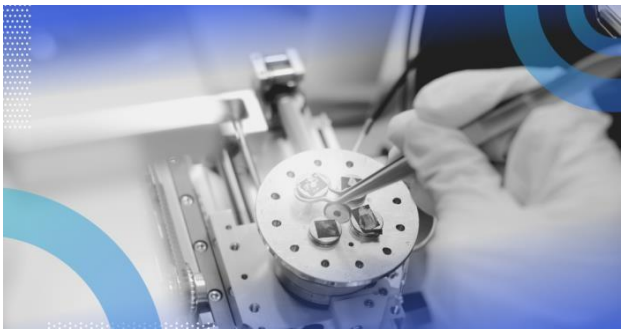
resolution of electrophoretic based E-ink is better than that of bichromal-based E-ink, but both are monochromatic in nature. To create color, E-ink joined hands with the Japanese company Toppan printing which producescolor filters.



The Principle of E-Paper

Working of nano technology

Nanotechnology operates by manipulating materials at the nanoscale, typically dimensions ranging from 1 to 100 nanometers. This involves both "bottom-up" approaches, where smaller components self-assemble to form larger structures, and "top-down" methods, which entail the reduction of larger structures to nanoscale dimensions. Techniqueslike scanning probe microscopy enable precise control and visualization at this tiny scale. At the nanoscale, materials exhibit unique properties due to quantum effects, influencing their mechanical, electrical, and optical characteristics. Nanotechnology spans diverse fields, including medicine, electronics, energy, and materials science. Applications range from targeted drug delivery systems and nanoelectronics to advanced nanocomposites and highly sensitive nanosensors. Despite its promising potential, nanotechnology faces challenges related to environmental impact, health considerations, and ethical issues, prompting ongoing research to ensure its responsible and sustainable development



Instead of manufacturing materials by cutting down on massive amounts of material, nanotechnology uses the reverse engineering principle, which operates in nature. It allowsthe manufacturing of products at the nano scale, such as atoms, and then develops products to work at a deeper scale.

IV. Advantages of e-paper technology

Electronic Paper offers several advantages over printed paper. For example, you can use electronic bookmarks, choose you preferred level of magnification, you can also use search to find information quickly, and you have the option to print on to real paper if required.

Advantages of electronic paper include low power consumption (power is drawn when the display is updated), flexibility, and better readability than most displays. Electronic-ink can be printed in any surface, including walls, billboards, product labels, and T-shirts. The ink flexibility would also make it possible to develop roll-able displays for electronicdevices. Also this display like in a brighter sunlight condition you can see each & every detail, each & every image, each & every design/diagram/layout in a very crystal clear manner.

Advantages of nanotechnology

The advantages of Nanotechnology are lowers costs, produces stronger and lighter wind turbines, improves fuel efficiency and, thanks to the thermal insulation of some nanocomponents, can save energy. The properties of some nanomaterials make them ideal for improving early diagnosis and treatment of neurodegenerative diseases or cancer.

Using nanotechnology, materials can effectively be made stronger, lighter, more durable, more reactive, more sieve-like, or better electrical conductors, among many other traits. Nanotechnology can be used to design pharmaceuticals that can target specific organs or cells in the body such as cancer cells, and enhance the effectiveness of therapy. Nanomaterials can also be added to cement, cloth and other materials to make them stronger and yet lighter.

V. Application of e-paper technology

Smart Office :E-paper displays are proving beneficial in digital signage solutions forsmart offices like employee ID badges that can store and display personal info and access credentials electronically without power consumption. Meeting room labels powered by E-paper help book meeting rooms efficiently while alerting about room capacity.

2. **Smart_Education:** Interactive E-ink displays are enhancing digital learning withapplications such as e-notebooks that support digital note-taking and storing lesson content with minimal eye strain. Interactive whiteboards with E-paper technology enable new collaborative teaching methods whilebeing eco-friendly.

3. **Smart Retail:** Electronic shelf labelspowered by electronic paper display technology allow hyperlocal, real-time pricing updates on shelves from a central control system. This helps retail outlets change prices dynamically based on time, location, inventory, and campaigns to drive more sales through engaging product displays.

4. **Smart Healthcare:** Bedside E-paper labels provide care teams access to correct patient information right at the bedside for privacy and accuracy. Applications such as E- workbooks can also be used to store and share medical records electronically, which reduces menial paperwork.

5. **Smart Transportation:** Applications like electronic bus schedules and maps at stations utilize E-paper display technology with battery backup to assist commuters in easily finding routes and timing without wasting energy on outdoor signage.

6. **Smart Advertising:** Large format E-paper signage for wayfinding and announcements is replacing wasteful traditional displays paper-like experience at malls, airports, and public.

Application of nanotechnology

Electronics: Carbon nanotubes are close to replacing silicon as a material for making smaller, faster and more efficient microchips Graphene's properties make it anideal candidate for the development of flexible touchscreens.

Energy: A new semiconductor makes it possible to manufacture solar panels that double the amount of sunlight converted into electricity. Nanotechnology also lowers costs, produces stronger and lighter wind turbines, improves fuel efficiency and, thermal insulation of some nanocomponents, can save energy.

Biomedicine: The properties of some nanomaterials make them ideal for improving early diagnosis and treatment of neurodegenerative diseases or cancer. They are able to attack cancer cells selectively without harming other healthy cells.

Environment: Air purification withions, wastewater purification with nanobubbles or nanofiltration systems forheavy metals are some of its environmentally- friendly applications. Nanocatalysts are also available to make chemical reactions more efficient and less polluting.

Food: In this field, nanobiosensors could be used to detect the presence of pathogens in food or nanocomposites to improve food production by increasing mechanical and thermal resistance and decreasing oxygen transfer in packaged products.

Textiles: Nanotechnology makes it possible to develop smart fabrics that don't stain nor wrinkle, as well as stronger, lighter and more durable.

VI. CONCLUSION

Today, paper remains the most popular document medium because of its credibility, tangibility, ease of use, flexibility, portability, and compatibility which has made it difficult to replace. Even with the prevalence of computers

and online documents, the paperless office is more distant than when it was proposed. Sheridon believes that E-paper will eventually be able to make power hungry desktop displays obsolete and help make heavy back-breaking textbooks something school children might learn about in a history class on their lightweight E-readers.

Nanotechnology has the potential to revolutionize our lives. This is because it presents almost unlimited potential to make remarkable changes in virtually all fields ranging from medicine, computer technology, construction, environmental remediation, food industry, to new energy sources. Nanotechnology is an emerging field in which new and innovative tools are being developed to tackle issues of water, air, and soil pollution. Nanomaterials are being functionalized with organic and inorganic materials to make them more useful for biosensing, environmental remediation, disease diagnosis, and much more.

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6. Diagnosis of Wear and Tear of Drill Bit Used inDental Operation Using IOT.

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***Abstract*— When dentist drill the teeth using dental drilling bit (bur), while in continuous use the drill bit undergoes wear and tear due to friction, if such worn bit is used during practice, there are chances that it gets break and stuck inside the teeth of patients and for removing that stucked bit some surrounding area of the teeth has to be operated and the problem increases. So, to prevent this, we're working over it to detect its usability.**

Keywords—Drill bur, Microcontroller, LCD display, GSM (IOT)

I. INTRODUCTION

The diagnosis of wear and tear in dental drill bits is crucial aspect of maintaining the quality and safety of dental procedures. Dental drill bits are essential tools used bydentists for tooth preparation, cavity shaping, and removal of decayed material. Over time, drill bits' experience wear and tear due to the abrasive nature of dental materials and the repetitive nature of their use. Up till now, this diagnostic process involves careful observation and assessment of the drill bits' physical condition and performance. In our project, we will delve into thekey indicators of wear and tear in dental drill bits, the importanceof regular maintenance, and the potential consequences of using worn drill bits. By maintaining a keen awareness of these factors, dental professionals can uphold the highest standards of practice and provide effective treatment for their patients.

Wireless technology has great potential for monitoring different bur wear conditions with better accuracy than the current system. Thus, the benefit of dental doctors is to produce a better decision support system that allows users to maximize productivity to improve the quality of dental drill bits. This paper discusses the implementation of monitoring dental drill bur parameters, namely resistance, real-time using Wireless communication with radio waves.

II. STATE OF THE ART

A. IoT-based Monitoring System

The topic of IoT is now interesting for many companies whoknow that this field has potential for development in the future. This has led to the development of new platforms and proprietary benefits. While IoT incorporates many technologies designed for different purposes such as GSM, Bluetooth, LTE,Wi-Fi, it also uses many technologies and networks specifically designed for IoT. For example, these are; SigFox, Lora WAN, IEEE P802.11ah (Low Power Wi-Fi), Dash 7 Alliance Protocol1.0, RPMA, nWave. The drill bit monitoring system records drill bit resistance, voltage drop and other data. The performance of dental materials is affected by wear detection equipment. This information is converted into information by the application that uses the care services, and the user (doctor, e.g. dentist) is giventhe necessary information about the difference between the services [6]. The composition of the Internet of Things can bedivided

into three parts: objects, cloud and network. Smartdevices and smart local machines connect directly to the physicalworld, forming the “end” (also called the “front”) of the Internetof Things. Cloud computing platform provides computing, storage and other services, carries out the integration process andintelligent analysis of the information needed by products, andcompletes the management to form the "cloud" (also known as the "backend") of the Internet of Things. The communicationinfrastructure of the construction and the cloud platform constitutes the “network end” of IoT

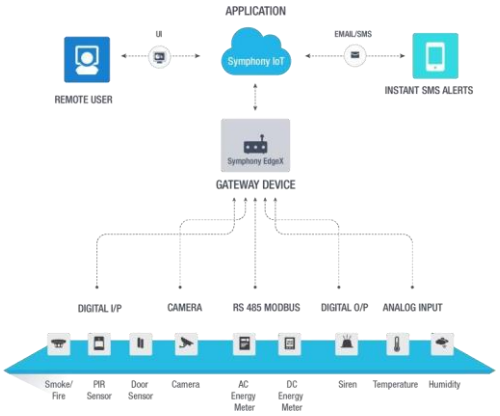
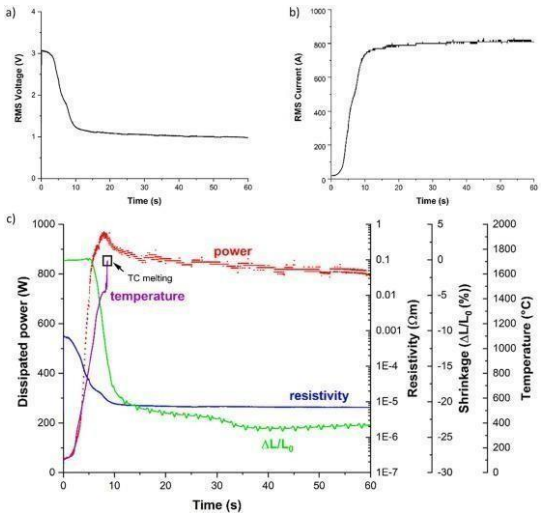


Fig 1. IOT architecture

B. Flash event in pure tungsten carbide

The use of alternating current for the WC (tungsten carbide) green structure causes its electrical properties to change rapidly. As can be seen, the voltage decreases from approximately 3V to 1V, while the current increases from 40A to 800A in less than 10 seconds. This behavior corresponds to a rapid change in the energy of the material, which simultaneously decreases by three orders of magnitude from 6.7x10^-3Ωm to 7.6x10^-6Ωm; the test will then continue almost indefinitely until rejected. As a rule, power absorption reaches a maximum of 1000W (9800mW/mm3) and then decreases slightly to 850W. As detailed in the picture. The sudden change in the resistance of the product as shown in Fig. 2 also includes (i) the rapid increase of its temperature reaching 1720 °C as evidenced by the melting of the thermocouple tip and, more importantly, ,
(ii) The sample suddenly decreased in the first 10-12 seconds (about 20%). The estimated heating rate is quite high; the average is 20,000 °C/min in the first 9 seconds and reaches a maximum of 50,000 °C/min. The actual experience of what happens during the rapid change of energy distribution is like the temperature increase of the product, which can be seen directly from the zirconia mold. For reference, a similar temperature (approximately 104°C/min) was predicted during thermal escape of flash-fired ceramics. Based on the features mentioned so far, the observed phenomenon can be described as resistive flash sintering (ERFS).



C. Microcontroller

The microcontroller used in our project is PIC18F25K22. Microchip's PIC18F25K22 is a 28-pin DIP microcontroller. The PIC18F25K22 controller provides all the benefits of the PIC18 microcontroller family (high performance at an affordable price) with the addition of advanced Flash programming. The PIC18F and K Series product families feature innovations that make these microcontrollers the perfect choice for many high- performance, power-saving applications. The Analog-to-Digital Converter (ADC) in our 18F25K22 microcontroller has more than 12 ADC channels. The Analog-to-Digital Converter (ADC) provided in our microcontroller 18F25K22 can convert the analog input signal into a 10-bit binary representation of the signal. Microchip's microcontrollers have analog inputs multiplexed with a sample and hold circuit. The output of sample and hold is connected to the input of the ADC. The ADC produces a 10-bit binary result from the completed prediction and stores the converted result in the ADC register

It retains the following features:

✓ Up to 1024 bytes of EEPROM data
✓ Up to 64 KB of system program memory
✓ Up to 4 KB of data output memory
✓ 10-bit resolution
✓ 12 analog input channels auto capture function
✓ Hibernate conversion can be done at this time

Fig 3. PIC uc

D. LCD Display

The electronic hardware used to display information and messages is called LCD 16×2. As the name suggests, since thereare 16 lines and 2 lines, a total of 32 characters can be displayed. (16×2=32) and each character will have approximately 5 × 8 (40) pixels. So all pixels on this LCD will be calculated as 32 x 40, otherwise it will be 1280 pixels.

It has the following features:

- ✓ The operating voltage of this meter is 5V
- ✓ The image frame is 7.2 x 2.5cm
- ✓ The maximum operating current when recording pixels is100mA
- ✓ The PCB size of the module is 8.0L x 3.6W x 1.0H dir cm
- ✓ HD47780 Based on controller
- ✓ Green or blue light available
- ✓ 2 lines and 16 lines available
- ✓ Number of LCD pins – 16
- ✓ All visible symbols – 32
- ✓ Ability to work in 4-bit and 8-bit format
- ✓ Pixels per symbol Squares 5 x 8 pixels
- ✓ The size of the symbol is 0.125 width x 0.200 height.

Because of all these features, an LCD monitor was used in our project. Below figure shows the LCD Display.

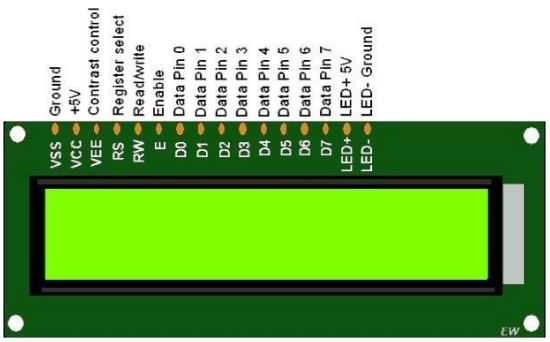


Fig 4. LCD Display

E. Dental Burs

There are many different types of dental burs on the market, each with unique advantages. Some work better in certain aspects, but choosing the right one is crucial to the commercial success of your development.

Types of Dental Burs are:

- ✓ Diamond Bur.
- ✓ Tungsten-Carbide Bur.
- ✓ Ceramic Burs.
- ✓ Stainless Steel Burs.

Diamond burs allow faster, smoother cutting and use in situations where cutting requires precision. Diamond burs with finer grit produce a higher degree of polish and are therefore better suited for precision work rather than removing large chunks of material. Diamond Burs have a stainless steel working part coated with fine diamond crystal which is defined as the rotary grinding instruments for hard tissues such as bones and tooth. Diamond Burs are used for connecting with dental hand piece. It can also be used for grinding metal, plastic, porcelain and other hard materials .It withholds the following features:

It withholds the following features:

- Diamond Burs are used by connecting to dental hand-pieceand rotates to grind hard materials and tissues etc.
- It is the dental diamond burs with stainless steel shank andnon-sterile instrument.

It consists of the following Main materials:

a) Metal base: Stainless steel (including nickel and chromium)

b) Working part: Fine diamond crystals attached to metal base(including nickel and chromium)

c) Shank: Stainless steel (including nickel and chromium)

III. DESIGN & METHODOLOGY

The main and controlling unit is a microcontroller (PIC18F25K22) and

behaves as the central unit for the whole system, its interfaces which connected with the sensor chip at the input end for gathering current readings and interfaces which connected with the wireless module at the output to transmit the sensed information towards cloud usingInternet. The microcontroller polls the sensor to retrieve information and transmits using the Internet to Thing-Speak application

IV. PROPOSED WORK PLAN

- Consulting Dentists & discuss on the problem statement.
- Study of various drill bits used in surgical.
- Acquiring data regarding Wear & Tear, life of use. Of drillburs.
- Gathering information of different Testing procedures for weardetection.
- Gathering information of various Control circuits & sensors.
- Writing a Embedded code to detect & display the % of wear.
- Prototype will be made as follows:

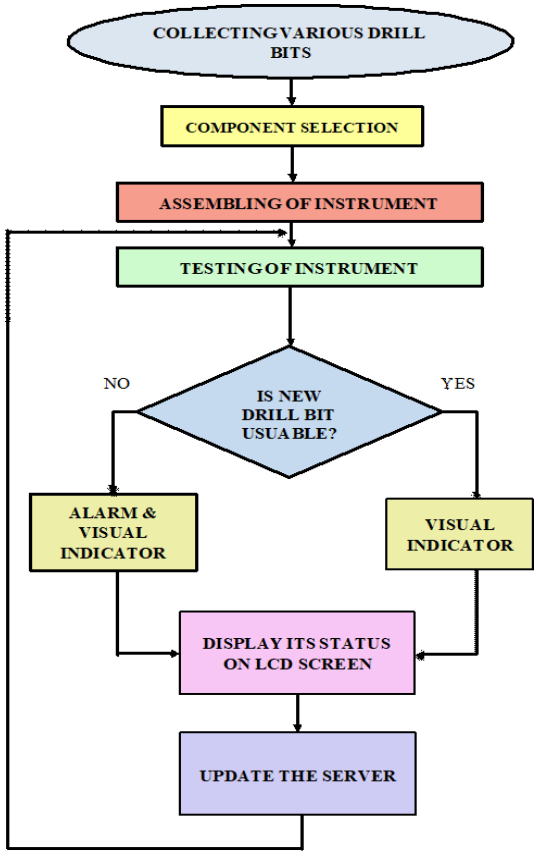


Fig 6. Methodology Flowchart

Resistance of a drill bit will be measured by applying ohm's law. If the amount of current flowing through a conductor (in this case, a drill) is known, a change will cause a change in voltage. This power change is directly proportional to the wear of the drill bit. A microcontroller with internal/external ADC will be used to measure the voltage change. Also the measurement will be related to the wear of the drill bit. Drill parts of various sizes will be checked for wear. PROPOSED BLOCK DIAGRAM

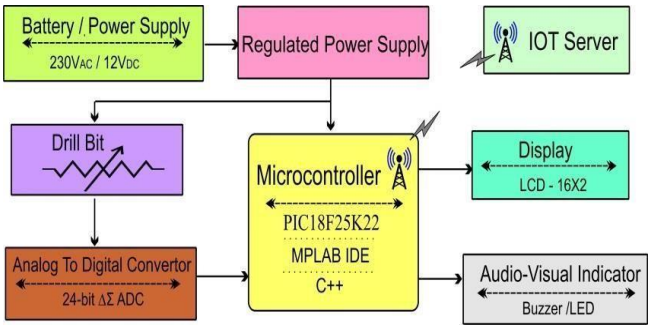


Fig 7. Block Diagram

V. CONCLUSIONS

We successfully evaluated bur wear on small drill samples of various sizes using the framework proposed in this paper. The output value of the microcontroller is captured in the cloud. These results reflect the dental report (information sheet) provided by the manufacturer. We made all results on puncture resistance instantly available in the cloud (Internet of Things platform) to anyone with valid credentials. This site is useful fordentists to easily track smartphone malfunctions and API credentials are available. Therefore, cloud-based real-time analysis of dental burs has been successfully implemented. This framework is very useful for dentists to easily perform dehumidification instead of traditional maintenance/analysis.

VI. ACKNOWLEDGMENT

First of all, we would like to thank our mentor, Professor Yogesh Gawali, who inspired us. He encourages us to use our imagination and asks us to do this without distraction. His extensive knowledge, experience and expertise in the field of

electronics and communications enabled us to complete this project. This effort would not have been possible without his help and interest. We couldn't have asked for a better mentor in our training. This measure would not be possible without everyone's cooperation. We were always there to support each other and that's why we were together until the end. Dr. Krutika Borle from Ranjit Deshmukh Dental College, Nagpur contributed to our BDS, MDS (Dentistry 1st Year) project also a very special thanks to Mr. Yogesh Khapekar, Director, YRK Controls for his technical support. I would like to express my gratitude to my parents, siblings and best friends for their love, affection, endless courage and pain devoted to my education. I am very grateful to all my friends at GH Raisoni who supported me in every situation and made my stay here unforgettable. I am thankful to all my friends and relatives for their support. I am also grateful to everyone who contributed directly or indirectlyto this project. Finally; I believe that this work will not end if I do not thank God, which is the advice of all the informants who eliminated my bag of ignorance with the light of knowledge.

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7. Classroom of the Future: AI's Game-Changing Role in Shaping Education

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ABSTRACT

The Paper" The **Classroom of the Future**," offers a comprehensive exploration of the role of artificial intelligence (AI) in education. It provides an insightful exploration of the intersection between artificial intelligence (AI) and education, offering a comprehensive overview of the history, applications, and potential impact of AI in the classroom of the future. It delves into the origins of AI, tracing its development from the 1940s to the present day, and highlights its role in revolutionizing various sectors, including healthcare and entertainment. The document also showcases specific AI tools andtechnologies tailored for the education sector, such as AI-powered teaching assistants, gesture recognition technology, and adaptive learning systems. Furthermore, it discusses the pros and cons of integrating AI into education, emphasizing the importance of responsible usage and the preservation ofthe educator's essential role. It presents a compelling narrative of AI's evolving presence in education and its potential to enhance learning experiences while emphasizing the need for thoughtful implementation and ethical considerations. Overall, the document provides a thought-provoking overview of AI's evolving presence in education and its potential to revolutionize the classroom of thefuture.

What is AI?

The history of artificial intelligence (AI) dates back thousands of years, AI began to take shape in the 1940's with the invention of programmable digital computer. Alan Turing, a British polymath, conducted substantial research in the field and coined the term "MACHINE INTELLIGENCE".

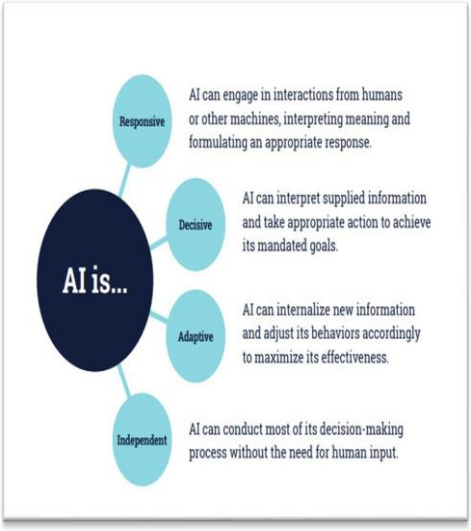
In 1956, the field of AI research was founded at a workshop held at Dartmouth College, where scientists discussed the possibility of building an electronic brain. In the workshop proposal, McCarthy used the term artificial intelligence for the first time They believed that a machine as intelligent as a human would exist within a generation and received millions of dollars in funding to make this vision a reality.

Artificial Intelligence is a specialty within computer science that is concerned with creating systems that can replicate human intelligence and problem-solving abilities.

Consider an AI-powered email spam filter. Traditional filters rely on predefined rules to identify spam. However, an AI-based filter learns from your behavior and email content. As you mark emails as spam or move them to the inbox, the AI observes patterns and refines its filtering criteria.

- ✓ Before we dive into AI's function in the education space, let's define this technology in general terms.
- ✓ Artificial intelligence allows machines to execute tasks that have traditionally required human involvement.
- ✓ In simple words, AI is the science of making machines that can think like humans

Role of an ai in various sectors: -



Artificial Intelligence (AI) has been transforming various industries and aspects of modern life, from healthcare to entertainment, and from transportation to education. The impact of AI is vast, and it has become an essential part of an everyday life.

- *AI in Cyber Security:*

AI is playing a crucial role in cybersecurity, detecting and preventing cyberattacks in real-time. It can analyze network traffic, identify anomalies, and block threats. This technology can also monitor social media, identify fake news, and prevent phishing attacks.

- *AI in Health Care :-*

AI has revolutionized the healthcare industry by providing more accurate diagnoses, developing more effective treatments, and improving patient outcomes. AI can analyze large datasets of medical records, images, and genetic information to identify patterns and predict diseases. AI is also being used to develop new drugs and personalized treatments, leading to more effective and targeted care.

- *AI in Entertainment:*

The entertainment industry is also being impacted by AI, it is used to create personalized playlist, identify trends, and optimize user experiences. In the gaming industry, AI is used to create more realistic characters and environments, and to develop more challenging opponents.

- *AI in Transportation:*

Artificial Intelligence (AI) has emerged as a transformative force in the transportation sector, reshaping the waywe move people and goods across the globe. AI is driving innovation and delivering substantial benefits in terms of safety, efficiency, sustainability, and convenience.

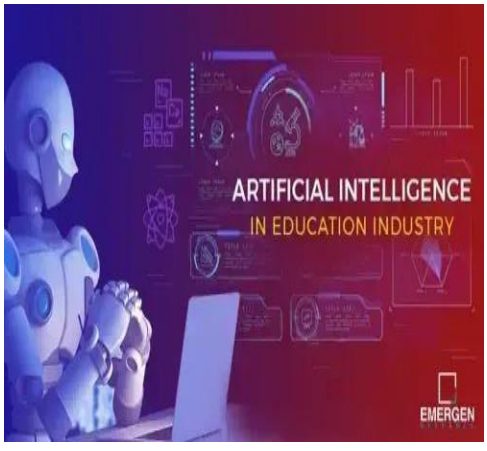
Implementation of Ai, Real Life Examples:

AI is increasingly a part of our everyday lives,

even if we don't always notice it. Here are some ways in whichAI is making a positive impact.

- **Personal Assistants:** AI-powered digital assistants on smartphones like Siri, Google Assistants, or Bixby canhelp manage daily tasks, set remainders, provide information, send texts, and more.
- **Online Shopping:** AI is used in online shopping platforms to provide personalized recommendations basedon your browsing and buying history.
- **Navigation and Traffic:** AI is used in apps like Google Maps and Waze to analyse real-time traffic and providethe fastest routes.
- **Email Filtering:** AI helps filter out spam emails, categorizing incoming emails, and even suggesting quickreplies in some email platforms.

Role Of Artificial Intelligence In Education: -



Artificial Intelligence is an emerging technology that started modifying educational tools and institutions. Education is afield where the presence of teachers is must which is the best educational practice the advent of Artificial Intelligence changes the teacher's job who are irreplaceable in the education system. With the combination of machines and teachers it is possible to pullout the best results from students.

Almost AI impacts every area of our life in the future and out of all those Education sector will be impacted hugely because teaching and learning is a major part of life and the current education system has a lot of changes to be desired. The schooling in olden days is not as flexible as what the future AI in education will present. The teachers that play the most important role in education system are not scalable and are expensive as well. In some of the country's teachers are given a heavy load of paper work and are undervalued. AI can help each individual separately by giving them separate curriculum based on their interest and skill assessments.

- *Gesture Recognition Technology*

The Little Dragon creates smart applications that analyze the user's facial expressions or gestures and adapt the user interface accordingly. Little Dragon also creates educational games for kids.

This gives them a chance to study for ten to fifteen minutes in their free time by using AI applications. AIhelps us understand the mood or ease of student during the lectures by using **Gesture Recognition Technology**. Since AI becomes more sophisticated the machine reads the facial expressions or gestures of the student and uses them to know if the student is struggling to understand the lecture and alter the lesson so that the student can follow up easily.

✦ *AI role for disabled students*

Disabled individuals can face numerous challenges in education. These can range from accessibility issues, lack of suitable learning materials, to discrimination and social stigma. AI has the potential to bridge the gap in the learning experience between disabled and non-disabled students by providing equal opportunities.

Below are the benefits provided by AI for Disabled students

- **Adaptive Learning Systems:** AI can be particularly for disabled students by providing customized learning experiences. Adaptive learning technologies, voice recognition software and AI powered assistive devices. AI powered tools can translate text into speech for visually impaired students and interpret speech into text for hearing-impaired students.
- **Assistive Robots:** Assistive Robots use AI to interact with disabled students, helping with tasks such as note-taking or physical mobility. They can also provide emotional support.
- **Speech Recognition Software:** Speech recognition software uses AI to convert spoken language into text. This tool is invaluable for students with physical disabilities or dyslexia.
- **AI-Powered Prosthetics:** AI-powered prosthetics learn from movement patterns to improve functionality. They provide physically disabled students with enhanced mobility and the ability to perform tasks independently
-

AI Tools Used In Education Sector:

AI tools have the potential to revolutionize education. They can personalize learning, make education more accessible, and enhanced student engagement. Teachers can use AI tools to work more efficiently and create personalized learning experiences for their students. AI is like a helpful assistant that can make teaching moreefficient. There are many exciting AI tools available, few are listed below,

1.ChatPDF is an AI-powered tool that allows users to interact with PDF documents in a conversational format, summarize and answer question for free.

2. Bing Chat is an **ChatGPT-4** powered chatbot that can help you browse the web, answer questions, and much more. It can be accessed through the Bing website or Microsoft Edgebrowser, and can be used to ask both simple and complex questions.

3.Eduaide.aI is an AI-powered teaching assistant designed to help teachers with lessons planning, instructional design, and generating educational content.

4.Hello History is an app that lets you have life-like conversations with historical figures. Get personal perspective on life, history, and the world from some of the most influential figures of all time- Cleopatra, Einstein, Buddha, and more.

PROS AND CONS:

Artificial Intelligence, or AI, is a really cool technology that can help us learn and teach in new ways. It's like having a super smart robot friend! AI can do lots of things to make learning better, but it also have some downsides. Let's explore the pros and cos of AI in education.

One of the good things about AI is that it can personalize learning for each student. That means it can help uslearn at our own pace and focus on the things we need help with. AI can also give feedback on our work rightaway, so we can fix our mistakes quickly. It can even automate tasks like grading papers, so teachers have moretime to help us one-on-one.

But there are also some challenges with AI. Some people worry that AI will take away teacher's jobs, but it's important to remember that AI is meant to be careful how wee use it. And some people think that AI will make it easier to cheat in school and spread false information. So we have to be responsible and use AI in the right way.

In the end, AI has the potential to make learning more fun and personalized. It can help us learn better and give teachers more time to help us. But we have to be careful and use AI in a way that respects our privacy and doesn't replace the important role of teachers.

"With the right balance, AI can be a great tool for education."

CONCLUSION

AI in education is a revolutionary change. According to a report issued by the Centre for Integrative Researchin Computer and Learning Sciences stated that the next level uses of AI in Education is not yet invented. So, the people working on AI applications should let the educators and education policy makers know about this in depth. Our future is AI so the educational system should start exposing their students to this sort of technology which started using a bit of AI.

As we have seen, the application of AI in educational context is growing rapidly. We have explored the variousAI techniques being used, the applications have been in development for almost fifty years, and the futuristic possibilities that are becoming ever more likely.

"The main aim of ai is to make the work of an educator easier but not to replace them

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8. Through Wall Radar Imaging

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Abstract

Through wall imaging (TWI) is one of the most rapidly emerging technologies where it tries to 'see' through visually opaque material like different types of walls and detect and image various targets behind the wall. It is a challenge for current researchers to design TWI system as well as interpret its data. The detection of targets becomes more challenging when no prior information of walls and targets is available. TWI scene may consist of various types of targets with different shapes and material properties (dielectric) [1]. Thus TWI system should have the capability to detect, locate, classify the objects and should be able to obtain size and shape of objects present in room which will be useful to the end user for interpretation. It is well known that radar suffers with strong clutter problems.

Through-wall detection and classification is very demanding for surveillance, security, and military applications in areas that cannot be sensed i.e. concealed object. In the domain of these applications, a key challenge is an ability not only to sense the presence of individuals behind the wall but also to classify their actions and postures. By using Ultra wideband (UWB) radars to penetrate wall materials and make intelligent decisions about the contents of rooms and buildings [2]. As a form of UWB radar, stepped frequency continuous wave (SFCW) radars have been preferred due to their advantages [3]. On the other hand, the success of classification with deep learning methods in different problems is remarkable. Since the radar signals contain valuable information about the objects behind the wall, the use of deep learning techniques for classification purposes will give a different direction to the research. In this work, we propose a mutual information maximizing deeply supervised network (MIMDSN) [4], which aims to extract accurate and robust 3-D human skeletons from TWR images. The SFCW radar is used to collect radar signals reflected from the human target behind the wall. These signals are employed to classify the presence of the human and the human posture whether he/she is standing or sitting by using CNN. The proposed approach achieves remarkable and successful results without the need for detailed preprocessing operations and long-term data used in the traditional approaches. TWRI methods operate in two steps: first the removal of wall clutter then followed by the recovery of targets positions.

Contents

This work aims to extract human features from 3-D TWR images and predict the coordinates of skeleton key points. The 3-D CNN is adopted for adaptive feature extraction and coordinate regression. CNN extracts features containing high-level semantic information from input images by stacking multiple convolution layers [5]. The ability to image targets behind building walls or to detect people under debris also including the classification of the human body has been drawing attention since the last decade. For this reason, unlike image processing, Ultra Wideband (UWB) radars as radio frequency sources more precisely achieve this kind of purpose applicable to real-world problems. UWB radars are used for different applications such as the detection and classification of aircrafts, collision avoidance, detection of a target, or the heart and respiration rate of a human. This kind of radar has several key advantages over narrowband continuous wave radars like having a very high downrange resolution of a target, allowing better separation

between targets and clutter due to the large bandwidth; multiple target detection capability; good immunity against multipath interference; and detection of both an object and its position [2]. The

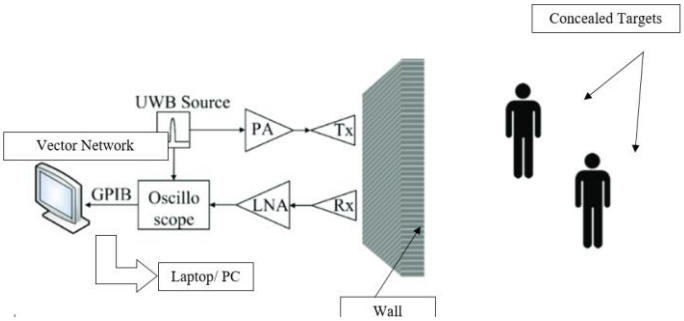

Fig. 1 Block diagram of UWB TWI radar

concept underlying through-wall human detection using UWB radars lies on a similar approach with that of radar imaging. A fraction of the transmitted RF signals is traversed from a nonmetal wall, reflected from the objects—even humans, and returned to the receiver imprinted by passing the nonmetal wall again having some signature of the objects within the room. By using this received signal, imaging of the objects is possible [3].
The SFCW radar is a UWB radar form with advanced features having considerable capabilities for a variety of applications. The main advantage of the SFCW radar is the high dynamic range and low noise floor. Furthermore, with the ability to avoid certain frequencies for transmission, the SFCW is preferred for certain restricted applications. Depending on these advantages of the SFCW radar, these radar systems are better choices on through-wall imaging due to the range, resolution, and propagation characteristics of UWB signals through a dielectric wall [6, 7]. Detailed information about the SFCW radar can be found in [8]

Mutual information maximizing deeply supervised network (mimdsn):
In this section, the definitions and notations of the problem are first elaborated. Then we introduce the three key components of the proposed mutual information MIMDSN in detail, which are a resolution-guided pose estimation network, a deeply supervised paradigm based on mutual information maximization, and an adaptive loss reweighting strategy. Finally, the implementation details are discussed.

- This work aims to estimate human pose skeletons from 3-D TWR images. The problem is formalized mathematically as (a) (b) (c) (d) Fig. 3. Different levels of supervision in deep learning. (a) Supervised learning. (b) Cross-modal learning. (c) Deeply supervised learning in [40]. (d) Deeply supervised learning in this work.

Qualitative Evaluation and Discussion

To evaluate the performance of the MIMDSN method with different identities, motions, and poses, we show several qualitative results in Figs. 2 and 3. The results illustrate that MIMDSN works well in different environments and targets, and can be generalized to untrained scenarios. For example, when deployed in wall-occlusive scenarios, our method can still estimate accurate pose skeletons. This is the superiority of our method over methods that lack penetrability. In scenarios where the optical system fails completely such as low-visibility scenes, it is difficult to provide corresponding training labels for radar images. Although MIMDSN never saw the samples of these occasions during training, it has learned the correlation between different key points of the human skeleton.

Fig. 2 Qualitative results in Multi-Target and wall-occlusive scenarios.

CONCLUSION

In this article, we present novel mutual information MIMDSN to estimate 3-D human pose skeletons using the TWR system. In order to alleviate the ill-posed problem caused by the physical characteristics of RF signals, the method adopts three key components. First, we propose a depth design philosophy of 3-D CNNs from the perspective of radar imaging resolution, and further design a pose estimation network to extract features of skeleton key points from TWR images. Then, based on the cross-modal supervision provided by the optical sensor, we construct a deeply supervised feature learning pipeline by maximizing the mutual information between features and pseudo labels. Furthermore, we adjust the learning degree of features at different levels dynamically through the adaptive loss reweighting strategy to enhance the discriminability of features and the accuracy of predictions. Extensive experimental results demonstrate the superiority of the method, and accurate 3-D human skeletons can be obtained in multi-target, wall-occlusive, and low-visibility scenes.

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9. Overview of Embedded System and its Advanced Applications

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Abstract: An embedded system is an application specific electronic subsystem which is used ina larger system and also used as individual system. An embedded system is generally made of software called embedded software and a hardware platform. At the heart of any embedded system is an integrated circuit. This integrated circuit can either be a microprocessor or a microcontroller. Embedded systems have many characteristics that other kinds of systems do not have. One of these characteristics is the extent to which they are reactive. In many cases, a system must react to changes that are occurring in its environment and give an output or result with little to no delay. In this paper, we have discussed the characteristics of Embedded System, types of Embedded System, recent trends in Embedded System and application areas of Embedded System.

Keywords
Microcontroller, Microprocessor, RTOS

1 Introduction

Embedded System is an integrated system that is formed as a combination of computer hardware and software for a specific function. It can be said as a dedicated computer system has been developed for some particular reason. But it is not our traditional computer system or general-purpose computers, these are the embedded systems that may work independently or attached toa larger system to work on a few specific functions. These embedded systems can work without human intervention or with little human intervention. Embedded systems core components include embedded hardware, embedded RTOS, device driver, communication stacks and embedded applications. The goal is to deliver affordable highly integrated devices that fulfill demanding safety, security, dependability and availability criteria while keeping cost down [1].

Types of Embedded Systems

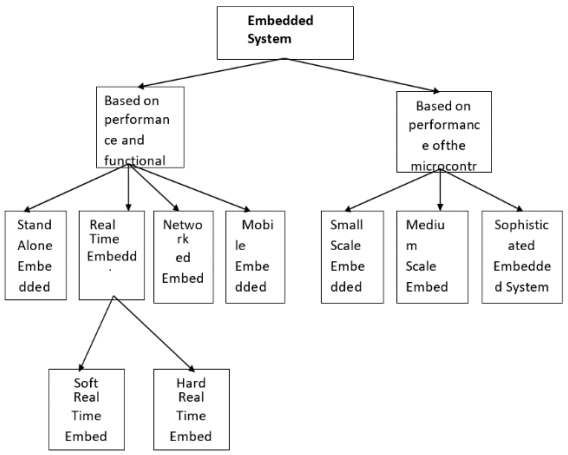

Fig. Types of Embedded Systems

Standalone embedded system: This system doesn't require host system like a computer system, it works by itself. For examples standalone embedded systems are mp3 players, digital cameras, video game consoles, microwave ovens and temperature measurement systems.

Real time embedded systems: A system called real time embedded system, which gives a required output in a particular time. These types of embedded systems follow the time deadlines for completion of a task. real time embedded systems are classified into two types such as soft real time embedded system and hard real time embedded systems based on the time preciseness.

Networked embedded system: Networked embedded systems are related to a network to access the resources. The connected network can be LAN, WAN or the internet. The connection can be any wired or wireless. This kind of embedded system is the fastest growing technological area in embedded system applications. For example, the LAN networked embedded system is a home security system wherein all sensors are connected and run on the protected protocol TCP/IP.

Mobile Embedded Systems: Mobile embedded systems are highly preferable in portable embedded devices like cell phones, mobiles, digital cameras

Small Scale Embedded Systems: These types of embedded systems are designed with a single 8-bit or 16-bit microcontroller. They have tiny scaled hardware, software complexities and involve board-level design. They may even be battery operated. When embedded software is developing for this tiny scaled hardware, an editor, an assembler or cross assembler, specific to the microcontroller or processor used, are the main programming tools. Usually, 'C programming language' is used for developing these systems.

Medium Scale Embedded Systems: These systems are usually designed with a single or few 16-bit or 32-bit microcontrollers or Digital Signal Processor (DSPs) or Reduced Instruction Set Computers (RISCs) being used. These systems have both hardware and software complexities. For complex software design of medium scale embedded system, there are the following programming tools: RTOS, Source code engineering tool, Simulator, Debugger and Integrated Development Environment (IDE). Software tools also give the clarifications to the

hardware complexities.

Sophisticated Embedded Systems: Sophisticated embedded systems have massive hardware and software complexities and may require ASIPs, IPs and PLAs scalable or configurable processors and programmable logic arrays. They are used for cutting edge applications that require hardware and software co-design and integration in the final system. They are constrained by the processing speeds available in their hardware units.

2 Characteristics of Embedded System

Task-specific: These systems tend to perform a concrete task repeatedly throughout theirlife cycle. So, a microwave will only ever function as a microwave.

Time frame limit: Embedded systems have to perform the required task within a particular time frame. For example, an anti-lock braking system needs to work quickly, otherwise accidents can occur.

Minimal UI: Typically, the system will have minimal or no user interface as a comprehensiveUI isn't available due to the size of the system.

Power efficiency: Embedded systems are typically small and can function with less amount of power while not being overly expensive.

Durability: The systems need to be reliable and stable in order to work for a long time In the future, we can expect to see more embedded systems designed specifically for without interference.

Device Cost: This is one of the major constraints when it comes to selecting an embeddedsystem. Cost should be as low as possible spend So, sometime reviewing the different options.

Size: for embedded devices it is also an important aspect since the size of the system will impactwhere it can be used.

HW-SW System: Especially, software testing is utilizing for more flexibility and features. The hardware is utilized for both security and performance. [3]

3 Recent Trends in Embedded SystemSecurity

Security is another critical concern for embedded systems, especially those that are connected to the internet.

Artificial Intelligence (AI)

AI is another emerging trend in embedded systems. AI refers to the ability of machines to learn from data and make decisions based on that data

Internet of Things (IoT)

A network of linked devices that communicate with one another online is known as the Internet of Things (IoT). This network includes everything from smart phones and smart home devices toindustrial sensors and medical devices. Embedded systems are a critical component of the IoT, as they provide the intelligence and connectivity that make these devices smart

the IoT. These systems will be smaller, more energy-efficient, and more reliable than ever before. They will also be designed to work seamlessly with other devices and systems, making it easier to create complex IoT applications. [2]

The embedded systems industry was born with the invention of microcontrollers and since then ithas evolved into various forms, from primarily being designed for machine control applications to various other new verticals with the convergence of communications.

Conclusion

Embedded systems are evolving rapidly, driven by emerging trends such as the IoT, AI, and edge computing. The future of embedded systems is full of exciting possibilities, including more intelligent, more connected, more energy-efficient, and more secure systems. As these systems continue to evolve, they will play an increasingly important role in our lives, from our homes to our workplaces to our hospitals.References

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10. Smart Helmet with Navigation using IOT

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Project Guide
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Abstract -"Smart helmet with GPS navigation using IoT" is an innovative wearable technology to increase passenger safety and comfort. It creates an essential communication system for passengers by integrating the real-time engine temperature sensor, leaning angle sensor, voice warning system and accident sensor using a gyroscope. Proactively solve engine overheating issue with timely alerts while monitoring the angle to ensure safety. Hands-free communication is facilitated by the voice module for instant voice alerts, and accident detectionsensors provide emergency alerts during rapid changes. This will provide an rider safety and also provide an various featuresof like an accident occurs notification to family and also inform to nearest ambulance of that area, it will give a voice warning of the over leaning angle while turning the bike to youand give notification, it will provide Bluetooth pairing to mobile to get voice command from google map for next turning.

Keywords — Smart helmet, IoT technology, safety alert, emergency features, voice commands, rider safety, wearabletechnology.

I. Introduction

In the advancement of security systems, we design the smart helmet with many feature which has to become an important replacement on the old helmet model. We have to be aware on the need on the safety measure in the motorcycle riding, we developed the smart helmet. This project will dedicated to improving the safety and comfort of passengers by comforting the journey. The smart helmet focus on the change in the motorcycle safety parameter by measuring engine temperature, measuring the leaning angle, voice warning system and detecting the accident using gyroscope device.

Motorcycles, mostly known for their riding journey and their efficiency, it also to face a challenges when it comes to safety measures. That the motive of project to make the motorcycle journey safe by focusing the various parameter like the temperature of engine while riding, by giving the voice warning on the extra leaning angle. Addition of accident detecting technology increase extra layer of safety by quickly detecting and send the message to ambulance and family or connect family member directly to helmet. As motorcycles has become a worldwide crucial transportation, smart helmet have become an icon of innovation and hope to reduce the risk. This becomes set of stage for a detailed checking of the individual products, features and overall impact that this smart helmet aims to overcome for the motorcycle community. The designing of smart helmet has become an important work in reshaping the old helmet model. We have to be aware for the risk which come in the motorcycle ride, that why developed the Smart Helmet. This new project is dedicated to improving the safety and comfort of rider by combining state-of—art and features.

II. Research Background

This kind of System is a pioneering project that integrates advanced technologies to

increase rider safety and comfort. In essence, the system addresses certain safety issues related to the operation of the motorcycle by adding new features. Real-time engine temperature measurement is done by the temperature sensor, which can instantly warn the driver about the possibility of engine overheating. Integrating an gyroscope sensor to ensure accurate measurement of the motorcycle's leaning angle during turning give instant warning to the driver in case of overtaking and provide greater safety. A unique feature of the system is the voice acknowledgment, which allows for hands-free communication with rider. Real-time audio alerts for important information such as engine temperature and lean angle help improve situational awareness. Accident detection using gyroscope sensor adds an extra layer of safety by detecting sudden changes and triggering emergency alerts. The microcontroller works as a central control unit, which is a communication network between various components. User- friendly interfaces such a voice warning. Continues testing ensures the reliability of everything and consistency of information for users in the use of motorcycle safety. In fact, the project aims to redefine motorcycle safety standards by harmonizing the latest technology with the health of the rider to ensure safety and fun. The primary objective of a smart helmet designed for route navigation and accident alerting in delivery and medical emergency scenarios is to significantly enhance safety, efficiency, and responsiveness in critical situations. This advanced helmet aims to provide precise GPS-based navigation guidance to delivery personnel, ensuring they reach their destinations swiftly and accurately, optimizing delivery logistics. The objectives behind your project of providing navigation and alerts after an accident are to ensure rider safety by offering real-time navigation guidance, alerting emergency services in case of an accident, and providing immediate assistance to the rider. It aims to minimize response time and provide crucial information to emergency responders for timely and effective assistance.

III. Literature Survey

1) Md. Motaharul Islam.et.al (2020):

Nowadays overpopulated countries like Bangladesh have become a warzone where thousands of people lose their lives and even more become handicapped due to road accidents. With the recent popularity of ride sharing apps like Pathao, Uber Moto, Shohoz etc. the number of bikes in Dhaka city has increased drastically. As bike accidents are becoming quite an alarming issue, we felt the need of an improved bike safety system. In this paper, we have proposed a system that detects bike accidents using MPU6050 (gyro sensor and accelerometer), SIM808 (GPS+GPRS+GSM), Raspberry Pi 3 Model B and Arduino Uno. We have placed the proposed system on the surface of the bike. If an accident occurs, the sensors will trigger and send a message containing the number and location of the biker to the nearest hospitals, police stations and registered family members.

2) Karl Ludwig Stolle.et.al (2022):

Motorcycle riders represent a highly vulnerable group of road users with high risk of heavy injuries and fatalities per distance traveled. Hence there is an ongoing demand for the development of assistance systems to improve riding safety. Collecting information about a rider's intention – the desired maneuver to carry out or trajectory to travel through – is considered as an enabler for new systems that can warn or intervene before or assist in dangerous driving situations. The observation of the rider's posture is necessary for a holistic understanding of the human-machine interface as riders typically move their body during riding for various reasons. The authors develop and test an on-road capable measurement system of high accuracy and robustness for the detection of rider upper body posture in riding experiments as off-the-shelf systems are not existent. April Tag

optical markers applied to the back of the rider that are filmed by a camera from behind prove to be superior to other concepts tested. Two new methods named subarea and dynamic frame rate evaluation are introduced to reduce computational effort from raw video data to rider posture information. First measurement results from on-road riding are presented and reveal positional

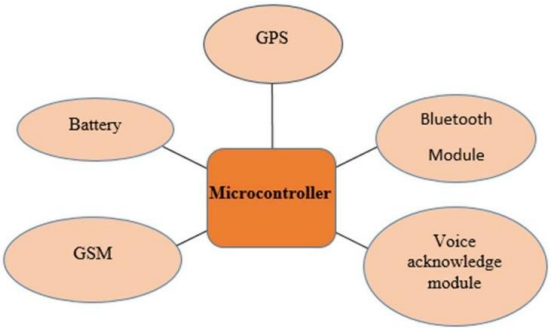
Errors below 1 cm or 3-degree rider lean angle. Based on the data that is collected in an ongoing riding study, the meaning of posture information for the identification of rider behavior and intention will be further investigated.

3) M Mostafa.et.al (2023):

The current traffic in large cities and urban areas has grown significantly, so a surveillance system is required to monitor traffic and avoid unnecessary delays and accidents. In this research study, computer vision-based speed estimation and object detection have been implemented for various automatic vehicles. Various image processing and deep learning-based methods and models have been used to test the proposed system. An open-source image dataset of five automobiles, car, bus, bike, truck, and local four-wheeler (CNG), has been utilized in this work. These 3,293 total images have been annotated with Rob flow framework and trained with YOLOv4, YOLOv5, YOLOv7, deep learning models, and the Haar cascade method. Average map scores of 0.956, 0.857 and 0.821 have been obtained for YOLOv5, YOLOv4 and YOLOv7 models, respectively, for different categories of vehicles. YOLOv4 and the Haar cascade methods have been employed to estimate the speed of the detected vehicles. The YOLOv4 technique performed best in speed assessment of various automobiles.

VI. Block Diagram

Figure1: Helmet with voice



It is an integrate part of helmet which is connected to helmet such as: Bluetooth module, GPS, Voice Acknowledge module, GSM and Battery.

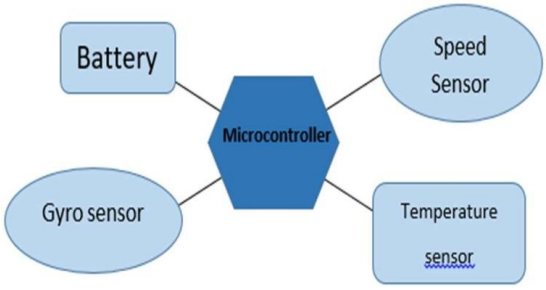
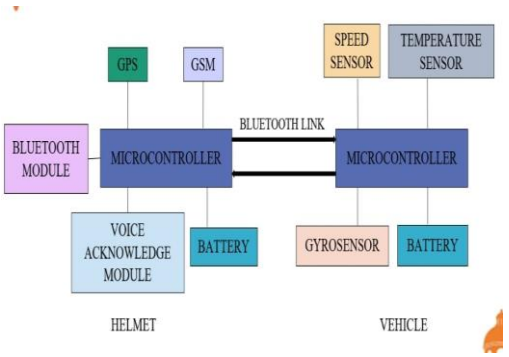


Figure 2: Vehicle implemented with gyro sensor

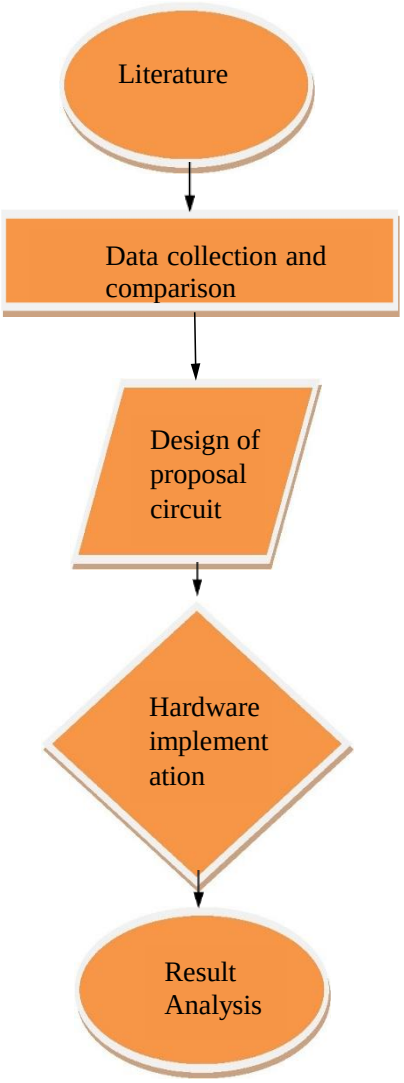


We propose the development of a Smart Helmet with advanced sensors for accident detection and a voice acknowledge which can connected through Bluetooth module to mobile for GPS navigation. This innovative helmet aims to enhance user safety by providing real-time accident alerts and convenient navigation information. The project will involve hardware integration, software development, and extensive testing to ensure reliability and user satisfaction.

V. Methodology

The path to improving motorcycle safety involves systematic application and driven test requires. First, we specific safety issues faced by motorcyclists are identified and then the procedures that need to be taken into account are determined, including functions such as temperature measuring, measuring leaning angle, warning sound and accident detection. Careful selection of materials and electronics are used for the hardware, while software is used to process of information as algorithms and sound logic. The system's user interface is designed to be understandable and feedback-oriented. Which will be coordinating for regular test and implement changes to ensure rider efficiency and effectiveness. User feedback provides detailed instructions and general information to help users understanding. The final step includes updating of the model, field testing, optimization and complete evaluation for actual motorcycle installation to ensure user satisfaction, reliability and operation. These will ensure to increased safety for cyclists.

Below flowchart is of how we implementing the project in hardware form firstly we will do a literature survey to get related information about this design, then secondly we will do data collection and comparison for what we have to implement, third we will to purpose design circuit to how we have to design the circuit, fourth we will implement the design in hardware form, then last we analysis the result we get and what we want. Below is the flowchart:



In the development of smart helmet is the recognition of the dynamic intersection of technological innovations and the need to improve rider safety. This recognition begins with the recognition of the risk as the main characters walking the difficult path and thus understanding the unique challenges they face. It continues to recognize the need for security solutions, thus facilitating the specific needs and capabilities. This certification involves careful selection and integration of various products by marking the integration of hardware and software required for integration. Additionally, paying attention to user- oriented design, such as the integration of audio acknowledge module, shows the importance of communication with the rider. Continues testing make user feedback and optimization demonstrate awareness of the nature of development and a commitment to continuous improvement. In fact, the agreement make a good understanding of the relationship between bike rider and technology, with the smart motorcycle

exceeding safety standards and taking on the task of creating a safe environment. We propose the development of a Smart Helmet equipped with advanced sensors for accident detection and a voice acknowledge for navigation. This innovative helmet provides to be enhance user safety by providing real-time accident alerts and convey to family and nearest hospital. The project will involve hardware integration, software development, and extensive testing to ensure reliability and rider satisfaction.

VI. Conclusion

In summary, the development of smart helmet using IoT demonstrates a strong commitment to the advancement of new technology and the safety of rider. Program pioneers are leading the change by recognizing the current challenges and need for safety solutions in motorcycle. The importance of carefully selected materials, user-friendly interface and testing demonstrate our commitment to creating intelligent machines. The combination of the best features such as measurement of engine temperature, leaning angle measurement, warning sound notice and accident detection creates a revolutionary change in improving the overall safety and awareness of motorcycle riders. Demonstrates continuous knowledge of improving development and implementing performance, based on previous field testing and improve the process. Finally, the System reflects the harmony between technology and rider-oriented design, marking an important step in redefining safety standards in motorcycle riding

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11. SCADA System in Healthcare

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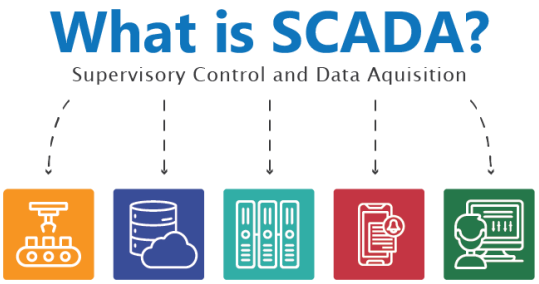
Abstract - SCADA in a hospital is like a superhero computer system. It watches over everything to make sure it's working well. Imagine it looks after the air conditioning, electricity, security, and even the machines that doctors use. It keeps an eye on them, makes sure they're okay, and helps to fix things if something goes wrong. Basically, SCADA helps hospitals run smoothly and keeps everything in check.

What is SCADA?

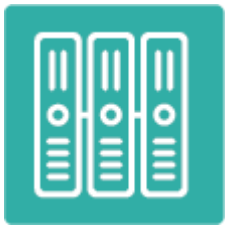
SCADA, or supervisory control and data acquisition, is like a hi-tech manager for big machines and systems in places like factories, power plants, or water treatment centers. It helps people to keep an eye on everything by collecting data in real-time, such as temperatures and pressures, and gives them a way to control and manage these machines from a central place. So, it's like a smart system that makes sure everything is working and lets people fix things if needed.



Inputs And Sensors:

In a SCADA system, inputs and sensors are crucial components, serving as the system's eyes and ears. Sensors act like detectives, monitoring factors such as pressure, temperature, and wind direction. Inputs, akin to switches or controls, allow users to interact with the system, facilitating actions like turning devices on or off. Together, inputs and sensors ensure the SCADA system is well-informed and can effectively control various processes.

PLC'S And RTU'S:



PLCs and RTUs in a SCADA system translate sensor and switch data into user-friendly information, such as converting binary code to "Off" and "On." They also interpret movement, indicating "Right" or "Clockwise" for increasing values and "Left" or "Anti-Clockwise" for decreasing ones. These devices can automate actions, like opening a relief valve in response to high pressure, either autonomously or based on manual commands. This functionality aids operators in monitoring and understanding the system efficiently.

Alarms and Notifications:

PLCs and RTUs in a SCADA system can automatically send alerts, such as notifying operators of high tank pressure. They are capable of commanding relief valves to address issues or triggering alarms and emergency actions in critical situations. Scheduled notifications assist operators in monitoring plant performance, providing timely insights for maintenance or attention to specific areas. This streamlined approach enhances efficiency and facilitates proactive management.

Human-Machine Interface (HMI):

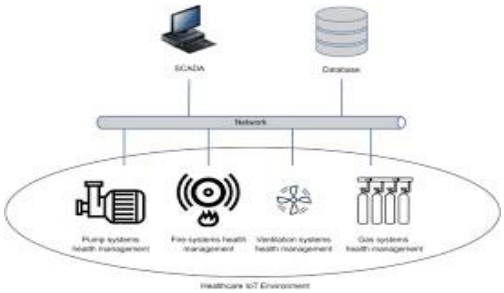
An HMI (Human-Machine Interface) is an interactive display for system control and monitoring. Users can operate it with a keyboard, mouse, or specialized buttons, presenting information through numbers, pictures, and camera feeds. In a factory, it enables users to visualize and manage processes, such as displaying images and liquid level graphs for a storage tank. HMIs aid users in understanding information, facilitating informed decision- making to optimize operations and prevent issues.

Historian:

The SCADA system's historian serves as its memory, recording all data, including machineactivations and HMI commands. It preserves a comprehensive history of process, plant, and system activities, accessible online or locally. Operators use

it to create reports and showcase plant performance to stakeholders. In troubleshooting, historical data aids in identifying issues, understanding causes, and implementing preventive measures for the future, addressing accidents or losses.

Overall view in shorts:



In healthcare, SCADA (Supervisory Control and Data Acquisition) is a smart system that helps to monitor and manage important data, like patient information and medical equipment, in real-time. It acts like a high-tech oversee, making sure everything runs smoothly and allowing people to control and address issues from a central location. Essentially, it ensures that the healthcare environment works effectively and can be adjusted if necessary.

Let's break down how SCADA works in healthcare step by step:

1) Setting Up Sensors:

First, sensors are placed around the healthcare facility. These sensors can be on medical devices like heart monitors, temperature gauges, and other equipment.

1. **Temperature Sensors:**

Checks if the fridge or freezer storing medicines and vaccines is at the right temperature. In healthcare settings using SCADA systems to monitor temperature, various temperature sensors may be used for storing blood products, vaccines, and medications.

Common types include:

- **Thermocouples:**

Inexpensive and versatile, they measure temperature using voltage changes in different metals.

- **Thermistors:**

Known for sensitivity, they use resistance changes to gauge temperature.

- **RTD's (Resistance Temperature Detectors**):

Provide high accuracy and stability across a wide temperature range.

The typical temperature ranges for storing blood products, vaccines,

and medications in healthcare:

- **Blood Products:**

  Minimum: Typically stored at temperatures around 1 to 6 degrees Celsius (34 to 43 degrees Fahrenheit).

  Maximum: Should not be frozen; avoid temperatures below 0 degrees Celsius (32 degrees Fahrenheit).

- **Vaccines:**

  Minimum: Often stored between 2 to 8 degrees Celsius (36 to 46 degrees Fahrenheit).

  Maximum: Specific vaccines may have different temperature requirements; consult guidelines.

- **Medications:**

  Minimum and Maximum: Varies widely depending on the medication; refer to specific storage instructions provided by healthcare providers or pharmaceutical companies.

1. **Pressure Sensors:**

   Keeps track of devices like infusion pumps and ventilators to make sure they're working properly.

- **Strain Gauge Pressure Sensors:**

Used to monitor pressure in devices like blood pressure monitors and infusion pumps

- **Piezoelectric Pressure Sensors:**

Employed in respiratory equipment and other devices where pressure changes need to be tracked.

3. Humidity Sensors:

Monitors moisture levels in places like labs to protect medicines and supplies.

Common types of humidity sensors include:

- **Capacitive Humidity Sensors:**

These sensors measure humidity by detecting changes in electrical capacitance.

- **Resistive Humidity Sensors:**

These sensors work by measuring the change in electrical resistance with humidity variations.

4. Biometric Sensors:

Tracks vital signs like heart rate and oxygen levels using devices like pulse oximeter.

These Sensors are typically:

- **Optical Humidity – Resistant Sensor:**

  These sensors are designed to resist the effects of humidity and are commonly integrated into pulse oximeters.

5. Radiation Sensors:

Keeps an eye on radiation levels in

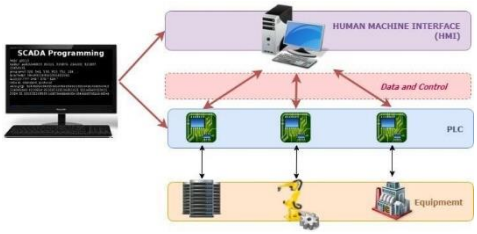
areas where X-rays and other medical imaging are done.

The specific type of radiation sensor commonly used is:

- **Geiger-Muller (GM) Counters:**

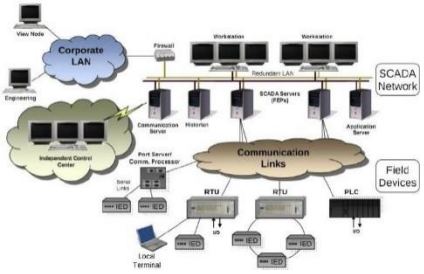
These sensors, often referred to as Geiger counters, are commonly used to detect and measure ionizing radiation, including X-rays.

2)Collecting Data:



The sensors continuously collect data, such as a patient's heart rate, body temperature, and other vital signs. They also gather information about the performance of medical equipment.

3)Sending Data to SCADA System:



The collected data is sent through a network to a central computer system, which is the SCADA system. This system acts like the brain that processes and manages all the information.

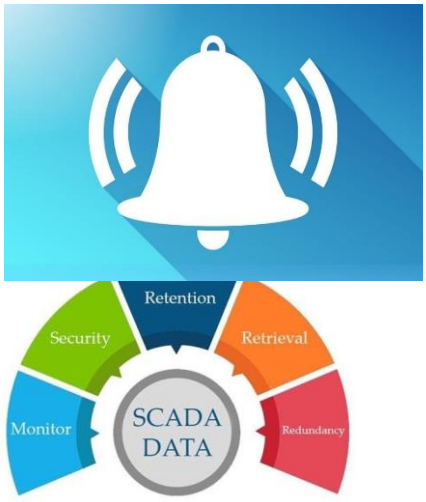
4)Centralized Control:

The SCADA system brings all the data together in one place. This is like having a control center where healthcare professional can see everything that's happening in real-time.

5)Monitoring:

Healthcare staff can monitor the data on computer screens. They can see how patients are doing, check if medical equipment is working correctly, and keep an eye on the overall health of the facility.

6)Alerts for Abnormalities:



The SCADA system is smart. It knows what "normal" looks like. If something unusual happens, like a patient's heart rate going too high or a machine networking properly, the SCADA system sends alerts to healthcare workers To provide the best care to patients.

- **Advantages:**

1. **Keep an Eye from Anywhere:**

   With SCADA, doctors and staff can check and control things in the hospital even from a distance. This helps them manage the hospital without always being there.

2. **Make Sure Patients are Safe:**

   By using SCADA, hospitals can make sure that everything is clean and safe for patients. It helps in stopping the spread of germs and making sure medical machines are workingwell.

3. **Manage the Hospital Better:**

   SCADA helps in doing things at the hospital more easily. It can do some tasks by itself, so hospital staff can focus on taking care of patient.

4. **Keep a Record of What Happened:**

   SCADA keeps a history of what happened in the hospital. This helps the staff to see trends, fix problems, and follow the rules.

5. **Find and Fix Problems Early:**

   SCADA can find problems with machines or things in the hospital early. This helps fixthings before they become big issues.

- **Disadvantages:**

1. **Can be Complicated:**

   SCADA systems are not always easy to understand. Some people

may find them a bit tricky or hard to use.

2. **Costly to Set Up:**
   Getting a SCADA system in place can be expensive. Hospitals might need to spend a lot of money to install and set it up.
3. **Need Skilled People:**
   You need special people who know a lot about SCADA to manage it. If the hospital staff doesn't have these skills, it could be a problem.
4. **Dependency on Technology:**
   Hospitals become more dependent on technology with SCADA. If something goes wrong with the system, it might disrupt the hospital's normal activities.
5. **Updates Can be Tricky:**
   When there are updates to the SCADA system, it can be a bit tricky to do them without causing problems. If not done right, it might lead to issues in the hospital's operations.

- **Applications:**

1. **Checking Temperature and Air Quality:**

SCADA helps keep an eye on the temperature and air quality in hospitals. It makes sureit's comfortable for patients and that the air is clean.

2. **Watching Medical Equipment:**

SCADA can watch over machines in the hospital, like X-ray machines or ventilators, to make sure they are working correctly. This helps in giving the best care to patients.

3. **Keeping Things Clean and Safe:**

SCADA helps in making sure that places like operating rooms and patient rooms are clean. It helps prevent the spread of germs and keeps everyone safe.

4. **Alerting for Problems:**

If something goes wrong, like a machine not working or a room getting too hot, SCADAcan send alerts. This helps hospital staff to fix problems quickly.

5. **Connecting with Patient Records:**
   SCADA can work together with systems that have patient information. This helps doctors and nurses to have the right information at the right time, making patient care better.

- **Future Scope:**

1. **Smart Health Supervisor:** Picture a super-smart helper for hospitals called SCADA. It watches over patient info and medical tools, making sure everything runs smoothly.
2. **Patient Bodyguard**: In the future, SCADA will be like a superhero,

keeping an eyeon patients' health signs and making sure they take their medicine.

3. **Privacy Protector:** SCADA will have strong locks to keep patient info safe from bad guys trying to hack into it.

4. **Online Doctor Helper:** As talking to doctors online becomes common, SCADA will help doctors keep an eye on patients through the internet.
5. **Independent Helper:**
   SCADA might become smart enough to fix things on its own, making healthcare work better without humans doing everything.
6. **Customizable for Doctors:** Doctors can change how SCADA looks and works to fit their needs, making it easier for them to do their job.
7. **Fixing Things Remotely:** SCADA might have the power to fix problems without people being there, reducing delays and making sure everything works.
8. **Always Learning:**
   SCADA could learn from its mistakes and get better over time, adapting to changes in healthcare.

- **In which cities SCADA is implemented:**

In India, these fancy healthcare systems could be implemented in big cities like Mumbai, Delhi, Bangalore, and Chennai. These cities have advanced healthcare systems, and as technology improves, we might see these cool systems there first. But, as time goes on, they could spread to more cities across the country.

- **Conclusions:**

The conclusion about SCADA systems in healthcare is that they play a crucial role in keeping medical processes running smoothly. They help monitor, control, and secure various aspects of healthcare operations, ensuring efficient and safe functioning of equipment and processes.

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12. Sustainable window film automated design for energy conservation and speed regulation in restricted areas

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Abstract
Railways or metros are made for the public and it's equally difficult to implement laws and have surveillance over the public to check for people not clicking photos or videos in restricted areas. Thus, we have proposed a feasible and a viable solution to this problem through our project Sustainable window film automated design for energy conservation and speed regulation in restricted areas in which we have microcontroller based GPS module which will control specialized smart window panes installed in metros which will turn opaque in areas where photography is restricted. The circuit for these smart window panes is designed by us. It uses a microcontroller which is programmed to supply sufficient current to align the crystals of the screen / pane and turn it into opaque window pane. Authority need to mark restricted latitude and longitude range. When restricted area comes which will be detected by GPS modem and Node MCU, the windows will turn opaque. These smart window panes or screens will be a revolutionary technology for the metros, railways, hospital OT and places like airports, restaurants, offices where there is a custom need of privacy. These specialized smart windowpanes would be controlled by an electronic circuit which consists of ESP8266, and the controls can be handled through a proper user interface provided by a microcontroller based GPS module. Also we have added an additional feature while using this module for cars that when we reach speed limit zones, car speed would be automatically regulated using GPS module and speed governors of car.

Keyword: Microcontroller ESP8266, Liquid crystal window (LCW), ESP8266, driver molecules, GPS module, POI technology

Introduction

In today's times, network of Railways and inter City metro trains have increased to a very great extent. From time to time it has been observed that areas relating to defense personnel or defense related activities, areas requiring high security or areas which are risk areas or are under multiple threats,

photography should be strictly prohibited. Earlier there were bans on restricting people on taking photographs or videos of railway stations or airports as these could be mapped by terrorists for planting bombs. These specialized smart windowpanes have been named by us as Smart Hide and Seek window for metro using POI technology windows which would normally be transparent, and passengers can have a comfortable view of the surroundings and in restricted areas it would turn opaque restricting the passengers to view and do not take undue advantage of the surroundings. Windows, which are essential for basic cooling and heating, are the parts of buildings that are most susceptible to light and heat. Air conditioners consume a significant amount of electricity to regulate the temperature inside of residential buildings, but energy consumption can be decreased by using the right glazing methods and materials. There are traditional methods for tint glass in automobiles and buildings, however they all still use fixed methods with a single degree of glazing. These glasses' glazing cannot be manually or automatically changed to reflect the brightness of the sun. In this study, a cutting-edge method is suggested that would let users utilize sensors and an interface with a microcontroller to automatically adjust a glass's glazing. The film's technological construction comprises of two conductive Polyethylene Terephthalate (PET) sheets coated with ITO sandwiching polymers dispersed in liquid crystal. Between the two thin PET sheets, the polymer dispersed liquid crystal (PDLC) serves as a conductor. Its official name is PDLC film. These liquid crystals are dispersed and move in a random manner if there is no free-flowing electric current in the film. The film becomes opaque as a result of the light being partially blocked. But as soon as the current begins to flow through it, the particles form a symmetrical arrangement that makes the film completely transparent. The movie enables the glass's state to be switched between opaque and transparent via switches, smartphone applications, or gestures. The opacity of this active smart film adjusts in reaction to an external voltage. Despite the smart film's relatively low power consumption, incorrect management, such as leaving the film on after use, might result in energy waste. The design of a clever, inexpensive, and effective POI smart controller for switchable

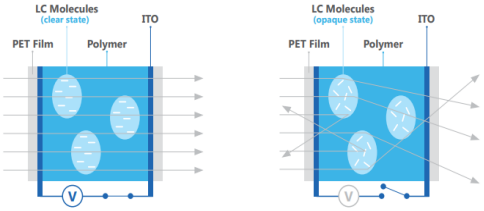

Fig 1:*Polymer Dispersed Liquid Crystal structure (PDLC)*

Polymer Dispersed Liquid Crystal (PDLC) films with energy-saving features is the focus of this research. When the liquid crystal molecules are activated, they prefer to move in the same direction and allow light to flow through, exhibiting a transparent state; when the power is off, they are disordered and appear frosted white; when the power is on, the glass will become clear. A smart switchable window called a polymer-dispersed liquid crystal (PDLC) alters its optical transmissions. When an alternating electric current stimulus is applied, the material changes from translucent to transparent.

Literature Review

By adjusting the voltage, PDLC glazing can adapt its transmission to suit the needs of the user [1]. Despite the haze that PDLC glazing experiences, manufacturers are working to provide fog-free PDLC [2]. The majority of PDLC glazing is employed for aesthetic, privacy, and solar energy control purposes. In terms of providing energy efficiency for structures and environmental welfare, conventional window solutions fell short. Regulations demand it [3] According to a study, smart PDLC glass can be used to reduce energy usage [4] The suggested method used a programmable Microcontroller light sensor to track the movement of the sun and modify the shading mode automatically and remotely control as desired by the user. According to the study, the technology might result in a 39% energy decrease when compared to traditional window systems. PDLC films have demonstrated outstanding UV blocking efficiency of up to 98% and NIR modulation efficiency between 12 and 38 percent. When a voltage is applied, electronically accessible liquid crystal device screens alter their transparency [4] to its ability to operate without polarizers, high transparency transmission, large viewing angle, quick switching time, lack of surface treatment, and potential for controlling the transmission level, polymer dispersed liquid crystal (PDLC) could be a suitable glazing material for building applications [5] In general, PDLC films, under a solid polymer matrix, are formed of lower molecular mass micro- sized drops of liquid crystal.

Methodology

It makes use of a microprocessor that is designed to deliver enough current to align the screen's crystals and transform it into an opaque window pane. A limited latitude and longitude area must be marked by authority. The windows will become opaque when a restricted area enters, that will be recognized by GPS modem and

Node MCU. These intelligent glass panes or screen will be a game-changing innovation for public transportation systems, railroads, hospital operating rooms, and locations with a specialized need for privacy, such as airports, restaurants, and offices.

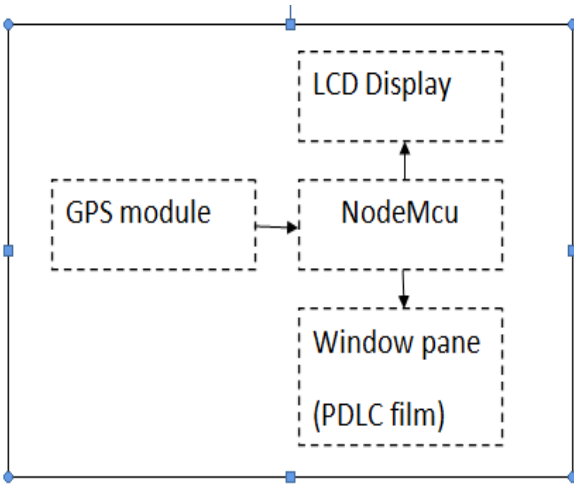

Fig 2: Generalized Block Diagram

Steps:

Step 1: Initially system is turned on in metro and GPS locations are turned on with display on LCD. The smart windows are transparent.

Step 2: When the longitude and latitudes that are set according to location where privacy is needed is reached, the system is activated and a signal is sent to the window film through nodemcu and the glass turns opaque hiding all the views for passengers.

Step 3: This system will then check for updates and once the areas of restricted entries are passed, system will again be deactivated and glass turns transparent.

This system ensures that privacy is maintained and also as it is automated with a GPS system, human efforts and chances of human errors are reduced. Fig 2 shows the generalized block diagram of the project. In this project system testing was undertaken to find out errors and troubleshoot them. This system has been dedicatedly designed for use in metros but this does not limit its use to this application. With mass production and the proposed low cost circuit, this technology can bring a big revolution in glass window pane industry for hotels, trains, stations, offices etc.

Fig 3: Implemented Project model of Sustainable window film automated design for energy conservation and speed regulation in restricted areas

Conclusion

Using POI Technology, we will operate specialized smart window panes installed in metros that will become opaque in places where photography is prohibited using a microcontroller-based GPS module. We

created the circuit for these intelligent window panes. It makes use of a microcontroller based system that is designed to deliver enough current to align the screen's crystals and transform it into an opaque window pane. A restricted latitude and longitude range must be marked by authority. The proposed work has been successfully implemented with a low cost and efficient circuit making it an economically feasible prototype for mass production and technologically feasible PDLC film based automated electronic system using POI technology. The module for car speed regulation is another parameter that would help to control over speeding and accidents.

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13. Nanotechnology: Bridging Nanophotonics And Quantum Electronics

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***Abstract*—** In the world of evolution everything needs to be changed or miniaturized to fulfill the need of a growing world. The paper "Nanotechnology: Bridging Nanophotonic and quantum electronics" provides a comprehensive overview of the evolution of electronics, tracing its progression from traditional scaling of Si integrated circuits to the forefront of nanotechnology. It encompasses aggressive miniaturization efforts using advanced materials like strained Si and Ge, resulting in faster transistors and extends to nano electronics, emphasizing size, weight, and power reduction through technologies such as optical-connect concepts, molecular organic electronics, and diverse memory devices. Focusing on nanoscopic transistors and nano circuitry, the paper highlights the transformative impact of spintronics and addresses the convergence of Nanophotonic and quantum electronics. This convergence aims to seamlessly integrate nanoscale photonic and quantum components, unlocking opportunities in faster information transfer, quantum computing, secure communication, and sensor sensitivity. It concludes by emphasizing the pivotal moment in reshaping electronic landscapes through the Union of nanotechnology, photonics, and quantum principles.

Introduction

The never-ending evolution of electronics has been a hallmark of human progress, propelling us from the era of conventional procedures for scaling down silicon integrated circuits to the cutting edge of nanotechnology, from the introduction of

vacuum tubes to the miniaturization of transistors. As the demand for smaller, faster, and more efficient electronic devices continues to grow, the field has witnessed remarkable progress. In recent times, the combination of electronics and nanotechnology has brought forth a new era, pushing the boundaries of what was once considered possible.

Nanotechnology, with its focus on manipulating matter at the atomic and molecular level, has paved the way for the development of nanoscopic transistors and nano circuitry. These tiny components not only enhance the efficiency of electronic devices but also contribute to the creation of smaller and more powerful systems. The significant advancements in electronic capabilities brought about by nanotechnology have sparked a revolution in various industries, ranging from computing to healthcare.

One of the fascinating advancements in this field is the emergence of spintronics, a technology that utilizes the spin of electrons to store and process information. This innovative approach has opened up new possibilities for creating faster and more energy-efficient electronic devices, promising a fundamental shift in computing.

Furthermore, the integration of Nanophotonic and quantum electronics represents a frontier where the manipulation of light and quantum phenomena intersect. This interdisciplinary collaboration holds immense potential to revolutionize communication and computation by leveraging the unique properties of both nanophotonic and quantum electronics. As these two fields converge, researchers are exploring novel methods to create faster and more secure communication systems and computational platforms.

VII. NANOTECHNOLOGY

Nanotechnology is the science of manipulating matter at the nanoscale, a realm that spans from 1 to 100 nanometers. At this tiny scale, materials exhibit unique properties that can be harnessed to revolutionize electronics. From quantum effects to enhanced conductivity, understanding the behavior of materials at the nanoscale has opened the door to limitless possibilities.

Nanoscale transistors are one of the most important applications of nanotechnology. Traditional transistors are limited in their size and performance, but nanotechnology allows transistors to be made at a scale at which quantum effects become significant. This leads to faster and more energy efficient transistors, which in turn improve the performance of electronic devices over time.

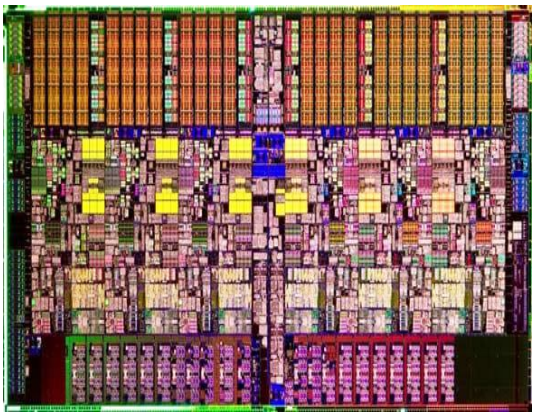
Nanoscale memory storage is another important application of nanotechnology. Non-volatile memory materials, such as

nano-wires and nano-dots, are used in memory devices. This allows for high-density and low-power memory storage solutions, which meet the growing need for compact and energy efficient data storage in a variety of electronic applications.

Nano sensors play an important role in the development of sensors used in electronic devices. Sensors can detect and react to changes at either the molecular or atomic levels, making them highly sensitive and selective.

Nanomaterials with special properties, such as nanomaterials and carbon nanotube, allow for the development of flexible, see-through electronic devices. This opens up new possibilities for wearable technology and flexible displays**.**

Fig. 1.1 Microscopic view of intel i2 Core



processor

VIII. NANOSCOPIC TRANSISTORS

A nanoscopic transistor is a transistor that operates at the nanoscale, typically with critical dimensions on the order of nanometers. Transistors are fundamental building blocks of electronic circuits, acting as switches that control the flow of electrical current. As technology advances, researchers and engineers aim to miniaturize transistors to enhance the performance and efficiency of electronic devices.

Nanoscale transistors are designed using advanced fabrication techniques and materials, allowing them to have features and structures at the nanometer level. One common type of nanoscopic transistor is the FinFET (Fin Field-Effect Transistor), which has a fin-like structure extending into the channel region, providing better control over the flow of current. FinFETs and other nanoscale transistor architectures enable the packing of more transistors into a given area, contributing to increased computational power and energy efficiency.

The shift towards nanoscopic transistors is driven by the desire to continue Moore's Law, an empirical observation and a guiding principle in the semiconductor industry, stating that the number of transistors on a microchip double approximately every two years, leading to a continuous increase in computing power. Traditional transistors were on the order of micrometers, but with nanoscale transistors, components can be made much smaller. This reduction in size allows for

more transistors to be packed into a given area, aligning with Moore's Law.

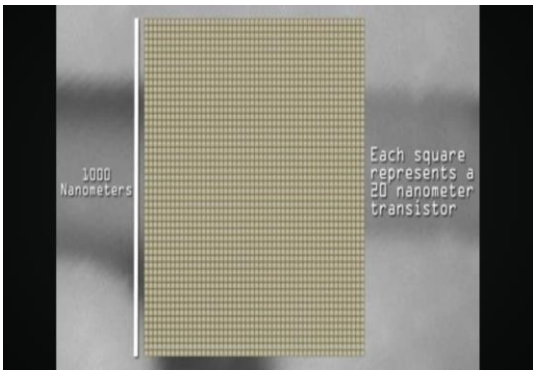


Fig.2.1 Nanoscopic Transistor inside processors

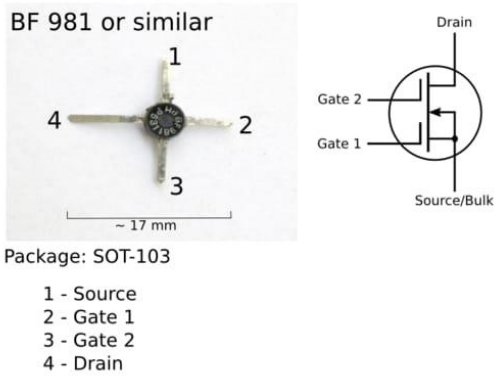


Fig. 2.2 symbol of MIGFET

IX. NANOCIRCUITRY

Nanocircuits are electrical circuits on the scale of nanometers. One nanometer is equal to 10-9 meters or a row of 10 hydrogen atoms. With circuits becoming smaller, they are able to fit more on a computer chip. Thus, they will be able to perform more complex functions using less power and at a faster speed. Nanocircuits are organized into three different parts: transistors, interconnections, and architecture, all dealt within the nano scale.

Scientists in India have achieved a groundbreaking development by creating the world's smallest transistor for nanocircuits, entirely constructed from carbon nanotubes. These nanotubes, rolled-up sheets of carbon atoms with a thickness over a thousand times smaller than human hair, have replaced traditional silicon-based transistors. The unique Y-shaped design of the transistor features two branches meeting at a single point, allowing current to flow through both branches. The flow is controlled by a third branch that can turn the voltage on or off. This innovation marks a significant leap forward, enabling the creation of nanocircuits entirely composed of nanotubes. Previously, logic circuits utilizing nanotubes required metal gates to regulate electrical current, but this breakthrough eliminates that need.

The potential applications of nanocircuits, particularly in the realm of computers and electronics, are substantial. Scientists envision enhanced computing speeds through the integration of nanocircuits. Short-term possibilities include hybrid configurations, combining silicon with a nano core—potentially leading to high-density computer memory with everlasting data retention. Nano Circuit design, unlike traditional methods, is likely to adopt a bottom-up approach due to the complex nature of these circuits, starting with a jumble of components and gradually sculpting them into functional devices.

However, the challenge lies in addressing defects and faults inherent at the nano level, considering the compactness of nanocircuits. While scientists have successfully created essential components such as transistors, logic gates, and diodes using organic molecules, carbon nanotube, and nanowire semiconductors, eliminating errors remains a critical hurdle in realizing the full potential of nanocircuits in all electronic devices.

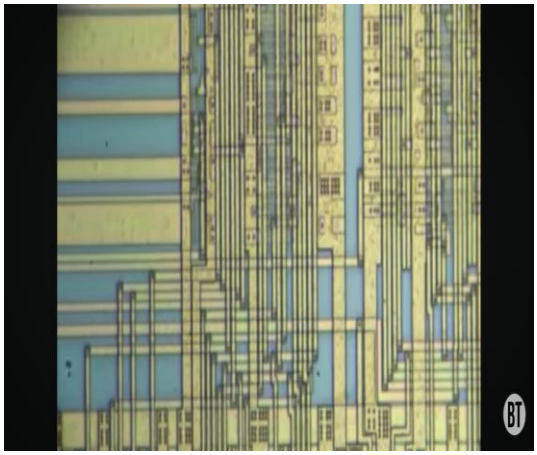


Fig. 3.1 Circuitry inside Intel i486 processor

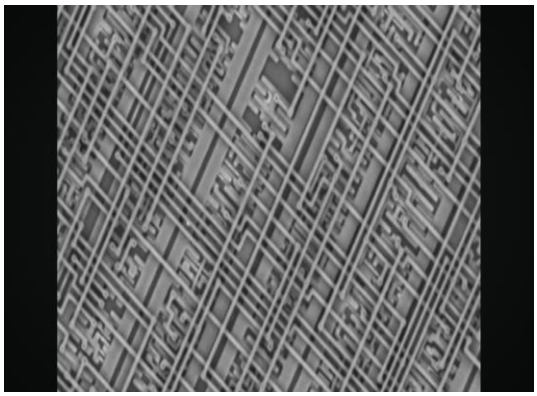


Fig 3.2 Circuitry inside Microchip

X. QUANTUM LEAP IN ELECTRONICS

Quantum electronics is the area of physics dealing with the effects of quantum mechanics on the behavior of electrons in matter.

Quantum electronics involves applying principles of quantum mechanics to electronic devices. It explores the behavior of electrons at the quantum level, leading to the development of quantum computing, quantum communication, and other advanced technologies. Key concepts include superposition, entanglement, and quantum bits (qubits) for information processing.

Integrating quantum mechanics with electronics has the potential to revolutionize the world of technology. A significant frontier is quantum computing where quantum bits (qbits) allow for exponentially faster calculations in cryptography, optimization and simulation. This represents a quantum leap forward in computing power that may unlock solutions to previously insurmountable problems.

On the other side of the world, quantum communication brings unprecedented security with quantum key distribution (QKD). By using quantum states, secure transmission is possible, making eavesdropping almost impossible.

With superior precision, quantum sensors will revolutionize healthcare, environmental monitoring and more. Their advanced capabilities promise to revolutionize imaging, navigation and the detection of physical quantities.

On the materials science side, quantum electronics has led to the discovery of new materials with special electronic properties, which have had a significant impact on superconductivity, and semiconductor advances.

In terms of quantum memory and information storage, quantum electronics offers the potential to create ultra-secure data stores.

These are exciting prospects, but challenges such as maintaining quantum coherence are essential for the practical implementation of these revolutionary technologies into everyday electronics.

XI. SPINTRONICS

Spintronics is the name associated with technology that utilizes both the intrinsic spin of an electron as well as its charge in transport devices. It is primarily concerned with solid-state systems and how manipulation of the electron spin state can result in appreciable changes in conductance.

Spintronics is considered as one of the most important emerging research areas with an immense potential to provide high speed, low power and high-density logic and memory electronic devices, and lower threshold current and high-power lasers (optoelectronic devices) as a source for circularly polarized light. While all-metal spintronic devices (magneto electronic) are mainly focused on memory devices, semiconductor spintronics is indispensable for logic and optoelectronic.

Spintronics, or spin transport electronics, offers several advantages and faces notable challenges. On the positive side, spin-based technologies exhibit low power consumption, as they leverage the intrinsic spin of electrons rather than charge. This characteristic makes them promising for applications demanding energy efficiency. Additionally, spintronic devices boast non-volatility, allowing them to retain information without continuous power, making them suitable for non-volatile memory applications like MRAM. The potential for high-speed data transfer is another advantage, as spin currents can propagate through materials with less resistance. Moreover, spintronics can be integrated into existing semiconductor technologies, enhancing compatibility with conventional electronic devices.

Fig. 5.1 Spintronic

XII. Bridging of Nanophotonics and Quantum Electronics

At the leading edge of scientific and technological innovation, nanophotonics and quantum electronics intersect to offer unprecedented possibilities for improving electronic devices. In nanophotonics, manipulating light on the nanoscale through structures like photonic crystals and plasmonic devices allows for efficient and compact photon control. Quantum electronics, based on quantum mechanics principles, explores the unique behaviors of quantum particles like quantum dots to create advanced electronic components.

The synergy between nanophotonics and quantum electronics opens up many opportunities. Integrating quantum dots into nanophotonic structures enables regulated photon emission, which is crucial for quantum information processing. Additionally, using nanoscale photonic elements enhances the coherence and interaction of quantum states, paving the way for ultrafast quantum computing, secure quantum communication, and highly sensitive quantum sensors. This cross-disciplinary collaboration has the potential to transform the landscape of electronic technologies, providing solutions to challenges previously thought insurmountable.

CONCLUSION

In conclusion, the face of escalating demands for faster information transfer, quantum computing, secure communication, and heightened sensor sensitivity, nanotechnology becomes an indispensable ally. The exploration of novel materials and fabrication techniques reveals a realm of opportunities poised to fundamentally reshape electronic landscapes. It underscores the significance of bridging Nanophotonic and quantum electronics—a momentous step that marks the dawn of a new era. Nanophotonics and quantum electronics research has immense potential through investigating novel materials, incorporating quantum dots, and creating quantum communication systems. These innovations are set to improve nanophotonic technologies and bring about groundbreaking advances in data processing and secure quantum communication networks. The cross-disciplinary aspect of this research highlights its possible influence on computing, communication, and sensing uses, directing the course of electronics in the future.

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14. Future Semiconductor “Graphene”

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Abstract - The semiconductor industry has long relied on silicon as the material of choice for transistors in electronic devices. However, recent advancements in material science have brought graphene to the forefront as a compelling alternative. This paper explores the advantages of graphene over silicon in transistor technology, highlighting key properties, performance metrics, and potential applications that make graphene a transformative candidate in the semiconductor landscape.

Introduction

Silicon has been the backbone of semiconductor technology, Silicon is available in a very large quantity and easily affordable. It can be used to both prevent and allow the flow of electricity. Innovation in the silicon industry has allowed semiconductor chips to become smaller and smarter, but the demand for higher performance and energy efficiency has create interest in different/alternative materials. The industry is facing increased difficulty in reducing the size of silicon transistors due to it’s physical limitations. In addition, the mining and manufacturing of silicon damage the environment and causes ecological imbalance. Pure silicon must be fabricated artificially, which results in the emission of carbon monoxide into the atmosphere and increases air pollution. This has led to the search for a more suitable material to replace 2 the silicon. Graphene, with its unique properties, is emerging as a promising replacement for silicon in transistor application

What is Graphene

A graphene is an allotropic (when an element exists in more than one crystalline form, those forms are called allotropes, the two most common allotropes of carbon are diamond and graphite) form of carbon and consists of a network of hexagonal cells having the thickness of a single atom. Graphene is not a completely unknown or exotic material: the graphite found inside the common pencils is in fact composed of a pile of graphene planes, bound together. In graphene, however, atoms are held together by very strong covalent bonds, to make it the most resistant material available today. A graphene crystal can be considered not only in the planar form but also in a rolled form, also known by the

term nanotube. In graphene, the length of carbon-carbon bonds is approximately 1.42 Å (0.142 nm).

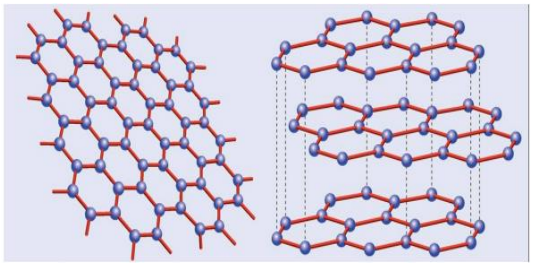

Fig1: Atomic structure of graphene

A carbon transistor could replace silicon. New research has shown that it is possible to build transistors; much smaller than silicon and possibly more efficient, with carbon sheets 0.10 nm thick. Unlike other experimental nanoscopic transistors, they do not require a complex manufacturing process.

These transistors are made of graphene, a material that conducts electricity much faster than most. It is a flat sheet of carbon atoms only one atom thick. It has great potential as a new (nano) electronic material thanks to the high mobility of its electrons. The big problem in high-speed electronic applications 3 is how easy it degrades, which reduces the performance of the devices. It could eventually lead to faster and more efficient electronic components that require less energy.

Graphene Properties

[1] Graphene's high elasticity and hardness

[2] Its high thermal and electric conductivity

[3] Its resistance (the toughest material in the world)

[4] Graphene is very light, like carbon fiber, but more flexible

[5] It consumes less electricity for the same task than silicon which gives this material great potential for development.

Benefits of Graphene-Based FETs

Graphene's superior electrical and thermal conductivity results in low resistance losses and better heat dissipation than silicon. Consequently, graphene transistors have the potential to provide enhanced performance and efficiency. The one-atom-thick structure means that the entire channel is on the surface. For sensor applications, the channel is therefore directly exposed to the material or environment under test. As such, some transistor are highly sensitive and suitable for a wide range of bio- and chemical-sensing applications. For example, it can detect individual molecules detaching from or attaching to a surface. Finally, researchers have established that using a thin, top-gate insulator material improves transistor parameters such as the open-circuit gain, forward transmission coefficient, and cutoff frequency. Consequently, this opens up other possibilities for GFET applications, including operations at very high frequencies.

Theoretically, the transistor has the

potential to switch at very high speeds approaching the terahertz range, which is several times faster than what silicon-based FETs can achieve. 4 The lattice structure of the traditional semiconductor materials has some limitations that cause it to dissipate more heat at higher frequencies. On the other hand, the hexagonal lattice structure of graphene, high electron mobility, and other factors enable it to operate at the terahertz frequencies much better.

The First Graphene Transistor

The first graphene transistor was introduced in 2004, but lost power and could not be turned off because electrons jumped too easily between carbon atoms. Now, Andre Geim and his colleagues at the University of Manchester, in the United Kingdom, have developed a graphene transistor that not only does not lose electricity but can also effectively control the flow of a single electron. The thin strip of graphene limits the quantum energy levels available for the flow of electrons, preventing them from jumping from one atom to another with such ease. In addition, an electric field is used to control the flow, adjusting the energy levels to turn the power on and off.

The graphene strip that makes up the device and the surrounding connections can be cut from a sheet of graphene, the same method used in the manufacture of silicon devices. According to Geim, graphene's potential as a successor to silicon is now beginning to be seen. Therefore, IT companies should increase their investment in research related to the possible uses of graphene.

"The theory and experiments say that two-dimensional flat crystals cannot exist." Geim explains. However, the researchers put a piece of graphene on silicon and placed the whole on a metal grill. Then, they used acid to dissolve the silicon, leaving graphene suspended over 500nm holes and a transmission electron microscope revealed that it is covered by tiny waves, which make the material remain stable.

Lack of Bandgap

Being a fast and efficient transistor, the transistor does not have a bandgap. The gapless structure means that the valence and conduction bands meet at zero volts, hence making graphene to behave like a metal. In semiconductor materials such as silicon, the two bands are separated by a gap which behaves like an insulator under normal conditions.

Usually, the electrons require some additional energy to jump from the valence band to the conduction band. In transistors, a bias voltage enables a current to flow through the band which acts as an insulator in the absence of the bias.

Unfortunately, the absence of a band gap in transistor makes it hard to turn off the transistor since it cannot behave as an insulator. The inability to completely

switch it off results in an on/off current ratio of about 5, which is quite low for logic operations. Consequently, using transistors in digital circuits is a challenge. However, this is not a problem with analog circuits hence making the transistor suitable for amplifiers, mixed-signal circuits, and other analog applications.

Technical Characteristics

The new graphene transistors have a channel length of only 140 nm or 0.14 μm, capable of operating at a cutoff frequency between 100–300 GHz, only limited by the parasitic capacitance of the substrate.

This frequency is comparable to that of the best electronic high mobility transistors on the market that have similar channel lengths. The result is an ultrafast transistor whose speed is similar to that of the best existing devices of similar size.

Graphene transistors remain stable and "conductive" even when they are only a few nanometre wide. This contrasts with all other known materials, including Silicon transistors, which oxidize, decompose and become unstable to ten times larger sizes.

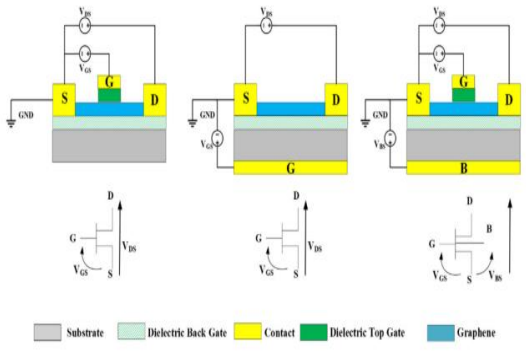

Figure 2. Most common topologies of graphene transistors. (left): Top-gated graphene transistor; (center): back-gated graphene transistor; (right): top- /back-gated graphene transistor.

Most Common Graphene Transistor Topologies

A field-effect transistor is a device characterized mainly by its three terminals (four terminals, considering the bulk terminal): the drain, the source, and the gate. The drain and the source are interconnected by the graphene channel. The gate is isolated from the channel by a gate dielectric. The channel is characterized by its length (L) and its width (W). For a given drain-source voltage (VDS) a current (IDS) flows through the channel, from drain to source. By applying a potential (VGS) on the third terminal (the gate), this current can be modulated by adjusting the charge of the channel through the induced electric field—the basic operation of the field-effect transistors. A GFET is a particular implementation of the above description, where the channel is implemented using a graphene layer.

This section is dedicated to describing the three most common topologies of graphene transistors. From the literature, as shown in FIGURE 2, we may identify three main types of GFET, classified essentially by the gate position: top-gated graphene transistor, back-gated graphene transistor, and top-/backgated graphene transistor.

Graphene Transistor is the Fastest Transistor

IBM has built the fastest field-effect transistor (FET) in the world based on graphene technology, and capable of operating up to the remarkable 26 GHz frequency. According to IBM researchers, the high mobility of electrons available with the materials derived from carbon allows frequencies even higher than 100 GHz and size of the transistor below 4 nm.

The operating frequency of 26 GHz has been reached by a graphene transistor (graphene transistor) having a gate length of approximately 150 nanometres; keep in mind that the frequency is inversely proportional to the square of the gate length, so by reducing the latter up to a value of 50 nanometres, it would be possible to reach the terahertz frequency range. Graphene is obtained through the deposition of carbon atoms on a thin film layer, using traditional lithographic techniques similar to those used in the manufacture of normal integrated circuits. Graphene is a special type of graphite, composed of a single layer of carbon atoms packed into a honeycomb lattice structure.

To recapitulate, Graphene, which consists entirely of carbon atoms arranged in a honeycomb-only honeycomb structure, has many features that make it attractive in electronics - especially for transistor applications such as radio chips. Graphene Transistors are revolutionizing the electronics industry. The properties of graphene could transform all activities that require computing capacity and, especially, the IoT sector. The development of graphene-based computers will increase device performance by 1000%, along with reducing costs due to the properties of this material. The discovery of IBM scientists could now lead to the technology finally becoming practicable.

How have IBM researchers succeeded in achieving such a high-frequency value?

First of all, the operating speed of a transistor can be increased by intervening on two primary factors:

1. Increasing the speed at which electrons move within the material. This is a substantial advantage of graphene-based technology: in this type of material, in fact, electrons move at very high speeds, allowing the realization of transistors with high speed and performance values.
2. Reducing the size of the transistor. This approach has been widely adopted in the past to increase the operating frequency of common silicon-based transistors.

Conclusions

In the coming years, the research aims to reduce the size of electronic devices and will mainly focus on nanotechnologies such as those that can be achieved with graphene. Electronic devices based on

silicon technologies will see their progress decrease or even come to a halt in the coming years, as researchers will have to deal with problems of instability and temperature dependence above certain limit dimensions of the structure. These types of problems do not affect materials such as graphene.

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15. A Review Paper on IOT Based Air Pollution Monitoring System

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Abstract:

Humankind, moving to a period centered upon improvement has overlooked the significance of supportability and has been the real guilty party behind the rising Pollution levels in the world's air among all other living life forms. The Pollution levels at certain spots have come to such high degrees that they have begun hurting our very own It wellbeing. An IoT based Air Pollution observing framework incorporates a MQ Series sensor interfaced to a Node MCU outfitted with an ESP8266 WLAN connector to send the sensor perusing to a Thing Speak cloud. Further extent of this work incorporates an appropriate AI model to foresee the air Pollution level and an anticipating model,

KEYWORDS: MCU, WLAN, AQI etc.

1. INTRODUCTION: Pollution can be well-defined as the presence of tiny elements that distract the working of ordinary processes and also yields undesirable health. In other words, pollution can disturb the natural phase and also can disturb the health of the living being. As industrial development is growing widely pollution is also getting make known to a huge manner. At present, there is Air, Water, and Soil is polluted worldwide. This only concentrates on Air pollution. Air pollution is the being there of impurity or tiny elements that affect living being health and surroundings. These pollutants result from vehicles, industries. The WHO (World Health Organization) states that 2.3 million persons die per year due to reasons directly qualified by air pollution. Based on the information above points out, the humanoid should focus on air pollution observing. Air pollutants are measured in Parts per Million (ppm) or ug/m3. Primary pollutants are released directly into the atmosphere. Secondary pollutants are produced when the primary pollutant reacts with other atmospheric chemicals. Air quality affects public health [2]. There are two approaches to checking air pollution at present-day. One is an inactive sample (non-automatic), and the other is constant online checking (automatic). The Inactive sample uses simple tools but it does not deliver real-time values. The procedure of continuous online monitoring uses sensors to monitor the parameters, and then send it to the control center by the network. The way records transmission includes wired and wireless organizations. Even although the system is dependable it is consuming small developments at big and dynamic range, such as complex network cabling, expensive, etc. at length rising communication knowledge, now a days air pollution checking method is often aimed in the wireless method. To implement such a system single-chip microcontroller along with an array of sensors, the IoT module is used. This system focus on gases such as CO2, temperature, and humidity via sensors. The hardware part collects air pollutant stages also pack them into the frame. The frame is uploaded to the IoT modem communicated to the significant server via IoT. This organization is low budget and energy effective in terms of devices.

2.LITERATURE SURVEY:

The wireless standard was used to design, build, and observe an Air Pollution Monitoring System for monitoring the combination of key air pollutant gases. Using semiconductor sensors, this device measures a mixture of hazardous gases. A single-chip microprocessor, an array of air pollution sensors, a GSM-Module, and a GPS-Module are all included in the hardware unit. The Central-Server is an internet-connected high-end personal computer application server. The hardware collects air pollution levels and stores them in a frame that includes the GPS physical location, time, and date.

1.Patil, P., et al. (2017) [1] developed smart IoT based system for vehicle noise and pollution monitoring. The hardware architecture as well as the software implementation is thoroughly detailed. IoT technology is also used to verify the system's performance. The clever intelligent environmental system that was built monitors the pollutants produced by automobiles and alerts vehicle owners to take action to reduce pollution. The data on pollution levels is also sent to a server for further study. Air pollution authorities can examine data and identify car registration numbers that contribute to increased pollution in the atmosphere. The designed system is low-cost, easy-to-use, and may be placed in any location. The created system outperforms the old system in terms of accuracy and cost.

2. Saiye, Y.D. et al. (2020) [2] designed air quality detection and monitoring system employs a wireless sensor network to monitor air quality in various places while also producing near real- time information and data that can be retrieved via smartphones, tablets and internet compatible device. Designed system that can track the amount of contaminants in the air developed by using Arduino Uno, a WIFI module, and a MQ135 gas sensor.

3.Chourey, Pet al. (2022) [3]Designed IoT baised air pollution monitoring system using MQ135,MQ7, and DHT11 gas sensors. These sensors will respond to the esp32 module, which will show the information on the ThinkSpeak web server, and configure a buzzer to notify us if the air quality drops below the set value.

4. Harsh Gupta and colleagues (2019) [4] developed an IoT based air pollution monitoring system for smart cities. Smart cities are under pressure to stay livable as the world's population becomes more urbanized. The air quality of urban centers has become a prominent source of worry around the world in recent years. As a result, in order to make a city smart and livable, it is vital to regularly evaluate its air quality index. We propose and construct an IoT-based Air Quality Monitoring System for Smart Cities in this research. Air quality data is retrieved in real time via smart devices and analyzed to determine the influence on city people.

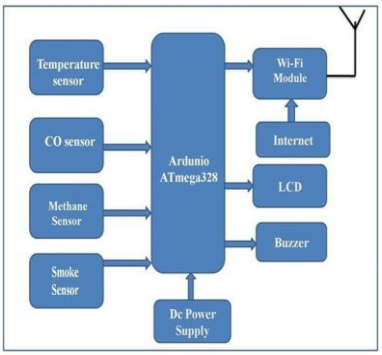
Harsh N. Shah and colleagues et al. (2018) [5] developed IOT based air pollution monitoring system using ATmega328P, Wi-Fi module ESP8266, MQ135 Gas sensor, MQ 6 LPG gas sensor, LM35 temperature sensor and humidity sensor SY-H5220. The Internet of Things-based Air Pollution Monitoring System is used to monitor the air quality via a web server. It will sound an alert if the air quality falls below a particular threshold, which signifies here are enough dangerous gases in the air, such as CO2, smoking, alcohol, benzene, NH3, and NOx. It will display the air quality in PPM on the LCD as well as on the webpage, allowing for easy monitoring of air pollution.

6.Sunil Mahesh Pattar et al. (2018) [6] reported survey on IoT-based air pollution monitoring system and purposed the level of pollution has risen through time due to a variety of factors such as population growth, increased vehicle use, industrialization, and urbanization, all of which have negative consequences on human wellbeing by directly impacting the health of those who are exposed to it.

3.METHODOLOGY:

In this project, we are working to make an IOT Based Air Pollution Monitoring System in which we will observe the Air Quality done on mobile using the internet and will initiate an alarm when the air quality goes beyond a certain level. When there is a sufficient quantity of dangerous gases exist in the air like CO2, smoke, temperature, humidity, and rain. It will show the air value in Parts per Million (PPM) on the L so that we can display it very easily.

Block diagram:



Air Pollution Monitoring System is based on the block diagram as shown in Fig.1. The data of air is recognized by MQ135 gas sensor and MQ6 LPG gas sensor. The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO2. So it is dynamic gas sensed for our Air pollution Monitoring system. When it will be connected to Arduino then it will sense all gases, and it will give the Pollution level in PPM (parts per million). MQ135 gas sensor will give the output in form of voltage levels and we have to convert it into PPM. So for converting the output in PPM, we have used a library for MQ135 gas sensor and MQ6n sensor. Sensor is giving value of 90 when there is no gas near it and the air quality safe level is 350 PPM and it should not exceed 1000 PPM. When it will exceed the limit of 1000 PPM, it will cause Headaches, sleepiness and stagnant, stuffy air. If it exceeds beyond 2000

PPM then it will cause increased heart rate and many different diseases. When the value will be less than 000 PPM, then the LCD and webpage will display “Fresh Air”. When the value will increase from 1000 PPM, then the buzzer will start beeping and the LCD and webpage will display “Poor Air, Open Windows”. And when it will increase 2000, the buzzer will keep beeping and give an alert message on smartphone through GSM. The LCD and webpage will display“Danger! Move to fresh Air”. It will contain temperature and humidity so it will possibly show the current temperature and humidity of the air. For temperature we have used LM35 sensor and for humidity SY-HS-220. According to the model the 4 sensors works as input data, they transmit data for knowing which gas it is, what is the temperature and humidity. LCD and Buzzer are the output devices. LCD shows the data of the gases in ppm (parts per million) and Buzzer is used when ppm crosses above a threshold limit.

HARDWARE COMPONENTS:

Arduino

Arduino Uno is a microcontroller board. In this project, we are working to make an IOT Based Air Pollution Monitoring System in which we will observe the Air Quality done on mobile using the internet and will initiate an alarm when the air quality goes beyond a certain level. When

there is a sufficient quantity of dangerous gases are existing in the air like CO2, smoke, temperature, humidity, and rain. It will show the air value in Parts per Million (PPM) on the LCD so that we can display it very easily. The Arduino Uno board includes
14 digital input/output pins 6 analog inputs, a USB Connection, a power jack,
a reset button. The user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and

interactive objects. The Arduino microcontroller is not only for technical persons but is intended for designers and artists also because of its focus to usability based on its plan which helps to achieve the intended goal

Gas Sensor:

The Gas Sensor (MQ2) component is used for the gas leakage finding. It is used for recognizing LPG Liquefied petroleum gas, CH4, CO (carbon monoxide), Smoke. The circuit is very simple. Gas sensor of the MQ-2 gas sensor is SnO2 (stannic oxide), which with lesser conductivity in clean air.

DTH11 Sensor:

DHT11 is featured to measure temperature and humidity sensor complex by using temperature & humidity sensing technique with output in the form of the standardized digital

signal . DHT11 is an inexpensive humidity and temperature sensor which offers high consistency and long period steadiness. DHT11 can be interfaced with any microcontroller like Arduino and get instant results. It gives the output in voltage.

LCD Display:

LCD (Liquid Crystal Display) an electronic display module. This is a basic (16x2) 16 character by 2 line display. Black text on Green background. It is used to show the Air and Humidity. A (16x2) LCD is a very plain module and is very normally used in different types of devices and circuits.

Buzzer:

A Buzzer or beeper is an electronic audio signaling device. Whenever the air pollution or the toxic level in the air goes beyond the threshold level the Buzzer makes sound starts beeping indicating Danger.

ESP8266:

The ESP8266 is low-cost. Every ESP8266 component comes pre-programmed with an AT expertise set firmware, meaning, we can simply join to the Arduino device. The ESP8266 module is a low-cost board . This module has a dominant sufficient on-board processing and storage capability that allows it to be combined with the sensors.

SOFTWARE REQUIREMENTS: -

Arduino IDE

The Arduino is an Integrated Development Environment (IDE) or Arduino Software has a text editor for writing programs. It also has a message area, text console, a toolbar with buttons for functions and a series of menus. It links to the Arduino hardware to upload programs and connect with them.

4.Thing speak:

Thing Speak is an Internet of Things (IoT) platform that lets you gather and hold sensor records in the cloud and develop IoT applications. The Thing Speak IoT platform delivers apps that let you study and visualize your value.

5. CONCLUSIONS:

The system utilizes city buses, industrial areas to collect pollutant gases such as CO, smoke, and temperature. Here we have successfully designed such a system that can monitor the real-time air pollution percentage present in the air which can be accessed from anywhere in the world so, here we have designed a circuit which makes takes corrective action on the increase of air pollution on the particular threshold value. The proposed Wireless Air Pollution Monitoring System be responsible for real-time info about the level of air pollution in these areas, as well as alerts in cases of extreme change in the quality of air. This data can then be used by the establishments to take prompt activities such as leaving people or sending crisis reply team.

The system uses city buses to gather pollutant gases such as CO, NO2, and SO2. The pollution facts from several mobile sensor ranges are conveyed to a central some that make these facts accessible on the Internet. The facts display the pollutant range and their conformance to local air quality.

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and Communication, PEC University of Technology, Chandigarh, India2 Professor, Dept. of Electronics and Communication, PEC University of Technology, Chandigarh, India3.

16. Vertical Take-off and Landing (VTOL) Drones: Revolutionizing Applications in Hilly Regions

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Abstract

Vertical Take-off and Landing (VTOL) drones have emerged as transformative tools, particularly revolutionizing applications in hilly regions. These versatile unmanned aerial vehicles (UAVs) exhibit the unique capability to ascend and descend vertically, overcoming the challenges posed by rugged terrains. Traditional drones have some restrictions in hillyareas. This paper presents VTOL drones which offers unparalleled access for various applications. The presented VTOL drones provide flexible and efficient solutions to address this problem. It has many applications in surveying, mapping, emergency response and agriculture. Their ability to navigate through uneven landscapes ensures precise data collection and swift response times in critical situations. This paper presents the pivotal role VTOL drones play in advancing technological solutions tailored to the specific demands of hilly regions, ushering in a new era of aerial capabilities that cater to diverse needs in challenging topographies.

Keywords: *Vertical Take-off and Landing, unmanned aerial vehicles, hilly regions, surveying and mapping*

1. Introduction

Vertical Take-off and Landing (VTOL) drones have emerged as a technological marvel, revolutionizing applications in hilly regions. These unmanned aerial vehicles showcase unparalleled versatility, seamlessly navigating challenging terrains with their unique ability to ascend and descend vertically. In hilly landscapes where traditional drones face limitations, VTOL drones redefine possibilities, offering precision and accessibility. From aerial surveys to

emergency response, their adaptability transforms the way we approach tasks in rugged topographies. This innovation not only enhances efficiency but also opens new frontiers in fields like agriculture, infrastructure inspection, and environmental monitoring. VTOL drones are a game-changer, ushering in a new era of aerial capabilities in challenging geographical settings. The basic structure VTOL is shown in Fig.1.

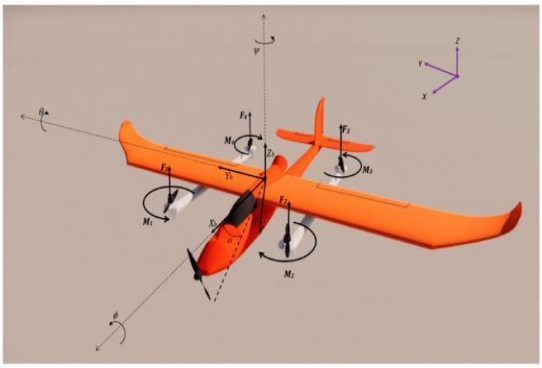

Fig.1: Quard-VTOL (vertical take-off and landing)

2. *WORKING OF VTOL:*

Vertical Take-off and Landing (VTOL) drones operate on a unique design and propulsion system that allows them to ascend and descend vertically [1,2]. The working mechanism typically involves a combination of rotor-based lift and traditional forward propulsion. Here's a brief overview of how VTOL drone's function:

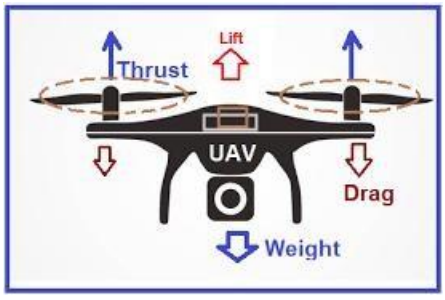

Fig.2: (forces acting on the craft)

VTOL drones are equipped with rotors that provide the necessary lift for vertical take- off and landing. These rotors are usually positioned in a way that allows the drone to hover in place or ascend and descend smoothly. The rotor's lift motion can be observed in Fig. 2.

2.1. Rotors for Vertical Lift:

Once the drone has reached the desired altitude, it can transition from vertical flight to horizontal flight. This transition is often achieved by altering the angle of the rotors or using a

2.2. Transition to Horizontal Flight:

combination of fixed-wing elements.

2.3. Forward Propulsion:

In horizontal flight, VTOL drones utilize traditional forward

propulsion methods, such as fixed wings or additional propulsion systems like jet engines or propellers. This allows the drone to cover longer distances more efficiently than traditional rotor-based drones.

2.4. Navigation and Control:

VTOL drones rely on sophisticated onboard navigation systems, gyroscopes, accelerometers, and GPS to maintain stability, control orientation, and navigate to specific locations. Flight controllers continuously adjust the speed and orientation of the rotors or propulsion systems to ensure precise control.

2.5. Autonomous Capabilities:

Many VTOL drones are equipped with advanced autonomy features, allowing them to operate autonomously, follow pre-programmed routes, or respond to real-time environmental conditions. This autonomy is crucial for various applications, including surveillance, mapping, and monitoring.

2.6. Vertical Landing:

When the mission is complete or the drone reaches its destination, it can smoothly transition back to vertical flight for landing. The ability to land vertically is particularly advantageous in confined spaces or areas with challenging terrain. The rotor's drag motioncan be observed in Fig. 2.

VTOL drones, with their versatile design, are well-suited for a wide range of applications, including agriculture, search and rescue, surveillance, and mapping, where the ability to take off and land vertically is essential for operational flexibility.

3. *APPLICATION*

Vertical Take-off and Landing (VTOL) drones have revolutionized applications inhilly regions, offering versatile solutions for various industries. Some notable applications include:

3.1. Agriculture:

VTOL drones are invaluable in hilly terrains for crop monitoring, precision agriculture, and spraying. Their ability to navigate varied topography allows farmers to assess and manage crops efficiently, optimizing yield and resource utilization [1]. The Fig. 3 showsthe application.

Fig. 3 (UAVs in Agriculture)

3.2. Surveillance and Reconnaissance:

In hilly regions where traditional surveillance methods may be challenging, VTOL drones provide a solution for law enforcement and security agencies. They can swiftly navigate complex landscapes, monitor remote areas, and gather real-time intelligence [2]. The Fig.4 show the application.

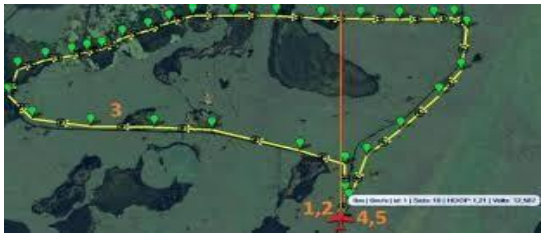

Fig.4: (how UAVs map areas for Surveillance) Environmental Monitoring:

Fig. 6 (UAVs for meds delivery)Mapping and Surveying:

VTOL drones play a crucial role in environmental studies by monitoring wildlife, vegetation, and terrain changes. Researchers use them to access remote and difficult-to-reach locations for ecological surveys and conservation efforts [1,2]. The Fig.5. show the application.Fig. 5 (UAVs for Thermal scan)

3.3. Infrastructure Inspection:

Hilly regions often have challenging terrain for infrastructure inspection. VTOL drones enable efficient inspection of power lines, pipelines, bridges, and other structures, offering a cost-effective and safe alternative to traditional methods [1]. The Fig. 5 show the application.

3.4. Emergency Response:

In disaster-stricken hilly areas, VTOL drones aid in search and rescue operations, delivering supplies, and assessing the extent of damage. Their agility and ability to access hard-to-reach locations make them essential in disaster response scenarios [2]. The Fig. 6 show the application.

VTOL drones are widely used for topographic mapping, land surveying, and geological exploration

in hilly regions. Their ability to cover large areas and generate high- resolution 3D maps aids in urban planning, construction, and land management [2]. The Fig. 4 shows the described application.

3.5. Transportation of Goods:

VTOL drones offer a unique solution for transporting goods in hilly terrains. They can overcome elevation changes efficiently, making them suitable for delivering medical supplies, equipment, or other necessities to remote or inaccessible areas [2]. The Fig. 4 show the application.

3.6. Communication Infrastructure Deployment:

In regions with challenging terrain, setting up communication infrastructure can be difficult. VTOL drones can be employed to deploy and maintain communication equipment, ensuring connectivity in remote hilly areas [1,2]. The Fig. 5 show the application.

VTOL drones, with their adaptability and ability to navigate challenging landscapes, are reshaping how industries operate in hilly regions. As technology continues to advance, these drones are likely to find even more applications, further enhancing their impact on various sectors.

4. FUTURE PLANS:

The future of Vertical Take-off and Landing (VTOL) drones holds tremendous promise in revolutionizing applications in hilly regions. As technology advances, these drones are poised to play a pivotal role in various sectors. In agriculture, they can optimize crop monitoring and precision agriculture on challenging terrains, enhancing yields and resource efficiency. Additionally, VTOL drones are expected to be integral in infrastructure development, conducting inspections and surveys with unparalleled agility. Search and rescue missions in hilly areas will benefit from their rapid deployment and ability to navigate complex landscapes. Moreover, the integration of advanced sensors may enable environmental monitoring and conservation efforts. The ongoing evolution of VTOL drone capabilities foretells a transformative impact on hilly region applications, shaping a more efficient and resilient future.

5. **CONCLUSION**:

VTOL drones are revolutionizing applications in hilly regions across various industries. Their unique capabilities of vertical take-off and landing, combined with horizontal flight, enable them to overcome challenges and unlock new possibilities

in agriculture, forestry, infrastructure inspection, emergency response, and more. As technology continues to advance and regulations evolve, VT

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2. Tilt rotor mechanism for VOTLs

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17. What is AI ? Application of Artificial Intelligence

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Abstract- Humans have always been interested in making machines that display intelligence. The Ancient Egyptians and Romans were lore is packed with tales of items which could move and talk like their human masters and there have been stories of sages from the middle ages which had accede-stuck by religious statues that were manipulated by priests behind the scenes. Medieval as to a homunculus – a small artificial man that was actually a living sentient being. And in fact 16th century Bombasts said, "We shall be like gods. We shall duplicate God's greatest miracle – the creation of man."

Content-

1)Introduction-Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think and act like humans. It involves the development of algorithms and computer programs that can perform tasks that typically require human intelligence such as visual perception, speech recognition, decision-making, and language translation. AI has the potential to revolutionize many industries and has a wide range of applications, from virtual personal assistants to self-driving cars.

Artificial Intelligence (AI) is the science and engineering that deals with the production of intelligent computer programs to solve complex problems in a more human-like fashion. Today, AI is applied in many fields including military, stock market, debit risk assessment, learning to read postcodes, medical diagnosis, automobiles, robot control systems, scientific discovery, and has become ubiquitous in numerous aspects of our daily lives . But many universities have not fully exploited AI techniques in educational practice. The use of artificial intelligence (AI) in the education sector is a new trend in the worldwide competitive business environment. Although AI in education has not been given much attention throughout the year's specific knowing the terms, tasks, methodologies, and applications of AI would provide the groundwork for the development of the education sector.

As an example, it is believed that playing chess well or some complicated card games need some form of human intelligence and also selecting the best diagnosis in a difficult medical case or developing something new, such as a mathematical theorem, some sort of art or even driving a car in

the heart of a congested city.

2)Need of AI- Understanding the role of AI in our lives can throw light on its need in society, businesses, and regular day-to-day life. Human efficiency, activity, and capabilities are highly improvised and augmented when coupled with intelligent machines.

Earth has already witnessed three industrial revolutions. The fourth one is presumed to be driven by artificial intelligence and its capabilities**.**

3)Types of AI-

a) Reactive Machines: AI capable of responding to external stimuli in real time; unable to build memory or store information for future.
b) Limited Memory: AI that can store knowledge and use it to learn and train for future tasks.
c) Theory of Mind: AI that can sense and respond to human emotions, plus perform the tasks of limited memory machines.
d) Self-aware: AI that can recognize others' emotions, plus has sense of self and human-level intelligence; the final stage of AI.

4)Advantages of AI -

a) It defines a more powerful and more useful computer
b) It introduces a new and improved interface for human interaction.
c) It introduces a new technique to solve new problems
d) It handles the information better than humans

5)Disadvantages of AI-

a) The implementation cost of AI is very high.
b) The difficulties with software development for AI implementation are that the development of software is slow and expensive. Few efficient programmers are available to develop software to implement artificial intelligence.
c) A robot is one of the implementations of Artificial intelligence with them replacing jobs and lead to serve unemployment.
d) Machines can easily lead to destruction if the implementation of machine put in the wrong hands the results are hazardous for human beings.

6)Applications of AI-

1. E-Commerce
2. Media
3. Health Care
4. Online Advertising
5. Innovations

7)Conclusion-

a) Artificial Intelligence has made a great deal of progress since its inception in the 1950s
b) The goal of general AI has been abandoned (at least temporarily)
c) Useful applications have appeared in all subfields of AI, including: Machine learning, computer vision, robotics, natural language processing and knowledge representation
d) The field continues to evolve rapidly
e) Increased complexity and unpredictability of AI programs will raise important ethics issues and concerns

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18. 5G TECHNOLOGY

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***Abstract*—** In wireless communication, Fifth Generation (5G) Technology is a recent generation of mobile networks. In this paper, evaluations in the field of mobile communication technology are presented. In each evolution, multiple challenges were faced that were captured with the help of next-generation mobile networks. Among all the previously existing mobile networks, 5G provides a high-speed internet facility, anytime, anywhere, for everyone. 5G is slightly different due to its novel features such as interconnecting people, controlling devices, objects, and machines. 5G mobile system will bring diverse levels of performance and capability, which will serve as new user experiences and connect new enterprises. Therefore, it is essential to know where the enterprise can utilize the benefits of 5G. In this research article, it was observed that extensive research and analysis unfolds different aspects, namely, millimeter wave (mmWave), massive multiple-input and multiple-output (Massive-MIMO), small cell, mobile edge computing (MEC), beamforming, different antenna technology, etc. This article's main aim is to highlight some of the most recent enhancements made towards the 5G mobile system and discuss its future research objectives.

1. Introduction

Most recently, in three decades, rapid growth was marked in the field of wireless communication concerning the transition of 1G to 4G. The main motto behind this research was the requirements of high bandwidth and very low latency.

5G provides a high data rate, improved quality of service (QoS), low-latency, high coverage, high reliability, and economically affordable services. 5G delivers services categorized into three categories: (1) Extreme mobile broadband (eMBB). It is a nonstandalone architecture that offers high-speed internet connectivity, greater bandwidth, moderate latency, UltraHD streaming videos, virtual reality and augmented reality (AR/VR) media, and many more.

(2) Massive machine type communication (eMTC), 3GPP releases it in its 13th specification. It provides long-range and broadband machine-type communication at a very cost-effective price with less power consumption. eMTC brings a high data rate service, low power, extended coverage via less device complexity through mobile carriers for IoT applications. (3) ultra-reliable low latency communication (URLLC) offers low-latency and ultra-high reliability, rich quality of service (QoS), which is not possible with traditional mobile network architecture. URLLC is designed for on-demand real-time interaction such as remote surgery, vehicle to vehicle (V2V) communication, industry 4.0, smart grids, intelligent transport system, etc.

1.1. Evolution from 1G to 5G

First generation (1G): 1G cell phone was launched between the 1970s and 80s, based on analog technology, which works just like a landline phone. It suffers in various ways, such as poor battery life, voice quality, and dropped calls. In 1G, the maximum achievable speed was 2.4 Kbps.

Second Generation (2G): In 2G, the first digital system was offered in 1991, providing improved mobile voice communication over 1G. In addition, Code-Division Multiple Access (CDMA) and Global System for Mobile (GSM) concepts were also discussed. In 2G, the maximum achievable speed was 1 Mpbs.

Third Generation (3G): When technology ventured from 2G GSM frameworks into 3G universal mobile telecommunication system (UMTS) framework, users encountered higher system speed and quicker download speed making constant video calls. 3G was the first mobile broadband system that was formed to provide the voice with some multimedia. The technology behind 3G was high-speed packet access (HSPA/HSPA+). 3G used MIMO for multiplying the power of the wireless network, and it also used packet switching for fast data transmission.

Fourth Generation (4G): It is purely mobile broadband standard. In digital mobile communication, it was observed information rate that upgraded from 20 to 60 Mbps in 4G [4]. It works on LTE and WiMAX technologies, as well as provides wider bandwidth up to 100 Mhz. It was launched in 2010.

Fourth Generation LTE-A (4.5G): It is an advanced version of standard 4G LTE. LTE-A uses MIMO technology to combine multiple antennas for both transmitters as well as a receiver. Using MIMO, multiple signals and multiple antennas can work simultaneously, making LTE-A three times faster than

standard 4G. LTE-A offered an improved system limit, decreased

(Data, Voice, and Video) wirelessly at any time anywhere in the world.LTE-A delivers speeds of over 42 Mbps and up to 90 Mbps.

Fifth Generation (5G): 5G is a pillar of digital transformation; it is a real improvement on all the previous mobile generation networks. 5G brings three different services for end user like Extreme mobile broadband (eMBB). It offers high-speed internet connectivity, greater bandwidth, moderate latency, UltraHD streaming videos, virtual reality and augmented reality (AR/VR) media, and many more. Massive machine type communication (eMTC), it provides long-range and broadband machine-type communication at a very cost-effective price with less power consumption. eMTC brings a high data rate service, low power, extended coverage via less device complexity through mobile carriers for IoT applications. Ultra-reliable low latency communication (URLLC) offers low-latency and ultra-high reliability, rich quality of service (QoS), which is not possible with traditional mobile network architecture. URLLC is designed for on-demand real-time interaction such as remote surgery, vehicle to vehicle (V2V) communication, industry 4.0, smart grids, intelligent transport system, etc. 5G faster than 4G and offers remote-controlled operation over a reliable network with zero delays. It provides down-link maximum throughput of up to 20 Gbps. In addition, 5G also supports 4G WWWW (4th Generation World Wide Wireless Web) [5] and is based on Internet protocol version 6 (IPv6) protocol. 5G provides unlimited internet connection at your convenience, anytime, anywhere with extremely high speed, high throughput, low-latency, higher reliability and scalability, and energy-efficient mobile communication technology [6]. 5G mainly divided in two parts 6 GHz 5G and Millimeter wave(mmWave) 5G.

deferral in the application server, access triple traffic

6 GHz is a mid frequency band which works as a mid point between capacity and coverage to offer perfect environment for 5G connectivity. 6 GHz spectrum will provide high bandwidth with improved network performance. It offers continuous channels that will reduce the need for network densification when mid- band spectrum is not available and it makes 5G connectivity affordable at anytime, anywhere for everyone.

1.2 Key Contributions

The objective of this survey is to provide a detailed guide of 5G key technologies, methods to researchers, and to help with understanding how the recent works addressed 5G problems and developed solutions to tackle the 5G challenges; i.e., what are new methods that must be applied and how can they solve problems? Highlights of the research article are as follows.

- This survey focused on the recent trends and development in the era of 5G and novel contributions by the researcher community and discussed technical details on essential aspects of the 5G advancement.

- In this paper, the evolution of the mobile network from 1G to 5G is presented. In addition, the growth of mobile communication under different attributes is also discussed.

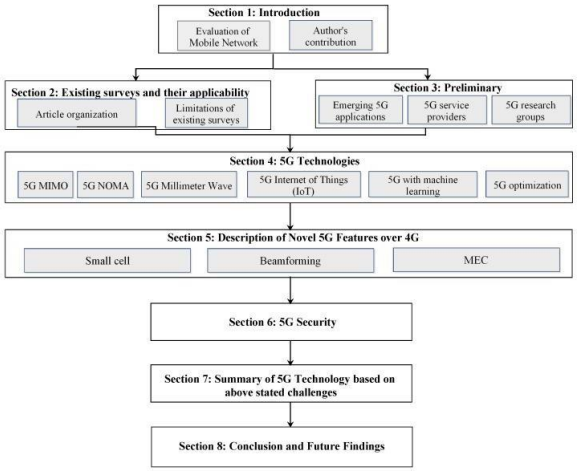
2. Existing Surveys and Their Applicability

A detailed survey on various technologies of 5G networks is presented. Various researchers have worked on different technologies of 5G networks. In this section, a tabular representation of existing surveys of 5G networks. Massive MIMO, NOMA, small

cell, mmWave, beamforming, and MEC are the six main pillars that helped to implement 5G networks in real life.

2.1. Limitations of Existing Surveys

The existing survey focused on architecture, key concepts, and implementation challenges and issues. The numerous current surveys focused on various 5G technologies with different parameters, and the authors did not cover all the technologies of the 5G network in detail with challenges and recent advancements. Few authors worked on MIMO (Non-Orthogonal Multiple Access) NOMA, MEC, small cell technologies. In contrast, some others worked on beamforming, Millimeter- wave (mmWave). But the existing survey did not cover all the technologies of the 5G network from a research and advancement perspective. No detailed survey is available in the market covering all the 5G network technologies and currently published research trade-offs. So, our main aim is to give a detailed study of all the technologies working on the 5G network. In contrast, this survey covers the state-of-the-art techniques as well as corresponding recent novel developments by researchers. Various recent significant papers are discussed with the key technologies accelerating the development and production of 5G products. This survey article collected key information about 5G technology and recent advancements, and it can be a kind of a guide for the reader. This survey provides an umbrella approach to bring multiple solutions and recent improvements in a single place to accelerate the 5G research with the latest key enabling solutions and reviews. A systematic layout representation of the survey in figure. We provide a state-of-the-art comparative overview of the existing surveys on different technologies of 5G networks in Table.



2.2. Article Organization

This article is organized under the following sections. Section 2 presents existing surveys and their applicability. In Section 3, the preliminaries of 5G technology are presented. In Section 4, recent advances of 5G technology based on Massive MIMO, NOMA, Millimeter Wave, 5G with IoT, machine learning for 5G, and Optimization in 5G are provided. In Section 5, a description of novel 5G features over 4G is provided. Section 6 covered all the security concerns of the 5G network. Section 7, 5G technology based on above-stated challenges summarize in tabular form. Finally, Section 8 and Section 9 conclude the study, which paves the path for future research.

This section describes recent advances of 5G Massive MIMO, 5G NOMA, 5G millimeter wave, 5G IOT, 5G with machine learning, and 5G optimization-

3.1. 5G Massive MIMO

Multiple-input-multiple-out (MIMO) is a very important technology for wireless systems. It is used for sending and receiving multiple signals simultaneously over the same radio channel. MIMO plays a very big role in WI-FI, 3G, 4G, and 4G LTE-A networks.

3. 5G Technologies

1. Data rate: Massive MIMO is advised as the one of the dominant technologies to provide wireless high speed and high data rate in the gigabits per seconds.
2. The relationship between wave frequency and antenna size: Both are inversely proportional to each other. It means lower frequency signals need a bigger antenna and vice versa.
3. Number of user: From 1G to 4G technology one cell consists of 10 antennas. But, in 5G technologies one cell consist of more than 100 antennas. Hence, one small cell at the same time can handle multiple users [45]. As shown in Figure 2.
4. MIMO role in 5G: Massive MIMO will play a crucial role in the deployment of future 5G mobile communication as greater spectral and energy efficiency could be enabled.

based approaches. In addition, the summary is also presented in each subsection that paves the researchers for the future research direction.

3.2. 5G Non-Orthogonal Multiple Access (NOMA):

NOMA is a very important radio access technology used in next generation wireless communication. Compared to previous orthogonal multiple access techniques, NOMA offers lots of benefits like high spectrum efficiency, low latency with high reliability and high speed massive connectivity.

- NOMA is different than all the previous orthogonal access techniques such as TDMA, FDMA and CDMA. In NOMA, multiple users work simultaneously in the same band with different power levels. As shown in Figure 3.
- NOMA provides higher data rates and resolves all the loop holes of OMA that makes 5G mobile network more scalable and reliable.
- As multiple users use same frequency band simultaneously it increases the performance of whole network.

CONCLUSION

5G Technology stands for 5th Generation Mobile technology.

5G mobile technology has altered the means to use cell phones within very high bandwidth. Users never experienced continually before such a high value technology. Nowadays mobile users have much awareness of the cell phones (mobile) technology. The 5G technologies include all the types of innovative structures which makes 5G mobile technology most powerful and in a huge demand in near future. A user can also catch their 5G technology cell phone with their Laptop to get broadband internet access. 5G technology with camera, MP3, video play-actor, large phone memory, audio player and much more you never imagine. For children astounding fun Bluetooth technology and Piconets has become in market.

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19. Application of Artificial Intelligence and Machine Learning

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Abstract :

This paper provides a comprehensive exploration of the dynamic field of Artificial Intelligence (AI) and Machine Learning (ML). Ashish and Rudraksh, students of Computer Engineering at Government Polytechnic Arvi, under the guidance of Dr. M.A. Ali (Head of Computer Engineering Department) and M.P. Ganorkar (Faculty Member, Computer Engineering Department), delve into the fundamental concepts, historical evolution, and the intersection of AI and ML. The study examines the significance and relevance of AI and ML in today's technological landscape, impacts of widespread AI and ML adoption. As AI and ML continue to shape our digital era, this paper aims to provide a foundational understanding for both novices and enthusiasts alike, emphasizing the transformative power and implications of these intelligent technologies.

Keywords: Artificial Intelligence, Machine Learning, Technology, Data Science, Automation, Future Trends, Ethical Considerations.

1. Introduction

1.1 Definition of Artificial Intelligence

Artificial Intelligence (AI) is the branch of computer science which deals withintelligence of machines where an intelligent agent is a system that takes actions which maximize its chances of success. It is

the study of ideas which enable computers to do the things that make people seem intelligent. The central principles of AI include such as reasoning, knowledge, planning, learning, communication, perception and the ability to move and manipulate objects. It is the science and engineering of making intelligent machines, especially intelligent computer programs

According to the father of Artificial Intelligence John McCarthy, it is "The science and engineering of making intelligent machines, especially intelligent computer programs". Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent humans think. AI is accomplished by studying how human brain thinks, and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems. AI can be classified into three main types: Narrow or Weak AI and General or Strong AI and Super AI.

1.2 Definition of Machine Learning (ML)

A computer program which learns from experience is called a machine learning program or simply a learning program. Such a program is sometimes also referred to as a learner. It is one of the applications of AI where machines are not explicitly programmed to perform certain tasks; rather, they learn and improve from experience automatically.

Deep Learning is a subset of machine learning based on artificial neural networks for predictive analysis. There are various machine learning algorithms, such as Unsupervised Learning, Supervised Learning, and Reinforcement Learning.

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2. History and Evolution of AI and ML

2.1 Artificial Intelligence

- Year 1943: The first work which is now recognized as AI was done by Warren McCulloch and Walter pits in 1943. They proposed a model of artificial neurons.
- Year 1949: Donald Hebb demonstrated an updating rule for modifying the connection strength between neurons. His rule is now called Hebbian learning.
- Year 1950: The Alan Turing who was an English mathematician

and pioneered Machine learning in 1950. Alan Turing publishes "Computing Machinery and Intelligence" in which he proposed a test. The test can check the machine's ability to exhibit intelligent behaviour equivalent to human intelligence, called a Turing test.

- Year 1955: An Allen Newell and Herbert A. Simon created the "first artificial intelligence program" Which was named as "Logic Theorist". This program had proved 38 of 52 Mathematics theorems, and find new and more elegant proofs for some theorems.
- Year 1956: The word "Artificial Intelligence" first adopted by American Computer scientist John McCarthy at the Dartmouth Conference. For the first time, AI coined as an academic field.
- Year 1966: The researchers emphasized developing algorithms which can solve mathematical problems. Joseph Weizenbaum created the first chatbot in 1966, which was named as ELIZA.
- Year 1972: The first intelligent humanoid robot was built in Japan which was named as WABOT-1.
- Year 1997: In the year 1997, IBM Deep Blue beats world chess champion, Gary Kasparov, and became the first computer to beat a world chess champion.
- Year 2002: for the first time, AI entered the home in the form of Roomba, a vacuum cleaner.
- Year 2006: AI came in the Business world till the year 2006. Companies like Facebook, Twitter, and Netflix also started using AI.

Now AI has developed to a remarkable level. The concept of Deep learning, big data, and data science are now trending like a boom. Nowadays companies like Google, Facebook, IBM, and Amazon are working with AI

2.1 Machine Learning

Arthur Samuel, an early American leader in the field of computer gaming and artificial intelligence, coined the term "Machine Learning" in 1959 while at IBM. He defined machine learning as "the field of study that gives computers the ability to learn without being explicitly programmed." However, there is no universally accepted definition for machine learning. Different authors define the term differently.Year 1943: Logician Walter Pitts and neuroscientist Warren McCulloch published the first mathematical modeling of a neural network to create algorithms that mimic human thought processes.

- Year 1949: Donald Hebb published the seminal book in machine learning development The Organization of Behavior:

A Neuropsychological Theory on how behavior and thought in terms of brain activity relate to neural networks.

- Year 1950: Alan Turing created the Turing Test to determine if a computer has real intelligence. To pass the test, a computer must be able to fool a human into believing it is also human at the University of Manchester.

- Year 1959: Arthur Samuel coined the term machine learning in a seminal paper explaining that the computer could be programmed to outplay its programmer.

- Year 1967: The nearest neighbor algorithm was written, allowing computers to begin using very basic pattern recognition.

- Year 1990: work on machine learning shifted from a knowledge-driven approach to a data-driven approach. Scientists began creating programs for computers to analyze large amounts of data and draw conclusions — or "learn" — from the results
- Year 2006: The term "deep learning" was coined by Geoffrey Hinton to explain new algorithms that let computers "see" and distinguish objects and text in images and videos.

- Year 2015: Amazon launched its own machine learning platform, Microsoft also created the Distributed Machine Learning Toolkit, which enabled the efficient distribution of machine learning problems across multiple computers.

3 Types of AI and ML

3.1 Artificial Intelligence

1. Weak AI or Narrow AI:

- Narrow AI is a type of AI which is able to perform a dedicated task with intelligence. The most common and currently available AI is Narrow AI in the world of Artificial Intelligence.
- Narrow AI cannot perform beyond its field or limitations, as it is onlytrained for one specific task. Hence it is also termed as weak AI. Narrow AI can fail in unpredictable ways if it goes beyond its limits.
- Apple Siri a good example of Narrow AI, but it operates with a limited pre-defined range of functions.

2. General AI:

- General AI is a type of intelligence which could perform any intellectual task with efficiency like a human.
- The idea behind the general AI to make such a system which could be smarter and think like a human by its own.
- Currently, there is no such system exist

which could come under general AI and can perform any task as perfect as a human.

3. Super AI:

- Super AI is a level of Intelligence of Systems at which machines could surpass human intelligence, and can perform any task better than human with cognitive properties. It is an outcome of general AI.
- - Some key characteristics of strong AI include capability include the ability

  to think, to reason, solve the puzzle, make judgments, plan, learn, and communicate by its own. Development of such systems in real is still world changing task.

3.2 Machine Learning

1. Supervised Machine Learning

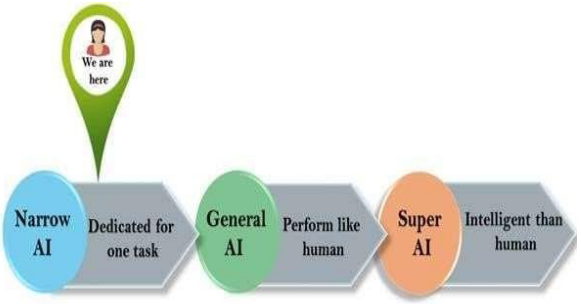
Supervised learning is the types of machine learning in which machines are trained using well "labelled" training data, and on basis of that data, machines predict the output. The labelled data means some input data is already tagged with the correct output. In supervised learning, the training data provided to the machines work as the supervisor that teaches the machines to predict the output correctly. It applies the same concept as a student learns in the supervision of the teacher.

Supervised machine learning can be classified into two types of problems, which are given below:

- Classification
- Regression

a) Classification

Classification algorithms are used to solve the classification problems in which the output variable is categorical, such as "Yes" or No, Male or Female, Red or Blue, etc. The classification algorithms predict the



categories present in the dataset. Some real-world examples of classification algorithms are Spam Detection, Email filtering, etc.

b) Regression

Regression algorithms are used to solve regression problems in which there is a linear relationship between input and output variables. These are used to predict

continuous output variables, such as market trends, weather prediction, etc.

2. Unsupervised Machine Learning

Unsupervised learning is different from the Supervised learning technique; as its name suggests, there is no need for supervision. It means, in unsupervised machine learning, the machine is trained using the unlabelled dataset, and the machine predicts the output without any supervision.

In unsupervised learning, the models are trained with the data that is neither classified nor labelled, and the model acts on that data without any supervision.

Categories of Unsupervised Machine Learning

Unsupervised Learning can be further classified into two types, which are given below:

- Clustering
- Association

1) Clustering

The clustering technique is used when we want to find the inherent groups from the data. It is a way to group the objects into a cluster such that the objects with the most similarities remain in one group and have fewer or no similarities with the objects of other groups. An example of the clustering algorithm is grouping the customers by their purchasing

2) Association

Association rule learning is an unsupervised learning technique, which finds interesting relations among variables within a large dataset. The main aim of this learning algorithm is to find the dependency of one data item on another data item and map those variables accordingly so that it can generate maximum profit. This algorithm is mainly applied in Market Basket analysis, Web usage mining, continuous production, etc.

Reinforcement learning

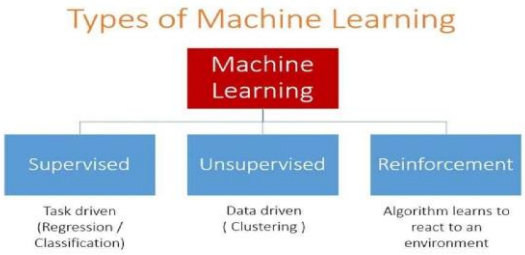
Reinforcement learning works on a feedback-based process, in which an AI agent (A software component) automatically explore its surrounding by hitting & trail, taking action, learning from experiences, and improving its performance. Agent gets rewarded for each good action and get punished for each bad action; hence the goal of reinforcement learning agent is to maximize the rewards.

Categories of Reinforcement Learning

Reinforcement learning is categorized

mainly into two types of methods/algorithms:

- Positive Reinforcement Learning: Positive reinforcement learning specifies increasing the tendency that the required behaviour would occur again by adding something. It enhances the strength of the behaviour of the agent and positively impacts it.
- Negative Reinforcement Learning: Negative reinforcement learning works exactly opposite to the positive RL. It increases the tendency that the specific behaviour would occur again by avoiding the negative condition.



Application

3.1 Application of AI

- **Natural language processing (NLP)**: NLP allows computers to understand and generate human language. This technology is used in a variety of applications, such as machine translation, spam filtering, and sentiment analysis.
- **Computer vision**: Computer vision allows computers to identify and interpret visual content. This technology is used in a variety of applications, such as self-driving cars, facial recognition, and object detection.
- **Machine learning (ML)**: ML allows computers to learn from data and improve their performance over time. This technology is used in a variety of applications, such as predictive
- analytics, fraud detection, and recommendation systems.
- Robotics: Robotics is the branch of AI that deals with the design, construction, and operation of robots. Robots are used in a variety of applications, such as manufacturing, healthcare, and space exploration.

AI in healthcare

- Disease diagnosis: AI can be used to analyze patient data and identify patterns that may indicate a disease. This can help doctors diagnose diseases earlier and more accurately.
- **Treatment development**: By analyzing large datasets of patient data, AI can identify new patterns and relationships that can be used to

develop new drugs and therapies.

- **Personalized care**: By analyzing a patient's data, AI can help doctors develop treatment plans that are tailored to the patient's specific needs.

AI in education

- **Personalized learning**: AI can be used to create personalized learning experiences for students. By tracking each student's progress, AI can identify areas where the student needs additional support and provide targeted instruction.

- Improved student engagement: AI can be used to improve student engagement by providing interactive and engaging learning experiences. For example, AIpowered applications can provide students with real-time feedback and support.

- Automated administrative tasks: Administrative tasks, such as grading papers and scheduling classes can be assisted by AI models, which will help free up teachers' time to focus on teaching.

AI in agriculture

- Crop yield improvement: Analyzing data on soil conditions, weather patterns, and crop growth with AI models and tools could help to develop strategies that can improve crop yields

- Cost reduction: Automating tasks with AI, such as harvesting and irrigation, which can reduce labour costs

- Environmental protection: Monitoring and managing natural resources, such as water and soil

AI in manufacturing

- **Improved efficiency**: Automating tasks, such as assembly and inspection

- **Increased productivity**: Optimizing production processes

- **Improved quality**: AI can be used to detect defects and improve quality control

3.2 Application of ML

1. **Image Recognition**

   One of the most notable machine learning applications is image recognition, which is a method for cataloging and detecting an object or feature in a digital image. In addition, this technique is used for further analysis, such as pattern recognition, face detection, and face recognition.

2. **Speech Recognition**

   ML software can make measurements of words spoken using a collection of numbers that

represent the speech signal. Popular applications that employ speech recognition include Amazon's Alexa, Apple's Siri, and Google Maps.

3. **Predict Traffic Patterns**

   To explain this, let's consider the example of Google maps. When we enter our location on the map, the application collects massive amounts of data about the present traffic to generate predictions regarding the upcoming traffic and identify the fastest route to our destination.

4. **E-commerce Product Recommendations**

   One of the prominent elements of typically any e-commerce website is product recommendation, which involves the sophisticated use of machine learning algorithms. Websites track customer behavior based on past purchases, browsing habits, and cart history and then recommend products using machine learning and AI.

5. **Self-Driving Cars**

   Self-driving cars use an unsupervised learning algorithm that heavily relies on machine learning techniques. This algorithm enables the vehicle to collect information from cameras and sensors about its surroundings, understand it, and choose what actions to perform.

6. **Catching Email Spam**

   One of the most popular applications of machine learning that everyone is familiar with is in detecting email spam. Email service providers build applications with spam filters that use an ML algorithm to

classify an incoming email as spam and direct it to the spam folder.

7. **Catching Malware**

The process of using machine learning (ML) to detect malware consists of two basic stages. First, analyzing suspicious activities in an Android environment to generate a suitable collection of features; second, training the system to use the machine and deep learning (DL) techniques on the generated features to detect future cyberattacks in such environments.

8. **Virtual Personal Assistant**

Virtual personal assistants help people access relevant information via text or voice. When a query is put into the system, the personal assistant gathers information by searching for it or recalling similar questions an individual has asked in the past. Some popular ML techniques involved in virtual assistants include speech recognition, speech-to-text conversion, natural language processing, and text-to speech conversion.

9. **Online Fraud Recognition**

One of the most essential applications of machine learning is fraud detection. Every time a customer completes a transaction, the machine learning model carefully examines their profile in search of any unusual patterns to detect online fraud.Stock Market and Day Trading

When it comes to the stock market and day trading, machine learning employs algorithmic trading to extract important data to automate or support crucial investment activities. Successful portfolio management, and choosing when to buy and sell stocks are some tasks accomplished using ML.

4. Conclusion:

In conclusion, the realm of Artificial Intelligence and Machine Learning stands at the forefront of technological innovation, reshaping the way we perceive and interact with the world. The journey from foundational concepts to advanced applications has been both remarkable and transformative. We have explored the fundamental principles underpinning AI and ML, delving into their intricate interplay and the pivotal role of data in shaping intelligent systems.

As we navigate through the diverse landscape of applications, from healthcare to finance and beyond, it becomes evident that AI and ML are catalysts for groundbreaking advancements. However, the expedition into this technological

frontier is notwithout challenges. The ethicalconsiderations surrounding bias, privacy, and societal impact underscore the need for a conscientious approach in deploying these powerful technologies.

Looking ahead, the trajectory of I and ML is characterized by an exciting array of possibilities. Recent breakthroughs in neural networks and deep learning hint at the potential for even greater strides in solving complex problems. The fusion of innovation, collaboration, and responsible practices will shape the future landscape, bringing forth solutions to hitherto unsolved challenges.

In our exploration of case studies, we witnessed tangible examples of AI and ML making a positive impact on diverse industries. These successes underscore the transformative potential of these technologies when guided by ethical principles and a commitment to societal well-being.

As we stand on the brink of a new era, the forecast for AI and ML is both promising and nuanced. Predicting trends and anticipating societal implications invite us to reflect on the responsible stewardship of these technologies. The journey into the future requires not only technical expertise but a collective commitment to navigating the ethical and societal dimensions of AI and ML.

In the ever-evolving landscape of technology, the dialogue initiated by this exploration must extend beyond this presentation. It is a collective responsibility to ensure that the unfolding narrative of Artificial Intelligence and Machine Learning is one of progress, inclusivity, and ethical consideration. The journey continues, and with it, the potential to create a future where AI and ML contribute meaningfully to the betterment of humanity.

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