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Internet of Things and Its Applications: A New Paradigm

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Abstract

As the Internet of Things (IoT) rapidly evolving and increasing its existence in the world of Internet, it has become important to know the various fields and areas of the application of IoT, and the challenges to its different applications. From smart cities to health care, smart agriculture, smart energy saving measures, to even smart water management, smart pollution control for better environments. IoT is expected to intrude into everywhere of our daily life which also includes security and safety of humans and their belongings. Moreover, these advantages are somehow interlinked which each other, from one point to another, causing a system of progressive effects. In this paper, we conduct a study and an overview of the role and upcoming trends in this technology of IoT.

Keywords-*Internet of Things; IoT applications; smart cities, smart agriculture; smart living, Artificial Intelligence.*

I. Introduction

The Internet of Things (IoT) is a network of connected devices that allows machines to run successfully, with financial gains and reduced staffing. The Internet of Things (IoT) is defined as a network of devices that feeds data to software or applications for communication and control. IoT is short for Internet of Things. The Internet of Things refers to the growing number of physical devices with IP addresses to connect to the Internet, and the communication that takes place between these devices and other devices on the Internet and machines. The Internet of Things refers to a network of millions of physical devices connected to the Internet and able to send information to each other[5].

Dishwashers, refrigerators, smart TVs, smart watches, cars and trucks, heating and air conditioning systems, energy devices and monitors, smart speakers, connected thermometers, home security systems, home robots, smart lights, energy monitoring, connected devices, smart door locks, and connected vehicle devices are examples of IoT devices you'll experience before.

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These devices are connected to sensors that transmit data in real time without human intervention. The field is booming and the business needs are huge. In the future, these connected devices will control everything from cities to home appliances. This technology will change the way we live and work.
It is one of the fastest growing industries. From transportation to healthcare, industries are increasingly using IoT to improve operations. Technology helps organizations to understand their customers' needs or expectations and provide better customer service. It also improves decision making and makes work more efficient [1].

Types of IoT Networks - There are 4 types of IoT Networks

1. CellularCell phones use the same cellular technology as smartphones to allow IoT devices to communicate.
2. Local and personal area network (LAN/PAN)
3. Low power wide area network (LPWAN)
4. Mesh networks.

1. 1 Cellular

Cellular networks use the same cellular networks as smartphones to enable IoT devices to communicate. Because these networks are designed for power hungry devices such as smartphones, they are not always considered the best for IoT devices. Finally, the mobile industry creates new technologies that are more suitable for IoT applications. Today, this type of wireless communication is very popular and is considered a reliable and secure way of IoT connectivity. Cell phone service is available in most of the United States, and this network has extensive coverage. However, utility rooms, elevator shafts, basements, etc. For the most demanding tracking, such as mobile connections, mobile connections are often not available (LPWAN, another IoT wireless technology, may be more suitable for these areas)

Although cellular networks are currently cheaper and more energy efficient than traditional telecommunications. Naturally, mobile devices connected to the IoT still require more power and energy than some. Another type of wireless network is stronger than mesh. The two cellular IoT wireless protocols currently competing for dominance are LTE-M and Narrow Band IoT (NB-IoT). If you're willing to pay the price and your data usage requires low power consumption, LTE-M is the best choice for IoT connectivity. Also, LTE-M networks have been deployed in the USA. This means you can start enjoying the benefits of this option today. NB-IoT is cheaper and uses less battery than LTE-M, but there is still not enough insurance to rely on the use of NB-IoT solutions[2].

1. 2 Local and Personal Area Networks (LAN/PAN)

Networks covering long distances are also called Personal Area Networks (PAN) and Local Area Networks (LAN). PAN and LAN networks are considered affordable, but data transmission can be unreliable at times. Wireless personal and local area network technologies often included in IoT solutions are WiFi and Bluetooth. WiFi can be used for applications running in a distributed environment ifthere are many access points in a single environment or a larger network. One downside of WiFi is that it only works when the signal is strong and you are close to the access point. Also, WiFi often consumes more energy than expected, but may work better (for example, your device only connects for a while to send data, then after it goes back to sleep).

Bluetooth Low Energy (BLE) is a more energy efficient wireless networking protocol - a battery powered by BLE can last up to five years if you don't receive data very often. However, it has a slower transfer rate and limits the amount of data it can transmit over WiFi. The WiFi and Bluetooth connect easily for the most part, but WiFi presents some security issues that can be difficult to overcome [1,3].

1. 3 Low Power Wide Area Network (LPWAN)

IoT devices run on LPWAN to transmit small amounts of data continuously and over long periods of time. This type of wireless network was developed in response to early problems with cellular networks. Supporters of the LPWAN project have more than WiFi and Bluetooth, but use less energy from the cell. Sigfox built the first LPWAN network in France and is considered the driving force behind its development (although Sigfox never left the US).

A well-known and widely used IoT network protocol in this category is LoRaWAN (Long Range Wireless Local Area Network) operating over LoRa (Long Range) communication network. The advantages of LoRaWAN for IoT devices are low power requirements (long battery life) and low-cost chipsets. Also, in good conditions, a station at a base or gateway operating on a long-distance link can serve a very large area, a few kilometers from the urban density and 15-30 kilometers from rural areas [4].

1.4 Mesh Networks

Mesh networks are best defined by network configurations, how objects communicate. In a mesh network, all sensor nodes cooperate with each other to distribute data to reach the gateway. (By contrast, a star topology is where all sensor nodes communicate with a central hub). Zigbee is an example of wireless networking technology for the IoT. Mesh networks are short-circuited, and you may need to install more sensors or use repeaters throughout the building to get the coverage your application needs. Also, the nature of these network communications can consume a lot of energy, especially if you need instant messaging like a quality lighting app (IoT applications that only need to update data occasionally use less energy.) However, mesh networks are also dynamic, finding the fastest path and improving reliable data transmission, and are easy to install, making them the choice for indoor use.

II. IoT Layers - There Are 7 Layers in IoT

IoT technology, despite being one of the most popular and promising technologies of its time, was poorly understood. While the technology is known to help create a connection between connected devices, little is known about how data is received from edge devices to their phones. There are different articles online that explain how the IoT works and the products or processes that make up its design. While most are true, only a few offer a clear picture behind IoT systems. To fully understand the functioning of an end-to-end IoT system, it is important to understand the 7 main layers in which it operates. Below is a list of all these 7 layers and their functions in the IoT system.

2.1. Sensors:

Sensors and other data collection devices form the first layer of the IoT system. They are the interface between the real world and the digital world, responsible for converting analog signals into digital ones. Temperature, distance, location, humidity etc. There are different devices such as thermometers, thermometers, thermometers, thermometers and thermometers that can read non-standard measurements. This tool is installed on the insert (product) and collects the required parameter data in the form of raw data.

2.2 Sensor for Gateway Network:

This layer is the first layer of the IoT system. It is responsible for sending data from layer 1 (sensors) to layer 3 (gateway). Data is sent from the sensors to the gateway via special communication channels with specific rules, syntax, semantics and synchronization patterns.

Data transfer is only possible if both the sensor and the gateway support the transfer protocol. Some of the protocols used to connect the sensors to the gateway are BLE, LoRaWAN, ZigBee and Sigfox.

2.3 Gateways:

Gateways are data collectors that collect data from sensors and send it to the reverse system. They are routers or modems that act as interfaces between the local sensor environment and the internet. They collect information from various sensors and send it to the data entry platform. Gateways and sensor-to-gateway networks are not required if the meters have gateways built into them or, in other words, can send data over long distances on their own. In this case, the detection device only needs to read the data and send it to the backend system.

2.4 Internet Gateway:

Internet Gateway is like a gateway sensor that supports data transfer from the gateway to the Internet/backend systems. This network can be a large area allowing data to be sent to remote locations. The most common methods used for broadband communication are Ethernet, Wi-Fi, satellite or cellular.

2.5 Data Retrieval and Information Processing:

In this process, the raw data collected from the previous 4 layers are transformed into useful data. Generally, data is stored in the cloud and accessed via mobile apps or backend systems of web apps.

The information received is transformed into value-added information displayed on the user's screen by advanced analytics and other processes.

2.6 Internet to User Network:

This is the last layer of the latest IoT protocol. Raw data stored in the cloud system is called up by this network and displayed on the user's screen in the form of additional useful information. The most common methods used to access data from cloud storage are Internet, Ethernet and Wi-Fi.

2.7 Value-Added Information:

Runs on the entire IoT system without finishing the post-processing. Archived data and value-added data are displayed on the user's screen, allowing them to monitor the assets they now want to track. Data can be presented as numbers, graphs, reports or charts; it enables users to gain insights and make informed decisions. One can access this information from any smart device, such as a smartphone or desktop, via a dedicated IoT platform that offers real-time alerts, reviews and remote monitoring.

III. IoT Technology Trends

3.1 IoT Security

Until now, security was a major concern when it comes to connectivity. A security vendor detected more than 100 million attacks against IoT endpoints in the first half of 2019 alone, highlighting the ongoing threat to the security of connected devices. That's why security is a growing aspect of IoT and many companies around the world are developing IoT security solutions using different technologies.

3.2 5G Technology Advances the Internet of Things

5G technology is more than a next-generation wireless technology, it is the foundation to unlock the full potential of the Internet of Things to revolutionize technology development. Undoubtedly the most important IoT innovation of 2021, as reliable connectivity will make IoT devices more efficient. Real-time data processing, lower latency, network connectivity, faster transmission and wider coverage are some of the things 5G will bring.

3.3 Blockchain

The rise of blockchain technology is one of the new IoT trends. Blockchain can provide data protection in IoT devices. Blockchain allows communication between many network nodes and ensures data security, so IoT applications are also suitable as they are always distributed.

3.4 Artificial Intelligence Applications Enabling IoT

Two technologies such as IoT and Artificial Intelligence can work together to provide business solutions. AI algorithms currently require very little data to provide efficient and effective results. The development of enterprise IoT using these two technologies can help automate many processes and reduce downtime, lower operating costs, increase efficiency and increase productivity.

3.5 Digital Twins

Digital twin technology trends focus in 2020. A digital twin is a virtual representation that acts as a real-time counterpart of a physical device or process. Digital twins can be used for many purposes, such as monitoring, diagnosing, optimizing, and managing asset performance and usage.

3.6. Voice-activated IoT devices

Amazon Echo, Siri, and Google Assistant have taken voice-based user interfaces to a whole new level. The voice interface will now be used in other apps across the enterprise, allowing us to switch locations, set commands and leverage our smart devices. Banks and fintech startups are pioneering the use of voice and speech recognition. Another major advancement in speech recognition is voice biometrics. It allows organizations to create a digital image of a person's voice by analyzing various specific properties such as tone, volume, intensity, dynamics, frequency and more. The company believes this process will be more secure than the current method.

3.7 Smart City

When we see the new technology of the Internet of Things, we cannot ignore the smart city. In the last five years, many government agencies have started to work on IoT technology that will affect the entire city. With big data, government, transportation, public safety, energy use, freezing of sustainable development, etc. will be able to apply many smart solutions for problems. Example: Singapore collects, analyses and shares data from connected devices to improve urban planning, transportation, and public safety.

3.8 Edge Computing

Edge computing is expected to increase significantly by the end of 2021 due to remote working and COVID-19. This innovation enables new businesses to emerge. According to Forrester, end-of-life marketers can and will be able to hold on to massive competition in the cloud market, driven by key vendors such as HPE, Dell, and IBM developing solutions for the cloud and the edge. Similar abilities Edge computing enables organizations to serve customers in new areas and support flexibility and management in a growing workforce.

3.9 Traffic Management

The thought of going to work first thing in the morning drives you crazy. In all cities in the world, traffic and congestion are the main problems that cause people to spend more energy and time on the roads during the day. Long journeys are a major economic problem, making traffic a major problem in cities around the world. Current IoT trends indicate that IoT technology is fit for this challenge. Many organizations today offer solutions and plans to create smarter communication networks using IoT technology installed in cars and trucks to reduce inappropriate traffic and accidents. Businesses, entrepreneurs, and governments are using IoT to improve products, save money and create a better customer experience. Although IoT technologies are still in their early stages of development in many applications, their overall impact on top businesses is huge. Let's look at some of the applications of IoT devices in specific industries.

IV. IoT Applications in Various Sectors

Today, many companies from different fields or departments are adopting this technology to simplify, improve, automate, and manage different processes. Next, we will share some of the wonders of the world using the Internet of Things [20,21].

4.1 Wearable Devices

Virtual glasses, wristbands for tracking calories and heart rate, or GPS tracking bands are just a few of the devices we have been using for a while. Google, Apple, Samsung etc. companies have developed and brought IoT and its applications into our daily lives. These are small, energy-efficient devices equipped with sensors, equipment to measure and read, and software to collect and organize user data and information. Another visible use of the Internet of Things is technology. Wearable technology includes smartwatches, fitness trackers, smart glasses and even connected fabrics.

a) Smart watches have a variety of functions, from reading newspapers and displaying notifications to tracking locations and viewing notifications. These wearables help parents keep track of their kids.
b) Wearable devices have played an important role in elderly care. Regular maintenance and site maintenance keep people informed. It doesn't end there. Nano sensors can predict the risk of many diseases, such as cancer. Early detection and prevention is key to using technology in healthcare.
c) Combined with an augmented reality (AR) device with a headset attached, the device can also provide surgeons with historical, historical, and current information during surgery.
d) Wearable devices are being researched to reduce workplace accidents in factories. Soldiers also use them in battle. The most obvious example of using IoT technology is Fitbit. Fitbit tracks users' activities and sleep patterns to support a healthy lifestyle.

4.2 Smart Homes

The most prominent application of IoT is smart home. Smart buildings use sensors to control and manage lighting, resource management and security. A smart home is a small, independent part of a smart city. An example of an IoT-based smart home system is Mark Zuckerberg's Jarvis. Zuckerberg's smart home system uses language as the context for commands.

There are internet adapters to plug in. The system is responsible for lighting the room, depending on what is in the room, and even music playing. The security system uses facial recognition to alert family members to the visitor's identity [9,10].

4.3 Health

Using wearable devices or devices that connect with patients, doctors can monitor patients' condition in real time outside the hospital. The IoT can help improve patient care and prevent fatal events in at-risk patients by continuously monitoring certain parameters and issuing alerts on vital signs. Another application is the integration of IoT technology into hospital beds and leaving its place to smart beds with special indicators such as vital signs, blood pressure, oximeters, and fever. Due to recent events, the medical industry has experienced growth in IoT innovation. During the Covid-19 crisis, telemedicine, digital diagnostics, remote monitoring, etc. The demand for IoT healthcare applications has increased, resulting in monitoring of the time and notification of patient health. IoT increases patient engagement and satisfaction with healthcare providers through easier and more efficient interactions and processes [6].

4.4 Traffic monitoring

IoT is very useful in managing traffic in big cities and contributing to the concept of smart city. When we use our phones as sensors to collect and share traffic data via apps like Waze or Google Maps, to monitor traffic, show the status of different routes and develop information about different routes, distances, estimated time of arrival for the same purpose. Sensors in roads and lighting transmit data to IoT systems. This information, collected over time, allows authorities to determine traffic patterns and rush hours. It also helps create solutions for water bottles. Riders can use this information to determine which areas are challenging and which alternatives can be used. This model is already available in third-party services such as Google Maps [7,8].

4.5. Fleet management.

Installing sensors on trucks ensures a good relationship between the vehicle and its occupants, and between the vehicle and its driver. Both the driver and the manager/owner have access to the software responsible for recording, creating, and editing the information, accessing a variety of information about the vehicle's condition, performance, and needs. However, the driver, who received the accident warning in time, was not seen. The application of IoT in fleet management helps geolocation (including monitoring and optimizing usage), performance analysis, telemetry management and fuel savings, reducing environmental pollution and can provide important information to improve driving your car [12].

By 2021, the next generation of cars will be smart cars, that is, they will be connected to the Internet. These vehicles ensure the safety of not only the driver but also other vehicles on the road. They will also be able to update software and reduce emissions. We now have electric scooters, bikes, and skateboards, but with the advent of the Internet of Things, companies will be able to reduce operating costs and provide a better experience for people, drivers and passengers.

Supply Chain Management (SCM) is a process that supports the supply of products and services from raw materials to customers. It includes inventory management, fleet management, vendor relations and planning. Many businesses were hit by supply issues during the Pandemic, especially when it led to a global shutdown in early 2020. With operations being conducted remotely, it makes sense for organizations to consider integrating IoT into their SCM processes.

a) The Internet of Things is used at various levels of supply chain management. Shipping companies use trackers to track assets. They also analyze transportation options to find the fastest and most fuel-efficient routes. Other parameters such as box temperature and humidity can also be monitored and controlled using the IoT.

b) IoT systems enable administrators to improve the delivery process by enabling intelligence. This means businesses can rely on the performance of their supply chains.
c) Real-time and remote management of fleets to ensure a seamless experience for managers and customers.

Delays or shipping issues can be reported to relevant personnel. In fleet management, the IoT provides end-to-end connectivity between vehicles and managers, and between vehicles and drivers. IoT focuses on vehicle health as well as asset management, complying with regulations such as pollution.

4.6 Agriculture.

Smart farms are a reality. Good soil is essential for producing good crops, and IoT provides farmers with the ability to gain detailed insights and key insights about their soil. A lot of information about the state and level of the soil can be obtained by using IoT sensors. Information such as humidity, acidity, availability of certain nutrients, temperature, and various chemicals can help farmers manage water use, improve water use, decide the best time to start planting, and even if it contains bacteria and soil replied. Agricultural IoT uses robots, drones, remote sensors and computer imaging to monitor crops, measure and map fields, along with ever-evolving machine learning and analytics tools, providing farmers with information to better agricultural planning to save time and money. .
With the help of IoT sensors, farmers can make more informed decisions. This will help them get better crops. It will also reduce costs by reducing the use of pesticides, water and electricity [11].

a) The sensors are used to provide detailed information about soil chemistry and fertilizer profile. Carbon dioxide levels, humidity, temperature, acidity and nutrient availability can affect a good harvest.
b) Smart irrigation is an IoT application to effectively control and use water in agriculture. The IoT system only allows water to flow when the soil is in a dry state. He even stopped eating once an earthquake happened. This reduces waste from human error.
c) Animal tracking involves the use of RFID chips to track the animal's vital signs, injection points and location.
d) Smart greenhouses use microclimates to grow crops rather than climate change. It monitors and controls all parameters with sensors, light, and water systems.
e) Predictive agriculture is the practice of using timely collected information to develop and use agriculture. The information provided by these sensors enables the farmer to decide on the ideal growth rate and the appropriate fertilizer.

7. Hotel Industry

The implementation of IoT in the hotel industry has led to an expansion in service quality. Many interactions can be performed using electronic keys that are sent directly to each guest's mobile phone. In other words, the guest's location, sending a quote or information about the job of interest, completing the order at the room or room service, paying the room fee automatically or requesting personal care products are the tasks that can be easily done by the guest. application of the combination. Using IoT technology management. Thanks to the use of the electronic key, the check-in process is automated, access control is provided, room availability information is given instantly and even housekeeping is provided to the cleaning staff.

The hospitality industry is facing a lot of stress due to the unprecedented global pandemic. Personnel and medical expenses cannot be covered due to international travel restrictions.

a) One way to solve costs is to turn to the IoT for automation. Interactions can be kept to a minimum by following social distancing rules, which tend to come and go. For example, an electronic cell phone key eliminates the need for physical check-in at the hotel.
b) The use of electronic keys ensures that the hotel management always knows where the guests are at the hotel. Additional claims can be paid directly instantly.
c) Room service and housekeeping can be done by mobile phone.
d) Smart lighting and consumer goods.

YOTEL hotels in Singapore have all these IoT systems. There are also adjustable smart beds, adjustable lighting, and smart TVs. Hotels even have robots to do the cleaning work. IoT trends such as driverless cars are not covered here. Although they've been playing for a while, there's still a lot of work to be done to make this a reality. Self-driving cars and countless other applications are what the world looks forward to in the future.

4.8 Smart grid and energy saving.

Advances in the use of smart meters or electronic meters and the installation of meters at different points from the manufacturer provide better control and management of the network. By establishing two-way communication between the service provider and the end user, the information is useful for diagnosis, decision making and improvement. It also provides end users with valuable information about their eating habits and the best way to reduce or improve their energy consumption.

Utilities are switching to IoT to improve energy efficiency. Suitable sensors are installed in the power meter, transmission line, generation plant and distribution point. This IoT system is called smart grid [13,14].

Smart grids use the Internet of Things in a variety of applications:

a) They give a warning in case of failure in an electrical transmission.
b) Sensors are used to detect abnormal situations in production lines.
c) They monitor power consumption and maximum data usage.
d) They hold data at the domain, organizational, and individual level.
e) They identify nodes that are lost during transmission.

f) They can detect the truth of the useless. It can analyze the efforts of users daily and make a positive difference in their carbon footprint.

It also helps keep energy prices down when they rise, as happened throughout Europe in the Ukraine-Russia war. Energy can be produced in power plants such as solar and wind power plants. Smart grids allow these different energy sources to be converted. In doing so, they ensure that the correct parameters such as voltage are maintained. Like all other IoT systems, the smart grid supports predictive maintenance. This greatly reduces costs.

4.9. Smarter City Building

Smart cities are cities that use mobile or wireless networks and sensors to be placed everywhere, such as installations and antennas. There are several ways IoT can be incorporated into the work of cities:

a) Traffic management: Sensors in roads and lighting transmit data to IoT systems. This information, collected over time, allows authorities to determine traffic patterns and rush hours.
b) It also helps create solutions for water bottles.
c) Passengers can use this information to determine which areas are crowded and which alternatives are available. This model is already available in third-party services such as Google Maps.
d) Monitoring Pollution: Air pollution is a serious problem in countries around the world. Using existing sensors, temperature, carbon dioxide levels, smoke and humidity can be easily measured.
e) Smart cities use it to collect data on air quality and develop mitigation measures.
f) Water Management: Service provider for a sensor service provider that helps to collect, process and analyze data to understand customers' behavior, monitors water meter malfunction, is connected to the internet and is replaced internally or externally with the water meter with the necessary software, reporting results and doing the job. to ensure.
g) Similarly, it provides end-users with the ability to monitor their consumption data in real time on web pages and even receive automatic alerts during testing that indicate a larger-than-average consumption data leak.
h) Resource management: The biggest determinant of urban life is waste, water and electricity management.

The sensor for water control is connected to the water meter internally or externally. These sensors provide information to understand usage patterns. They catch things that don't work and start doing the right thing. Ideas in wastewater can be used to create a water quality. The IoT-enabled waste management system creates a geographical waste map. These systems self-clarify processes; for example, by setting an alarm when the trash is full. They also provide more information on waste analysis and how people can improve waste disposal. Power management comes in the form of smart grid described in this article.

a) Parking lot solution: Parking problem is not good, but it plays an important role in traffic management. Smart parking solutions provide drivers with real-time information about available spaces.
b) Infrastructure management: public infrastructures such as lighting, roads, parks and gas distribution are expensive. Fix any of these tasks that make up the daily routine. IoT-based monitoring and control systems look for signs of wear and tear when analyzing patterns. This approach could save cities a lot of money.
c) Disaster management: IoT can be used to connect disaster areas to alerts. For example, forest fires can be stopped and brought under control before they get out of control.

In 2017, Spain announced the conversion of the Balearic Islands into an IoT lab. Sensors are built into existing TV and radio masts to monitor weather and noise. Authorities also plan to use the IoT for tourism and crowd control. In Palo Alto, California, smart parking has been implemented at various city parking lots. It directs drivers to the nearest stop and has been shown to reduce traffic congestion.

4.10 Management

One of the most common applications of IoT technology is control management. By combining sensors and software dedicated to CMMS / EAM management, a variety of tools are achieved that can be used in various disciplines and applications with the brand goal of extending the lifespan of physical assets while ensuring asset reliability and availability. While the features of the software responsible for the processing and collection of data collected by the sensors are specifically designed for the management of physical needs, there are hardly any restrictions on their applications. Real-time monitoring of physical abilities can be determined when metrics are not based on quantity and responsibility for care (CBM), or even when artificial intelligence (AI) algorithms such as machine learning or deep learning are used to predict before they happen.

V. Advantages of IoT

The concept of IoT has two definitions [5]:

Automation: The general concept of IoT includes direct communication between standalone devices, devices, and other devices without human intervention.

Connection: A thriving network of international connections provides easy access to a variety of information.

Given these features, the IoT should use a variety of technologies to enable automatic data transfer, analysis, and response of various devices. For example, cloud computing and wireless technologies have greatly improved connectivity, while automation would not be possible without artificial intelligence, big data, and machine learning.

Let's see how these features lead to the many benefits of IoT technology and services. It's worth noting, however, that this short review focuses mostly on the business benefits of IoT, with little mention of its potential applications for humans and homes. And many of these outcomes have interactions where one leads to the other, resulting in a range of positive outcomes.

5.1 Increase worker productivity and reduce workforce

With IoT solutions, mundane tasks can be automated so that human resources can be transferred to more difficult jobs, especially those that require unorthodox thinking and individual skills. In this way, the number of employees can be reduced, and the operating costs can be reduced.

5.2 Effective Management

Another key benefit of connected smart devices is the management of various business areas, including inventory management, delivery, fuel management and spare parts. For example, this approach includes the use of RFID tags and connected devices to track the location of equipment and products.

5.3 Efficient use of resources and assets

Planning and effective monitoring with the help of connected sensors can lead to efficient use of capital such as energy management and better water use. For example, a simple motion detector can save a lot of electricity and water, making both small and large businesses more efficient and environmentally friendly. It will also assist in quality control and product development.

5.4 Operating cost

Due to automatic planning and control, lowering the costs provided by raw materials and other production methods, the equipment will again be more and therefore more useful. Likewise, IoT devices simplify management across multiple departments and company structures.

5.5 Increase occupational safety

In addition to the above benefits, regular maintenance is also useful for ensuring occupational safety and compliance. In addition, safe working conditions increase brand awareness and trust by making businesses more attractive to investors, partners, and employees. Intelligent technology can also reduce the possibility of human error at all stages of the business, increasing security. In addition, a network of IoT devices such as security cameras, sound sensors and other surveillance devices can be used to protect businesses from theft or even surveillance.

5.6 Business Development and Business Development

Smart home devices, especially voice assistants and other devices that communicate directly with users, provide important information for business analysis.

IoT helps businesses by collecting a lot of unique customer data to create marketing strategies, advertising plans, cost-effective policies and other business activities and management.

5.7 Customer development and retention

Collecting the above-mentioned user-specific data using smart devices can also help businesses better understand customer needs and behavior. IoT also provides automated monitoring and customers that purchases require after-sales maintenance, use time, warranty expiration, etc. Improves customer service by supporting notifying after-sales services.

5.8 Business excellence

Because of better performance, companies using IoT solutions can offer more services or products for the same price or improve their performance compared to their competitors. Alternatively, such companies may perform tasks that are more difficult in terms of production complexity, time or volume. As a result, the use of smart solutions makes businesses more competitive and attractive to potential investors.

5.9 Many companies rely on image

Companies using advanced solutions, especially IoT, often create excitement for customers, investors and other business partners who understand the many advantages that IoT brings. Also, if companies provide a safe and secure working environment guaranteed by a network of smart devices, it will be easier to attract employees who know the employee. Many applications of IoT can be found in various areas such as IoT and embedded systems [15-18]

VI. Disadvantages of IoT

While the benefits of IoT are welcome, especially in the context of making a profit of the business, the technology also has some threats. To be fair, let's take a brief look at the disadvantages of IoT.

6.1. Security flaws

Inadequate security measures are the most suspicious factors hindering the overall development of IoT. Fears of data breaches are common, as smart devices collect and transmit confidential information that could have serious consequences if leaked. However, IoT solutions rarely have the necessary tamper protection or comply with all data protection standards, encryption protocols, and other regulations and technologies designed to prevent unauthorized access to information. Failure to properly protect data can have costly, damaging, and even negative consequences: loss of personal information, privacy, equipment or product loss, damage, etc. theft. Therefore, the development and implementation of IoT solutions in the business world should be done by professionals who can ensure that the installed hardware and software are weak and well-protected against theft. As IoT devices connect and communicate with the network, each can be the target of various attacks, such as network and hardware attacks. While cybersecurity is the most important thing for IoT developers, because nothing is perfect, one or more IoT devices can be stolen and the data contained in IoT systems can be misused.

Questions and doubts remain about security and privacy, especially IoT devices used in sensitive sectors such as healthcare and finance, and big data exchange. Think of the data generated by all household appliances, technology, medical devices like heart rate monitors and oxygen, utilities like water and transportation, and many other internet-connected devices. This is an attractive place for attackers and hackers. Worse still, the IoT can be used to control citizens rather than help them [23,24].

6.2 Associated Costs

Implementing IoT infrastructure in a company means creating a link between various smart devices and related assets, including electrical and communication networks. Such a plan therefore requires huge resources to develop, maintain and gradually expand the network according to future needs. While IoT solutions have many benefits, they take a long time to turn a profit and the financial benefits outweigh the initial cost of implementation. Deploying IoT systems often requires significant investment of time and money. IoT devices must be purchased by employees, installed, networked, and finally set up by support by calling the manufacturer for assistance.

For small IoT systems that go to one location, businesses can quickly pay for this investment. But the cost increases when companies scale their IoT systems to multiple IoT devices. In this broader context, the priority of any project using IoT is to prepare resources and strategies before purchasing. This will ensure that IoT devices are useful to the business, work as expected, and the business can manage them.

6.3. Power Dependency

Although the Internet of Things refers to the operation of various devices, such networks are still dependent on other factors that must be considered for success in business. First, the stability and power of the smart device depend on it, so carefully plan the additional process to be provided. The appropriate amount of UPS equipment should include surge protectors and other equipment with a degree of protection (IP).

6.4. Network Dependency

An important aspect of the Internet of Things is the dense interconnection of all devices and access to the global network. That's why IoT devices still need an infrastructure to enable seamless wireless and wired communication with precision, low latency and connectivity: the Internet. Therefore, to enjoy the benefits of IoS, the business must first provide all necessary network equipment: cables, routers, hubs, local data storage, etc.

6.5. Advanced skills

IoT solutions require experienced professionals who are responsible and fully understand their work and its results. Deploying, deploying, managing, and scaling IoT solutions in the business world requires skilled managers who can find and hire hardworking employees because they demand high salaries. All employees involved in the use of a smart device network must receive training and appropriate instruction. Therefore, while IoT reduces the need for human resources, additional employees need to be well trained in order not to interfere with the operation of smart devices and not create a "snowball effect".

6.6 Compliance and Integration International Standard

Currently, there is no international compliance standard for IoT. This makes it difficult for devices belonging to different companies to communicate, making it difficult to integrate multiple devices into a single network.

The lack of design causes IoT application developers to worry about interoperability, as each company creates their own solutions, making it difficult for customers to choose from the many options available as a result. Also, each IoT device from different manufacturers may require different configurations and hardware connections, making it difficult to implement effectively. Therefore, the construction time and cost increase. Although this shortcoming will disappear if all manufacturers agree on a common standard, IoT devices may experience connectivity issues even after the implementation is complete. Now social problems can cause people to buy products from a particular manufacturer, making them a monopoly [19,22].

6.7 Personal security

In addition to IoT devices such as security cameras, door locks, smartphones, fire alarms and access control to protect the space or protect against danger, there are also IoT devices such as smart kitchens and boilers, water. Medical devices, lighting controllers, medical systems and smart cars can cause illness and even death if they fail. For example, if the IoT system that ensures the integrity of the bridge fails, there will be loss of life. As companies race to dominate the competitive IoT market, they often overlook some vulnerabilities in IoT technology. The main reason for these problems is the rapid development of IoT without any legal regulation.

Given the importance of the role that security critical IoT devices play, ensuring that they cannot enter the market until the cybersecurity posture is satisfactory should be a priority. Unfortunately, this is not the case.

VII. Conclusion

The Internet of Things, though not immediately but gradually, has begun to change our way of living and working. The Internet world knows that still more innovations in the field of IOT and artificial intelligence are yet to come. The Internet of Things has the potential to increase the amount of information and transform companies and organizations across the entire global market. As we can see, the Internet of Things has been considered as one of the best technologies that will be more accurate and useful in the future. Even in its current state, the potential of IoT solutions is exciting and the quality appealing. However, it is important to know that integrating IoT into the business requires effort and expertise to take advantage of these benefits without incurring a disadvantageous burden.

IoT solutions are developing all over the world and the upcoming developments of IoT will play an important role in the future. Major technologies such as Cloud computing, Big data, artificial intelligence, and cyber security will play an important role in the development of worldwide connectivity and the Internet of Things. IoT is taking over all aspects of our lives. The Internet of Things has the potential to change the way people interact with the world around them. Like any other technology, IoT has its pros and cons. IoT impacts personal life and work, though saving time and money, improving quality of life and improving processes, but there is also the possibility of losing them. Technological progress is inevitable. Explorations and experimental analysis for modeling of various IoT architectures pertaining to future applications is a scope of further research in the area of internet of things [25-27]

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An Agent-based IoT System used as Data Transmission Mechanism for Greenhouse Environment Monitoring and Control

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Abstract

Integration of IoT in farming has resulted in some major developments in the field of agriculture. Greenhouse technology is booming since last decade as more crop yield is achieved with best quality. Hence greenhouses have become a major source of income. But the catch is being able to produce the exact kind of environment to the crop while being away from the actual field. This is where IoT sweeps in. The sensor devices are used to sense various parameters in the greenhouse and the sensed data can be monitored through a website. In our project, we are proposing a system that integrates IoT, automation and cloud storage facilities. Automation in greenhouses according to the sensed data will minimize human intervention and the cloud storage facility helps to store the sensed data for future analysis. A GSM (Greenhouse Monitoring System) module is also included.

***Keywords**: Greenhouse, Data communication, Internet of Things (IoT) Agent*

I.Introduction

In today's life, technology is updating, and agriculture needs to be improved. Greenhouse Monitoring System (GMS) is a system that is used to monitor various parameters essential for in-door farming. [1-3] GMS is built using Internet of Things (IoT). The main benefit of IoT is to monitor farmland using wireless sensor networks. GMS aims to collect data from the field using DHT-11, soil moisture and water-level sensors, store it on the website while providing automation in the field when needed. Some of the benefits of IoT-based farming are:

Greater Efficiency: IoT technology allows farmers to save time and resources by automating various processes. Sensors can monitor soil moisture levels to ensure accurate watering, while smart irrigation systems can adjust water usage based on weather conditions.[4]

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Increased Yield: By collecting data on soil moisture, nutrient levels, and crop growth, farmers can optimize their farming practices to maximize yield.[5]

Enhanced Sustainability: IoT devices can help farmers reduce their environmental impact by using resources only when necessary. This can also help reduce costs and increase profits.

Better Quality: IoT sensors can detect pests and diseases early on, allowing farmers to act before they spread to other crops. This can lead to higher quality crops and a better reputation for the farmer

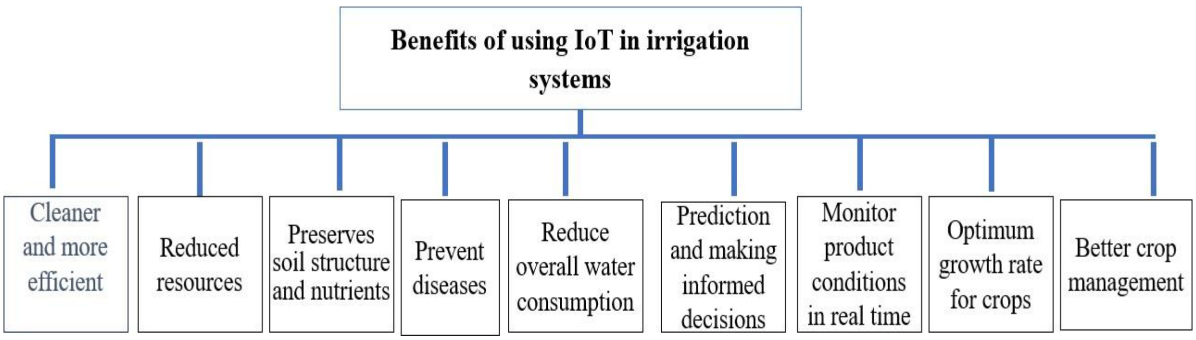

Fig. 1. Benefits of IoT in irrigation systems.

The soil moisture sensor used covers 20cm-30cm land and the DHT 11 sensor has a range of

-20˚C to 60˚C. The sensed values are converted from analog to digital and sent to the ESP 8266 microcontroller which then sends it to the Thing speak website using Wi-Fi, where they are stored. SMS alerts are sent when the soil moisture value falls below the threshold and when humidity or temperature values exceed the threshold. Along with SMS alerts, automation of motor pump when soil moisture level falls below the given threshold and automation of motor fan when humidity or temperature values exceed the given threshold takes place [6].

The remote monitoring and intelligent control system is to establish a wireless automatic control system for greenhouses by programming a microcontroller, which consists of electrical measurement circuits and mechanical actuators, as well as technologies that provide overall efficiency. Sensors help provide a well-controlled and monitored environment for growing plants. The greenhouse is monitored using sensors which give input parameters (Temperature (^{o} C), Humidity (%), Water Level and Soil Moisture) to the system. These are converted into human readable language and stored for future purposes. The microcontroller is programmed such that it controls the automation of the water tap and fan based on the values gathered by the sensor nodes. Microcontroller also has a GSM module connected to it, which is used to send updates through SMS to the owner regarding the automation system. We have managed to build a product that uses hardware that are easily available in the market and are affordable. It successfully stored the sensed values and sends SMS alerts to the farmer. The motor pump and fan attached to the system are turned on and off according to the values sensed on the field [7].

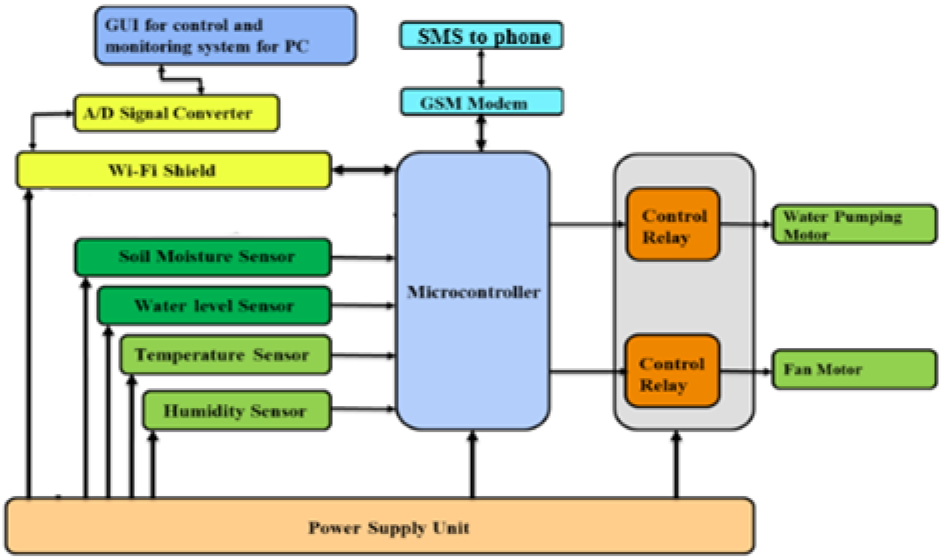

Fig 2: Functional Block Diagram

I. Problem formulation

Integration of IoT in farming has resulted in some major developments in the field of agriculture. Greenhouse technology is booming since last decade as more crop yield is achieved with best quality. Hence greenhouses have become a major source of income. But the catch is being able to produce the exact kind of environment to the crop while being away from the actual field. This is where IoT sweeps in. The sensor devices are used to sense various parameters in the greenhouse and the sensed data can be monitored through a website. In our project, we are proposing a system that integrates IoT, automation and cloud storage facilities. Automation in greenhouses according to the 6 sensed data will minimize human intervention and the cloud storage facility helps to store the sensed data for future analysis.

OBJECTIVES:

- To store the sensed data for further analysis.
- To build a system that provides automation in the greenhouse.
- To send SMS alerts to the owner regarding the automation system.

APPLICATIONS:

- This system can be deployed in any greenhouse environment.
- This is used to provide real time information to the owner.
- Helps deliver yield with better quality.

- The farmers/owners remotely operate the tap and fan.
- The sensed values can be used in future to improve farming techniques.

II. Literature Survey Review

An IOT Based Crop-field monitoring introduces an irrigation automation system that describes how to monitor a crop field. From the research we conducted, a system is developed by using sensors and according to the decision from a server based on sensed data, the irrigation system is automated. The user can monitor the system remotely with the help of an application which provides a web interface to user. Cloud computing devices are used at the end of the system that can create a whole computing system from sensors to tools that observe data from the agriculture field. A few papers have also integrated Machine Learning for better yield prediction. Most of the projects have used RaspberryPi microcontroller which is expensive. A system using sensors that monitor different conditions of environment like water level, humidity, temperature etc., the processor along with IC-S8817BS and wireless transceiver module with ZigBee protocol is used. The field condition is sent to the farmer via mobile text messages and email from the experts. With this system Sensor node failure and energy efficiency are managed. Zigbee technology is used which sometimes lacks in range of communication [8]. A method to evaluate the use of wireless sensor network used in automating irrigation and data are sent to the web server through wireless communication. The sensors are used to sense the temperature, humidity, moisture for crop monitoring. The irrigation is automated when the sensor reading goes below the threshold values. The farmer is regularly intimated with the field conditions. It also explained that in greenhouses, light intensity control can also be automated in addition to irrigation. Here, the prediction of crop water requirement is not efficient house monitoring system based on Zigbee technology [9].

The system performs data acquisition, processing, transmission, and reception functions. The aim of their experiments is to realize a greenhouse environment system, where the of system efficiency to manage the environment area and reduce the money and farming cost and save energy. IOT technology here is based on the BS structure andcc2530 used like processing chip to work for wireless sensor node and coordinator. The gateway has Linux operating system and cortex A8 processor act as core. Overall, the design realizes remote intelligent monitoring and control of greenhouse and replaces the traditional wired technology to wireless, also reduces manpower cost [10]

III. Proposed System

IoT-based smart farming is highly efficient when compared with the conventional approach. In the proposed system, we use a DHT-11 sensor for sensing temperature and humidity, a water level sensor to sense the water levels in the water tank and a basic soil moisture sensor for sensing the moisture levels in the soil. The sensed data is stored in ThingSpeak cloud which is an IoT analytics platform used to analyze live data streams. A DC motor-pump and DC-fan are integrated to the system which is operated automatically by setting up the threshold values. A GSM module is included which sends SMS alerts to the farmer regarding power cuts when humidity exceeds a certain threshold value and when moisture levels in soil drop down to a specific value. ESP8266 microcontroller is used as it is cost effective and has a built-in Wi-Fi module.

4.1 System Architecture

The system comprises various hardware and software components. The microcontroller is placed on the breadboard. Breadboard is used for building various temporary circuits. These circuit wiring can then be hardwired which is known as Printed Circuit Board (PCB). Using female-female jumper wires, the microcontroller is connected to sensors namely soil moisture sensor used to sense the moisture levels in soil, a temperature and humidity sensor for sensing the temperature in the greenhouse, water level sensor used to sense the water levels in the tank, GSM module used to send SMS alerts to the user and relays. Relays are to pass large currents through the contacts to control the electrical load. It permits a small amount of electric current to control high current loads. The relay is connected to the power supply and the motor fan and pump. It helps in the operation of the fan and pump in the system. The microcontroller used is ESP 8266 which has a built-in Wi-Fi module. The microcontroller is programmed in such a way that the sensed values are sent to the cloud to store over Wi-Fi.

The GSM module is used to send SMS alerts to the owner or the user. It is configured to send alerts such as power cuts which may affect the automation of fan and pump or when humidity exceeds a certain threshold value and when moisture levels of soil drop a specific value. The values sensed are stored in the cloud for future analysis. The system is built to operate automatically by setting the threshold values (done by owner and can be changed if needed) or manually. This feature helps in extreme cases such as failure of automation systems. All the components used are commodity hardware which means are easily available and less cost.

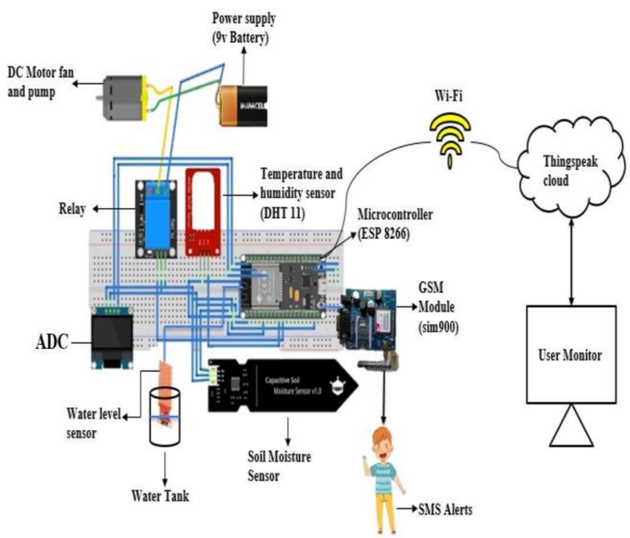

Fig 3. Deployment level Architecture

IV. Methodology

Our aim is to create a prototype model, which can be easily installable in the field and is also easy to use as farmers might not have the technical knowledge. With the use of IoT, the system is automated.

4.2 Components Used:
The whole system can be divided into two parts: hardware and the software. The software part consists of user interface i.e. the website hosting cloud. In the proposed system we are using ThingSpeak cloud. **ThingSpeak** provides data ingestion and storage for our agricultural sensors and controls. It supports MATLAB using which we can build graphical representations which is useful even for a normal person to understand. We can see visual representation of the data collected by the sensors which helps in better understanding of the crop health. ThingSpeak helps us to access smart objects information without the need to set up servers or developing web applications. We communicate with ThingSpeak using the REST API.REST API is used with HTTP to implement RESTful IoT services. It is easy to use and is a scalable protocol which is highly language independent. This protocol can be accessed using easy commands such as POST, GET, PUT and DELETE methods within a database system like SQL through CURD.

The hardware part consists of many subcomponents,

a) Microcontroller: ESP8266
b) Temperature and humidity sensor: DHT 11
c) Soil sensor
d) Water level sensor
e) Analog to digital converter: MCP 3008
f) DC Water pump
g) Relay
h) 9v battery and battery tag
i) DC fan
j) USB cable
k) GSM module: sim 900
l) 12v Adapter
m) Female-female jumper wires

Steps for Execution

i.The hardware is fixed onto a board so that the components do not get misplaced.
ii.The Node MCU (ESP 8266) is connected to the PC using a USB cable.
iii.The Arduino IDE is used to upload the code.
iv.A sim is placed in the GMS sim slot and checked for signals.
v.The sensed values are stored in the Thing Speak website. The website is password protected and can be accessed anywhere with a proper internet connection.

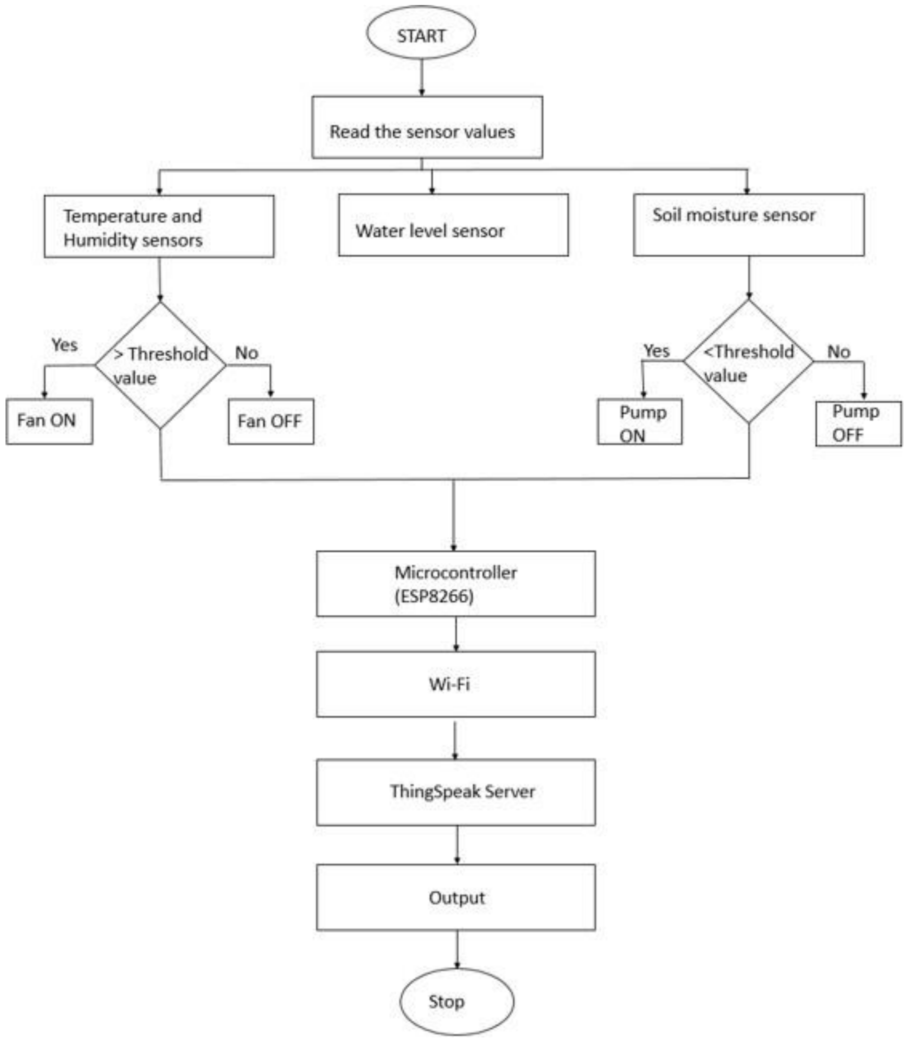

Fig 4 Process Flow

V. Results and analysis

The hardware components are connected to the computer in which the code is executed. As soon as the code is run, the parameters collected by the sensors are stored in the cloud and if any of the sensor values exceed the threshold set in the code, the corresponding fan/ pump automation will begin. The system along with the sensors performs accurately. It is easy to use and maintain and has only development investments and low maintenance costs. It requires internet connection to work, and to store the sensed values in the cloud. The sensors detect the surroundings approximately and send it to the microcontroller. It then processes the information and displays it on Arduino IDE. The results are also sent to the GSM module so that it passes the information to the farmer via GSM network. Here, the farmer does not need to have a smartphone, normal cell phones also can work to share information with farmers from fields.

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The following figures show the parameter readings stored in the cloud.

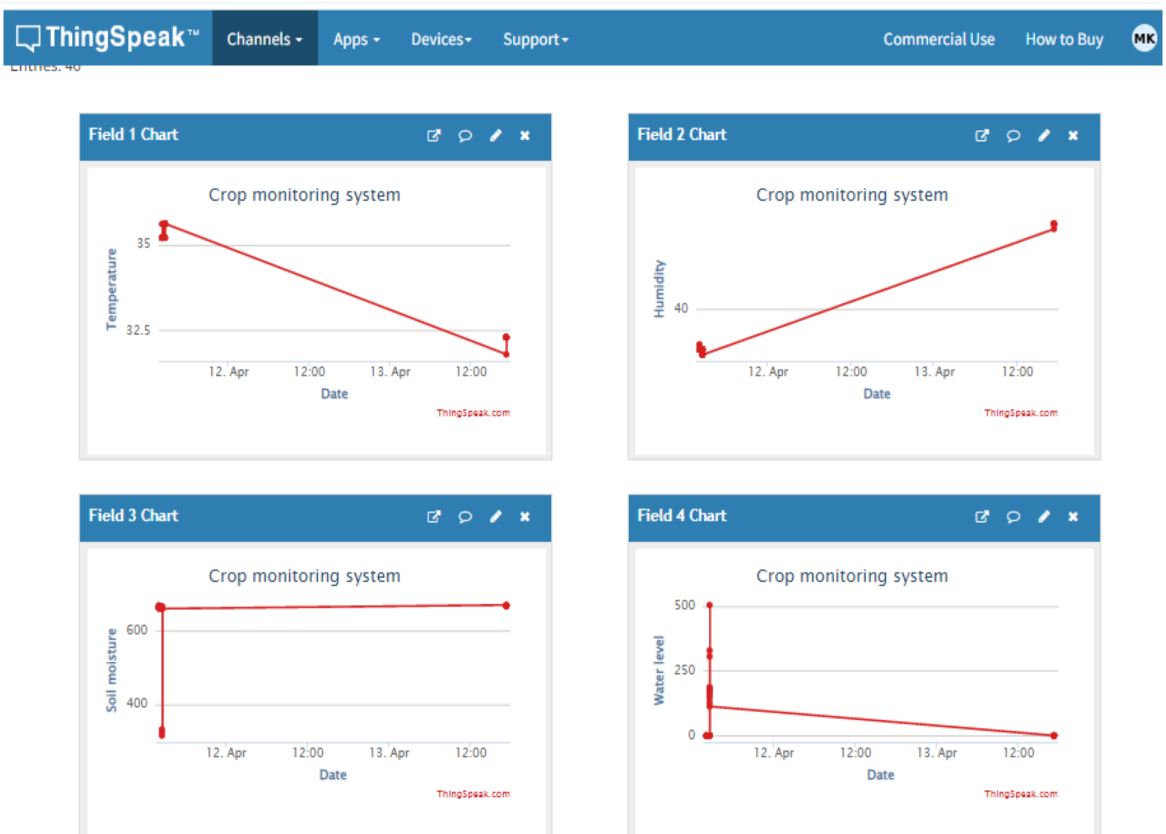

Fig 5 Line graphs of Temperature, Humidity, Soil Moisture and Water level

Once the sensed values exceed the threshold values, SMS alerts are sent to the given mobile number every 10 seconds till the sensed values come back to normal. The system is tested in various environments to check for the accuracy and functioning of the product. These test cases can be tabulated in Table1.

Table 1: Test cases in various environments

Environment	**Temperature (˚C)**	**Humidity (%)**	**Soil Moisture (mm)**	**Automation**
Store room with open windows.	32.3	42	669	OFF
Terrace on a sunny day	41.7	39	603	Pump ON Fan OFF
Rainy Day	36	47	671	Pump OFF Fan ON

Closed room with AC	22.7	29.6	670	OFF
Classroom with fans ON	33.2	49	649	ON

The above data is collected by setting the Humidity threshold to 45% and Soil Moisture level threshold to 670mm.

VI. Conclusion

Thus, we can conclude that the paper proposes a system that integrates IOT with traditional farming approaches resulting in a modern system for agriculture. Commercial farming or greenhouses are very much dependent on such systems as the quality and quantity of their yield is very important for the business.

The proposed system makes it easy to monitor the crop remotely. The cloud stores all the sensed data and produces a graph of the same. This helps the farmer to improve their agricultural techniques accordingly in the future. The automation system attached automates the fan and water pump in the field whenever the sensed values exceed the threshold set by the farmer. This automation helps the farmer to save time and energy by going to the greenhouse and turning them on/off by himself. However, at the time of automation system failure, the farmer can manually turn on/off the fan and water pump. This concept of modernization of agriculture is simple, affordable, and operable.

VII. Future Scope

The proposed system can be improved in the future by adding more sensors such as to measure the quality of air to see if any harmful gases are present in the greenhouse. Furthermore, a camera can also be integrated into the system, which will increase security. The GSM module used is a low-level module hence in future a more powerful module can be used which is affordable by all for better communication.

The concept of the usage of IoT for irrigation can be prolonged in addition to other tasks in farming together with farm animal management, fireplace detection and climate management. This could limit human intervention in agricultural activities. Moreover, the system can be integrated with Machine Learning so that the crop yield can be predicted way before and changes in the farming can be applied accordingly.

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Declaration of Competing Interests:

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement:

Krishna Madhumitha: Conception and design of study. Ameena Fatima: Conception and design of study. Ismath Razi: Acquisition of data and Analysis

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Signboard Text Translator: An Essential Guide for Tourists

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Abstract:
These days mobile phones are playing a major role in our lives. Everyone is relying on mobile phones to get their things done, which indirectly reduces the human power in the processes. Most of the signboards in tourist places are written in English and most of the local people in India may not exactly interpret what is written on the signboard. For tourists, following sign boards for knowledge and avoiding risks is important. The main aim of this project is to recognize the text on the signboard, classify it and then translate the English text to Telugu so that it helps local people to understand and encourages them to travel without hesitation.

Keywords: *Tesseract OCR engine, Text extraction, Image processing, Segmentation, Signboard detection, Text recognition, and classification.*

I. Introduction

Signs are everywhere to indicate or convey something to a person travelling to a new place. Signs may be informative signs, warning signs, or precautious signs. These signs are to be followed by travelers for safety and these signboards will help travelers around the world to know more about that place. There might be times when local people can’t properly understand the English text on the signboard. This should not make local travelers take a step back and hesitate to travel. As mobile phones are easily accessible nowadays, we wanted to solve this issue with mobile phones. This is a mobile application which will translate the English text on the signboard to the Telugu language. This application uses the Tesseract OCR engine which extracts the text from the signboard and later it is translated. The steps include Image processing, text recognition, text extraction- pre-processing, segmentation, extraction, post-processing, text extraction.

II. Problem Formulation

Many people in India might not be comfortable with the English language. Even if a person

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knows English, there is no guarantee that he/she will understand the text written on the signboard. It might be complex for a few other people. Focusing on this problem, we want to give a solution to those who need help understanding signboard text while traveling.

III. Literature Review

No.	Title	Description	Reference
1.	Text extraction from images captured via mobile and digital devices	It extracts and recognizes text on the image scanned through mobile phones and then translated in the required extension.	[1]
2.	Real-time traffic sign board detection and recognition from street-level imagery for smart vehicle'	This system proposed automatic detection and recognition of text and symbols in traffic signs. Search regions within the image must be defined.	[2]
3.	Indian sign board recognition using image processing techniques	This project identifies and recognizes traffic sign boards from static digital images in various backgrounds and lighting conditions. It first uses colour processing techniques to isolate relevant colour data from the image.	[3]
4.	Faster R-CNN: Towards real-time object detection with region proposal networks	A Region Proposal Network (RPN) that shares full-image convolutional features with the detection network is introduced, thus enabling nearly cost-free region proposals.	[4]
5.	Review on text recognition in natural scene images	This paper shares a detailed analysis of the existing models	[5]
6.	Region-based object detection and classification using	This research work focuses on improving the R-CNN, Fast R-CNN, and YOLO architecture	[6]
7.	Signboard detection and recognition using artificial neural network	This paper presents the recognition of scene text from the outside environment focusing on signboards	[7]
8.	Urdu text detection and recognition in natural scene images using deep learning	In this paper, the proposed method covers the detection, orientation prediction, and recognition of Urdu ligatures in outdoor images	[8]

9.	Road-Sign Detection and Recognition Based on Support Vector Machines	This paper presents an automatic road sign detection and recognition system based on support vector machines (SVMs). It can detect circular, rectangular, triangular, and octagonal signs and, hence, covers all existing Spanish traffic-sign shapes	[9]
10.	Improved Real-time Signboard Detection and Translation Using FRCNN	This paper states that, according to their project, a mobile phone here acts as a translator. Text recognition is divided into several levels. It is translated into Urdu and English	[10]

IV. Methodology

A. Capture Module

The capture module handles input. It is hardware dependent. We are currently working on the Windows platform. The image is captured and sent to the capture module. This capture module then sends the image to the detection, recognition, and translation module.

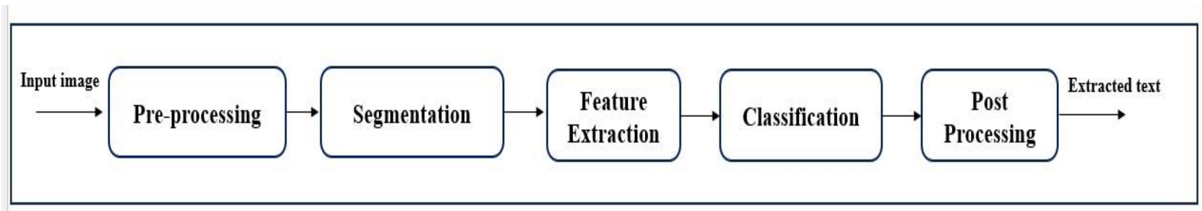

Fig. 1: Optical Character Recognition

B. Detection, Recognition and Translation Module

The picture is inputted into the recognition and translation module for processing. The recognition and translation module is a key part of the system. The module first performs sign detection and only focuses on the text areas. The sign extraction results are also fed back to a user for potential. These sign regions are further processed and fed into the OCR engine, which recognizes the contents of the sign areas in the original language. Then, the recognition results are sent to the translation module to obtain an interpretation in the target language.

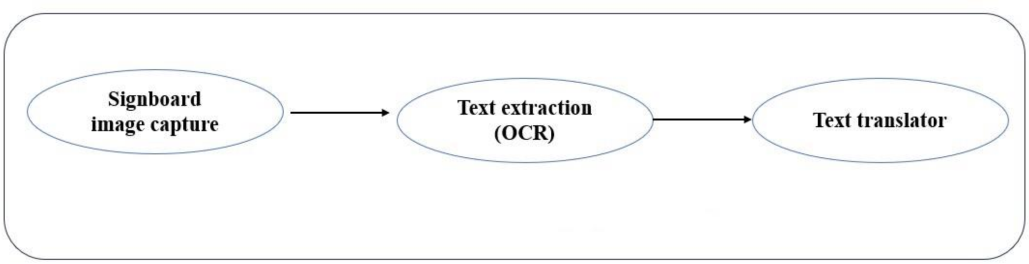

Fig. 2: Block Diagram of the Proposed Approach

C. Interaction Module

An interactive module provides an interface between a user and the system. A user-friendly interface is important for a user-centered system. It provides the necessary information to a user through an appropriate modality. It also allows a user to interact with the system if needed. In our current system, the interface provides the recognition/translation results.

V. Results and analysis

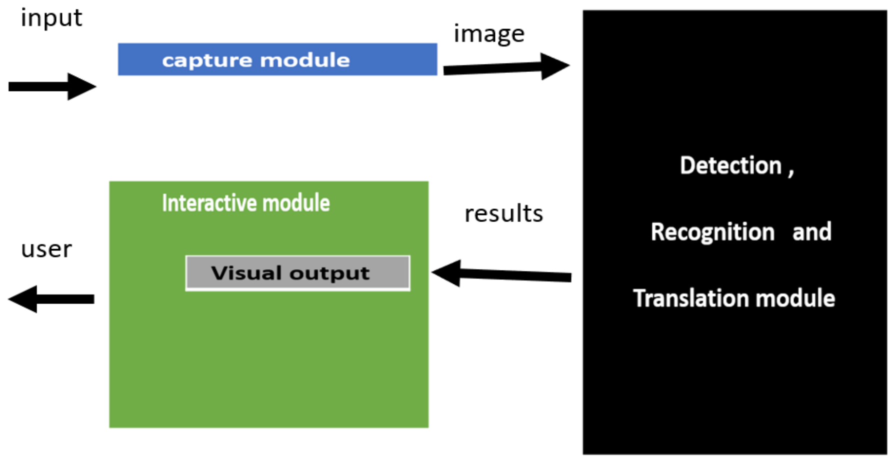

Fig. 3: Methodology

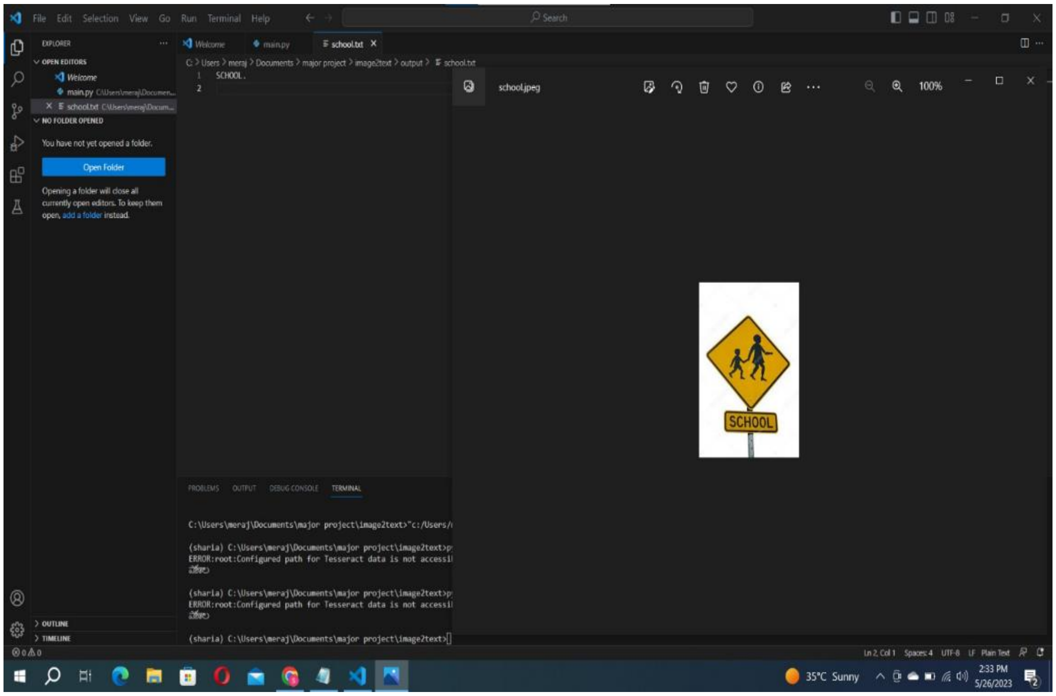

Fig. 4. Input image

Fig. 5. Output Image

VI. Conclusion

The accuracy of the system has been measured by containing the number of correctly recognized images. This system is developed to make it easier for travellers who travel across various parts of India to translate the signboards into English which will be difficult for them to understand. The system translates signboard images captured using mobile phones from English to Telugu. The purpose of this project is to remove the language barrier that people are facing nowadays. The proposed system can detect the signs, and translate the texts in different fonts, colours and lights. In future the this work will be extended to detect images and text written on it even from a far distance. The model can even process blur images and translate them into the required language. Regional languages can be added to translate so that it can help people speaking that respective language.

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Declaration of Competing Interests:
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Credit authorship contribution statement:
Swetha Ponnapalli: Conception and design of study. Sharina Zainab: Conception and design of the study. Rida Fatima: Acquisition of data and Analysis

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Deficiencies in Construction Practices in Kashmir with Reference to Earthquake

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Abstract:
After the Kashmir earthquake in 2005, a technical committee was set up by Government of Jammu and Kashmir to investigate deficiencies in construction practices to train civil engineers in the area of earthquake resistant construction and to go in for prefabricated construction of infrastructure. The first author was Superintending Engineer, Central Public Works Department and was involved as an expert along-with a team comprising of experts from Indian Institute of Technology Roorkee, United Nations Development Program and Bureau of Indian Standards. The paper reports the issues involved on the subject.

Keywords: *Seismic resistance, investigation, deficiencies, construction, training, prefabrication, infrastructure, non- engineered construction, rehabilitation.*

I. Introduction

An earthquake of magnitude 7.4 on the Richter scale occurred on 8-10-2005 at 9:20 AM in Kashmir. The epicenter was in Muzaffarabad in Pak- occupied Kashmir. About 2000 persons died at Kamalkot, Tangdhar and Uri. Some deficiencies were noted in construction practices in Kashmir region. The first author was a Superintending Engineer, Central Public Works Department, Government of India and was office-in-charge of construction activities in Kashmir and was asked by the authorities concerned to make suggestions for better practices with reference to the codes of practice of Bureau of Indian Standards. The present paper reports the deficiencies noted in the non-engineered construction practices in Kashmir. Training was imparted to the concerned engineers of Jammu and Kashmir. Proceedings of the program were broadcast live on Door-Darshan, the national television network. An ex-officer of Bureau of Indian Standard (BIS) was also involved in the training program. The first author was common to both the training programs, conducted by Central Public Works Department (CPWD) and another one jointly by IIT Roorkee, UNDP, BIS and CPWD.

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II. Damage to buildings in Kashmir

Most of the buildings in Uri, Kamalkot and Tangdhar region were constructed of stone or brick masonry in mud mortar. At some places, timber buildings were also seen. Important buildings, government offices, hospitals and hotels were generally made of reinforced content concrete.
Various types of construction in deceasing order of damage due to earthquake are listed hereunder:

1. Stone masonry- suffered the maximum damage
2. Brick masonry- suffered lesser damage as compared to that in stone masonry in general
3. Timber construction- suffered still lesser damage as compared to that in stone/ brick masonry
4. Reinforced cement concrete- suffered little or no damage

III. Damage in buildings in stone/ brick masonry

As per codal provisions of Bureau of Indian Standards, 1:6 (cement: sand) mortar mix is required in stone work while 1:4 (cement: sand) mix is specified in brick work. (1,2)
Further, walls must not be out of plumb; the above mentioned guidelines were not followed in some of the damaged buildings.
Non-provision of bond stones, plum stones and corner stones was observed in damaged stone masonry in many cases. Such provisions are required for seismic resistance in stone work.

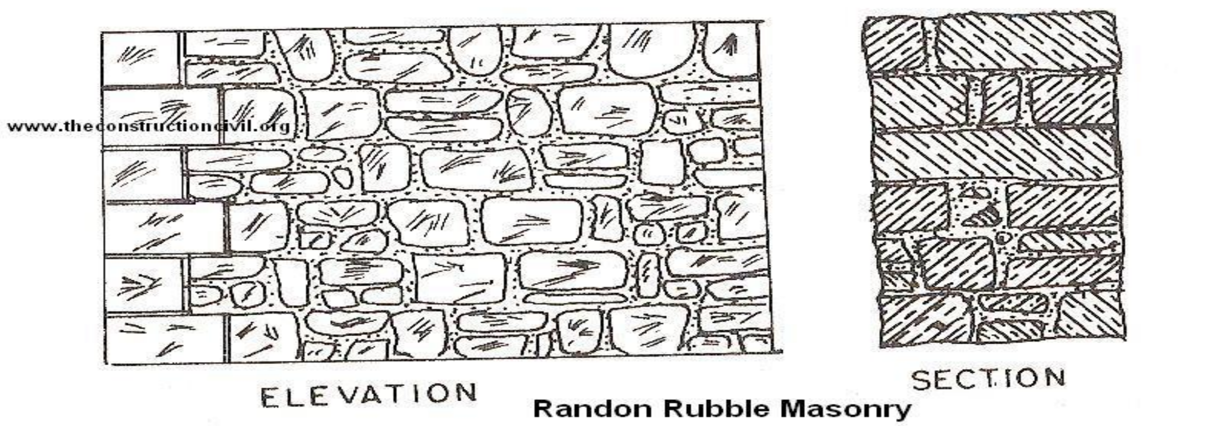

Fig:1 Randon rubble masonry

Horizontal bands are required for seismic resistance in stone/ brick masonry at the following locations:

a. Plinth
b. Sill
c. Lintel/roof
d. In vertical direction, provision of corner reinforcement is required for seismic resistance in buildings.
e. Besides, vertical jambs are required around doors and windows.

IV. Model construction

Model construction, incorporating provisions stated in the preceding paras was done in stone and brick masonry for demonstration at Uri and Tangadhar so that the same could be adopted by Kashmiris during reconstruction of their damaged buildings.

V. Training Program

Training programs were conducted at Baramula and Kupwara. The lectures of training imparted by CPWD were broadcast live on DD Kashir (Govt. controlled channel of television network). The first author of the paper made presentation on the subject matter on TV. It was emphasized that codal provisions regarding bond and plum stones in masonry need to be followed for better seismic resistance. The training programme dealt with masonry as well as reinforced cement concrete structures.

VI. Weak Corners

Structural weakness of corners in masonry due to inadequacies in corner provision of pillars was highlighted. It was emphasized that placement of windows near corners must be avoided during re-construction. It was suggested that windows should be placed nearly in the middle of the wall. It was emphasized that window area in such locations (falling in zone V) should not exceed one-third of the wall area in general (3, 4).

VII. Non provision of bands

As stated earlier, bands at roof, lintel, sill and plinth level are required for better seismic resistance. In actual practice,it was seen that only thin timber planks (thickness being less than 25 mm) only were in use in Kashmir region which was found to be inadequate.

VIII. Dhajji Dewari

'Dhajji Dewari' (Persian word for patch quilt wall) is a traditional building system practised in some buildings in Kashmir. Completed walls were plastered in mortar. It was seen that buildings which comprised of 'Dhajji Dewari' suffered little damage in general (Fig 2).

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Fig:2. 'DHAJJI DEWARI' construction in Kashmir

IX. Corner reinforcement and jambs

It is stated that corner rebar is a necessity in earthquake prone regions. Window and door openings need to be provided with vertical bars in jambs also. Such provisions were seen to be non- existent in masonry buildings in Kashmir.

X. Long unsupported walls

Long unsupported walls, even upto 20m in length were seen at places. It is stated that unsupported length beyond 7 m need cross walls with proper jointing. Proper inter-connection between longitudinal and cross walls must be provided for better seismic resistance.

XI. Timber Trusses

Some timber trusses were seen to have only vertical members and no diagonal members. Further, proper anchorage to supporting columns or walls was seen to be non- existing. Nailing of joints was seen to be the common practice, which did not provide adequate seismic resistance. Metallic strips with nuts and bolts, which provide better seismic resistance should be used at joints.

XII. Foundations

In hilly areas, more damage occurred due to different levels of foundations in the same building. Foundation should preferably be placed at the same level for better seismic resistance. In case of level difference, the line joining foundation should not be steeper than one vertical to two horizontal as shown in Fig.3

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XIII. Stepping in Foundations

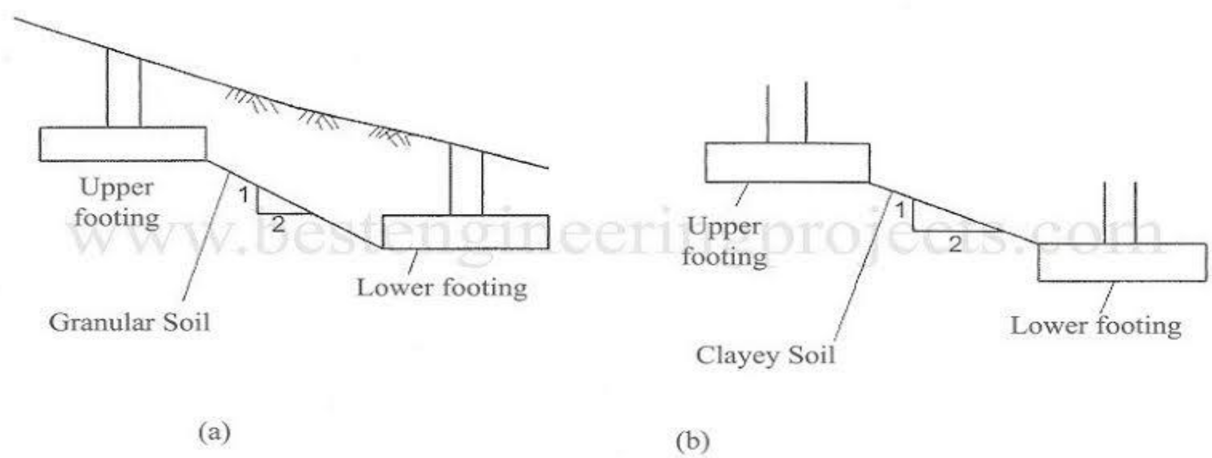

Fig: 3 Footing on sloping ground

XIV. Projected features

Minimization of projected features like staircases is desirable in earthquake prone areas. Provision of adequate embedment of projected features in masonry walls require proper workmanship. Deficiencies in respect of projected staircases on outer walls of buildings were seen to exist at many places in Kashmir.

XV. General observations

It was observed that in non-engineered buildings, quality control was lacking in general. Precautions are required in construction work relating to proper connectivity through bands etc. The bands at various levels as discussed earlier would provide better seismic resistance.

XVI. Pre-fabricated construction

Construction of semi-permanent type prefabricated construction was done at Uri, Tangdhar and Poonch by Central PWD and some other Government as well as non-government organisations. Main prefabricated structures (6*20 m size in plan) were constructed at 55 different locations to house about 100 persons in each of these. The total number of constructed units including bathrooms, kitchen etc. was 150 nos.

XVII. Discussions

Issues relating to deficiencies in construction practices in non- engineered buildings in Kashmir are brought out. Guidelines are provided in brief for better seismic resistance in such buildings.

XVIII. Conclusions

1. Quality construction with adequate bands at various levels performs well during earthquakes.
2. Following the provisions of BIS codes of practice ensures minimization of damage due to earthquakes.
3. Timber structures provided better seismic resistance than construction in brick or stone masonry.
4. Brick masonry provided relatively better resistance than stone masonry in general.
5. Reinforced concrete construction was not seen to be the practice in Kashmir. Wherever engineered construction using reinforced cement concrete was done, there was little damage.

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