SMART ELECTRONIC SYSTEM DESIGN

Dr. Muthupandi G
Rahul Sharma

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CHAPTER 1

ANALYSIS ON THE BENEFITS OF SMART IRRIGATION SYSTEM TO IMPROVE THE PRODUCTIVITY OF CROPS

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ABSTRACT: ***Water is the basic need of every living being so they must get an adequate amount of water with food. The food is obtained from plants that make their food by using water and sunlight. There is an increase in population, so it is needed to increase the production of food. The advancement in technology helps a farmer to improve the vision of the new systems in agriculture, like using sprinkles and drip irrigations instead of an open flow system to avoid the wastage of water. In Agriculture use of an adequate amount of water for the growth of crops is necessary, many developed irrigation methods are used for watering the crops to increase productivity. The focus of the study is to analyze and discuss the technical advancement in irrigation systems. Different irrigation techniques are discussed by different experts according to the requirement of crop and soil using the Internet of Things (IoT) and Artificial Intelligence (AI). Thus, further study helps in analyzing the latest technologies used for irrigation and what drawback in the system with the suggestion to improve them.***

KEYWORDS: ***Agriculture,Crops, Internet of Things (IoT), Irrigation, Sensor, Soil, Water.***

1. INTRODUCTION

Every living thing needs freshwater, thus conserving water is a top priority for us. Traditionally the watering of crops is done by using a pump where the water has given a particular direction using soil rows as shown in Figure 1. By utilizing modern technologies, water should be used efficiently in irrigation. It's critical to stay on top of emerging developments in irrigation to prevent free-flowing water and manage it using Smart Irrigation (SI) techniques as shown in Figure 2.

These devices are equipped with hardware, connectivity, and various types of sensors that may be monitored and controlled remotely, as well as communicate and collaborate with others through the Internet. There are a variety of ways to distribute water in agriculture operations that involve water inputs, commonly referred to as irrigated agriculture. The various alternatives have varying levels of productivity, and in certain surroundings, an exact method should be utilized for a particular yield. Irrigation methods vary greatly; however, it may categorize them as flood, spray, drip, and nebulizer irrigations are all options for how water is dispersed. The presence of sensing devices can also have irrigation without attention, in which the quantity of moisture is not measured. While in scheduled irrigation, in which the water is distributed according to the yearly needs.

Figure 1: Represents the Traditional Water System Where the Water Followed the Particular Pattern in the Farm [1]**.**

Figure 2: Represents the Micro Irrigation Water Sprinkler System where the Water is Spread in Surrounding Crops within the Range of Sprinklers [2].

The most crucial medium for plant development is soil. However, several factors such as soil wetness, Potential of Hydrogen (pH), and humidity differ from one place to the next. Nutrient testing provides useful data about the soil that may be utilized to improve plant development. The suggested project may be controlled through the webpage using parameter threshold values and instructions. The suggested system may be controlled and manipulated and turns "on" and "off" based on the given settings. Because it is fueled by photovoltaic (PV) panels, the suggested system has the advantage of mobility and minimal maintenance costs. In addition, the proposed system not only irrigates the land but also can eliminate microorganisms. In many affluent nations, SI systems are used to reduce water waste. The planned project's scope is significant since it irrigates the largest area of land possible while also remotely monitoring the land. A solar-powered robot with a high-resolution camera and sensors is used to monitor crop health. The farmer is alerted through the GSM cellular network if the detected value of moisture in the soil, humidity, temperature, and the water level is less or more than the defined threshold [3]–[6].

The necessary steps are conducted to provide soil nutrients via a watering pipeline, sprinkle the field with bacteria-killing chemicals, and maintain the proper threshold values. Agriculture uses a lot of freshwaters all over the planet. Because of the significant population expansion, the ratio will rise over time. As the world's population grows, so will the need for

food and water. As we all know, our agricultural land provides all of our food. In everyday living, water waste has long been a big worry for our civilization. The supply of water varies greatly from one place to the next. Some areas have an abundance of water, while others have a scarcity. The irrigation for agriculture is critical, as the wasting of water must be reduced as soon as possible, as water use rises in tandem with population expansion. To compensate for these losses, an automated irrigation system is being developed, to irrigate the whole area. The field is dispersed around the city. The robot passes over all of these regions to feel the field's state and transmits the acquired data through message with the GSM network from a mobile phone application [7], [8].

Atmospheric conditions play an essential role in both crop development. The thermal conduction commonly has a unit of "Celsius", "Fahrenheit", and "Kelvin degrees" and humidity is the number of water vapors in the atmosphere. Moreover, brightness is linked to temperature since direct solar radiation elevates the temperature and causes more evaporation in the soil. The average annual precipitation influences the requirement of irrigation for the crops. The pH sensors functioned to detect the pH of soil and water provided during the irrigation as shown in Figure 3.

Figure 3: Represents the pH Sensor Kit for Analyzing the pH of Soil [9]**.**

A temperature sensor measures the temperature of the body which might be available in numerous dimensions, and each one measures temperature using distinct methods as shown in Figure 4. A spring is linked to a rod at the sensor's tip, which leads up to the item scale. The spring senses the end of the stems and sits inside them.When heat is given to the detecting coil, movement is induced in the coil, which causes the gauge's needle to move, indicating the temperature. Temperature sensors are inexpensive, accurate, and dependable in repeated tests. Both integrated as well as surface mount applications benefit from them because of the decreased thermal mass, they have a quick response time. In most cases, any vibratory wire type is fully interchangeable.

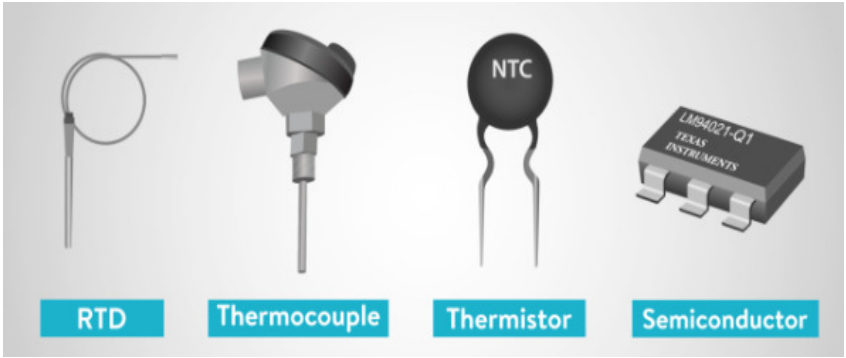

Figure 4: Represents the Temperature Sensor Used in Analyzing the Temperature of the Environment [10]**.**

The humidity sensors are electrical circuits that detect and display the humidity and ambient heat of the environment, wherever it is fixed which helps in understanding the content of water vapor present in the atmosphere. Resistive, capacitive, as well as thermal humidity sensors are the three most common kinds as shown in Figure 5. To compute the humidity level, all 3 types will detect minor changes in the environment. There will be two pieces to wireless sensors: a transmitter and a receiver. Information from process control devices is converted into wireless communication by the transmitter. The wireless signal is converted by the receiver into the required output. Wireless standards are changing all the time, and as a result, wireless sensors are becoming accessible for these diverse protocols. “NFC", "RFID", "Bluetooth", and "Zigbee-based" sensors are all common wireless sensors.

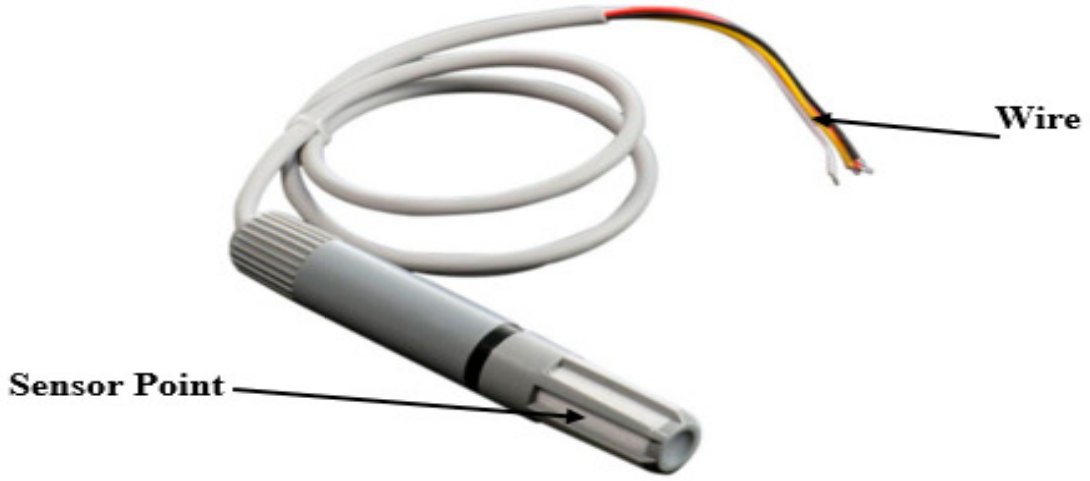

Figure 5: Represents the Humidity Sensors Used for Detecting the Level of Humidity in Soil and Environment[11]**.**

This section delves into the construction of a sophisticated water system. The system's key components are the soil dampness and "moisture sensor", Arduino Microcontroller, Central Cloud Storage, and a variety of applications. Soil dampness and moisture data are continuously collected using the ground and this data is transmitted by the Arduino device. The data is sent to an integrated cloud via the “Arduino” pack. This cloud is linked to a wide range of applications. Ranchers can use a variety of treatments to control moisture and wetness. A rancher can specify certain features for a yield. If the actual moisture and soil dampness levels are within their range, the dazzling water system activates the sprinklers. The sprinkler, on the other hand, remains turned off. When the plant roots do not get the water of water they are not able to grow or they may dry with time, so water management should be done.

2. DISCUSSION

Prakash Kanade et al. developed a system for SI for which they've created a project that uses IoT and machine learning to tackle these irrigation issues. Sensing devices like temperature sensor, raspberry pi or pressure sensor, bolt IoT module, pH sensor, and humidity sensormake up the hardware. Farmers will use less field water as a result of the "temperature sensor" predicting the weather conditions in the region. A pH sensor can assess the soil pH at regular intervals and anticipate whether or not it needs extra water. The main goal was to establish an irrigation system automatically and save water for future use, which was successfully developed to assist the farmer [12].

Qazi U. et al. studied and researched the SI System for Sandy Soils in a dry area. Arabian Peninsula" is a dry region with a scorching desert temperature and a significant lack of water. To prevent surface evaporation losses, IoT-based underground SI systems may be fundamentally created for these locales. The “sandy soil” characteristics in “Western Saudi Arabia” were taken into account in theoretical calculations to assess the effectiveness of an underground SI system in this study. For twin types of “sandy soil”, the effect zone of soaking induced by underground reflectors in the desired foundation region of the crop was investigated. The COMSOL is Multi-physics simulation results show that the underground SI system may be used to successfully control the target root zone at optimal saturation conditions while also preventing surface evaporation losses [13].

Malik Mustafa et al. discussed on SI system, where sensors are located at the bottom of the plant in the earth to collect the agent's dampness state for logical water distribution booking. The signals generated and identified by soil humidity sensors should be stored in a microprocessor for pre-programmed systems. A “cloud-based” SI system is studied, this system uses sensors to collect constant SI system data, saves it in the cloud, and then sends an order to the owner of the data, who then makes the appropriate action based on the conclusion [14].

Ahmed Hassan developed a Robot for SI systems by Exploiting Arduino. The suggested SI system would water the area for several acres at a time, and a remotely operated robot powered by photovoltaic panels has been designed. An application was used to operate the robot wirelessly. To examine the state of crops and feel the quality of the soil, a robot is equipped with several sensors and cameras. The field will be separated into several sections, and the robot will run over all of them for commercial purposes, sensing the soil's condition and sending the data to the phone through the GSM module, in addition to processing data to the PC/Laptop [15].

M. Safdar Munir et al. studied and developed “Intelligent and SI System Using Edge Computing and IoT”. They used a smart strategy that used ontology to determine half of the choices and relied on sensor data values for the other half. The conclusion is the product of a "machine learning algorithm" that takes into account the ontology decision and the sensor readings (KNN). Additionally, between both the central IoT server and also the GSM module, a periphery server is introduced. This method will not only decrease the delay probability to connects the IoT with a network of devices to resources effectively and efficiently track all the records, analyze the records at the end device, and transmit only some specific information to the main Central network to forecast the irrigation demands of soil, and display the result on display modules [16].

Favour Adenugba et al. approached the SI system in Africa. SI systems that use they have demonstrated how sensor and geographic information from an Internet of Everything (IoE) may be used to manage and monitor a “solar-powered SI system”. Using the “Radial Basis Function Network (RBFN)”, the acquired data is utilized to forecast environmental conditions. The irrigation system is controlled using expected water level values, weather forecasts, moisture, temperature, and irrigation data. A web platform was created to provide remote monitoring and control of the system for water [17].

Prakhar Srivastava et al. discussed on use of the “ESP8266 Wi-Fi module” based SI System.This study explains how IOT may be used effectively in conventional agriculture. The Wi-Fi module helps in analyzing the conditions of crops and alerts the controller to respond for the next process. The focus of the study was to develop a system that makes irrigation easy, where the watering can be monitored using the website so to control the

process of irrigation. Using a website makes it easy to process any operation on the farm from a long distance using IoT [18].

Zahra Amiri et al. discussed the placement of moisture sensors in drip irrigation.A significant element in determining a suitable area for monitoring "Soil Water Content" (SWC). The major problem in precision agriculture is the forceful flow of water and growth of roots in the ground, rather than wasteful water consumption. The focus of this research was to see if the distribution of SWC in a muddy ground during two phases of maize development influences the best site for SWC tracking in drip irrigation. An increase in root development surrounding the drippers at the time of harvest improved the range of water absorbed in various soil levels, limiting the best location for the sensing module to the higher films, for water absorption by larger roots. Soil sensors like “tensiometers” should be installed horizontally at 5.2 m and 10.2 m deep below the ground, with a drip knob oriented near the maize row [19].

Mason O. Stahl and Kaighin A. McCol discussed, the periodic series of surface moisture. In many regions of the world, the seasonal cycle has a significant role in soil moisture temporal variability, which has crucial consequences for agricultural seasonal forecasting as well as human and ecological health. The yearly cycle of soil moisture has significant regional variability, but a dearth of worldwide measurements has hampered the development of cogent hypotheses to explain that variability. They discussed the global seasonal cycle of soil surface moisture using 6 years' experience in satellite observations. Five unique seasonal cycle regimes are identified using an unsupervised clustering approach. Every seasonal cycle regime occurs across both hemispheres, on several continents, and in vastly diverse climates. To explain this regional diversity, they show that a basic yet physically-based groundwater level model, which only takes rainfall and surface ultraviolet radiation intakes and has no free factors, can recreate the known seasonal cycle regimes quite well. Surprisingly, there is no requirement for data on forest or land cover. The first study of the climate system of soil surface dryness is based on worldwide measurements that everyone are aware of that.

A sufficient quantity of water is required for effective agriculture, with the soil being able to keep the moisture and absorb it as needed. With the growth of agricultural techniques, the usage of "Arduino" and IoT is rising, allowing the owner to monitor the providing authentic crops from a single location that uses the GSM network and the internet. The usage of sensors is vital in assessing the status of soil, such as whether it is dry or not, wet soil indicates the presence of water, whereas dry soil indicates a lack of water, hence, the IoT aids in increasing the water availability to crops by providing water to the soil. Most studies are focused on SI systems, and so many technological advancements are beneficial development of society. Food is a primary necessity of active organisms, and as the population grows, so does the demand for food. However, as the land available for agriculture shrinks, farmers must become more creative in their use of modern and sustainable technologies to increase productivity.

The usage of cloud storage makes it simple to determine the measurement of time that soil will keep a water-based on the temperature difference. As a result, cloud storage makes the data available to the user for a short period, which is beneficial to the farmer. Clean water is essential for all living things so it is necessary to preserve the water as the water is getting wasted during free-flow irrigation which can be reduced using contemporary technology. It's vital to keep up with current innovations in irrigation to avoid free-flowing water and regulate it using SI techniques. As a result, as the temperature rises, so does the amount of water available to crops, which must be met to enhance agricultural yield.

3. CONCLUSION

The plants are incapables to absorb nutrients from soil if the water level is decreased below their absorption limit. So, to maintain the water in the soil for crops it is necessary to provide an adequate amount of water for their growth. Plants need water daily for their growth so it is necessary to maintain the water level for obtaining high productivity. The many researchers belonging to different fields researched and reviewed many techniques and methods of irrigation using IoT so that the farmer or user can monitor the growth of crops and do preventive measures to improve the profits. The use of cloud storage in the system makes it easy to access the previous data for the user whenever required to check the pH level, duration of irrigation, etc.

The delivery of the proper water volume at the correct location inside the facility is required by scientific scheduling. This needs continuous monitoring of the root zone's soil moisture content, as well as the start of irrigation on the desired schedule based on the plant's characteristics, development, soil type, and environment. As a result, sensors directly to the root zone in the soil are required for scientific irrigation to acquire a realistic moisture condition. The irrigation system described in this article is cloud-based and IoT-based. This system uses sensors to capture actual irrigation data, save it in the clouds, and then transmit a signal to the cloud provider, who then takes action depending on the outcomes. Thus, using the study it becomes easy to analyze the different methods used in agriculture. The use of IoT and AI is helping farmers by reducing their labor and by giving them the best suggestion for their crops. The sector of agriculture will improve with time and within the next few years, it will become robotic farming where common farmers also afford to use robots at minimum costs and also improve the irrigation methods.

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CHAPTER 2

EXPLORING VARIOUS INITIATIVES OF USING INTERNET OF THINGS (IOT) FOR INCREASING AGRICULTURAL PRODUCTION

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ABSTRACT: ***Agriculture using the Internet of Things (IoT) is a new technology that is adopted by many farmers around the world. The different methods of agriculture are now used and utilized by farmers throughout history with traditional practices. There are various applications of IoT in agriculture that are discussed and studied by different experts in the world. The focus of the study is to explore the different initiatives using IoT in agriculture for various activities. This study highlights different efforts made using the technology in agriculture. The different sensors and processors are used and installed in the machines that are useful in alerting the user to conditions of crops and farming-related fundamentals. Thus, it can be said that using IoT is beneficial for the farmer as it increases productivity and profits and also avoids financial losses. The use of IoT will increase within the next few years as it will be applicable in all fields of technology at a low price so that every farmer can afford to install it.***

KEYWORD: ***Agriculture, Farmer, IoT, Production, Sensor, Technology.***

1. INTRODUCTION

The activity of raising cattle and plants is known as agriculture and the implementation of agriculture, which allowed people to raise domesticated animals to provide surpluses of food that allowed people to live in cities, was crucial in the growth of sedentary human civilization. Agriculture has a long history dating back thousands of years. Approximately 105,000 years ago, people began harvesting wild grains, and approximately 11,500 years ago, they started planting them. Over 10,000 years ago, cattle were domesticated and including at least 11 different parts of the world, plants have been grown independently. Although nearly 2 billion people still relied on subsistence agriculture in the 20th century, modern farming consisting of multiple monocultures started to dominate agricultural production [1].

Textile, fuel, food, and raw material might be considered broad categories for the key agricultural outputs. Eggs, Cereals, fruit and vegetables, oil, meats, milk, and fungus are only a few examples of food classes. Except for developing economies, where the small farm is being replaced by modern farming and mechanization that results in a massive increase in crop yield, over one-third of all workers worldwide are in commercial agriculture, making it the second-largest industry after the service sector as shown in Figure 1. Agriculture is one of the important occupations in the world which produces the food and the raw material for the food with a growing population it is necessary to increase the productivity of the food and food crops to serve the growing population [2],[3].

Crop yields have significantly grown access to advances in agriculture, plant genetics, agrochemicals like fertilizers and pesticides, and technological advancements, but they also damage the environment and the ecosystem. Selective breeding and contemporary methods of livestock farming have both improved meat production, but they have also sparked questions about animal health and environmental harm. Aquifer depletion, deforestation, antimicrobial resistance, and other farming contamination are a few examples of environmental problems.

Agriculture contributes to and is impacted by environmental problems such as soil erosion, desertification, loss of biodiversity, and rising temperatures, all of which can reduce agricultural productivity (Figure 1). While many genetically modified organisms are being employed, others are prohibited in some nations.

Figure 1: Illustrates the Aerial Surveillance Vehicle for the Agriculture for Analysis of the Conditions of Crops in the Soil [4]

There are different farming methods used having different objectives and products which are practiced by the farmers and are listed below:

1.1.Specialized horticulture:

The rising demand for fresh produce in heavily urbanized regions with dense populations gave rise to specialized horticulture. In France, Switzerland's Lake Region, and northern Hungary, it has been used successfully for vineyard development.

1.2.Subsistence Farming:

Subsistence farming is the practice of raising crops and animals only for the farmer's consumption. It involves working in small agricultural areas with fundamental farm machinery. It is believed that the majority of subsistence farmers are impoverished and hence unable to buy better seeds and fertilizers. As an outcome, the farms are located on land with poor soil fertility or challenging topography. Low-yielding subsistence farming doesn't employ irrigation or power, both of which are frequently unavailable to these farmers. Virtually no food is sold at a profit since the producer and his family consume most of the food that is produced.

*1.3.**Intensive Subsistence Farming:***

1.3.1. Rice as an important crop:

In tropical areas with heavy rainfall and dense population, intensive agriculture is practiced. As it can serve and provide employment for a large population in each unit area, rice is the crop that is cultivated most widely. The majority of farmers use animal and labor power to complete farming tasks in Southeast Asia. Composted manure is used by most farmers to boost farm output per square foot.

1.3.2. Rice as an unimportant crop:

Similar to subsistence farming, where rice is the main crop, this approach is done in areas with little rainfall. In addition to rice, farmers also produce millet and wheat as grains.

Central And South America and also regions of Africa, the Asian sub-continent, and the Mid-East which receive minimal rain year-round, all practice agriculture.

*1.4.**Mediterranean Farming:***

Mediterranean agriculture involves growing crops and rearing cattle in the arid Mediterranean climate. The main agricultural products grown in the region are farm animals and plants including vineyards, citrus fruit, and grains. Horticulture is also practiced because of the winter rains, with the bulk of crops being seeded in the winter.

*1.5.**Commercial Grain Agriculture:***

Commercial grain cultivation developed from agricultural mechanization. It is mostly utilized in areas with little rainfall and a low population density. These regions produce grains that can survive in arid climates because they are weather- and drought-tolerant. In Australia and South America's grasslands, plains, and subtropical grasslands, grain monoculture is the most prevalent practice.

*1.6.**Arable Farming:***

Arable farming, as opposed to pasture or mixed agriculture, is the production of plants without the use of animals. Both a large, industrial-scale, and small size are possible. Annual crops grown on cultivated land include fruits, veggies, grains, cassava, potato, and lentils.

*1.7.**Shifting Cultivation:***

Crop rotation is a common practice in the tropics. The forest will need to be chopped and burned to be removed. The area that has been cleared is farmed for 3 to 5 years, until and unless weeds and local flora take over, whichever happens first. When this occurs, farmers remove another forest tract for agriculture and leave the field fallow for a while. It's a form of manual labor-intensive subsistence farming. People who work in this type of agriculture, which focuses on producing grains, are much more likely to live in tropical nations like Southeastern parts of Asia.

*1.8.**Nomadic Herding:***

Nomadic herding is the practice of maintaining and grazing animals on uncultivated pastures. In semi-arid and desert regions like Arabian regions, Africa, and the Eurasian plateau, it is typical. The process resembles pastoral farming. They include sheep, livestock, camel, horse, goat, and mules. An endeavor is a form of subsistence gardening meant to supply the family with food.

*1.9.**Rudimentary Sedentary Tillage:***

Contrary to other agricultural practices, rudimentary sedentary agriculture is a form of continuation farming that is carried out on the same piece of land year after year. The area is left fallow for a few years to reestablish soil fertility. It is common in the tropics and involves growing cereals and tree crops like the Para rubber tree.

1.10. ***Pastoral Farming:***

The main focus of a livestock ranch is animal raising. Contrary to nomadic herders, farmers live in towns rather than moving about in need of pastures and fresh water. Animals can graze in regions called pastures. This type of agronomy is carried out for profitmaking purposes in many areas of the world where there are vast swaths of land with enough room for animal eating. Southern and Northern America and the land of Australia have among the

earth's lowest rainfall rates, making them regions where commercial pastoral farming is performed on a massive scale. Most ranch animals are raised for their meat and fiber. A significant component of pastoral agriculture is dairy farming.

1.11. Commercial Plantations:

Commercial plantations, sometimes referred to as industrialized agriculture, plantation farming, or tree crop farming, cover vast areas of land. Even though the activity only occupies a little area of land, it has a substantial commercial value. Among some of the tropical crops planted are tea, rubber, cocoa, coconut, cocoa, vineyards, pears, spice, citrus, avocados, mangoes, and palm oil. It is frequently used in regions such As the African, Asian, and American continents that were colonized by Europeans. In colonial administrations, the bulk of plantations was created to supply tropical products to European markets. Most of the plants are tree crops, therefore starting is very expensive.

1.12. Mixed Farming:

Grains and animal husbandry, sometimes known as mixed farming, comprises both the raising of animals and the production of crops. Except for Asia, it is indigenous to the moist, semi-regions of the planet. It is a style of farming that has its roots in Europe. Market infrastructure is intimately related to the growth of mixed farming. In the UK and New Zealand, it is extensively practiced. Mixed farming involves cultivating a variety of crops with varying maturation periods on the same plot of land. It flourishes in areas with sufficient rainfall or irrigation facilities.

Due to the time-consuming nature of the conventional or outdated techniques of agriculture, not all crops can have their conditions examined. The usage of IoT in agriculture will assist the farmer in keeping an eye on the health of the cattle, crops, and orchids. IoT is being used more and more in both industrial and business applications. Utilizing makes it simpler for people to oversee many tasks, including farming, from a single location anywhere in the world. Both production and profit may be increased by using IoT. Thus some applications of IoT are not known which are useful in agriculture which is discussed in this study and compared with the before studies made by different experts from all over the world.

2. LITERATURE REVIEW

Amjad Rehman et al. explained that with the use of IoT, farmers may successfully employ technology to remotely monitor their fields at all times. For agriculture monitoring and testing, a variety of sensor modules, including distributed Wireless Sensor Network (WSN), are used, which is particularly significant owing to their precise output and use. Furthermore, the camera is used to observe the scene from a distance. The goal of this intelligent farming system is to identify existing methods that may be utilized to increase crop output and cut down on time, like crop, pesticide, irrigation systems, and flood control. In smart agriculture, the study presents IoT applications, advantages, existing challenges, and future solutions. Dewan Md Nur Anjum Ashir et al. discussed the agriculture and the IoT for Achieving the Sustainable Developments Goal (SDG). Instead of debating social or global development objectives, researchers are more interested in the introduction of new models and technical advancements. To close this gap, a model of precision farming is constructed in this work, and we concentrate the model on how it addresses SDG aims. According to the research, smart agriculture helps achieve the objectives outlined in SDGs from 6 to 12. Since most countries are seeking to industrialize more and get closer to achieving the SDGs, this research is crucial for both developing and developed countries [5].

Badri Narayan Mohapatra et al. explained how the IoT may be used to monitor crops and serve other agricultural needs. Agriculture has always required a high level of work, professionalism, and resources. According to the authors most of the world now relies on agriculture for the production of food, economic development, commerce, and employment. Around the world, many agronomists, farmers, and scientists have developed various strategies and solutions to address these problems. The IoT is a rapidly expanding field of technology that will enable cheaper, more efficient, and more productive smart agricultural systems. This study encourages further study of how electronics and internet technologies are used in agriculture and farming. Luis Omar Colombo et al. their study describes the design of a sophisticated agricultural system for crop yields that are based on well-liked cloud data storage and data analytics services, low-cost IoT sensors, and these services. In addition, a novel data-mining technique is suggested for the prediction of total production from heterogeneous data sources, leveraging both crop production and climatic data. This method was initially tested with open historical data from the northeastern part of the Mexican state of Puebla, which was gathered from sources of data from either the "National-Water Commission" as well as the "Agri-Food Information Service" of a Mexico Government, using conventional machine-learning techniques.

He Yang et al. studied on using IoT and Deep Learning (DL) in agriculture. In the framework of DL, this study intends to investigate how IoT and agricultural information categorization are applied to farm productivity and economic management. The findings demonstrate that, with constant parameter values, the model's loss value starts to rise linearly at around 1400 steps and rises to the predicted level. This study enhances the uses of agricultural information and the relevance, thoroughness, and correctness of information gathering inside the case of agriculture science and innovation. Mohammad Hossein Ronaghi and Amir Forouharfar, goal of that study is to pinpoint the key elements that have an impact on how farmers in Iranian Middle Eastern nation, accept and subsequently use IoT in smart farming. UTAUT has thus been employed contextually as the study's theoretical framework. In the end, the findings showed that behavioral intention had a substantial influence on how IoT technology was used. The findings have repercussions for IT authorities in the Middle East's agriculture industry, where water and arable land are two vital yet scarce economic resources. As a consequence, promoting smart farming would be impossible unless farmers met the criteria suggested by the research findings for utilizing IoT technology [6].

Eissa Alreshidi design the technology-based Smart Sustainable Agriculture (SSA) approach throughout many centuries, agriculture has been a significant food source for people, including the creation of practical agricultural techniques for many kinds of crops. The first part of that research looks at the technologies already used for SSA, and the second part identifies the IoT/AI technological architecture that can support the creation of SSA platforms. This study analyses SSA research and development, adds to the body of knowledge and offers an architecture to create a platform for smart, sustainable farming as a remedy [7]. Nahina Islam et al. discussed the IoT and Unmanned Aerial Vehicle (UAV) Inspired Sustainable Smart Farming Application and Communication Technology. That study investigates the communications technology, network functionality, and connectivity needs for smart farming while outlining some of the significant IoT and UAV applications in the field. Two case studies are used to assess smart agriculture's connection issues and potential solutions. To overcome the connection issues with smart farming in study 1, suggest and test blended Long Range Wide Area Network (LoRaWAN) gateways. Investigate satellite communication solutions in case study 2 to connect rural Australian smart farms. The report concludes by highlighting obstacles to this topic's future research and providing strategies to overcome them [8].

A. A. Raneesha Madushanki et al. applied the sensor data collectors, technologies, and sub-verticals including crop management and water management will be provided in their study's analysis of recently created IoT applications inside the agricultural and agriculture sectors. Future research should focus on the scalability of IoT systems, phenotypic variation aspects, IoT network architecture, methods of data analysis, size or magnitude of the identified land or agrarian field, IoT security and risk alternatives, related technologies, storage systems, cloud hosting, and power supply units, among other topics [9].

There are various studies made by different experts in the field of IoT and agriculture combined. There are many studies on the different aspects of agriculture done in the world, which are studied by different researchers. The studies which are done previously are getting better and better with time and involvement in technology. The use of IoT and AI makes farmers easy to do their work from one place. The importance of this study is to understand the different aspects of technology in agriculture. The study is necessary to overcome the previous drawbacks in the application of technology to make farmer life better.

3. DISCUSSION

There are different applications of IoT which are now developing in every field. The use of IoT in every machine and application is increasing which makes it easy for the operator to operate these machines from any position as shown in Figure 2. Various applications are using IoT in domestic, commercial and now it's been agriculture. The use of IoT and AI in agriculture is increasing with time. The surveying, spraying, irrigation, detection, etc. are the areas for the application of the sensor. The input modules are the sensors like humidity sensor, moisture sensor, temperature sensor, cameras, and pressure sensor which are directly connected to the microcontroller and then to the storage unit. The data stored in the storage unit is analyzed with previously stored data and if the data is missing it is stored for future use.

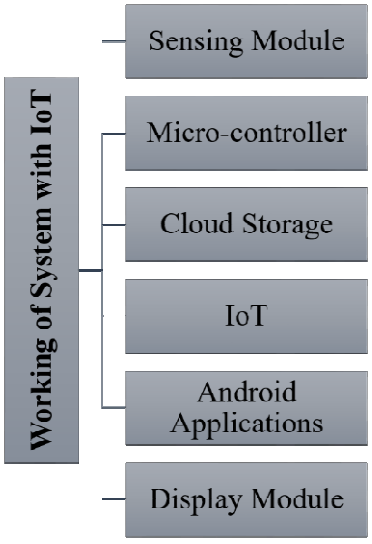

Figure 2: Represents the Working of IoT from Input to Output in Any Application.

The stored data is displayed on the android application on the output or display module from which the user can be able to decide as per the requirement. The display module is mobiles, screens, laptops, etc. which shows the results of the analysis in agriculture. Agriculture is one of the main and initial food-producing fields which produces the ram material required for preparing food. The crops on the farm belong to different conditions and climates with different physical orientations. There are various applications of IoT in different fields which

help to improve the technology with machines in different fields which increases productivity. The use of IoT is now increasing with time as everyone is getting aware of the applications of IoT in agriculture. The application of IoT in agriculture makes the farming process easy, the farmer can do their work from one place using the technology. The use of technology in hardware and software is easy nowadays which is seen in the study, which is now useful and important.

The use of mobile makes the life of the common man easy in every field. The technology in spraying, security, harvesting and irrigation helps the farmer to complete their tasks from one place. Intensive and extensive agriculture are the types of agriculture that are important and followed in most farming activities. Animal husbandry is the field related to farming is also known for using this technology as milking, washing, brushing, and feeding is also known as getting automatic. There are various applications and uses of technology that are adopted by farmers in many countries as shown in Figure 3. Thus, most advanced countries do such farming and get more profits compared to the other farmers.

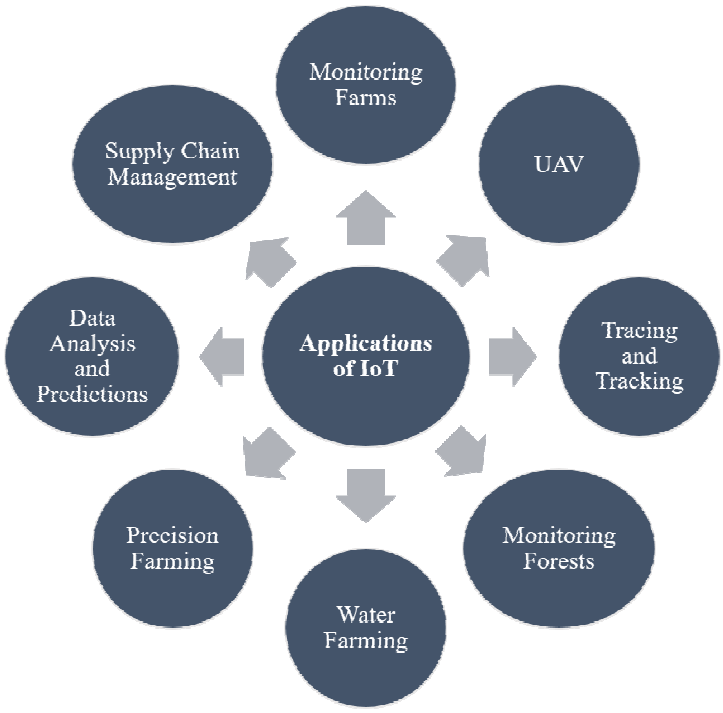

Figure 3: Illustrates the Application of IoT in the Different Areas of Agriculture.

The application of IoT is increasing day by day there are various applications of IoT which are implemented in agriculture as shown in Figure 3. The use of UAVs in agriculture makes the farmer's life easy for effective surveillance and monitoring over a vast area from one place, while due to aerial spraying robots it becomes easy for the farmer to spray the fertilizers, insecticides, and pesticides from one place. The tracking and tracing of the daily updates on the farms for various agriculture activities daily help the farmer analyze the efficiency and productivity of the farms. Water management using agriculture makes the irrigation system easy for the farmer. The alerts on the climate and the dryness of soil based on temperature based on sensors made it easy to fulfill the demand of water for crops and soil as per requirement automatically.

The monitoring of different domains of agriculture made the life farmer comfortable so they can know the status of their farm and crops as well as their livestock from one place which reduces the labor costs. The different types of farming utilize different technologies which

include intensive, extensive, precision, and livestock farming. There are various types of agriculture-related business where the utilization of IoT affects the life of the farmers which includes horticulture, dairy, sericulture, meat production, sericulture, lac culture, etc. temperature management helps to maintain the temperature in the greenhouses or livestock farms to avoid the economic losses.

There are various sensing modules used in the sensing at the initial stages which are connected to the microcontroller which analyses the information given by the sensor in the form of a signal and responds according to the inputs. There are many studies on the application of sensors, IoT, and AI in agriculture which makes farming easy. Farming is now becoming very productive which is increasing the profits of farmers. The different papers, studies, articles, and works of literature have analyzed the importance of agriculture in the world and the parameters that help to improve the productivity in agriculture. Thus, the study is necessary to know such techniques to achieve the SDGs for the betterment of society.

4. CONCLUSION

The food and food products are obtained from plants and plants-dependent occupations such as agriculture. Agriculture is now integrated with technology which makes the farmer smarter in agriculture. There is the various application of IoT in the field of agriculture which have discussed by many experts in their studies. The use of IoT is very helpful to farmers as it makes irrigation easy so that wastage of water is avoided. Various applications of IoT alerts the farmer on the display module and also update the detail to the farmer wherever they are necessary. Thus, after studying the different studies of different experts around the world it is seen that using IOT is useful for humans in any field. So the IoT should be installed and used by every farmer which will help to improve the productivity of crops. The IoT and AI are very useful for the farmer and within the next few years, the use of smart technology will help the farmer in agriculture so from a long distance also anyone can do the farmer.

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CHAPTER 3

ANALYSIS OF THE SMART HOME AUTOMATION SYSTEM USING VARIOUS TECHNOLOGIES

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ABSTRACT: ***The automation of the home is a new and advanced technology that not only makes the home smart but also provides high security from theft. The use of high and advanced technology with artificial intelligence (AI) and IoT makes the house smart. The focus of the study is to analyze the various technologies used in developing a house automation system. The different experts study the different technologies on the different aspects of house automation. Various applications are connected to the system which help to make the house smarter which are a lighting system, door system as well as sound system, and highly advanced robot systems which are capable of replacing all human labor easily with time. Thus, it can be said that using various technologies develops high smart systems with AI and also increase house security from any accidents. In the next few years, the smart home system will be adopted all over the world at a low cost that is affordable to the common man.***

KEYWORDS: ***AI, Automation, IoT, Security, Technology.***

1. INTRODUCTION

With home automation, a user may access and manage a house's appliances from any location in the globe using a mobile device. House automation may refer to a single programmable device, such as a smart thermostat or sprinkler system, but it more correctly represents a home in which practically every smart light switch, appliance, outlet, and the air-conditioning scheme is connected to a network that can be controlled remotely. This includes an alarm system, along with all various smoke detectors, locks, windows, security cameras, doors, and other sensors that are connected to it from the standpoint of home security as shown in Figures 1 [1], [2].

Figure 1: Represents the atomization of the Technology in the Home Automations.

Up until quite recently, only bigger commercial structures and affluent houses had automatic centralized control of all systems throughout the building. Building automation, which often just involves lighting, heating, and cooling systems, seldom offered more complex management, monitoring, and scheduling features and was only available from specific

control locations within the building. The IoT, where everything has a given IP address and can be watched and accessed from a distance, is a move toward home automation. The earliest and also most prominent beneficiaries of this strategy are smart appliances and gadgets that are Ethernet or Wi-Fi connection to LAN (Local Area Network). However, companies have also looked at the possibility of IP-based inventory management, as well as the integration of electrical systems and even specific points, such as lighting control and electrical outlets, into home automation networks [3]–[6]. Although it may be a while before using the mobile browser to find a misplaced sock, home routers are becoming better at supporting more systems and gadgets. Unsurprisingly, one of home automation's two primary qualities is automation. Automation is the capacity to plan and schedule actions for the network's devices. Time-related instructions, such as making house lights switch on or off at particular times each day, may be included in the programming. It can include unplanned actions, like switching on all home lights whenever the security system goes off. Once people begin to grasp the potential of building automation scheduling and may think of countless practical and original ways to improve life. Monitoring systems and accessibility are the second key feature of modern home automation.

While some one-way monitoring equipment has been available for a while, the ability to genuinely access private home networks since has only just been accessible with the growth of smartphones and tablets. It may be seen and operate the system itself, as well as any related devices, using any Internet-connected device with a suitable home automation system. Monitoring applications may provide a great deal of information regarding the house, from the present situation to a thorough account of everything that has occurred thus far. Users may check the status of the security system, the lights in the house, if the doors are secured, the temperature inside, and much more. Users can even access original video feeds and watch what's happening in the house while gone if the home automation system includes cameras. Many significant actions may be carried out with even basic alerts. Every time the security system detects a possible issue from major weather notifications to motion sensor alerts to fire alarms can set it up to deliver push notifications or an email. Users may set up a passcode lock to notify when a child arrives home from school so that can receive notifications for less important occasions as well. When start engaging with the smart home system through the remote app, begin to have true hands-on control. Users can reconfigure the schedule, remotely control doors, reset the thermostat, and control the lighting everything from a smartphone, to anywhere in the globe, in addition to arming and deactivating security systems.

The opportunities for building automation are almost endless as manufacturers continue to develop more and more intelligent appliances and gadgets. Thus, it is now becoming necessary to develop advanced automation systems for homes also to provide luxury living for the user with security. Automation is becoming necessary to reduce the time for various activities in the house. Robots and automated machines are now used over the world and still, there are many improvements and advancements in the application which are to be studied. The comfort with security is the aim of implementing and developing automatic systems. Thus, it is necessary to the different technologies that are applicable to house automation for various systems.

2. LITERATURE REVIEW

N. Sriskanthan et al. develop a system for home automation that uses Bluetooth. The idea of a smart house will soon be realized through a variety of “intelligent” gadgets, including mobile phones, air conditioners, home security systems, home theatre systems, etc. They have led to the development of Personal Area Networks in the domestic setting, allowing all of this

equipment to be connected and controlled by a single controller. The late 1990s saw the development of Bluetooth technology, which is the best option for this problem. The use of Bluetooth technology in such networking and home automation setting is described in this study. It suggests a network made up of several client modules and a mobile, remote host controller. Through Bluetooth devices, the client modules connect with the host controller [7].

Ahmed ElShafee and Karim Alaa Hamed are making a Wi-Fi-based home automation system and putting it into action. The design and prototype execution of a novel home automation system using Wi-Fi technology as the network architecture linking its components is presented in this study. The suggested system has two basic parts; the first is the servers that expose the system core and control, maintain, and keeps an eye on users' homes. The second component is the hardware interface component, which offers the sensors and actuators of the smart home system with the proper interface. The system supports a large variety of home automation devices, including security and power control components [8].

Rozita Teymourzadeh et al. developed a smart Home Automation System Using GSM. The goal of home automation systems' expected future is “Full Home Control”, which is the subject of this research study. The study and use of home automation technology utilizing a Global System for Mobile Communication (GSM) modems to manage home appliances including lighting, climate control, and security systems via SMS text messages. Homeowners will be able to check the status of any controlled appliances from their mobile phones, whether they are remotely switched on or off. A maximum of four loads were used to implement and test the suggested prototype of the GSM-based home automation system, which yielded an accuracy of 98% [9].

Atit Dharmendra Patel et al. designed the home automation system creation and design. IoT is a technology that has been around for a rather long time, and its real-world applications are incredibly astounding and beneficial to both the individual and society at large. This study describes the creation of a basic yet expandable home automation system. After development, the website may be launched on any web hosting platform the user chooses. For this project, our website and MySQL server will be hosted by the 000-web host web hosting service. After the project, the team is being able to design, create, and install a smart home system with several internet-connected sensors and gadgets that can be managed and watched anywhere around the globe.

Muhammad Shujat Ali et al. studied comparison of the IPV-4 and IPV-6 home automation systems based on thwarting reconnaissance attacks. This study aims to assist and provide support in meeting the needs of elderly and disabled people residing in homes. The management of home appliances uses both the control technique and the tone approach. The research community has generally stated that network “Reconnaissance Attacks” on IPv6 are often impractical since it would be extremely difficult to scan all 264 servers in an IPv6 subnet for addresses. This study of IPV-6 hosting schemes now in use plans a new approach and moves in the direction of “mitigating reconnaissance threats”.

Ajay Bolla et al. utilize ultrasonic sensors for home automation the project's goal is to conserve energy throughout autonomous household systems. Whenever home automation controls the power usage of gadgets in the house, it is discovered that energy consumption drops by 18.70 percent. However, intelligent automation often results in cost savings of 40 to 75 percent, with a payback period of several years. Understanding the various forms of software automation is essential. To determine an object's motion, sensors are utilized. Ultrasonic sensors are employed in home automation systems.

Sajjadul Islam Nader et al. developed Cost-effective IoT and GSM-based home automation and surveillance system. Day by day, our civilization continues to advance. The home automation system is one of today's most exciting technological innovations. The fast development of technology and automated systems greatly facilitated human living. In this project, the IoT is used to create an advanced smart house with an enhanced security system. Using an internet interface like smartphone apps like Blynk, the user may operate and monitor the system. To assure a better life for ourselves and our families, the primary goal of this project is to develop small home automation and security system.

Olutosin Taiwo et al. designed deep learning-based improved intelligent home automation control and security system. In this study, a smart home system that can monitor environmental conditions, manage household appliances, and detect activity in the home, as well as its surroundings, is presented. An algorithm is created that used a deep learning model for improving the building automation system's intruder detection and reducing the likelihood of false alarms. The CNN model was used to conduct an experimental examination of human movement patterns to assess the categorization for the identification of people. The CNN classification method had a 99.8% accuracy rate.

Md. Sayeduzzaman et al. IoT is the connecting of gadgets. To preserve public health by sanitizing the interior surfaces of homes, this advances IoT technology by developing an automated sanitization device. The auto-sanitization features of smart houses can serve as a model for lowering COVID-19 transmission rates. It can also serve as an illustration of a time- and money-saving strategy for leading a tidy, comfortable, and joyful existence. A fog disinfection device, NodeMCU, Arduino Uno, and different sensors were suggested by a smart house with just an auto-sanitization system to create the prototype. Through a smartphone application, this gadget may be utilized online anywhere around the globe.

Numerous functions, such as garage door management, voice control, lighting control, keyless entry, climate control, live or recorded video footage, and two-way audio, are part of the Vivint smart home security system. If starting from scratch with home automation and want the assurance of expert installation and a complete, fully integrated system, Vivint's smart burglar alarm is a terrific option. Additionally, one might be able to incorporate any smart home appliances currently own with a Vivint security system. For voice control, Vivint integrates with both the Google Nest nest thermostat and operates either Amazon Alexa as well as Google Assistant. Additionally, may link a variety of smart gadgets to any surveillance system via Z-Wave. Thus, it is necessary to know the different methods to develop the home automation system for making a comfortable lifestyle for users.

3. DISCUSSION

Theoretically, anything that could be networked can be mechanized and remotely managed. Home automation most frequently links straightforward binary equipment in the real world. This applies to both “ON” and “OFF” devices, such as security sensors, and also “open” and “closed” ones, such as plugs, electronic locks, and lights. Home automation only becomes intelligent when Internet-enabled devices are used to control and connect to this network. The personal computer, upon which some of the early home automation was created, is the standard control device. Today's home automation systems more typically employ the control panel of this security system and an easy app layout that can be accessed by an Internet-enabled Computer, or smartphone, to distribute programming and monitoring control.

Although many of the manufacturers' smart devices are loaded with cutting-edge features, very few of them provide the degree of integration needed to be a part of a complete home automation system. The issue has been considerably exacerbated by the fact that each

manufacturer has a unique perspective on how these devices should be connected and used. Even if there is a washing machine, smart TV, coffee machine, thermostat, refrigerator, or any other Internet-enabled home appliance now on the market, the result is frequently a distinct control technique for each device as shown in Figure 2. Home automation might become standardized soon, allowing us to fully benefit from all of these new opportunities.

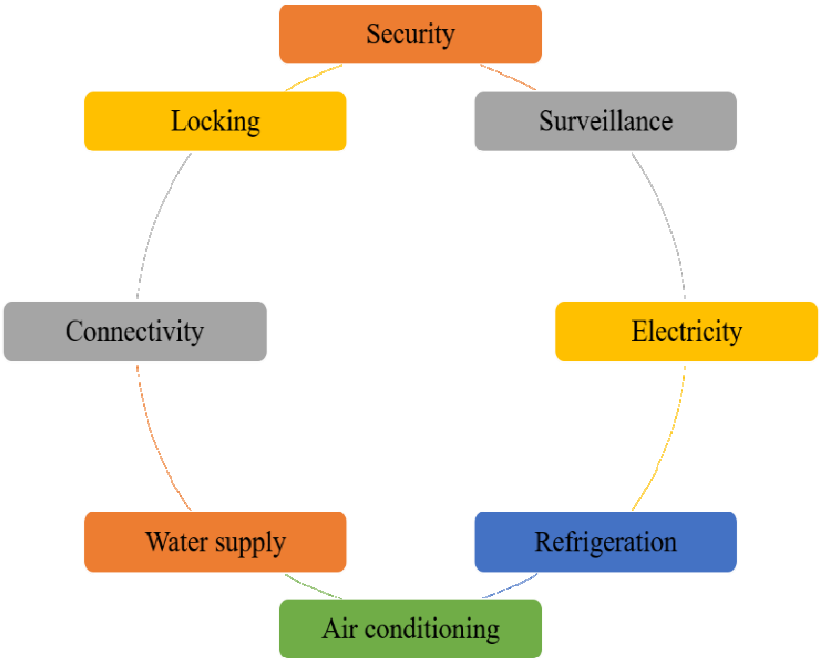

Figure 2: Represents the Application for Managing Different Automation Systems using Technology.

This essentially refers to the doors, windows, and environmental controls that make them warm and secure, such as thermostats, smoke alarms, temperature, humidity, fire, and carbon dioxide sensors. Home automation solutions from security companies should also offer alternatives for security cameras for more real-time convenience, security, and control. The better systems will also allow for the integration of individual power outlets and lights into the home automation plan. Home automation offers unrivaled potential for energy, which in turn reduces costs. The thermometer is already intelligent since it controls the heating and cooling of the house by using a temperature threshold. The majority of the time, thermostats may be configured with various goal temperatures to reduce energy consumption during the times of day when the user is least likely to gain from the air – conditioning. At its most basic level, home automation provides predetermined automation to lighting so coordinate energy consumption with the regular daily schedule. Electrical components or even specific gadgets can be automatically turned off during times of day when they are not needed with more flexible smart home devices.

The scheduling may be further divided to differentiate among weekends and, in some circumstances, even distinct seasons of the year, much like with standalone devices such as thermostats and sprinkler systems. Although rigid timetables are beneficial, many users work irregular hours. By adding “routines” to the device and remotely operating it as needed, energy costs may be cut even more. In those other words, might program a “coming back home” event that, for example, activates warmth and lighting as the user drives home from work with a single swipe on the smartphone. When leaving during the day, an opposing “going home” event might prevent wasting resources on unattended lights and appliances.

3.1. Advantages:

Managing every home gadget from a single location. Here, convenience is a major consideration. A huge advance in technology and home management is being able to keep everything connected through a single interface. Theoretically, all it takes is learning how to operate one app on a tablet or smartphone to access a wide range of features and appliances across the house. This makes it simpler to get the functions for home and significantly reduces the learning curve for new users.

3.1.1. Flexibility for new devices and appliances:

When it comes to accommodating new appliances, gadgets, and other forms of technology, smart home systems often have a remarkable degree of flexibility. No matter how cutting-edge appliances appear to be now, newer, more spectacular versions will be created as time goes on. Beyond that, should add to a collection of gadgets to replace the more outdated ones or look into cutting-edge technology to go with indoor and outdoor locations. Homeowners' jobs will be a lot easier if these newcomers can be integrated easily, and it will be possible to keep updating to the newest lifestyle technologies.

3.1.2. Maximizing home security:

Home security may dramatically increase when security and surveillance functions are added to smart home networks. There are many alternatives available here, but just a small number of them are being investigated right now. Home automation systems, for instance, may link motion detectors, security cameras, automatic door locks, and other physical security measures across the house so that they can be turned on from a single mobile device before going to bed. Additionally, the user may select which devices they want to use to get security alerts, determine when the time of day an alert goes off, and opt to view activity in real-time whether they are at home or halfway around the world.

3.1.3. Remote control of home functions:

Never undervalue the influence remote access to home systems may have. On a particularly hot day, the user can ask their home to cool down just in time for them to arrive home from work. The user may set the oven to begin preheating while still in the supermarket if they need to start supper quickly. The user may also verify if the lights were left on, who is at the front entrance, or whether all media was switched off while they were away.

3.1.4. Increased energy efficiency:

The adoption of smart home technologies can help make a room more energy-efficient. For instance, a programmed smart thermostat automatically learns the user's schedule and temperature choices and then recommends the optimum energy-efficient settings throughout the day can provide the user more exact control over apartment heating and cooling. To save energy waste, lights and motorized blinds can be programmed to convert to an evening mode whenever the sun sets or to turn on and off automatically when a person enters or exits a room.

3.1.5. Improved appliance functionality:

Having a smart house might also make running appliances easier. Finding better applications and channels for preferred television will be much easier with a smart TV. Without ever having to worry about overcooking as well as undercooking chicken, a smart oven will help prepare it to perfection. When entertaining guests, maintaining a movie and music collection may be made simple with a well-designed home theatre and audio system. In the end,

automation technology would connect appliances and other systems to increase appliance performance and generally make home living much simpler and more fun.

3.1.6. Home management insights:

The capacity to get insights into how the house functions have merit as well. The user may track their energy use patterns as well as how frequently they watch TV, the kinds of meals they make in the oven, and the kinds of goods they store in the refrigerator. With the help of these insights, the customer may be able to examine every day routines and behaviors and make necessary modifications to lead the desired lifestyle.

3.2.Disadvantages of Home Automation:

3.2.1. Security Issues:

As more people utilize smart home gadgets, security will, like it does with other computer equipment, become a bigger problem. There will undoubtedly be a variety of security issues that surface, and as a result, smart home security software and equipment will proliferate.

3.2.2. App security:

Typically, smart home gadgets include companion applications that may be used to operate them. However, to do so, they are given several rights that have an impact on the device's operation, such as the ability to open and close a smart lock that secures the house. Hackers might control the entrance to homes if they acquire access to these applications, which could have significant security ramifications. The ideal method for making ensuring smart home applications are as current as possible and installing any software & security upgrades as soon as they become available can help prevent this.

3.2.3. Greater acceptance:

Many new technologies can occasionally be viewed as unneeded, and some people may now think the same about smart home technologies. But just as appliances like washing machines, microwaves, and TV remote controls have evolved to become vital in the home, it's likely that in a few years, no one will question using their voice to operate their lights or robotic vacuum cleaners to clean their house. Although they are not unheard of, attacks on smart home technology are uncommon. It is up to the individual to balance the security and financial dangers with the variety of advantages that smart home technology provides.

3.2.4. Wireless security:

Almost all smart gadgets rely on wireless connection in some way for their operation (Wi-Fi or Bluetooth). As with all digital communications, wireless communications have the potential to be intercepted by hackers, who might then use this information to access smart home equipment. Since Wi-Fi is one of the most widely used methods of connecting to smart home devices, it is crucial to safeguard the home Wi-Fi router and may.

3.2.5. Integrated systems:

One system may be used to operate all of the smart home gadgets thanks to integrated smart home systems offered by some manufacturers. The risk here is obvious if hackers get into the system, they may take over the smart home and control everything.

3.2.6. Cost: Extremely expensive:

Even while many smart home gadgets are now within most people's budgets, completely outfitting a home with smart gadgets is still rather expensive. However, most computing

technology improves with time and becomes more affordable. This surely applies to smart home technology as well. Thus, home automation is developing with the time new ideas, as well as parameters of automation, are developed by different companies and researchers. The innovations in the application of technology are increasing with time which helps society adapt to it. Home automation is costly but with time it will be implemented all over the world. With the development in the application of technology with different distant communication modules, it is easy to implement the technology with different devices and systems. The systems are developed with the time for different machines and systems which makes the necessary to know the different aspects of home automation on the human lifestyle.

4. CONCLUSION

The use of AI with automation increases the effectiveness in the house. The work of houses for various gadgets becomes easy using AI and IoT. House automation reduces the robberies and theft issues by the installation of advanced security and surveillance system. Various input modules are used in designing and developing the smart home model. The person in the house can sit in one place and continue doing work without any disturbance. The use of an automatic housing system reduces the work and stress of doing small activities or daily chores. Different technologies in the market are used in the house automation and controlling of the house system. Various technologies evolved with time in the home automation system which provides luxury to humans and reduces labor costs with comfort. The development in technology is seen with highly wireless systems and also the application of robots for commercial as well as domestic purposes. Thus, from studying the different technology researched by different experts, it is seen that the house automation system is helpful but the cost of installation is high so it is not affordable to the common man. The study further will develop a system that will be cost-efficient and anyone from a middle-class family also be able to install it in their house.

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CHAPTER 4

DEVELOPING A SYSTEM USING INTERNET OF THINGS (IOT) TO CONTROL IRRIGATION SYSTEM

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ABSTRACT: ***Soil is the main thing in agriculture as crops are grown in soil, and the crops absorb the moisture and nutrients from the soil. There are many research and devices that are developed in different parts of the world by using moisture sensors. So, the focus of the study is to develop a system using a moisture sensor that helps to detect the moisture level of soil and supply an adequate amount of water. The use of technology makes it easy for the operator to carry out water irrigation to the crops automatically depending on the soil moisture content. The system contains a few important components like a pump, sensors, controller, dispensing unit, Internet of Things (IoT), etc. thus the developed model is useful in irrigation. The use of artificial intelligence in the system helps to reduce the work stress of farmers. Within a few years, this system will be applicable on all the farms and studied using advancing networks and technology.***

KEYWORDS: ***Agriculture, Irrigation, Internet of Things, Moisture Sensor, Soil.***

1. INTRODUCTION

Agriculture serves as both the backbone of the economy and a significant industry. All nations have serious concerns about the developing problem of agriculture automation. The need for food rises as the world's population rises, which is happening quickly. It has been incredibly challenging for the agricultural business to find methods and procedures that would enable them to completely meet the expanding wants and requirements due to the growing population and the shifting expectations of consumers. Agriculture is one of the most important societal sectors since it supports advancements. To enhance the industry's overall outcomes and results, it is crucial to make sure that improvements are done. The technology used in food production should encourage significant innovation and development to meet changing consumer demands. Since the majority of nations depend on the agricultural sector, it is essential to utilize agricultural resources. Smart irrigation is a growing field of science that use data-intensive techniques to boost agricultural output while lessening its effect on the environment. A deeper knowledge of the operating environment and the operating activities is made possible by the data that modern agricultural operations collect from some sensors.

The amount of water in the soil is known as its moisture. It can be described in terms of weight or volume. In situ devices or remote sensing data can be used to measure the moisture content of the soil. Water that enters a field is removed by flow, draining, evaporation, or transpiration. Moisture removal, water loss from the field is the process of water immediately evaporating off a field's surface and entering the atmosphere. Water is removed from a field by evaporative cooling when it vaporizes inside the plant. The liquid that travels from the surface to the edge of the field is known as discharge. Drains are subterranean passageways through which liquid seeps into the earth in a downward or field-end direction [1],[2]. Water is a major problem when it comes to planting growth since it has an impact on erosion, soil formation, structure, and stability. Plants require water for four reasons:

- It makes up between 80% and 95% of a plant's protoplasm.

- The process of photosynthesis requires water.
- It is the solvent used to transport nutrients into, inside of, and throughout the plant.
- It offers the turgidity necessary for the plant to maintain its appropriate alignment.

Leaching is the process by which water changes the soil profile through decomposing and re-depositing mineral or organic soluble compounds and colloids, frequently at lower depths. Inside a loam soil, particles make up 50% of the volume, gas makes up 25% of the quantity, and water makes up 25% of the volume, of which most plants will only have access to 50%, with significant variance based on matric potential. Gravity, osmosis, and capillarity all have an impact on how water travels through soil. Under its buoyancy, water displaces air from linked Macropores as it penetrates the soil. This process is known as slaking. The soil and other factors that affect it determine how quickly a land can contain moisture. The biggest holes (Macropores) are the first to be drained by a plant's roots as it expands. The excess moisture is only found in the medium- and tiny pores while the bigger pores soon start to store only air (Micropores) [3].

Plant roots are unable to remove the water from the tiniest holes because it so firmly adheres to the surfaces of the particles. As a result, not even all soil moisture is accessible to plants, with texture playing a significant role. When the soil is saturated, nutrients may be lost when the water drains. Under the impact of pressures in which the soil is locally wet and by capillary forces pull to drier sections of the soil, water travels in a draining field. The majority of a plant's water requirements are met by transpiration the evaporation of its leaves while a smaller portion is met by osmosis differential pressure between the plants' inner as well as soil solution. Although some sections of the plant root are also able to remoisten dry areas of the soil, plant roots must actively seek water and develop selectively in moister soil microsites. Crop output will suffer from a lack of water. The majority of the water is utilized for transpiration, which brings nutrients into the plant [4],[5]. Some drawbacks or barriers to using smart irrigation systems as shown in Figure 1.

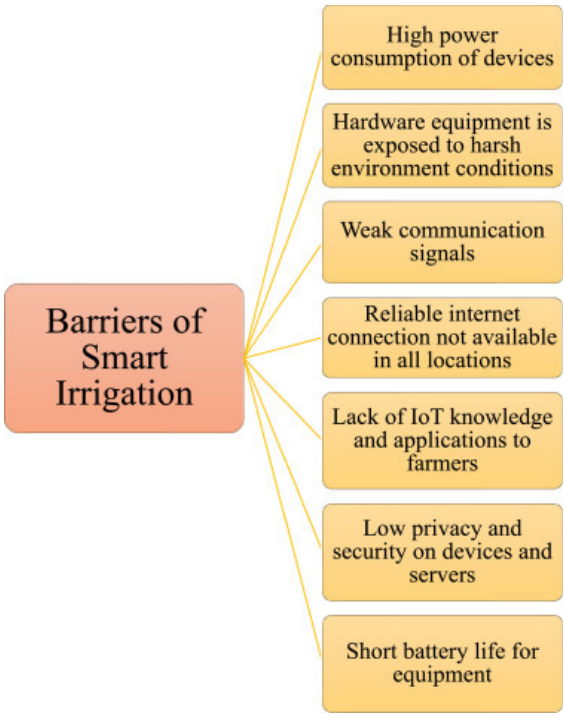

Figure 1: Illustrating the Barriers of the Smart Irrigation System.

The maximum moisture content of the soil is measured by soil moisture sensors. The moisture content of the soil liquid such as water indirectly means using some both these properties of soil, such as resistance value, dielectric constant, or connection with neutrons as a substitute for the moisture content, because the direct specific gravity quantification of unrestricted moisture in the soil extraction of the raw, rinsing, and weighing of such a sample. It is necessary to calibrate the correlation property and soil humidity since it can change based on the environment, including the soil type, temperature, and electric conductivity. The soil moisture has an impact on the reflected microwave radiation, which is employed for remote sensing in agriculture and hydrology. Farmers and gardeners can both employ portable probing tools. Sensors that assess the volumetric water content are commonly referred to as soil moisture sensors. Tensiometers, as well as gypsum blocks, are examples of other types of sensors that measure the water potential characteristic of soils, which is also known as soil moisture content [6]. Technologies commonly used to indirectly measure volumetric water content (soil Moisture) include:

- Galvanic cell: The energy the soil generates may be used to estimate the quantity of water present since water functions as an electrode and generates electricity. The galvanic cell is the underlying technology of this idea.
- Time-Domain Transmissions (TDT) and Time-Domain Reflectometries (TDR): The dielectric characteristics of a particular control volume around the sensor are calculated by monitoring the propagation velocity along a buried transmission line.
- Soil resistivity: The amount of moisture in the soil may be determined by observing how vigorously the soil opposes the passage of electrical between two electrodes.
- Neutron moisture gauges: The soil water between sources and the detection probe is determined using the water's neutron moderator characteristics.
- Frequency Domains Reflectometries (FDR): To ascertain the dielectric characteristics of a given volume element adjacent to the sensor, various operating frequencies of such an oscillatory circuit are monitored.

However, the improper use of agricultural components might harm the ecosystem. Lack of field competence and a lack of land reservoirs might be two of the main causes. The frequent removal of water from the soil has caused the water levels to drop, which has assisted in the growth of areas of unirrigated land. As a result, strengthening agricultural systems has become essential, and nations are now striving to put in place efficient frameworks where systems might be operated effectively. Artificial intelligence (AI) technologies and solutions are being used in contemporary agriculture and sustainable farming methods. The multifaceted area of sustainability has drawn a lot of attention from academics in recent years across a variety of disciplines. Due to its interdisciplinary character, sustainability includes a wide variety of themes, including climate, ecology, the green economy, food safety, sustainable agriculture, clean technology, etc. Thus, the application of AI in agriculture has received more recent attention.

A developing method that automates irrigation systems and reduces water use, the Smart irrigation system improves performance. This method helps farmers to satisfy their demands using a newly accepted strategy that conserves water for the irrigation process by adjusting irrigation depending on real soil and weather conditions. There are various methods to make irrigation automatic as different sensors and technologies are connected to the machines which help the user to operate the agriculture activity from a long distance. Water is a basic requirement for the crops for their growth and the generation of food or other products as the output. Thus, the study is necessary to develop a system for automatic irrigation for crops and plants whenever there is a depletion in the moisture level of the soil.

2. LITERATURE REVIEW

Monalisha Pramanik et al. developed automation of a basin irrigation system based on soil moisture sensors. According to the authors, one of the biggest uses of fresh water for agricultural purposes is irrigation. In establishing and testing the IoT-based system through a wireless network between the fully automated check gate and moisture sensor that can also influence individuals based on factual soil moisture status, a study was performed in a confined threshold watershed layout in a loamy soil. Nine irrigation events with bare soil were used to test the system. Under soil moisture deficiency situations, three distinct operating plans based on various soil moisture sensor placements had been examined. They concluded that the automation increased irrigation application efficiency overall by up to 86.6 percent.

Zahra Amiri et al. the purpose of that study was to ascertain how the location of oil Water Content (SWC) observation in drip irrigation may be influenced by the distributions of SWC in a loam soil surface during two periods of maize development. Due to an increase in root growth surrounding the drippers at the time of harvest that increased the diversity of root moisture absorption in various soil levels, the best position for soil sensors was thus limited to the upper layers, where the highest root water uptake occurred. Generally, it is recommended to set ground sensors, such as tensiometers as well as TDRs, at the depth of 10 to 20 cm either from the soil surface or at a distance of 5 to 20 cm horizontally as from crop, with drip tape being placed close to the cornrow [7].

Dr.S.Gnanavel et al. developed an automated irrigation system powered by the IoT utilizing an Arduino UNO and a soil moisture sensor. The most suited crops for the specific soil will be identified by this investigation. The land is adequately watered when irrigation is required. The system sensor recognizes it and automatically switches off the pump motor when the level of water in the fields reaches a certain level or the level of water in a well approaches the minimum level. As a result, there is less physical effort required, and the land receives efficient irrigation. Additionally, the pump motor's operational life is lengthened.

Xianzhong Ding and Wan Du discussed Deep Reinforcement Learning for Irrigation Control (DRLIC). The DRL control agent occasionally outputs dangerous actions. The authors implement a safe approach that uses a soil moisture forecast to measure each action's performance to avoid any potential harm to the health of the plants. Finally, they create a wireless network, sensor and control nodes, sprinklers, and true irrigation facilities where they install DRLIC in a testbed made up of six almond orchards. Studies discover that DRLIC may save up to 9.52 percent more water than a common irrigation system during a 15-day in-field testing.

Usman Iqbal et al. utilize locally developed soil moisture sensors to precisely irrigate wheat crops using a variety of irrigation techniques. The use of sensors for real-time soil moisture monitoring has the potential to reduce the need for irrigation and increase water efficiency. Under various planting geometries and irrigation designs, field irrigation techniques comprised, perforated pipe irrigation, drip irrigation, and flood irrigation. Depending on the state of the soil's moisture, irrigation was provided. Wheat crop irrigation using microcontroller-based technology has been tested. For calibrating and water management, Raspberry Pi-3 (Model B) operated equipment in the distribution board (DB) made good use of indigenous soil moisture sensors. It concluded that the wheat grain yield under pierced pipe irrigation treatments was considerably higher (p 0.5) compared to wheat grain yield under flood irrigation treatments.

Khongdet Phasinam et al. study examined an intelligent irrigation system that uses machine learning to process data in the cloud utilizing a range of IoT and cloud-based architectures. To increase the amount of water utilized in agricultural irrigation, technology such as intelligent irrigation schemes must be implemented. Such a system has the potential to be quite accurate, but it requires data about just the soil and climate of the region in which it will be utilized. The system is built to assess soil moisture and humidity. Farmers receive accurate information on water content regulation.

K.Y. Raneesh et al. have investigated autonomous micro-irrigation using sensors for soil moisture. Through drippers, sprinklers, foggers, and other emitters, the liquid is watered on the surface and subsurface of the field using this technique. Tubes and drippers that feed water directly toward the base of each particular crop can be used for micro-irrigation. The main factor affecting how much water and other substances' energy is exchanged between the ground surface and the atmosphere is soil moisture. The water content of the soil is measured by a soil moisture sensor. They concluded automatic irrigation is a system that uses soil moisture sensors to carry out all activities linked to the provision of irrigation or fertilizer to the crop automatically with minimal operator involvement.

Marjan Aziz et al. discussed Scientific Irrigation Scheduling (SIS), to measure soil moisture precisely, that study employed three different types of soil water sensors, comprising tensiometer sensor systems, irrometer detectors, and gypsum slabs. The findings demonstrated that in comparison to existing soil moisture detectors and farmer practices, the irrometer sensor functioned as anticipated and helped to save irrigation water by between 17 and 25 percent in 2018 as well as 2019, respectively. The study's findings point to an efficient technique for maintaining olive grove output while increasing yield effectiveness.

There are different studies made by different experts on the application of technology in agriculture. The manual to motorize to automatic there is advancement in the application of irrigation systems. The use of Wi-Fi, IoT, Arduino and AI for irrigation is now used and utilized all over the world as these technologies help the farmer to reduce the time and work stress during the irrigation system. Thus, the study is to suggest and developed a design that will automatically alert the user of the irrigations in different regions of land by detecting the moisture level in the soil to increase the productivity of the farm.

3. DISCUSSION

The monitoring of several parameters in real-time by IoT systems in general leads to the development of enormous amounts of data, and IoT irrigation systems are no exception. Given the existence of big data, it has become crucial and urgent to create systems that can effectively evaluate and handle the data.

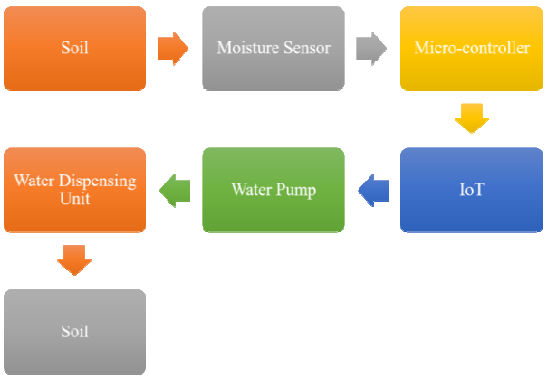

Figure 2: Illustrates the Simple Block Diagram for Irrigation Using Moisture Sensors.

Given that handling large data may be challenging overall and may overuse natural resources, it has been argued that a greater emphasis on sustainable management of big data is urgently required. The soil moisture sensor application is very useful for the farmer in agriculture for the irrigation system. There are various types of moisture sensors used in various applications. Figure 2 shows the simple working of a system for detecting moisture in the soil to regulate the irrigation system. The moisture sensors, pump, controller or processor, IoT, display module, water pump, and water dispensing unit are the components of the system. The simple block diagram of the system is shown in Figure 2 below to understand the process of irrigation.

Irrigation is one of the important tasks in agriculture, as for growing crops water is necessary. Table 1 shows the main components of an irrigation system using moisture sensors. The water pump and motor are used to lift the water to dispensing unit. The dispensing units are placed within a particular distance adjacent to each other to provide an adequate amount of water to the soil. The microcontroller is used for controlling the irrigation of the soil as it is connected to the irrigation system and controller through IoT.

Table 1: Illustrates the Main Components of the Irrigation System Using Moisture Sensors.

Sr. No.	Instruments	Quantities
1	Water Pump	1
2	Micro-Controller	1
3	Moisture Sensor	1
4	Water Dispensing Unit	1

For agricultural applications, measuring soil moisture is crucial for better irrigation system management by farmers. By better managing soil moisture throughout crucial plant growth phases, farmers are not only able to produce crops with less water overall thanks to their knowledge of the precise soil moisture levels on their fields, and they're also able to maximize crop yields and quality. Soil moisture sensors are used in residential lawns and landscaping throughout cities and suburban settings to communicate with a watering controller. A conventional irrigation clock may be upgraded to a “smart” irrigation controller by adding a soil moisture sensor. This controller will stop watering operations whenever the land is already moist, such as after a recent rainstorm event.

The soil moisture sensor is often used in research applications, such as irrigation planning in agriculture and horticulture, climatology, or environmental science, as well as supplementary sensors for ground respiration measurement techniques. Golf courses use a moisture sensor to increase the effectiveness of their agricultural security to avoid over-watering and the leaching of fertilizers and other chemical products into the ground. Some instruments may be used to check if plants have enough moisture to survive that are very inexpensive, straightforward, and does not need a power source. A meter determines whether the ground is too dry, damp, or moist for the plant after placing a probe into it for around 60 seconds. Thus the irrigation system is necessary for agriculture as the plants are dependent on the water for growing and increasing their productivity, which is studied by different experts in their study.

3.1. IoT System Advantages for Irrigation:

There are several advantages to using IoT systems for irrigation, some of which include reduced total water usage, high cost and performance efficiency, lower energy consumption, reduced crop loss, as well as more. Water, time, and money are all saved with smart irrigation systems. According to studies, cloud-based Smart Irrigation systems may reduce the amount of water used for landscape irrigation by up to fifty percent. Because of the consequent water savings, smart systems often pay for themselves within two years. Lower water use is one of the key advantages of IoT systems for irrigation. Additionally, with such a method, the majority of irrigation-related tasks are automated, just the necessary water is used for irrigation, and waste is reduced. A significant quantity of water was lost in the irrigation process when human participation was necessary for the previous methods of irrigation when the majority of handling and operations were performed manually. With smart irrigation, there is little to no human interaction, and water is only utilized where and when it is needed. One of its other advantages is high cost-efficiency since less water is used and more accuracy in the process results in lower costs and total expenditures. The strategy also considerably reduces energy use since machines work for shorter periods and controlled breaks are made throughout the process, which results in lower total energy usage (Figure 3).

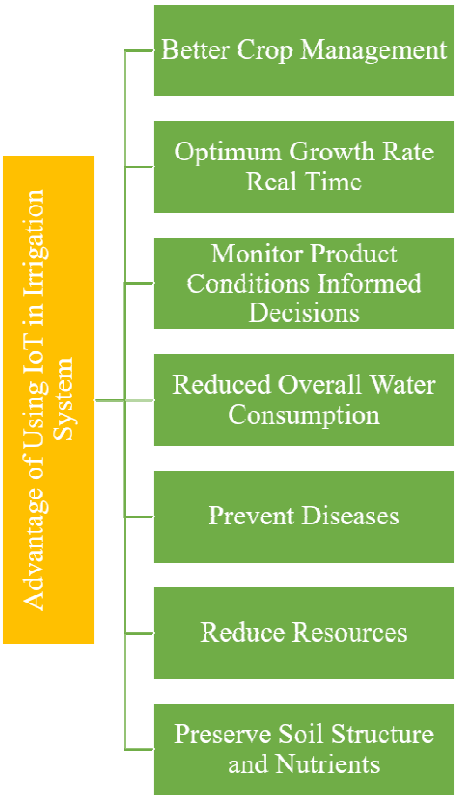

Figure 3: Illustrating the Various Advantages of Using IoT in irrigation Systems.

4. CONCLUSION

There are various irrigation methods using the technology, but using a moisture sensor in agriculture is very useful in agriculture as the water level of the soil is maintained using the moisture sensor. The growth of crops depends on the water supplied to the crops, so soil moisture is important as the plant absorbs the moisture from the soil. Various studies are developed for studying the applications of sensors with technology. The moisture sensor application helps in maintaining the moisture level to increase the productivity of agriculture. Thus, the use of IoT with the controller helps the farmer to detect the condition of the soil for

maintaining the water flow to the crops. Thus, it can be said that using technology like AI, IoT, and Arduino is useful for the farmer to increase production. The technologies are now used in different fields and future they will help the farmer in guiding cultivation and harvesting to improve productivity and profits.

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CHAPTER 5

A COMPREHENSIVE STUDY ON THE IMPLEMENTATION OF INTERNET OF THINGS (IOT) IN EDUCATION SECTOR

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ABSTRACT: Internet of Things (IoT) is considered as the fastest growing technology in the present era, most of the modern technologies depend on the IoT. The term IoT is deliberated by numerous specialists as it signifies the succeeding phase in the digital world. In this paper author described all the parameter of the IoT, and all the application of IoT in education sectors. Current study is conducted to analyses the current knowledge of IoT in Education sector. In this review study authors mention many papers which is review and research both. but all the paper having same term with different approach that means, using the term of IoT with different algorithm and system in education sectors. Under this review author cover around all the important application of IoT in educational sectors. And also discussed all the application with their examples.

KEYWORDS: Education Sector, Education, IoT, Technology.

1. INTRODUCTION

The word IoT is stand for 'Internet of Things', was used in the firstly by the Kevin Ashton in 1999. IoT is deliberated by numerous specialists as it signifies the succeeding step to the digital the world. IoT gives advantages for the employability and develop the attractiveness of educational and commercial formations [1]. digital uprising, presents the trend of IoT and automation. interchange by dissimilar dealers mention to Industry 4.0 which are established on Internet of Things. Currently, numerous capitals from place to place in the world jump a conversion process to be smart cities Moreover. several educational establishing in the world jump to practice Internet of Things [2]. Then, such revolutions need to demonstrate IoT technology to the engineers. A number of advanced education creations start to offer IoT related optional subject to 'Engineering' under Graduate scholars and 'Computer Science' [3].

The education sector is changing due to the Internet of Things (IoT). The problematic state known as the IoT denotes the linkage of the physical objects in the near future. The utilization of IOT and its applications in numerous sectors have been analyzed and summarized in a wide range of evaluation studies. The internet of things makes it possible to link people and things at anytime, anywhere, and preferably through any method or service [4]. The entire world of education has transformed as a result of technology. Education has changed the way we live, from the innovative learning methods of open institutions to the use of tablets in the classroom. These advancements, though, pale in comparison to the massive transformation that the IoT is bringing about in the field of education [5]. The IoT is a techniques which connect or link the people device and data and the process the value and the quantity of the information then author can collect, allowing the stockholders in the educational sectors to change information in to valuable information.

In this paper author described all the parameter of the Internet of things, and all the application of internet of things on education sectors this paper gives the complete review on

the basis of application of internet of things, so the author covers as much as possible all the points in their review paper like they cover the point like smart education system, smart teaching, smart classroom and the also cover smart classroom all the topics possible by the concept of the internet of things. Under this paper the authors collect the data from the various paper and sites and also explain the future scope for the further research on this topic because it is not a complete use of the internet of things[6]. Simply we understand by this any things which is connect through a wireless network and by which we communicate or exchange the data from one to another or give command to any things called as the internet of things (Figure 1).

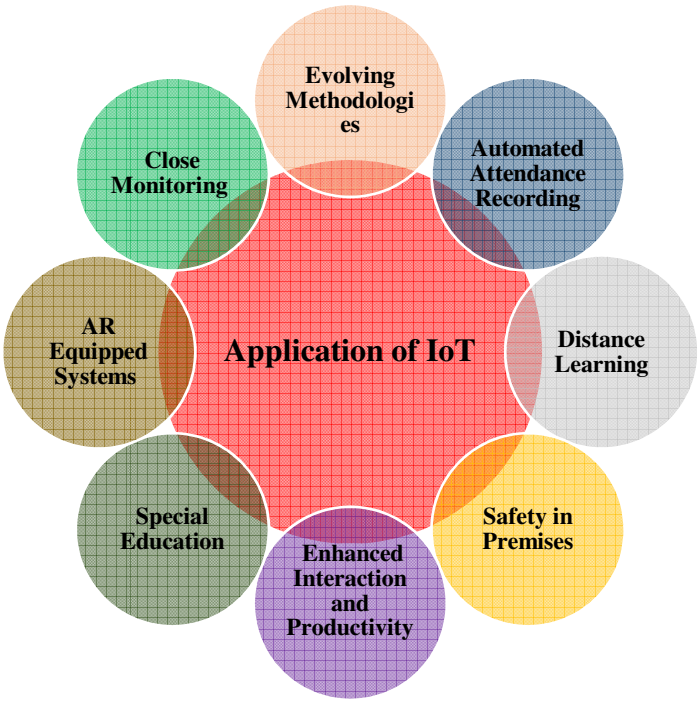

Figure 1. Application of Internet of Things in Education Field

Under the term of internet of things it is commonly used techniques in every sector or every fields like every wireless network is defined under the internet of things, there are so many application for many sectors like smart home, it is the term in which all the appliances controlled in the wireless mode called smart home, smart hospital, smart shopping mall and so on[7]. These all the application of internet of things in all sectors, it is the most important term in present era for advancement of any things.

2. LITERATURE REVIEW

Shrinath et al. in this paper authors discussed about the IOT and its applications in the sector of education and as well as others, the Internet of Things that allow the public and things to connect with each other any times with the help of wireless network. In this paper authors give brief overview on the term of internet of things and also discuss the possible solution for use in education sectors. Their paper having three main parts which is classified as the overview of internet of things applications, internet of things in education sectors and last is value added service in education through internet of things.

Mostafa Al-Emran et al. in this paper authors discuss about the challenging stage that describes the relationship of physical object in future under the internet of things. Also they discussed about the application of Internet of Things in various domain and deep study about every domain. Nonetheless research which is neglects and provides a full review study about

the application of IoT in education sectors. The aim of their review paper to provides various opportunities and tasks for future trial for IoT application in education sectors. In their review paper they describes about the adaptation of Internet of Things in educational sector, medical education and their training, green IoT in education, vocational education and their training, Finally they discussed about the adaptation of the internet of things in various sectors [8].

Suja P Mathews and Dr. Raju R Gondar, in this paper the authors discuss about the Internet of things in the educational fields. While the institutes give significantly to technology. And take its benefits to the technical challenges and also cost implication. They discuss about the internet of things like it's based on the cloud system having extreme potentials to enable educational institute to take benefits of the making advance in cost effective cloud technology.in this paper they discuss various technology which is used in to collect the data or information, managing the informations on the cloud systems or maintaining over all institutional data and information of students and teachers and also used for the maintaining the campus infrastructures. In this paper the authors also discuss about the feature of the internet of things in the educational sectors like e learning, campus indoor and outdoor navigation system, student tracking and safety and also the student data management [9].

Asim Majeed and Mahmood Ali in this paper the authors discussed about by the use of internet of things how they make a system which helps in the educational sector for smart parking system, smart classroom system and delivering smart education to students. By their study they research on the internet of things for making a system to creating a smart institutions with the help of some sensors and the some modern technology. The output of the system is like the interaction between the objects and the peoples. In this paper the authors also work for the educational sector with internet of things technology to improve technically or working for making smart institution [3].

Jan Francisti et al. in this paper authors discuss about the internet of things, the internet of things is becoming a regular part of the life. It is uses in many sector like education, medical, airport etc. in this paper the described the previous existence devices like smart band and eye tracking technology. With the using existing technical methods and solution they make a device which track the attention of the student while they learning by the recording their heart beat rate and the tracking eye of students. This device useful for the betterment of the students focusing on study [10].

Shahla Gul et al. the authors discussed in their paper about the extremely growing the trend of Internet of Things by which people connect anything with the internet. Under the academics the use of internet of things like to create a good opportunities and possibility of improvement in the education sectors.in this paper the authors tries to present some previous research work and task and also represent the impact of internet of things in the future institution for educations [1].

Deyong Chen, in this paper the author discussed about the use of Internet of things in multiple education sectors like for mathematics, technology, science and so on. Author thanks to advancement of the internet of things. By this technology students learn with modern system all the subjects using their smartphones. Authors mainly focused on the online education platform for the English training. Author discussed so much algorithm in their paper for the online learning platform.

Hicham EL Mrabet and Abdelaziz Ait Moussa, the authors discussed in their paper about the rapid evolution of the technology like wireless communication and the information technology which built a new standard of the internet which is called IoT. In which the author discussed about the application and feature of the internet of things technology like

connecting the people with the objects and exchange the data with it by the help of IoT. Author research for smart classroom with the help of IoT and advance learning for basic and secondary schools.

3. DISCUSSION

According to the above study which is completely depend on the IoT by which the smart class and smart study possible. This review for the area of education using internet of things for betterment of education. There is so many application of the IoT in education sectors and the above review study authors discussed about the researches and algorithm for the betterment of the education sectors. Let's discuss about the application of IoT in education fields with the help of Table 1.

Table 1. Illustrate the table of Application of Internet of Things

S No.	Application Of Internet Of Things In Education Sectors.
1	AR Equipped Systems
2	Special Education
3	Safety in Premises
4	Enhanced Interaction and Productivity
5	Close Monitoring
6	Distance Learning
7	Automated Attendance Recording
8	Evolving Methodologies

3.1 AR Equipped Systems

AR stand for the Augmented Reality, it is an also called as enhanced version of real world which is presented in most easy way with the help of computers tools. By the use of augmented reality, the device or the technology enhanced of made more efficient which is depend upon the internet of things, also evolved new techniques like to check the exam sheets of student with the barcode scanning and also analyze and evaluate exact one.

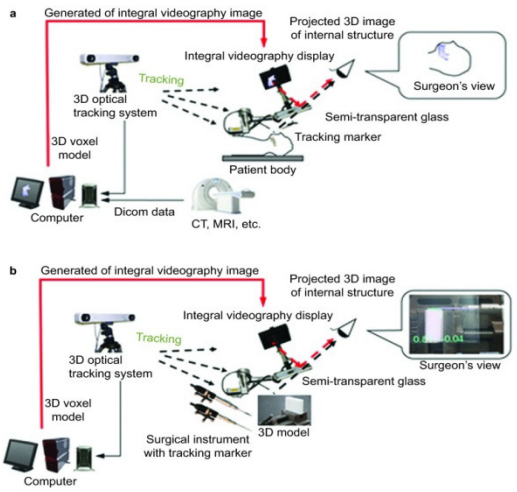

Figure 2. Augmented Reality System Working with the Internet of Things Model

Augmented reality with its sound and the graphics linked with a software system which gives improved details and the three-dimension vision of the subject's actuality trained for example. The anatomy of human nose student understands in better way as than the old strategies like theory and explanation of the subject in the loud way in the classroom. Such training resources can be bit by bit and progressively be informed in school organizations and portal by administration authorities permitting the students to catch and see animated representations of the matters where they believe right (Figure 2).

3.2.Special Education:

After sometime there was almost very complicated and relatively very tough for disable student to get education in any field and also facing difficulties to net explore or normal education. For helping to the disable student, they use internet of things and by it to makes a smart tools for the disabled student by the help of these tools disable students take explore and normal both education easily (Figure 3). And also, for the helping purpose of disabled student making a classroom with fulfillment of all their needs which is necessary for the education and the classroom environment are according to there needs. For example – they can take help from the system which made by the use of sensors and the IoT, which is glove and the tablet and it produce verbal speech translated from sign language which the lecturers can use during teaching the concepts which is mentioned in the books.

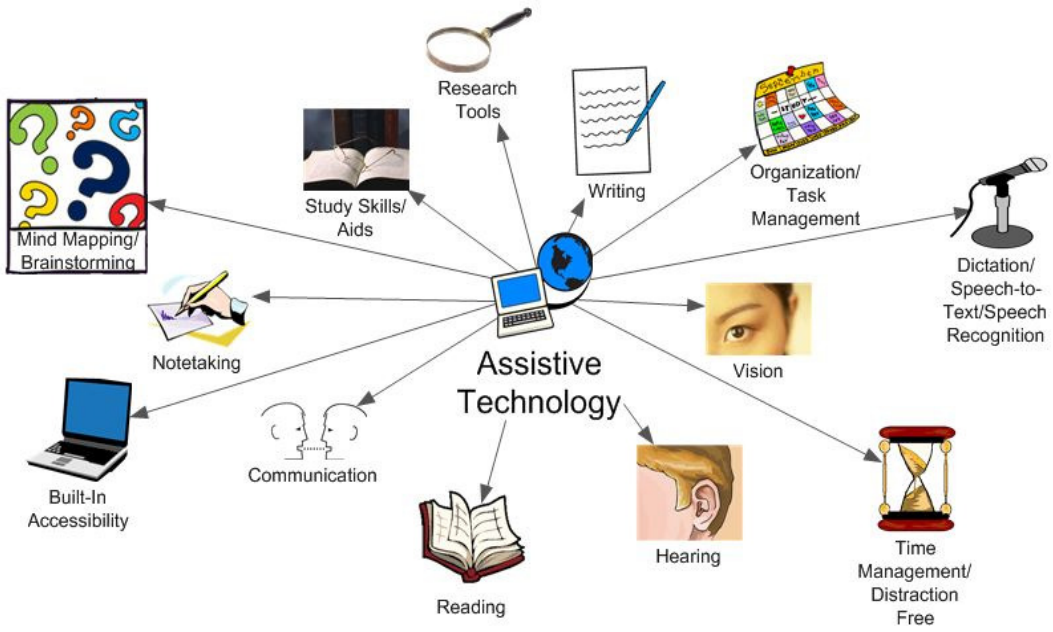

Figure 3. Working Figure of Assistive System for Disable People [Source: Google].

3.3. Safety in Premises

In most of the schools and the organization facing absence the infrastructure to detect the red flags for the theft, sexual harassment, abuse, and the others crime which is occurs in the organizations and they have not proper plan for these emergencies' situations. Internet of things can help to overcome these issues at large level. In the case of slightly terrible action that becomes supervised on the camera. It must be directly taken carefulness of by the network system that switch on the camera recordings which displayed in various monitor screen in the any organization. Also internet of things used in the fire alarm system that means in any case any short circuit or fire occurs then the system generated an alarm at exact position of the problem, so there is low disturbance and risk in resolving the problem.

3.4.Enhanced Interaction and Productivity.

Smartphone based virtual application-based classes make the student more communicating. When they are learning with the Smartphone based virtual application-based classes then they are more able to understand. And they have also capability to think beyond the syllabus and classes and interact easily for clear their doubts.

3.5.Close Monitoring

No issue from where the person use websites portal is from the inside the school or outside the college or school at any specific subject, because it also has an option to monitor the student time utilization on the sites or performing which kind of activities and how much time spent by the scholar on particular topics. On the basis of education by the IoT the sensors which used in the system collecting the data of the student and also shown its topics related posts and articles automatically. And by this system u can easily determine the progress report of the student and cross check the data by one click. And also monitor student's area of interest. By the modern systems we can also prevent the misuse and also prevent unnecessary activity which performed by the students.

The modern device are assembled or designed with the security option and guardian control option by which the guardians control the systems and check the system by which also the chance of unnecessary use or misuse of the system is completely prevented.

3.6.Distance Learning

The system Centered on the IoT having the special software. Having the ability to storing the data in an application form, and it gives a sign in and sign out facilities for these facilities we need a special log in and the password which is provided from the institution by which the student who is not present in the classroom then access the class from anywhere. This system helps all those learners who is not able to part of any educational institute or not capable to be a part of the big educational institute then this system provide feature of online learning, prerecorded classes etc.

3.7.Automated Attendance Recording

The professors are concerned about student attendance, and in the institutions, it is a daily task that cannot be substituted. IoT can assist in providing an explanation for this significant task of recording a scholar's appearance and computing it for a variety of objectives. Nearly any lecture's homework assignment can be sunk with the aid of IoT. As students enter the classroom, their attendance can be automatically recorded using biometrics or a barcode system based on their identity card number. There is almost no probability of differences or storage in this method.

3.8.Evolving Methodologies

When we discuss the Internet of Things (IoT) in education, we mostly refer to the combination of internet and digital based intelligent systems for lecturers and students in educational institutions. The modern educational system is accustomed to tools like e-books. which can be downloaded and are presented with expanding and saving geographies, smart panels in place of chalkboards, which can be used as a blackboard to write by a chalk and also can show students subject-related pictures and visuals. Such gadgets are connected to a centralised computer, which may manage and watch over the categorization of students according to curriculum and topic. Not only this, but smart security cameras, GPS-enabled

schools, speech-to-text note-taking systems for students, and speech command systems for instructors.

4. CONCLUSION

The term of IoT stand for IoT was use firstly by the 'Kevin Ashton' in 1999. The word IoT is deliberated by numerous specialists as it signifies the succeeding step to the digital the world. IoT advantages the employability and nurture the attractiveness of educational and commercial formations. Under this paper the author research on the some other paper which is related with IoT in education sectors. In this review paper author want to explore the application of the IoT. So they described all the applications of the IoT in education sectors. In this paper author shows how education easy for the disabled person, how distance learning is possible all about the distance learning and also describe about the internet of things. They also discussed about the automatic attendance record system. The internet of things is important at present scenario and it is also applied in our present time like a smart phones smart home appliances and others, it is also help to new enhancement in the modern system. Also, it provides opportunities for further research on any sectors.

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CHAPTER 6

RECENT TRENDS AND FUTURE CHALLENGES OF IOT DEPLOYMENT IN THE AGRICULTURAL SECTOR FOR FARM MANAGEMENT

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ABSTRACT: ***Owing to the increasing need for foodstuffs, both in consideration of amount as well as variety, it has become more necessary to modernize as well as strengthen the farming industry. A set of cutting-edge technology known as the IoT (Internet-of-Things) provides considerable potential for transforming the farming industry. Technological agencies, academic institutions, as well as companies are contending for market share to offer agrarian industry partners an expanding range of IoT products, laying the foundation for just a clear function whenever IoT reaches a widespread innovation. Cloud technology that is currently extremely widespread, alongside edge computing could be used to support, save, as well as evaluate the massive amounts of the datasets created through IoT gadgets. Big Dataset, also known as IoT dataset handling as well as assessment, could be utilized to simplify processes, predict consequences, as well as improve several activities in real-time. This concept of gadget compatibility among diverse platforms has prompted this same creation of the required utilities, that can be utilized to create novel systems as well as programs that enhance the utility of dataset streams produced at the channel's edges. Wireless Sensor Networks (WSNs) innovation had a huge influence on the agriculture sector, and this is predicted also that the Internet of Things would have a similar beneficial effect. This paper gives a preliminary explanation of contemporary IoT innovations, including existing applications in farming, how valuable they may be for prospective producers, as well as the challenges facing IoT mass acceptance.***

KEYWORDS: ***Agriculture, Data, Foodstuff, IoT Technology, Security.***

1. INTRODUCTION

Nutrition safety is now a top issue in all countries throughout the globe due to the expansion of something like the planetary populace, the depletion of ecological assets, the increasing loss of cropland, and especially the rise of unexpected climatic circumstances. Due to such issues, the farming sector is moving toward "intelligent agribusiness," which aims to increase logistical effectiveness as well as production via the use of big datasets as well as IoT technologies. Several current cutting-edge products including innovations, including WSNs, cognitive radios, as well as ad-hoc networking, cloud technology, and big dataset, including end-consumer programs, are integrated into the IoT. Innovative methods including technological advancements are continually being put forward as well as put into practice to suit the demands of mankind today [1]. Due to that, this same IoT has emerged. This same IoT is indeed an infrastructure of all things which are integrated into gadgets, detectors, computers, business applications, as well as individuals via this same Internet ecosystem to converse, interchange data, as well as engage to offer a thorough alternative among the genuine globe as well as the computerized globe. IoT technology has been deployed within a variety of fields recently, including intelligent farming, automated cars, intelligent housing, intelligent buildings, intelligent power, school administration, medical, as well as a transportation [2], [3].

Information Collection, as well as analysis, are significant issues that provide substantial hurdles inside the field of intelligent agribusiness, in addition to the primary issues of detecting, and gathering information, including operating equipment to react to the actual agricultural world. Because of the sheer volume of information being gathered, conventional methods of information collection, organization, and analysis become impractical. Consequently, it is necessary to study as well as implement big data analytics technologies for sustainable farming. Owing to some distinct features of the area of intelligent agribusiness, also including unorganized content as well as multiple forms, including such writing, photos, sound, as well as videos, financial records, but also marketplace data, records collection and analysis are challenging. The usage of cloud infrastructure for information analyses as well as preservation that are gathered from farmland has recently been launched by applications as well as innovations. To lower delay, and expenses, as well as enhance Quality, cloud-based big data analytical approaches like edge technology as well as cloud technology are indeed suggested [4]–[6].Figure 1 illustrates the potential of the IoT in the context of the agriculture sector.

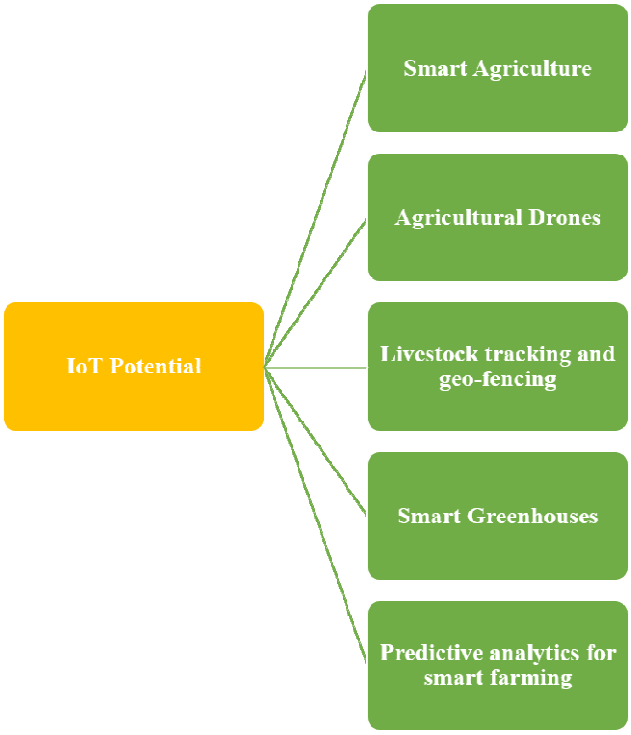

Figure 1: Illustrates the potential of the IoT in the context of the agriculture sector.

Since it nourishes the entire community, farming is vital to the country's budget. In this way, this connects as well as communicates with other pertinent businesses throughout the nation. Whenever a nation has a significant agrarian basis, it is regarded as culturally as well as financially wealthy. Almost the majority of nations depend heavily on agriculture for jobs. To help with cultivation as well as livestock care, large farms often need to hire extra personnel. Almost the majority of such large ranches have close-by manufacturing facilities wherein their produce is cultivated as well as refined. Substantial advancements have indeed been achieved to increase farming production during culture while using lesser commodities as well as labourers [7], [8]. This phrase intelligent cultivation relates to this well-recognized and superior method of agricultural administration which has gained popularity in contemporary agribusiness. Farming, as well as data techniques, are used to manage harvest quality as well as productivity, which includes keeping an eye on field's plant status including related variables. In the essence, one goal of intelligent cultivation would be to

keep the final item's value whilst lowering the price of agro supplies. Traditionally, fertilizers, as well as pesticides, have indeed been administered using large quantities at a set rate, treating the entire area as just a specific treatment area. Notwithstanding such, the great populace density hasn't ever allowed for a balance between supplies as well as needs throughout historical times. Around 2055, the world's populace is projected to increase by almost 30%, reaching 9.80 billion people [9].

Almost the majority of this projected populace increase will come from emerging nations. However, urbanization is anticipated to accelerate, having 75.0 percent of the planet's inhabitants living in cities around 2045. Additionally, wage standards would have been far greater than there are today, which would increase the consumption of foodstuffs, especially in emerging nations. Such nations would therefore be increasingly aware of their respective diets including agricultural safety. Because of this, customer tastes could change from grains as well as starches to beans until ultimate protein. To sustain this bigger, greater urban, as well as the richer populace, foodstuff output needs triple by about 2040. For instance, this same existing 2.10 billion tonnes per year of grains output needs to be increased to about 3.0 billion tonnes, and the monthly output of beef must be increased considerably greater than 100 million tonnes to satisfy the 490 million tonnes of consumption [10]. As crop sowing is now minimal, some producers choose to use traditional techniques. To enhance arable field output, farmers, municipalities, agribusiness experts, and even academics are all looking into novel approaches. They are impacted by ecological factors including global warming, rainfall, and especially vegetation. The richness of environmental ground has a major role in crop yield. As just a consequence, it's crucial to categorize lower-nutrient crops as well as increase their accessibility to excellent commodities. Because the majority of agricultural yield is influenced by land nutrients, it's indeed difficult to grow high-quality harvests. To accomplish this goal, it is also necessary to identify as well as improve nutritional substance that is lacking [11].Figure 2 illustrates IoT applications for smart farming.

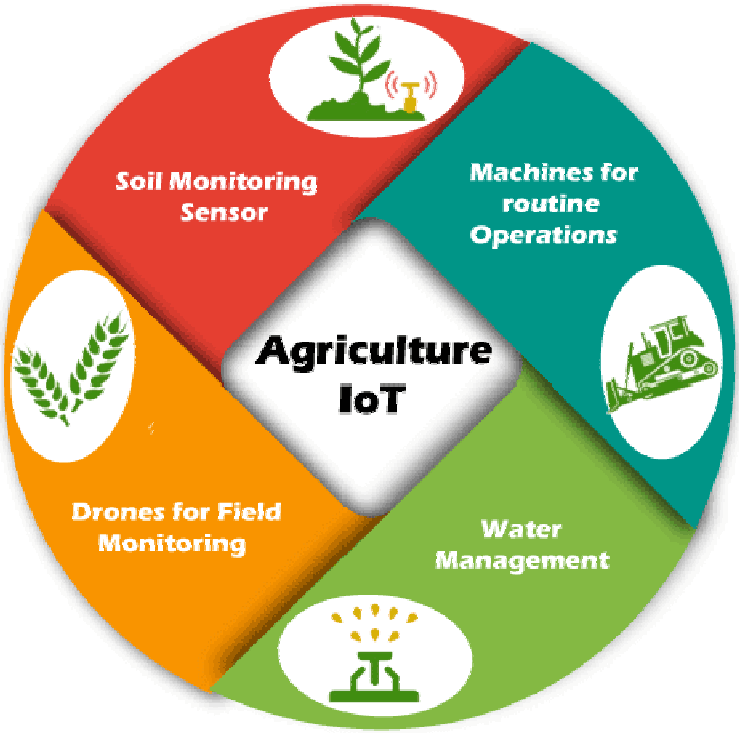

Figure 2: Illustrates IoT applications for smart farming [Source: Javatpoint].

It is difficult to identify illnesses among plant stems. Herbicides that are linked to the illness could be utilized to inhibit it unless this is discovered early. The lack of essential fertilizers frequently harms plants. Therefore, it's indeed crucial to apply fertilizers of something like the right kind. It's indeed difficult for producers to collect knowledge about particular farmland's topsoil minerals, stream nitrogen, soil moisture, weather factors, especially annual agricultural facts. Moreover, despite getting access to information, people are unable to make smarter judgments. Modern as well as technical ideas, but also contemporary technology, are widely used in numerous sophisticated fields including agriculture-related sectors. Most growers are ignorant because minimal meaningful knowledge regarding their topsoil can be gleaned through environmental study. These results of topsoil tests help producers determine the best product but also how much fertilizer to administer depending on the needs of the ground [12], [13]. Among the most important problems inside the agriculture industry periodically involves the use of inadequate fertilizer. Topsoil investigation is essential to adjust for this. Additionally, knowing the fertilizer's type, distribution schedule, as well as dosage seems to be essential for the healthy growth of crops. While choosing plants, producers also shouldn't consider ecological factors. The diagnosis of illnesses in foliage becomes similarly challenging [14]. Figure 3 illustrates the structure of IoT (Internet of Things) which includes the perception layer, application layer, and network layer.

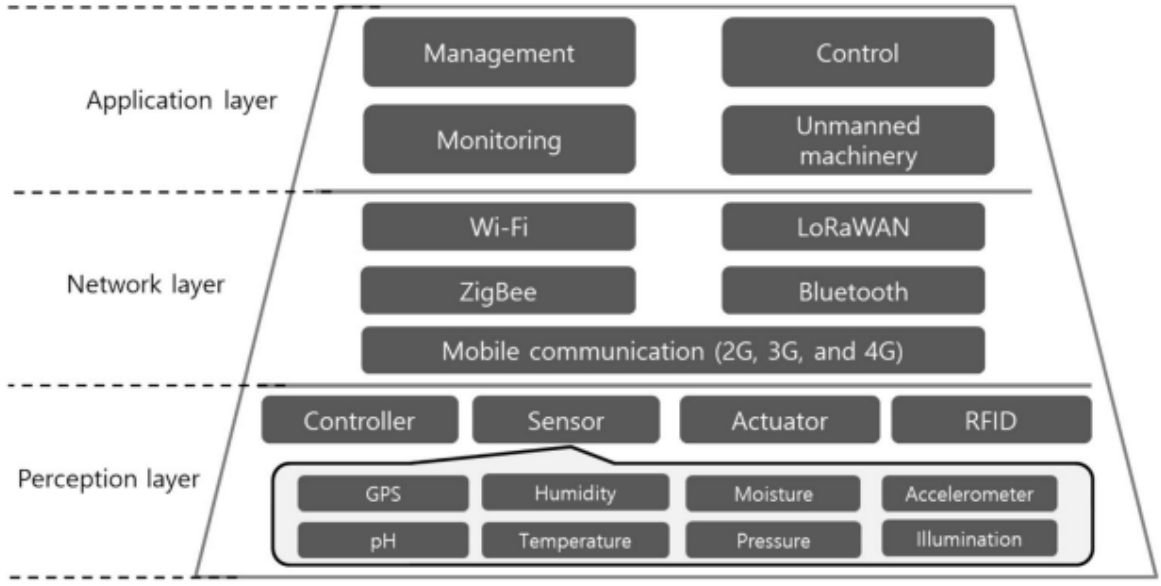

Figure 3: Illustrates the structure of IoT (Internet of Things) which includes the perception layer, application layer, and network layer [15]**.**

2. DISCUSSION

Any connection of machines facilitating M2M (machines-to-machines) communication relying on wired as well as wireless connectivity is known as the IoT. This well-recognized IoT technology in farming is indeed a cutting-edge innovation that may be used all season round to increase farming productivity. One goal of this work would be to compile examples of IoT applications for farming mechanization inside the farming industry as well as to examine the opportunities but also constraints for furthering IoT implementation. IoT has been anticipated to improve output in farming in a variety of ways. A precise paradigm of agrarian output is set to give way to a mini-precision paradigm in croplands as well as conservatories. This same ideal growth or dwelling environment for both veggies as well as livestock would be provided via networked, ubiquitous computation combined with accurate facility surveillance. In addition to controlling the transducers in the greatest effective manner

imaginable, maximizing utilities and resource utilization, automated devices would be capable to manage the operation in line with marketplace conditions, increasing revenue while reducing expenses in every manner imaginable. But on the opposite side, foodstuff supply networks that are outfitted using WSN, as well as RFID (Radio-Frequency-Identification) technology, would be capable to keep track of every step of a company's lifetime, generating automated decisions in the event of a defective item, and therefore boost customer confidence in security [16], [17].

Every one of the aforementioned represents an upbeat perspective on Interconnection in agribusiness. But there are going to be a lot of unique actors throughout this idea. Regional connections must be protected from external networking disruption initially, particularly as such innovations develop to their fullest capacity. Inside a true Internet of Things environment, approximately the majority of the participants would employ various devices having various technical specifications as well as sensory properties. There must be a certain degree of connectivity, and screening, including meaningful tagging of the information flowing out of every provider. Only one method that information from very diverse origins may be utilized to improve a pooled choice assistance or expertise systems is also another use this manner. With such a solution to be implemented, safety, confidentiality, as well as management over the access privileges to the data are essential. To protect the marketplace versus unconventional strategies, much of the information used in business tactical preparation could be revealed to or accessed through unauthorized parties [18].Figure 4 illustrates the smart IoT-based smart sprinklers for farming irrigation.

Figure 4: Illustrates the smart IoT-based smart sprinklers for farming irrigation [Digiteum].

The IoT is quickly developing, giving rise to several cutting-edge services as well as solutions. The connectivity of diverse dissimilar technologies, and IoT safety guarantee at different stages, including analysis that would provide a deeper understanding of Big Dataset to optimize different corporate operations, are all the subjects of extensive study. This same supply from customers for information about the fabrication process as well as the ecological impact of the goods individuals purchase, but also nationwide policies of authorities across the globe that aim to boost manufacturing rates of fresh-cut veggies as well as mutton at

lesser costs with greater top-notch norms, open up a vast market for IoT advancement as well as adoption. As per the previous authors' survey, forecasts of the prospective advantages of the IoT from 2014 to 2021 range widely, from a minimal level of $10 trillion to an even higher of $18 trillion, without accounting for enhanced total revenue, advantages from price savings amongst businesses as well as industries, or the overall boost in financial action brought on by IoT. This same adaptability, optimization, as well as accuracy which IoT provides in the manufacturing operations of the business including workload of any sort, account for a significant portion of its additional worth.

Thus, predicting all stages of agriculture industry activities would undergo significant transformation in the relatively foreseeable ahead is indeed not particularly dangerous. IoT has enormous financial potential, which has attracted many extremely major businesses to engage inside it. Instances include Cisco's latest $1.40 billion buying of Jasper Innovations, a development corporation of such an IoT virtualized console, but also Google's latest $3.20 billion funds buy of Nest Labs, another corporation that specializes in IoT for smart things. These deals demonstrate this same IoT's enormous possibility as well as demonstrate why it is so appealing to both major shareholders as well as titans of the industry. But overall process of forming a company is indeed not straightforward. It’s precise, owing to the IoT's broad scope, organizations interested in it only engage in some or a handful of its components. To provide certain global rules inside the developing IoT craze, companies would eventually have had to work with each other, leaving behind all competitiveness or the concept of what is most essential.

An additional component of IoT that calls for more safety includes middleware, which sits above the networking as well as implementation levels but it is in charge of handling information handling while serving as a communications gateway amongst them. Transparency, as well as safety information retention, are essential for intermediary level safety. Even with greater advanced equipment than the systems used throughout IoT installations, this radio channel presents difficulties for privacy in communications. As just a result, threats including denial-of-service assaults, security breaches, man-inside-the-middle assaults, including malware uploads that targeted potentially disrupt privacy as well as information security may simply be introduced into modern IoT infrastructure. Hazards at the networking interface may be countered by techniques for identification, penetration monitoring, and credential administration, including negotiations. Inside this same IoT concept, the implementation level is indeed the topmost level. It should be the location wherein vast information floods come to a stop, necessitating more storing as well as computing power. It explains how the program overlay and cloud are so tightly intertwined. Cybersecurity, confidentiality, and backups, including restoration, are just a few of the safety concerns that this situation shares with the clouds as a whole. Controlling methods are required to govern accessibility entitlements to everyone or a portion of the content, either for physically individuals as well as across devices or even corporations, as well as credentials and copyright of something like the content.

Such infrastructure's goal in terms of mobility again for foods as well as agriculture industry seems to be to make data as well as products transit easier while also improving worldwide manufacturing integrated supplying chains infrastructures. IoT technology increasingly changing corporate operations by enhancing the movement of resources as well as goods with greater precise but also real-time transparency. Higher-quality services, program building facilities that are independent of equipment, and just enough memory but also processing power are all provided by cloud technology to save as well as analyze the dataset generated at the network's edges. As a result, it appears as the perfect addition to IoT innovations as they

work to create the Cloud-based-IoT paradigm. Nevertheless, the enormous volume of the dataset generated at the channel's edges may be very expensive to send to the clouds, either in regards to expense as well as delay. Consequently, determining the best balance among the burden which will be handled inside the cloud as well as the edge storing as well as computation is a crucial issue. Cloud Technology is indeed an augmentation of something like the cloud computation concept that broadens the possibilities for developing applications as well as cloud platforms including solutions. The atmosphere's features provide difficulties not just for the equipment but also for the protocol stack. Owing to the low price of cabling, radio transmission is used the greatest frequently in agriculture installations. The surroundings are recognized as being one of the main causes of poor radio connection performance due to the impacts of multiple-path transmission as well as its contributions to ambient pollution. Common transmitters function worse in real-time deployments when there are impediments inside the way of communication, including heat, moisture, personal contact, and high-low moisture. Consequently, following the needs as well as difficulties of the country setting, the dataset must be conveyed utilizing strong and trustworthy technology.Figure 5 illustrates the major challenges faced by the farmers to adopt the IoT technology in cultivation.

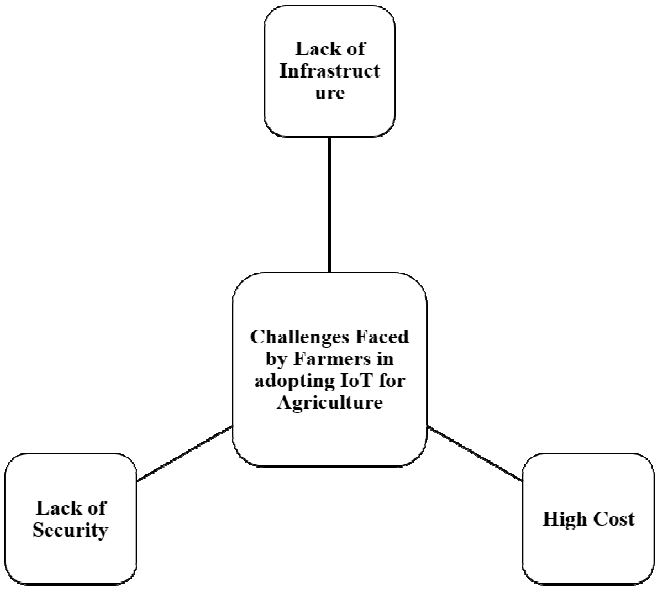

Figure 5: Illustrates the major challenges faced by the farmers to adopt the IoT technology in cultivation.

All parties participating throughout this channel's transition to a linked web of smarter things must be protected in terms of safety, validity, and secrecy, including anonymity. In another term, IoT should provide explicit assurances ensuring only allowed parties may retrieve as well as alter information inside the application plane, provide security versus outside assaults inside the perception stack, and also safeguard the aggregate of information inside the networking stack. The three needs for IoT safety are accessing restriction, secrecy, as well as identification. Data capturing integrity as well as equipment security are indeed the two main prevalent safety problems at the perceptual level. This former is crucial inside the context of farming because the gadgets may be set up in wide areas as well as operate unattended for extended lengths of time. A singular safety method is typically insufficient owing to the dispersed character of IoT as well as the possibility that its gadgets could be installed inside a variety of contexts. Leaks of data that may reveal a position and similar private stuff are often the main cause of RFID privacy problems.

Information encrypting, the deployment of blocking tagging, periodic change of labels, jammer, including, lastly, a tagged annihilation strategy, or the actual death of something like a tag, is surveillance remedies. RFID tagging is passive while sensing networks are proactive as well as linked to dynamic features of objects. As a result, it's indeed necessary to apply encrypted methods, key release rules, and intruder detecting systems, including protection routing regulations while constantly taking into account the physical limitations of intelligent gadgets. Different safety initiatives for detector access points arise, as well as cryptography, personality verification, information flow rate regulations, information filtering processes, and so on. Inside the existing IoT notion, information flows from the finished gadgets to a link that is responsible for submitting such information to numerous different facilities, including virtualization. Also needed are information collection safety mechanisms for the perceptual level. These risks include eavesdropping, manipulation, fraud, as well as impersonation attack, to name only a handful. As just a result, throughout the information gathering stage, originality, confidentially, and information consistency should be guaranteed. To achieve this, key administration methods and secured transit rules, including sensing network identification standards should be used to prohibit dataset accessibility by unwanted parties.

Due to inadequate connectivity equipment, growers would not be able to generate revenue from IoT technologies if they use this. Farms are situated in isolated locations with little web connectivity. Communication troubles could render a sophisticated surveillance technology ineffective since farmers want reliable accessibility to agricultural information at all times and from every place. Costly technology has been required to apply IoT in farming. Although detectors are indeed the lowest costly part, it could still require greater than $1,000 to equip every rancher’s land using it. Autonomous equipment is higher expensive than humanly controlled equipment since it requires agricultural administration technology as well as cloud storage to retain information. It's indeed important for producers to engage in such innovations to increase company revenues, and it would be challenging for businesses to accept a new expenditure necessary to establish IoT equipment in existing fields. Although IoT gadgets can reach the web because typically communicate with earlier technology, there remains no assurance whether devices will be capable to receive unmanned aerial vehicles imaging information or detector digital display by using a community network. IoT agriculture equipment captures a huge quantity of information that is challenging to secure. The information from IoT companies' databases might be stolen as well as altered by somebody with unauthorized entry.

3. CONCLUSION

Our research shows how IoT may be used throughout into intelligent agricultural industry as well as provides an analysis of IoT products. To do this, researchers assess the framework (IoT gadgets, modern communications, big dataset collection, and computing), implementations, and development schedule of IoT-based intelligent agricultural landscapes. We additionally go through the prospects as well as possibilities for IoT implementations in intelligent agribusiness, as well as the problems as well as difficulties that still need to be resolved. Researchers anticipate that these latest findings would serve as crucial guides for additional investigation and the development of Internet of Things (IoT) technologies which seek to increase the production as well as efficiency of the agricultural industry while also easing the transfer to an agroecological viable long term. Individuals would constantly require food and drinking even though marketplaces might expand as well as contract, innovative company concepts might appear or go. Because of this, the advancement of industries like foodstuffs as well as farmland would always take precedence, particularly in

light of the current global realities. As just a result, IoT within agribusiness has great promise for the long term as a catalyst for productivity, durability, as well as scaling throughout this sector. With something like a rise in awareness of cutting-edge technology as well as the desire to raise total production, creative Implementations in agribusiness would grow over the coming several decades. Additionally, competitive participants inside the agribusiness industry would use tactics including partnerships, joint ventures, acquisitions, and many others to broaden their product options for producers. Using cutting-edge tools as well as technology at their fingertips, the next generation of farmers would develop into astute decision-makers.

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CHAPTER 7

DESIGNING A SMART THEFT DETECTION SYSTEM FOR MAINTAINING SECURITY AND SAFETY USING PASSIVE INFRARED SENSORS (PIR)

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ABSTRACT: ***As technology is emerging day by day, people are depending more on technology and it helps them in many fields. In the present era, technology is part of our life which makes human life comfortable and easy. Here, this paper aims to develop a system that is useful for overcoming the problem of theft, thus benefitting people who have homes and shops. As it is associated with IoT, the system is called a smart system for theft detection. In this proposed system, the author uses an Open CV (Open Computer Vision) camera module which helps the system with image recognition, and the author also uses a servomotor to cover all the angles by the camera. Since the camera is mounted over the servomotor, which makes the proposed system different from another existing system, this proposed model outperforms standard modules. In addition to that, the authors also implement these components for making the system more realistic and precise which further contributes to its success.***

KEYWORDS: ***Camera Module, Internet, Platform, Sensors, Technology.***

1. INTRODUCTION

With modern technologies, people live their lives in the traditional way which means they use traditional methods for communicating with anyone who is living in a different city, and also use traditional agriculture methods and so on, and people feel much tiered. After introducing the technology everyone feels very light and cool with the use of technology [1]. In the present era, we live with technology which means technology is used in our daily life. Technology has made lots of changes worldwide [2],[3]. The upcoming century will be more comfortable because of the extreme rising in technology, now technology creates its trends for the comfort zone of the public. Technology creates the term smart, which means the technology generates shortcuts and works effectively[4]. So many inventions take place under the term of the internet of things, it is the general term that makes any modules smart. Nowadays security and safety are more important for living a safe or good life, so there are so many problems faced by the common man, mainly facing the theft problem generally for overcoming this problem the author wants to make technology, but there are so many existing technology but these are so expensive so and having their cons and pros so the author wants to enhanced in the existing technology and create smart theft detection system for to maintain safety [5].

In this system they use so many sensors and the technology like internet of things and others, it is the most trending technology in the world because by the use of the internet of things they make smart systems easily it is the most common technology which is used in many sectors like in smart home, smart cities, and in all smart automation the commonly used technology is an internet of things (Figure 1) [6]. It shows the correct platform for smart innovations through the use of the Internet of things and it provides opportunities the explore ourselves in any sector and also provides the base for any automation systems [7].In this world that is slowly becoming more tech-aware, theft prevention would become advantageous. To apprehend the thief, a variety of theft recognition systems are offered, and

they can be further enhanced. [8]. In some cases, these technologies make it impossible to catch the thief. Even if the thief is apprehended, the victim cannot recover their precious possessions. Prevention is preferable to cure [9]. The person will not suffer any loss if the theft is stopped [10].

This proposed system has the ability of image recognition which helps the owner to identify moving objects. In this proposed system they used a servo motor and an open Computer Vision (CV) camera to capture the area [11]. In the proposed system they also use so many electronic modules and sensors for the betterment of the system[7].

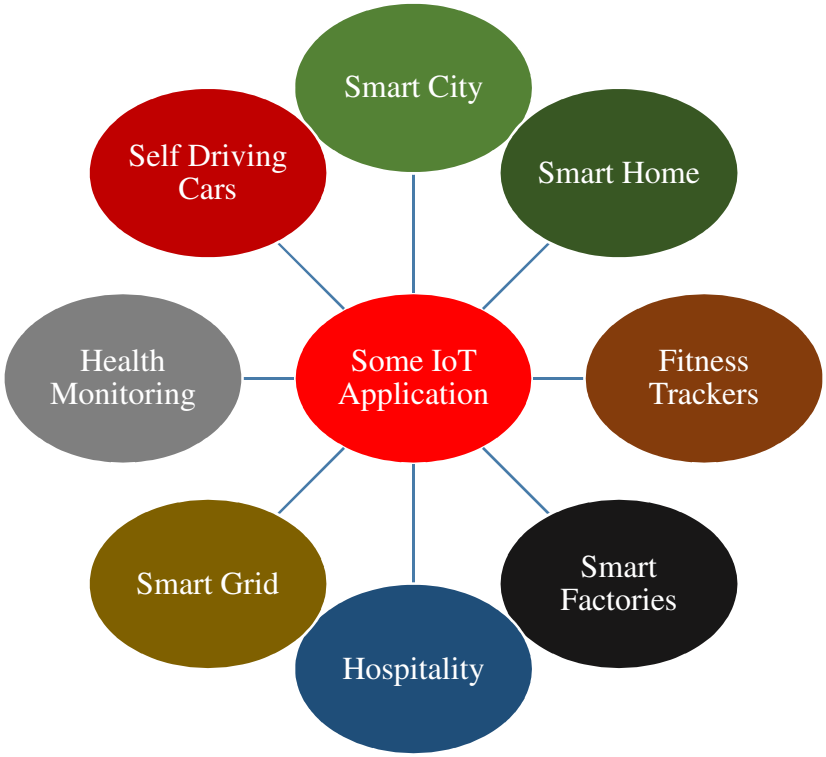

Figure 1: Illustrating the Major Applications of the Internet of Things.

In this proposed system author used a PIR (Passive Infrared) sensor for motion detection as a main component of the smart theft system. it works on the principle of infrared sensors which calculate radiating infrared (IR) light from the objects in its range of view [12]. It is the main component by which the theft detection system achieves its main function which is to sense the movement of anything [12].

2. LITERATURE REVIEW

Sadhana Godbole et al. demonstrated a smart system that has safety and security features for protecting people from the thief, they give a review of the theft detecting system which is based on the principle of PIR. PIR stands for Passive Infrared Sensor, it is used to sense the motion of objects. In their study, the author provided a review of the theft detection system and the authors also discusses its making process and the components which are used in it. They used Raspberry pi as a microprocessor and attached all the components with it, it is used as the main component by which the Buzzer, PIR sensor, and other components are attached. They also provide a backup system, which is helpful during the absence of electricity. If the PIR detected any kind of motion then the system sends a notification on the preinstalled number by the GSM module and also plays a buzzer. It is a safe system and it is easily implemented in homes and jewelry shops etc. [13].

Muhammad Zeeshan Saeed et al. discussed the IoT based on the smart security system, the IoT helps to create smart technology, smart cities, and smart homes. In their proposed system they used Arduino mega board as the main component which is called a microcontroller. A couple of microwave and passive infrared sensors are used to detect the signature. The Arduino mega board is linked with each sensor node. The Arduino Mega Board creates a notification alarm and transmits it to the 3G/GPRS Shield (SIM5215A) module if an intrusion is found. The user's cell phone and the internet server are connected twice, with the first connection utilizing 3G/GPRS and the second using GSM [3].

Prithvi Nath Saranu et al. provided a concept of house security for theft by using an intelligent system of surveillance. In this system, they used PIR (Passive Infrared) sensor and an RP sensor. In their proposed system they used Raspberry pi as a main component and attached all the components to it. In their study, they demonstrated that when movement is sensed by the PIR sensor then the Solenoid valve is activated and sprays chloroform on the detected object, and automatically switches on the room camera by which the householder watches the live activity. Hence, in their proposed system, when the system detects any movement then it notifies the owner about the object's movement via calls and mail services, therefore, providing the concept of a smart home automation system for the detection of theft [14].

In the above-discussed paper, one thing is similar in all papers that are providing the security to avoiding or overcoming the theft issues. As above mentioned, every paper uses its methodology to make theft detection systems.

Research Questions.

- How to make a theft detection system using PIR sensors?
- Explain the working principle of the PIR sensor.

3. METHODOLOGY

3.1.Design and Sample.

Designing the smart theft detection system needs some components that are Raspberry Pi, PIR (Passive Infrared) sensor, an open CV camera module, text to speech speaker module, a servo motor, and a solenoid valve. The authors design a system with some enhancements in existence system that works much more smartly than the existing system.

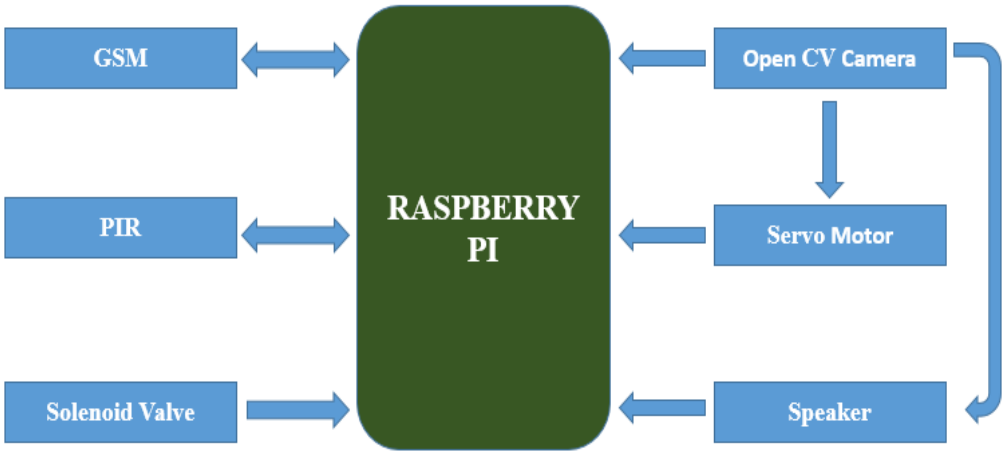

Figure 2: Block Diagram of Smart System for Theft Detection.

In this proposed system author introduce a smart system for theft detection, this proposed system has image recognition ability which is achieved by the use of an open CV camera module, and it has the ability to speech audio by the use of a speaker as shown in Figure 2. In this proposed system author use Raspberry Pi as the main unit that is the microprocessor and all the component directly connect with the raspberry pi, open CV camera module connect to the raspberry pi directly and use in image recognition, speaker module also connect with the microprocessor which is used for audio feedback system, buy the help of servo motor we change camera direction, in this proposed system we use also solenoid valve for the spray chloroform on the detected stranger, and (Global System for Mobile Communication) GSM module used for transferring a message on predefined numbers.

Working of the system is defined as when using power on the system then all the components get activated if the PIR sensor sense any movement then the camera module focus on that particular object by the movement of the servo motor which is sensed by the PIR sensor, the camera module recognize a particular object and by the speaker module get output. By the salmonoid valve it sprays chloroform on the detected stranger, By the GSM module, it sends text messages to the pre-installed number about the detected stranger.

3.2.Instrument.

In this proposed system author used so many components all of components described below in Table 1.

Table 1. List of Components that are used in the Theft Detection System.

S.no.	Components
1	Raspberry Pi
2	Open CV camera
3	GSM
4	PIR sensor
5	Speaker
6	Servo motor
7	Solenoid Valve

3.2.1. Raspberry Pi

It is a type of microprocessor, a type of small sequence of Single-Board Computer (SBC) which is established in the UK by the Raspberry Pi Foundation with Broadcom. It is usually used for robotics and making projects under electronics.

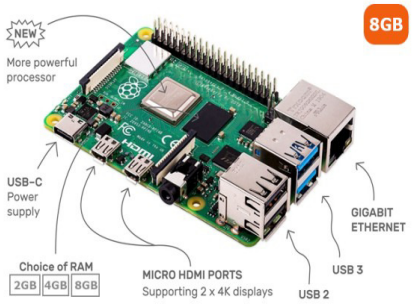

Figure 3: A Pictorial Representation of the Microprocessor Board (Raspberry Pi).

It is widely used in many places like, whether monitoring, because it is pocket-friendly and cost-effective, modularity, and open in design. It is also called a mini-CPU. It has so many pins and portals and also has RAM which is called Random Access Memory (Figure 3).

3.2.2. Open CV Camera Module

Open Computer Vision (Open CV) is an 'open-source' module. It is used mainly for image recognition, it is a BSD-licensed image processing packet that contains functions for each type of image processing, from simple picture decoding, object detection, enhancement, object tracking, color space conversion, etc. it is programmed easily with programming language Python.

3.2.3. GSM

GSM stands for the Global System for Mobile Communication. It is a mobile network which is work digitally that is widely used by mobile phone users worldwide. It operates at the frequency band 900 or 1800 MHz frequency band. Commonly there are three digital wireless tools are used which are Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), and GSM.

3.2.4. PIR Sensor

PIR Sensor is the sensor that is used for sensing the motion of an object and is continuously used to analyze where people have moved out of the sensor range or in the sensor range. It is a small module having inexpensive, has low power consumption, is easy to implement, and is portable. For these reasons, it is easily found in gadget and appliances which is used for home and business purpose. It is also called a pyroelectric sensor (Figure 4).

Figure 4: An Illustration of a PIR motion sensor for motion detection.

3.2.5. Speaker Module

It is a module that gives output as a play high-quality audio, the speaker module depends on the speaker amplifier IC which is 8002. It is also used as a buzzer for the output. The audio output volume is controlled by the potentiometer. This module has so many advantages like simplicity for the interfacing, long durability, and compact footprint.

3.2.6. Solenoid valve

Solenoids are electrohydraulic valves that control the transmission liquid flow which helps to change the gear. It is used for the movement of fluid in the desired way, it opens or closes by electrical signals. The proposed system is used as a sprayer for spraying the chloroform on the detected strangers.

3.2.7. Servo Motor

It is a type of motor which rotate as per desired way or rotate as per needs. A servo motor is defined as a rotatory linear actuator or actuator, it permits the specific control of velocity, linear position, and acceleration. It is used in the proposed system for the angular movement of the camera which is mounted on the servo motor.

3.3.Data Collection.

The data which is given by the National Crime Records Bureau (NCRB) shocking the stolen property record in 2017 is 7.39 lakh (Table 2). National Crime Bureau released finally the estimated crime data for 2017 after 1.5 years (Table 3).

Table 2: Table of Stolen Property cases which Records in Particular Cases.

S.no.	Year of crime	Crime data provided by the NCRB
1	2005	399,789
	2007	428,550
2	2008	456,495
3	2009	455,942
4	2010	473,128
5	2011	491,162
6	2012	491,356
7	2013	563,207
8	2014	618,403
9	2015	645,015
10	2016	641,851
11	2017	739,949

Table 3: Nature of Crime Responsible For Stolen Property in 2017 (NCRB).

S.no.	Nature of crime	Nature of Crime in Percentage
1	Theft	79.6
2	Burglary	14.9
3	Dacoit	0.5
4	Robbery	4.2
5	Others	0.8

3.4.Data Analysis

There are some data regarding stolen property, which shows the rise in a stolen property case. These problems are reduced by the use of the smart theft detection system and which provides safety and security for the property and person also (Figure 5).

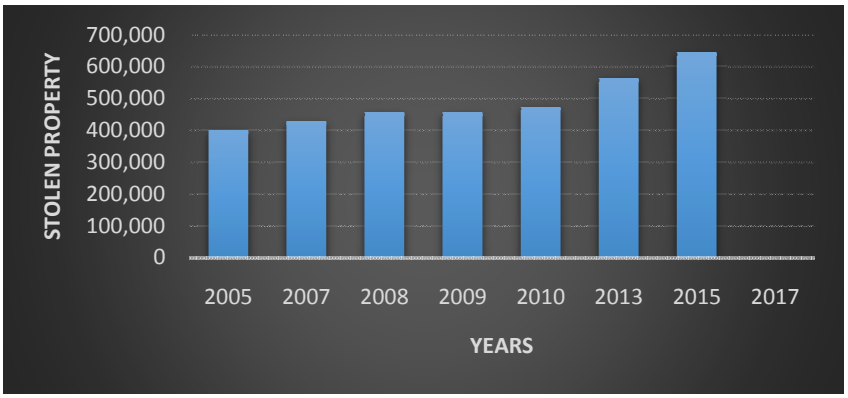

Figure 5: Graph for Stolen Property in Particular Year Data Given By the (NCRB).

There are some more data given by the National Crime Records Bureau in which they provide data regarding the method of the crime and provide records in percentage (Figure 6).

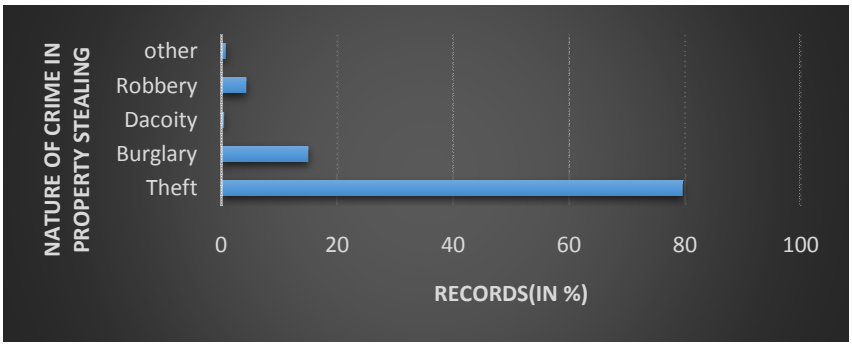

Figure 6: A Graphical Representation Illustrating the Nature of Crime Stolen Property in 2017.

4. RESULT AND DISCUSSION

There are so many cases of stolen property it is rapidly rising to the national crime record bureau provided data. And for overcoming the following problem smart technology is very important for making the proposed system and also for making smart homes and cities. In the

present scenario, all the systems work digitally and most smart technology is centered on the IoT. With the use of the internet of things, we create a smart device that helps us to provide a smart solution to any particular problem, which makes our cities and homes smart. In the proposed system authors use so many sensors and connect all the modules with the main unit which is a microprocessor and also it works on the concept of internet of things technology which makes this proposed system smart. It is useful for the householders and the shop holders to improve the security and safety features smartly and also capable to create unconscious states for the detected strangers.

5. CONCLUSION

The existing theft detection system was not having an image recognition capability by which it senses any object. Thus the user has no complete idea regarding the detected object. However, the presented module user will have a complete idea about the detected object. In the proposed system the author also implemented a servo motor to cover all the angles of the particular room. The camera module is implemented on the servo motor which the camera module is capable to cover all the angel of particular rooms. The proposed system also works in the desired way by the change in their component programming which is possible on the platform of raspberry pi IDE. The open CV camera module has the ability of image recognition. This module also uses for preprocessing of images widely in many systems.

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CHAPTER 8

DESIGNING THE SMART HOME SECURITY SYSTEM BY IMPLEMENTING SMART SENSORS WITH ARDUINO

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ABSTRACT: ***In the present era, security and safety are more important. There is a technology that is more progressively used in the security system, influenced by modern technology. When there is a smart home with smart technology and with the less human effort it is known as the modern home. There is some existing system available for security but it is not pocket friendly. So the author wants to design cost-effective products for every class of human. The design of the smart security system uses cost-effective components and uses a simple algorithm. This system is centered on the concept of the internet of things (IoT). It is defined as a smart door lock that helps to increase security. It's based on the image recognition and detection concept. With help of this system, people reduced the graph of theft and robbery cases which is related to home and offices. With the increase in technology, the upcoming scope of this system will increase. In the future scope if implemented more smart sensors and the component over the main unit then it is more precise and effective.***

KEYWORDS: ***image recognition, implemented, internet of things, Smart security system, theft.***

1. INTRODUCTION

In the present era, security and safety are more important. There is technology is more progressively used in the security system, influenced by modern technology [1]. When there is a smart home with smart technology and with the less human effort it is known as the modern home. Since there is the beginning of digital and wireless technologies when each work together it presents new smart technology which is a smart automated security system [2]. The automatic home security system is designed with some sensors and surveillance cameras previously [3]. Faster information transmission is done with the help of a Wi-Fi system, which helps the user to control the system and monitor the system worldwide [4]. In the present scenario, technology is rapidly increasing causing an enhancement in the security system of the home [5].

Figure 1. Demonstrate Animation of Image Processing for Image Recognition System [Source: Google].

Automation in safety and security systems makes it more realistic. In the home, there is much electrical equipment that is needed all-time monitoring from the remote [6]. Home safety and security system are used to protect the home and keep protected valuable things, and also keep your family protected and safe from the thief and burglars [7]. In the United State, home is related to a burglary that takes only 13 seconds, and so on. Most of the robberies are done with the help of a gun, identity theft is a leading crime in the US Canada, and United Kingdom [8]. Nowadays the increase in demand for the internet of things delivers effective data storage and interchange by connecting the electronic sensor with physical devices and the internet (Figure 1). The Internet of things generating a revolution worldwide and it has become a part of life [9].

As robbery and burglary have always been issues, from small homes to massive industries, surveillance is crucial to ensuring our safety [10]. IoT is a public services network centered on a constantly available Internet. IoT can be conceptualized as a web of physical things that connect to the Internet [11]. A Raspberry Pi is a small, inexpensive, cost-effective computer [12]. Since a few years ago, the Raspberry Pi platform has gained significant traction. In this paper author use microcontroller as the main unit and attaches every sensor to it[13]. The author uses ESP 32 cam module for Image recognition and also uses CCTV [14]. Use a servo motor for covering the angle and use a stepper motor for the door lock. Use Global System for mobile communication (GSM) module for conveying messages regarding any stranger detection. Use a speaker module for generating audio feedback or alarm [15]. This proposed system is based on smart technology and works on the technology of the internet of things which means we check our system from anywhere with the help of an application that is designed for the system [16]. Figure1 demonstrates the animation of image processing for image recognition [17].

2. LITERATURE REVIEW

Suraj Pawar et al. discussed in this paper about the IoT makes the system smart. In this paper, the author worked on designing smart home security. Author use raspberry pi as a core unit which is called microprocessor and use ‘Passive Infrared’ (PIR) sensor for motion recognition. use ultrasonic sensor for detect any object which in in the range of ultrasonic sensor and they use stepper motor for door lock and unlock the buzzer and camera module also implemented in this system. Author suggests an intelligent home security system that is Internet of Things and face detection enabled to address the issue like robbery, theft. In their system, a web camera that is associated to a Raspberry Pi and equipped with PIR and ultrasonic sensors is used. To address this issue, author suggest In the event of a power outage. This system is battery-powered. The home landlord can also examine activity within the home via an android or ‘web application’ linked to a Raspberry Pi on the internet. Users can also add new person's faces to the databanks via an Android application or a web application, for example, guests [13].

Tanaya et al. discussed the technology which is helpful in the sector of home security. In the present era, technology is developing quickly which causes home security systems to advance. Automation in the security field increases authenticity. Homeowners have access to a variety of electrical appliances that must constantly be monitored from a distance. In this paper, a face detection method and a home security system are both suggested. An independent system is implemented using the Internet of Things as a communication network. Python-coded Raspberry Pi is employed as the controlling unit [1].

Siddharth Wadhwani et al. discussed modern technology and its enhancement, in the present scenario most of them depend on the technology by which they perform their task smartly

and it also helps to enhance the knowledge about the technology and future of any technology. The author uses so many components to make a smart security device for the smart home via the concept of the IoT technology and Arduino as a microcontroller, which works as the main component means all the components are attached to it directly. In this paper, the author presents home security systems and home automation techniques. In this paper, they make the system to monitor all the smart home appliances. They also work with the magnetic sensor which is helpful to enhance door-breaking security. This paper gives information on how the internet of things concept makes our life easier [2].

Neha Patil et al. discussed in their paper the IoT-based intelligent security system by the using of a microprocessor which is raspberry pi. In this paper, they discussed communication and described it. Communication is defined as the interchanging of data from one side to another called communication. In this paper, they use a raspberry pi as the main unit and also use Open Computer Vision (CV) camera module for face detection. The system is connected with the Wi-Fi module for wirelessly operating from anywhere. The Raspberry Pi controls image processing and attention-getting algorithms before sending captured photos via Wi-Fi to interested parties through email. It makes use of a standard webcam [18].

3. METHODOLOGY

3.1. Design and Sample.

The proposed system uses so many components for achieving its targeted goal, the author wants to make a cost-effective system for everyone. They designed their system based on Arduino implemented with the ESP 32 camera module. This makes the system pocket friendly for every class of people. The designing process did not use many complex methods. Under designing of proposed system author needs an Arduino module, GSM, Speaker Module, Servo motor, stepper motor, and ESP32 camera module. Under the designing process of the proposed system, we take Arduino as the main unit, to this author connect all the components. The Block illustration of the system is given in Figure 2.

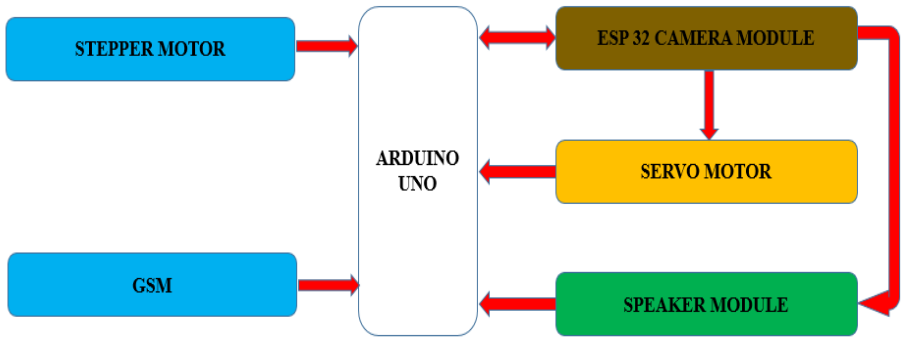

Figure 2. Illustrate Block Diagram of Smart Security System for Enhancing Security for Home and Office.

We connect the ESP32 cam module with the microcontroller, the working of the camera module is to achieve object detection and face recognition. ESP32 cam module has an inbuilt WIFI module and it can create its webpage and IP (Internet Protocol) address. With the help of their IP address users track the system from anywhere. The author uses a servo motor for changing the angle of the camera module because the camera module is mounted over the servo motor. The author uses the GSM module which system is capable to send messages to the user and with the help of the stepper motor system able to close or open the door. All the module work through the microcontroller and every module working are specified by the

programming of the modules. The programming platform which is used to program the components is ‘‘Arduino Integrated Development Environment’’ (IDE) which uses the programming language C. for the desired outcome of the component programming of each component necessary.For achieving the main object of the proposed system, implement all the components in the desired format. Then achieve a smart security system for enhancing security for the home and offices. For ESP 32 camera module, provide an image database for face detection. Manually users add or delete information about the new person in the system.

3.2. Instrument.

There are many components used to make a smart security system. The list of the instrument given below in Table 1. Specification of the components is also discussed below.

Table 1. List of Components which are Implemented in Proposed System.

S.no.	List of Components
1	Arduino Uno
2	ESP 32 camera module
3	Stepper motor
4	Servo motor
5	GSM
6	Speaker

3.2.1. Arduino Uno.

Arduino. cc created the open-source ‘Arduino Uno’ microcontroller board created on the Microchip ‘ATmega328P’ processor. A numeral of development boards (shields) and additional circuits can be interfaced via the board's sets of ‘digital and analog input/output (I/O) pins. Pulse width modulation (PWM) can be output on six of the sheet's six analog I/O pins and six of its fourteen digital I/O pins. The Arduino IDE can be used to program it if it has a type B USB connector (Integrated Development Environment). It can be driven by a Universal Serial Bus (USB) connection or an exterior 9-v battery and runs on voltages between 7 and 20 volts. It shares several similarities with the Arduino Nano and Leonardo. Figure 3. shows the circuit board of the microcontroller.

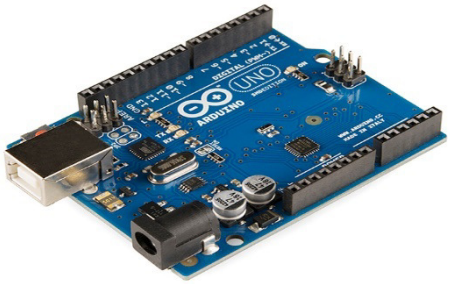

Figure 3. Image of the Arduino Uno Microcontroller Board [Source: Google].

3.2.2. ESP 32 Camera.

The ESP32-CAM is an ESP32-based, compact camera module with low power consumption. It features an inbuilt memory card slot and an OV2640 camera. It is mostly used in smart IoT

applications, QR identification including Wi-Fi image upload, wireless video monitoring, and others. ESP32 cam module in the proposed system for image recognition and face detection. It improves security at a low cost and it is easy to implement on the Arduino board.

3.2.3. Stepper Motor.

Electrical energy is transformed into mechanical energy by motors. Electrical pulses are translated into particular rotating movements by a stepper motor. Stepper motors are excellent for positioning applications because each pulse produces a precise and predictable movement. A Stepper motor is used in a proposed system for opening and closing the door after image recognition by the ESP32 cam module.

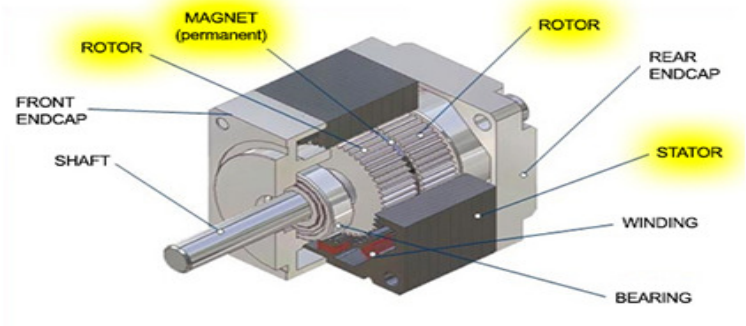

Figure 6. Illustrate the Image of Stepper Motor in Detail [Source: Google].

3.2.4. Servo Motor.

A servo motor is a kind of motor that has extremely accurate rotational capabilities. This type of motor typically has a regulator board that gives a response to the motor shaft's present location. This response allows the servo motors to revolve very precisely. A servo motor is used to spin an object at predetermined distances or angles. It consists of a straightforward motor that drives a servo instrument. A motor is mentioned as a direct current (DC) servo motor if it is driven by a DC power source, and an alternate current (AC) servo motor if it is driven via an AC control source.

3.2.5. GSM.

Global System for Mobile Communications, or GSM. Mobile voice and data services are transmitted using this digital cellular technology. The following list of GSM-related key facts.

- Early in the 1970s, Bell Laboratories developed a mobile radio system based on cells that gave rise to the GSM concept.
- The GSM standardization group was founded in 1982 to develop a uniform mobile phone standard throughout Europe.
- The most extensively used telecommunications standard, GSM, is used all across the world.
- Each 200 kHz channel in the circuit-switched GSM system is divided into eight 25 kHz time slots. In the majority of the creation, GSM uses 900 Mega Hz to 1800 Mega Hz in mobile communication bands. In the US, GSM uses the 850 MHz spectrum.

3.3. Data Collection.

With the rising of technology, technology gives relaxed full life to the human being. In the present era technology play a major role in human life. It changes the lifestyle of human

beings, and also give solution to any problem. For overcoming the problem of burglary, robbery, and theft, the author designed a smart security system for houses and offices. There are some data on theft given by National Crime Record Bureau (NCRB) from Delhi city. This table no. 2 represents the data of theft crime in Delhi city the data is given by NCRB. The data given by the National Crime Record Bureau of the year from 2010 to 15 November 2019 are shown in table 2.

Table 2 Theft Crime Data in Delhi given by National Crime Record Bureau.

S.no.	Year of Crime	Number of Crime
1	2010	20
2	2011	22
3	2012	22
4	2013	21
5	2014	80
6	2015	105
7	2016	155
8	2017	170
9	2018	196
10	2019	216

3.4.Data Analysis.

NCRB is provided exact registered data which collect from every police station. According to the above data, it is clear how many theft crimes occur every year. According to this data cases of theft rapidly increase between the years 2014 to 2019. The recorded cases directly jump 21 to 80 cases in the year 2014 after the year 2014 it continuously increased. The given data is defined in Figure 7.

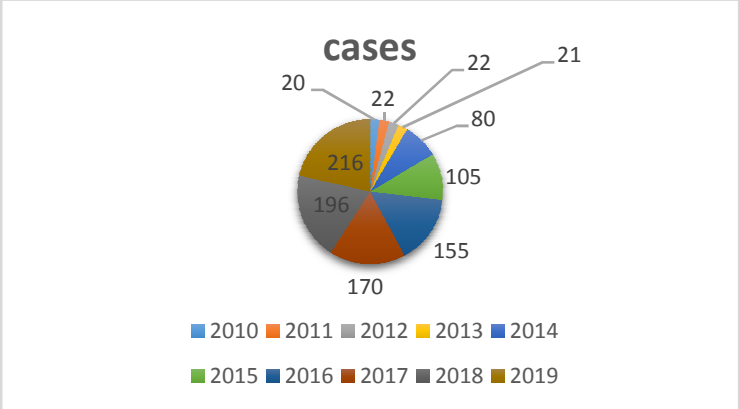

Figure 7. Demonstrate the Data related to theft cases in Delhi which are given by NCRB.

4. RESULT AND DISCUSSION

When implementing all the components in the proper format. Then author achieves a smart system for the security of homes and offices. System outcome after the implementation is achieved. It works as an enhanced version of the previous exiting system. It provides more accuracy and it is easy to use the module. It helps to reduce the information which is provided by the NCRB in the future which means it can reduce crime scenes and maintain security for home and office. If the person is a stranger then the system does not give the authorization to access. So when any person stands in front of the system it always repeats the recognition process. India's theft rate of data is given by the global economy in Figure 8.

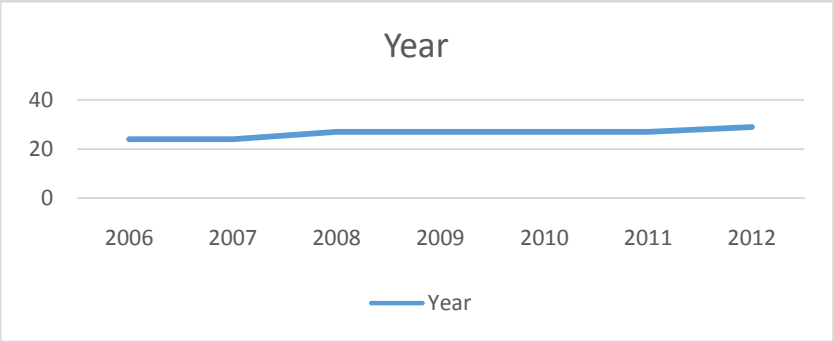

Figure 8. Theft per 100000 People from the Year 2006 To 2012 in India

5. CONCLUSION

In the present era, security and safety are more important. There is a technology that is more progressively used in the security system, influenced by modern technology. When there is a smart home with smart technology and with the less human effort it is known as the modern home. In the present scenario, technology is rapidly increasing causing an enhancement in security systems for the home. Automation in safety and security systems makes it more realistic. In the home, there is much electrical equipment that needs all-time monitoring from the remote. In this paper, the author offered a smart security system for maintaining the security and safety of homes and offices. In this paper, the author mentioned all the components and the proper methodology regarding the proposed work. For making this proposed system they use so many components which are all mentioned above in a detailed way. The important objective of this paper is to design a hybrid model which helps maintain home and office security. Due to the graph of increasing data of theft, and robbery worldwide. The author designed a hybrid security solution. For designing, use a microcontroller as the main unit and implement all the modules over the microcontroller. Which is mainly used in image recognition and detection of the person and gives authority after this process to access the home and offices. If the face is not matched then it sent the message through the GSM module to the pre-installed numbers. In the future scope if implemented more smart sensors and the component over the main unit then it is more precise and effective.

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CHAPTER 9

PROPOSE A HYBRID MODEL WITH IMPLEMENTATION OF DRIP CONCEPT AND SMART IRRIGATION SYSTEM WHICH BASED ON THE MICROCONTROLLER

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ABSTRACT: ***Numerous sensor- dependent smart irrigation model with accompanying phone applications have been developed over the years to manage this challenging issue, but there is still debate over their dependability as data volumes increase and the latency amount of Internet of Things devices. Resources in recent decades, an intelligent, smart, and fully automatic farming system was both necessary and highly required. In response to the ongoing problem of water loss, an Internet of Things- dependent intelligent watering system has been developed for this purpose. So the author proposed a design of hybrid and intelligent irrigation model for overcoming the water wastage issue and also for betterment of the existing irrigation system. So for making a hybrid concept author combine two preexisting methods which is drip irrigation system and other is smart irrigation system. In this proposed system author give the facility for controlling the system to user is mobile application. By which user track the system and irrigation of crop from anywhere, with the advancement of technology and the sensors the system will enhance in future.***

KEYWORDS: ***Agricultural,Crops, Hybrid, Irrigation,Moisture.***

1. INTRODUCTION

Resources in recent decades, an intelligent, smart, and fully automatic farming method was both necessary and highly required. In response to the ongoing problem of water loss, an Internet of Things-dependent smart irrigating model has been developed for this purpose [1]. There are two specifics to this agricultural sector. There are three types of plastic pipes used for farming: low, high, and walk-in. Due to its larger dimensions, the high pipes is more practical to seed, spray, and harvest in than the low and walk-in tunnels [2]. Contrarily, traditional farming is the most unpredictable and leads to more water waste. The issue we'll discuss in this paper with respect to smart irrigation is the need for any application created for or utilized with a smart irrigating system to still be more effective and suitable [3]. Exactly speaking, it indicates that a large-scale IoT application requires more than just cloud computing. To handle various forms of data from various sources, there must to be something like a quicker, more effective application employing a better design (sensors) [4]. A rapid and efficient irrigation system's primary goal is to use water sparingly in order to fulfil a field of plants' urgent requirement for water while conserving insufficient sweet water reservoirs [5].

Numerous sensor-dependent intelligent irrigation systems with accompanying smart phone applications have been developed over the years to manage this challenging issue, but there is still debate over their dependability as data volumes increase and the inactivity rate of Internet of Things models [6]. Similar to in earlier studies, the input, temperature, parameters humidity, light intensity and soil moisture, were employed, and a fuzzy logic algorithm was used to determine whether to water plants or not.Numerous healthcare systems have used the same fuzzy logic to monitor the wound's temperature, blood pressure, oxygen levels, and infection status [5][7].Similar to that, this technology greatly aided fire alarming applications in 2018 and 2019 [8]. Now, we have developed a new technology that combines semantics

and machine learning for more or less input characteristics, such as the kind of, climate, the type of soil, and the type of crop with the outputs from the sensors, which include soil moisture, humidity, and, temperature [9][1].

In this proposed system author use IoT concept with microcontroller [10]. In this smart irrigation system implement so many sensors and components for achieving the goal [3]. In this system use drip irrigation system for less water requirement by this people save the water for future. There are so many existing smart irrigation system but each have their own pros and cons [11]. So author use the concept of drip irrigation system and implement it with the smart irrigation concept. Then they obtain the hybrid smart irrigation system which helps to save water for the future use [12]. The suitable crops for drip irrigation system is demonstrate by the Figure 1.

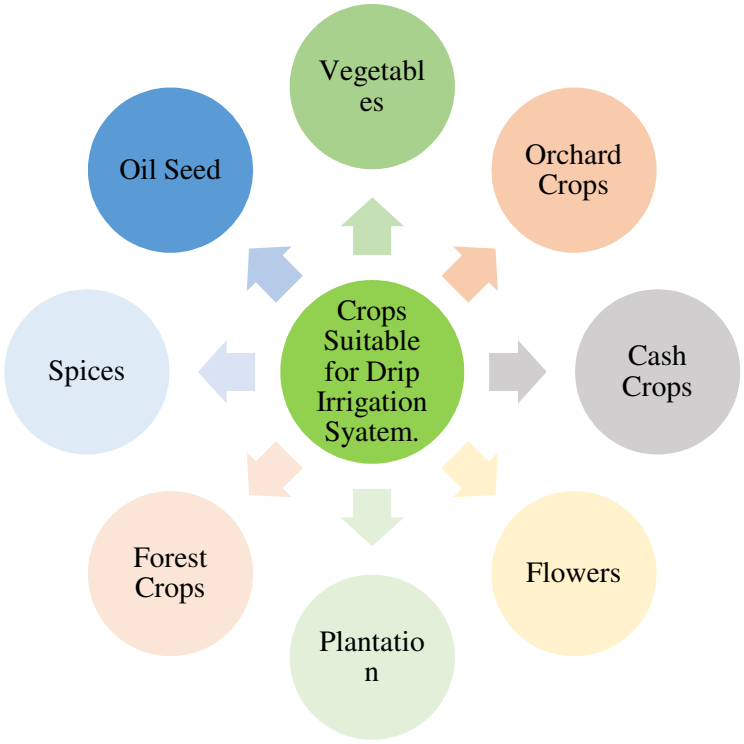

Figure 1. Demonstrate the suitable crops for drip irrigation system via Image.

To achieve the concept of hybrid model of smart irrigation system, use both concepts. By implementing the all components together, there many sensors attached with the microcontroller like, soil moisture sensors, humidity sensors and so on. This smart system also need an application by which farmer track the system and requirements of the water to crops [13].

2. LITERATURE REVIEW

Rafi Ullah et al. discussed in there paper about the smart irrigation system which based on the energy-efficient water management platform (EEWMP). In present era, requires precision agriculture, especially in those with large populations, fertile land, and scarce water supplies. Countries can use efficient irrigation methods to use freshwater and use the extra water for arid territories. SWAMP's main goal is to automatically, distribution, consumption and manage water reserves and at various levels, prevent problems with under and over-irrigation, and automatically manage time to increase production. An enhanced version of SWAMP was suggested by this study, is EEWMP is an Internet of Things-dependent intelligent irrigation

system that makes use of open-source clouds, fusion centers, and field-deployed sensors and sinks. The effectiveness of both approaches is assessed in terms of energy consumption, network [1].

Juliana Ngozi Ndunagu et al. discussed in their paper about the smart irrigation devices which works with the concept of the drip system. Under this paper smart irrigation system (SIS) build by the help of the microcontroller which implemented with sensors and the components. It works on the threshold value of the samples. In order to base irrigation choices on web resources similar to the climate prediction from "weather.com" and sensor results from soil examples, the methodology integrates hardware and software components. The edge server then analyses the acquired data and updates them each 15 minutes. The onset value determines the Depending on the irrigation schedule, the system begins pushing water or ends the watering process. In order to control and monitor the model using an edge application for Android or a web browser, a web application was created to show the results. The informations are in 'comma-separated values' (CSV) layout and have 143731 entries containing the data that were captured and measured.

M. Safdar Munir et al. discussed in their paper how to irrigate the crop with less water, so they propose a system for smart irrigation with less water and for save water for future use. There system based on the concept of IoT, and they use Arduino as a microcontroller. A significant amount of water was lost due to improper watering techniques. Author used an intelligent strategy that was professionally able to use ontology to make 50percent of the judgment, and the remaining 50percent of the choice is dependent on sensor information values. The final conclusion is derived from the sum of the sensor data as a consequence of a machine learning algorithm.

3. METHODOLOGY

3.1.Design and Sample.

This introduced system helps to reduce the water consumption in irrigation of crops. In this proposed system, use two concept together by which it is called hybrid system. This system defined a smart irrigation concept with less water. In this system author use microcontroller as a main unit, all the components are connected through the main unit.

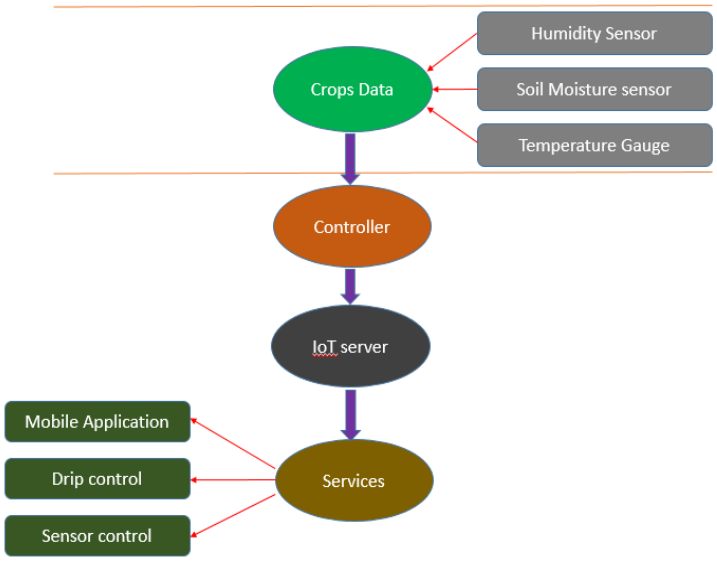

Figure 2. Demonstrate the Block Diagram of Flow of Working of the System.

Also implementing the concept of drip irrigation system with it, it has its own concept of irrigation and its own components like drip needles, pumps, pipe and so on. The flow of the working is, firstly the sensors monitor the field data and sent it to the microcontroller then microcontroller upload on the server by the help of Wi-Fi. This smart system need a mobile application for tracking the crops and system both from anywhere. So by the mobile application it farmer track the system and the data of the crop. And also operate smart irrigation system by the help of mobile phones or laptop. Flow of working is also defined by flow chart given in Figure 2.

For making the hybrid technology for irrigation system, firstly take the microcontroller and then attached all the sensors through the microcontroller. In this system author use thermometer for temperature sensing and 'soil' moisture sensor for checking the moistness level in soil. And for uploading the data on server also use the Wi-Fi module. For achieving the drip concept in this system author use relay for switching operation of pump. For the water supply also use 2KW water pump and attach with relay switch. Also use pipes and dripping needles for achieving the drip concept. The working model of drip concept is illustrate in figure 3.

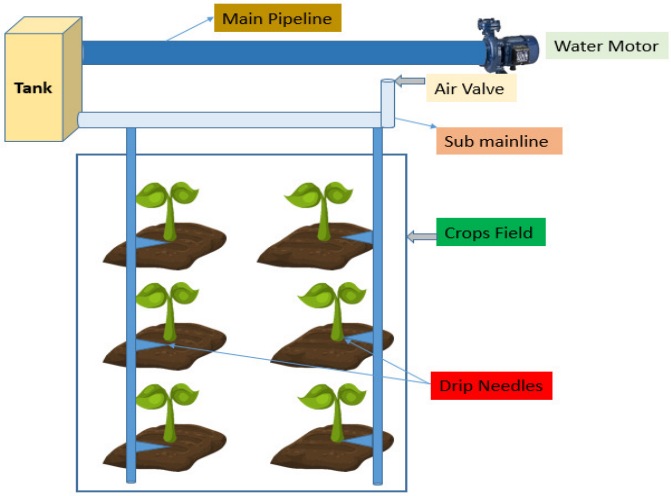

Figure 3. Illustrate The Working Model Of Drip Irrigation System.

3.2.Instruments.

In this hybrid and smart irrigation system author use many components. All the components mention in the Table 1 which is given below.

Table 1. Illustrate the List of Components.

S.no.	Components
1	Arduino
2	Water Pump
3	Moisture sensor
4	Humidity sensor
5	Temperature Gauge
6	Wi-Fi module

3.2.1. Arduino Board.

Arduino is an open-source electronics platform with straightforward hardware and software. Using an Arduino board to capture inputs such as light on a sensor, a finger on a button, or a tweet, you may start a motor, switch on an LED, and publish something online. Your board will be given instructions on what to do by sending a set of commands to its microcontroller. You do this by utilising the Processing-based Arduino Software (IDE) and the Wiring-based Arduino Programming Language. Numerous projects throughout the years, from straightforward household goods to complex scientific apparatus, have employed Arduino as their brain. This open-source platform has drawn a large international following of scholars, enthusiasts, creatives, programmers, and professionals.

3.2.2. Water Pump.

To move a liquid, all pumps rely on fundamental forces of nature. Air is pushed aside as the moving pump component (piston diaphragm, impeller, vane, etc.) starts to move. An area of low pressure (partially created by the passage of air) can be filled with more air or, in the case of water pumps, water. Pump used in proposed smart irrigation system, for pumping the water from the bore well to tank.

3.2.3. *Soil Moisture sensor.*

Soil moisture sensors keep track of the soil's water content to determine how much water is stored in the soil horizon. Soil moisture sensors do not immediately measure water in the soil. Instead, they monitor changes in another aspect of the soil that is known to be related to water content. Soil moisture sensors keep track of the soil's water content to determine how much water is stored in the soil horizon. Soil moisture sensors do not immediately measure water in the soil. Instead, they monitor changes in another aspect of the soil that is known to be related to water content. This sensor used in the proposed system to notify the how many moisture in the soil. Pin specification and image of soil moisture sensor demonstrate in Figure 4.

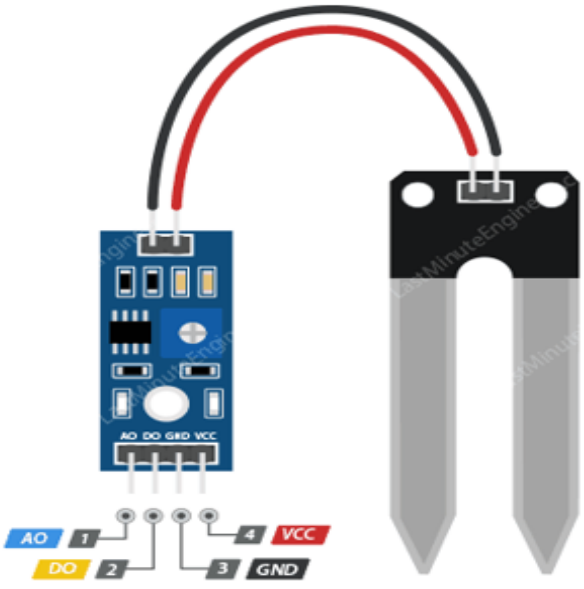

Figure 4. Demonstrate Pin Specifications by Image of Soil Moisture Sensor.

3.2.4. Humidity sensor

In order to function, humidity sensors must be able to detect changes in electrical currents or air temperature. Capacitive, resistive, and thermal humidity sensors are the three most

common types. To determine the air's humidity, all three types will keep an eye on even the smallest alterations in the environment.

3.2.5. Wi-Fi module.

An independent system on chip (SOC) with an integrated transmission control protocol (TCP/IP) protocol stack, the ESP8266 WiFi Module allows any microcontroller to access your WiFi setup. The ESP8266 is adept of unloading all WiFi networking tasks from one more application processor or presenting an application. Wifi module is important in the proposed system for making the connection between the server and the system. Wifi module and all the components connected through the microcontroller. And the working of all modules described by the programming. Programming of each components done on the platform of Arduino IDE in C language.

3.3.Data Collection.

In this paper author propose a hybrid and smart system for irrigation of the crops. Some irrigation model are already existing and also useful for the irrigation. Author Collect the worldwide data of user of drip irrigation system and also data of crops for analyzing that data. By the help of the existing data author analyze how many farmer use the existing model and what types of problem they face. With the rising of trend of technology people need better option for their self. And table no. 2 shows how many country adopt the drip irrigation system and which crops are suitable for it.

Table 2. Data of the Country Who Adopt the Drip Irrigation System Worldwide Sensor.

S.no.	Crops	Percentage	Country	Adaptation percentage
1	Corn	21%	India	11%
2	Cotton	24%	China	15%
3	Tomato	13%	USA	15%
4	Potato	8%	Tunisia	7%
5	Other Crops	34%	Pakistan	3%
6			Saudi Arab	5%
7			Turkey	7%

3.4.Data Analysis.

In present era technology makes our work easy and effort less. People want the technology by which their production will increase. So the farmer use many technology in there agriculture. Irrigation of crops is most important in farming but with traditional way wastage of water is much more. So for overcoming the problem of wastage of water during irrigation several model are presents. And the author also proposed a hybrid and smart irrigation model by

which also the wastage of water is reduced. The analysis of the present data are given below by the help of Figure5 and 6.

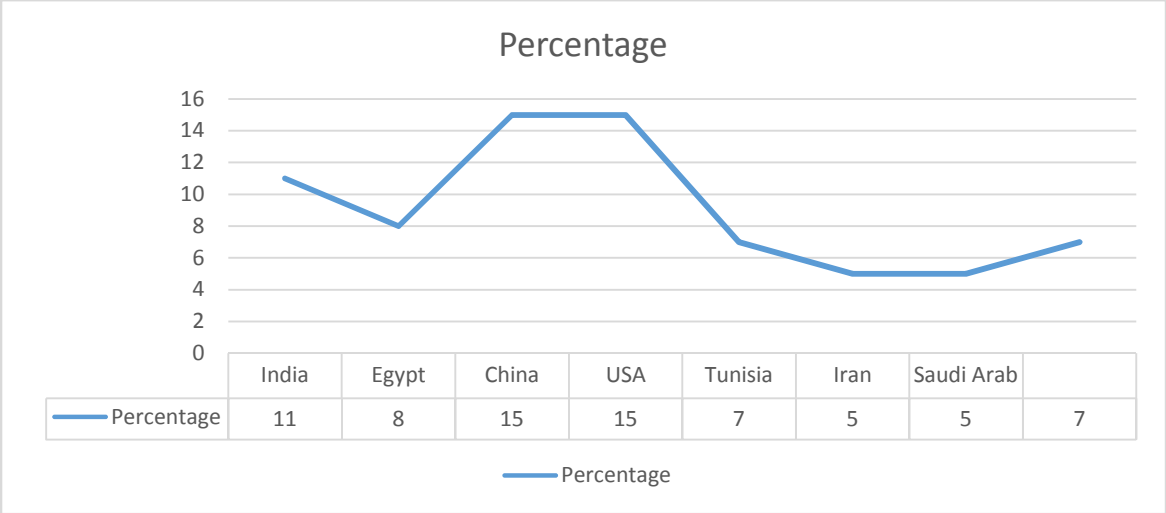

Figure 5. Analysis the Data of Country Who Use the Drip Irrigation System.

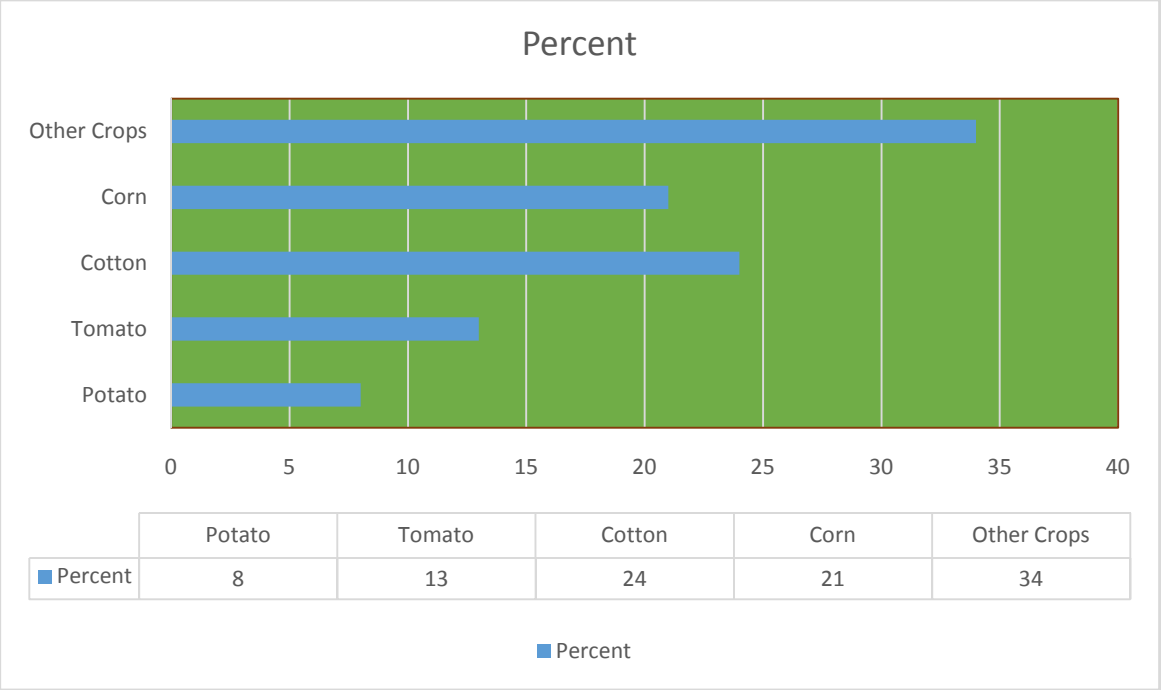

Figure 6. Analysis of the Data of Drip Irrigation of the Following Crops.

4. RESULT AND DISCUSSION

With the completion of implementation of the components, achieve a working module of hybrid and smart irrigation system. By which irrigation of the crops will be done easily and with less amount of water. By the help of the sensor's user monitor all the parameters which is helpful for crop irrigation. With the help of soil moisture sensor user monitor moisture of soil and by the temperature gauge monitor the temperature of the soil. After the installing system by the use of temperature gauge user monitor the temperature of soil which is given in figure 7.

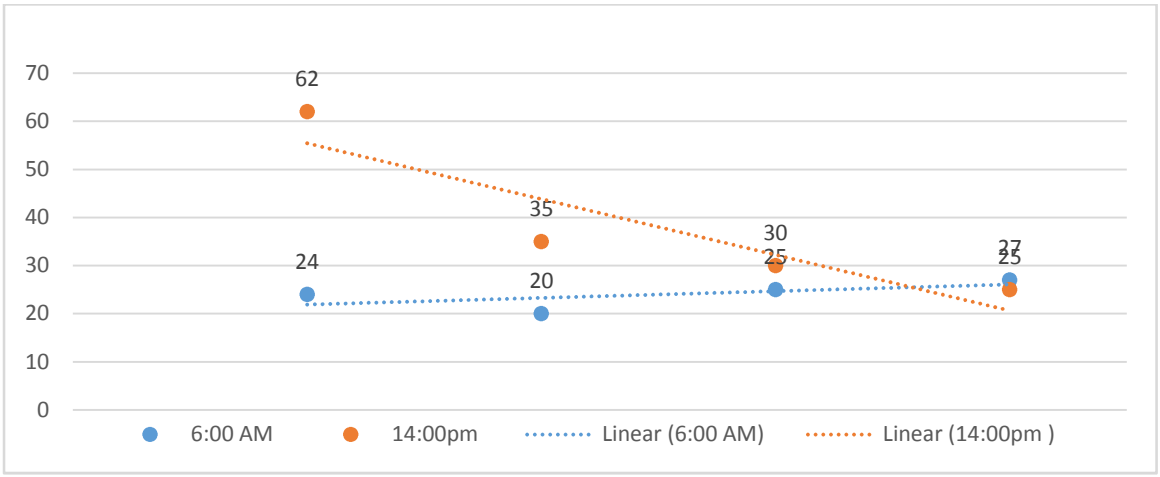

Figure 7. Demonstrate the Temperature of Soil Without Irrigation.

5. CONCLUSSION

Resources in recent decades, an intelligent, smart, and fully automatic farming system was both necessary and highly required. In response to the ongoing problem of water loss, an Internet of Things-based intelligent irrigation system has been developed for this purpose. There are two specifics to this agricultural sector. There are three types of plastic pipes used for farming: low, high, and walk-in. Due to its larger dimensions, the high pipes is more practical to seed, spray, and harvest in than the low and walk-in tunnels. The flow of the working is, firstly the sensors monitor the field data and sent it to the microcontroller then microcontroller upload on the server by the help of Wi-Fi. This smart system needs a mobile application for tracking the crops and system both from anywhere. So by the mobile application it farmer track the system and the data of the crop. And also operate smart irrigation system by the help of mobile phones or laptop. Water plays major roles in every one's life, for overcoming of wastage of water during the irrigation of crops, author proposed a smart system. Which is also capable to overcoming the water wastage during irrigation. With the advance sensors and upcoming technology, the betterment of the system is possible.

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CHAPTER 10

ENHANCED MODEL OF SMART PARKING SYSTEM USING RADIO FREQUENCY IDENTIFICATION (RFID) AND WI-FI MODULE

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ABSTRACT:Due to the rapid urbanization that resulted in greater growth rates for the urban economy, income, and living standards of residents in addition to the rapid population expansion, the number of people who own their own private vehicles has been steadily increasing. And due to increase of the vehicles people facing the parking problem for overcoming this problem there are many smart parking services are available. But the author enhanced the existing model by the using some other modules and for different algorithm. Author also mentions the existing problem and the existing approaches. With this model offer the facility smart phone applications and the websites. With the help of this facility user easily track the parking and fetch the information regarding the parking occupancy from anywhere. Also book the parking space and book time slots for the parking. In the application so many facilities offer for the user. This system has three layer one is hardware model layer second is server layer and last is the application or user layer. With the rising of technology and by the adding of camera modules also add the safety modules and enhance the model further there are many future scopes for the further research.

KEYWORD: ***Internet, Information, Parking, Traffic, Vehicles***.

1. INTRODUCTION

The traffic control and management systems predominate as a result of improvements made to the Internet of Things (IoT) in many facets of human life. And for that, a number of clever solutions are put in place.to control the crowded, heavy traffic in cities. Typically, a long time ago, human migration was rapidly expanding towards large cities, practically everywhere. The planet, therefore traffic problems are likewise getting worse. Additionally, and more particularly in circumstances of finding the spaces for parking [1]. Finding a parking spot stands out in particular. A location in a congested city with accessible parking lots Automobile owners have faced a significant problem [2]. The methods used most recently to locate car parking lots are manual; as a result, the instance of locating parking spaces in the It is difficult to navigate a major metropolis with a dense traffic flow. Some Computerized methods were utilized in parking lots to maintain the inspections [3]. On vehicles entering and exiting parking spaces and monitoring systems are primarily made possible by the surveillance apparatus (e.g., CCTV) [4]. Nevertheless, it hinges on the individual; with any luck, he or she might locate the parking arriving at the parking location, therefore this is quite important. Obvious that finding things takes the most of the time. Parking spot, if one is available [5].

In most circumstances, the vehicle's Holder at all times finds the parking spot far from where they're going, thus this is not. Both in the Czech Republic and other nations, the number of automobiles is steadily rising [6]. The Central Auto-moto Club of the Czech Republic reports that there is other than 5.50 million listed automobiles in the country. Which indicates a 2.4-fold rise in their population since 1989. Difficulties are growing as the number of automobiles increases. Alongside the parking also emerge [7]. Prior to anything else, these

issues frequently arise at sporting and cultural events, moreover, near administrative structures, or banks. During rush hour, parking is available in towns and cities times also presents a serious issue. A lack of information lack available parking places may cause drivers to parking lots that are fully occupied, which ultimately results in [8]. This article's goal is to suggest a sophisticated 'smart parking lot system' built on the small personal computer (PC) platform, coupled with a prototype installation that would address the aforementioned issue. This objective is to utilize mesh networks and the most recent IoT concepts. Features provided by the Android OS as the complete remedy to be reasonably priced and easily deployable [9]. The smart city project, where cutting-edge technology like the Internet of Things has been widely implemented in, also includes the smart parking system. Providing the services that users need will make their lives more convenient across many sectors. Through its utilization, Thereby, users or motorists can locate a parking lot in any location. Of the city and shall hold the empty parking space in accordance giving to their preferences, employing Internet connectivity, of mobile modules or/and electronic approachable gadgets [10]. It's possible that parking fees are paid with debit or credit cards at the same parking space with automated payment systems. Utilizing the Internet, clever online parking the user should precisely follow any applications or parking systems obtain all the information that is available [11]. In the proposed system author propose a RFID based project which is also provide a mobile application facility in the smart parking system [12]. So also WIFI module attached for provide the internet connectivity to the parking model [13]. The application of RFID module is demonstrated in Figure 1.

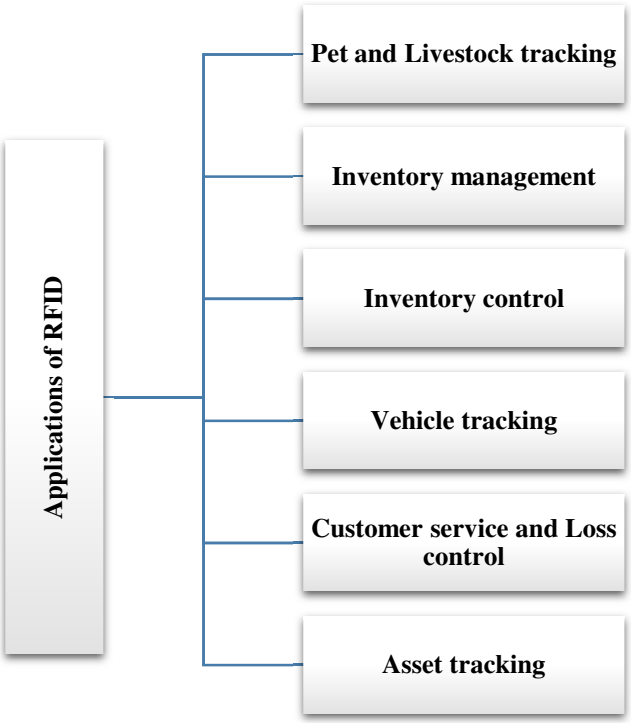

Figure 1. Demonstrate the Application of the RFID Module.

2. LITERATURE REVIEW

Vladimir Sobeslav and Josef Horalek discussed in their paper about the vehicles parking problem and solution. Car parking is a significant issue in town areas, both in established and rising nations. The problem is primarily in the urban center and adjacent roads. Local consultants must respond with restrictions, and the existing situation is uncomfortable for many inhabitants. So, they decided to give approach of smart vehicles parking system. They

use the IQRF communication module platform and some other sensors. The suggested solution makes use of current IoT methodologies and knowledge such micro-PC platforms, IQRF and sensors. It is a solution that is affordable and has the possibility for extension and integration by further IoT facilities as equated to a dedicated and pricey system [14].

Aamir Shahzad et al. discussed in this paper about the smart parking system for the vehicles. On the study of this paper,this education employs an innate approach to create a accessible 'smart vehicle parking system' (SVPS), an intelligent system capable of controlling the enormous mass of automobiles throughout space searching and performing well tasks for parking booking and organization, with the use of shorter-path processing techniques points are common, helping people obtain parking data quickly and opportunely. This study used a mapping technique that included system parking for that purpose. In this paper author use RFID sensor with different other modules.To save the real-time data from the mounted and organized sensor maneuvers in the 'RFID-WSN network', an integrated network architecture called RF-WSN (radio frequency identification and wireless sensors network) is used [15].

ShangbinNing et al. discussed in their paper,most traffic jams, accidents, and pollution in cities are caused by individuals driving carelessly in quest of parking spaces, which has a detrimental effect on people's quality of life. It is practicable to solve parking issues if parking allocation is the main issue by using space managing based on an online intelligent parking system. However, current research has struggled to simultaneously fulfil allocation effect and speed. When addressing the problem of large-scale dynamic parking allocation. We initially create an online "Collection Allocation-Response" smart parking system (CARSP) to provide parking services to customers and rental parking spaces from vendors in order to solve this problem. To generate income for system administrators. Then, we suggest a brand-new allocation strategy called 'Doubly Periodic Rolling Horizon' (DPRH) that carry out reallocation and allocation in a circular manner over long periods of time.

In the above papers, authors working for overcoming the problem of vehicle parking. And introduced so much new technology for vehicle parking which is called small parking system. And from the above-mentioned paper author takes idea and concept of the new system.

Research Question:

- What is RFID concept?
- Which technology use in the smart parking model?
- Why smart parking system is important?

3. METHODOLOGY

3.1.Design and Sample

The suggested parking system's objective is to create a sophisticated and cost-effective method for finding open spots in an outside parking lot. It is created on a small PC. The primary objective of this study is to develop a completely automatic 'smart vehicle parking system' (SVPS) that should suggestively minimize the personnel typically needed in present straight parking schemes and utilize an effective method of using radio frequency identification Network of wireless sensors using (RFID) technology. In this proposed model also use the infrared sensor in parking place for indicates the occupancy of the place. Design of the system based on the microcontroller all the modules are connected through the microcontroller, RFID use for the gate entry and infrared UDE to show the occupancy of the parking space, wifi module use to give internet connectivity to the smart parking system. On the gate of parking attached one display for give the information about the parking space. For

security we use servo motor on the gate and RFID senor both and both are attached with the microcontroller. When the user scan RFID card on the RFID sensor, if the card is valid then gate of parking space open. For giving online booking service or online availability checking, also designing an application. Working flow of the system demonstrate by the Figure 2.

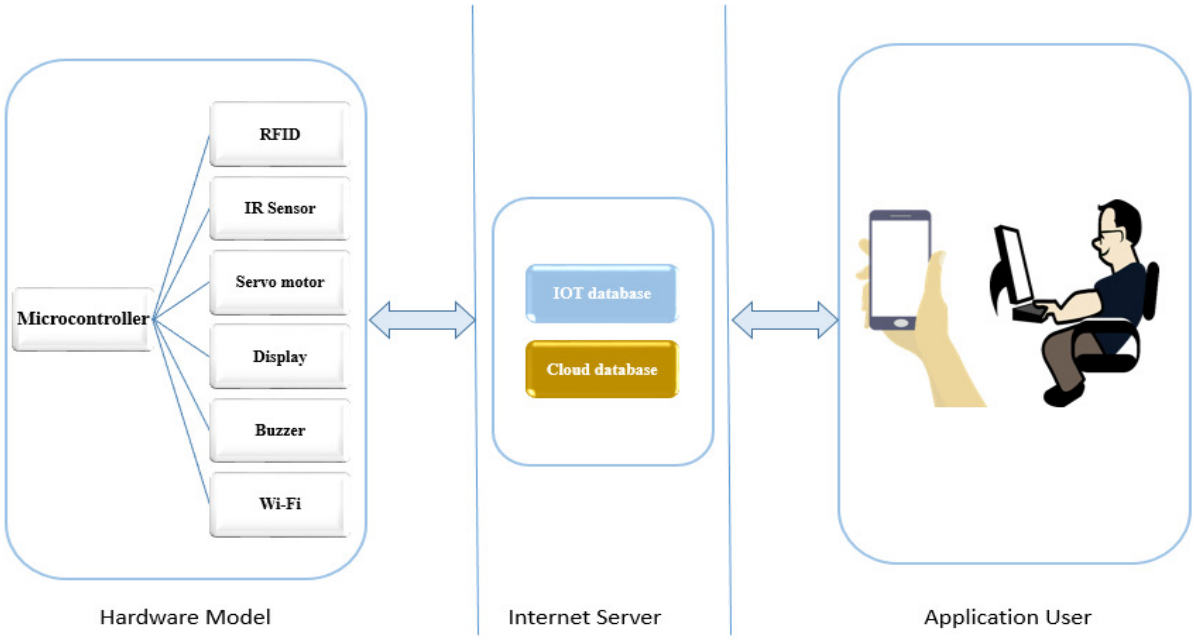

Figure 2. Demonstrate the Flow of Working of Smart Parking System Online.

This figure shows the how user fetch the information about the parking space online by the use of smartphones and laptop. This figure shows the hardware model connect with the server, that means all the data of hardware module are stored on the online internet server and also store the real time data which obtain from the sensors of the hardware at the real time. By which the application user fetching the real time data from the server. The block diagram of hardware model demonstrates by the Figure 3.

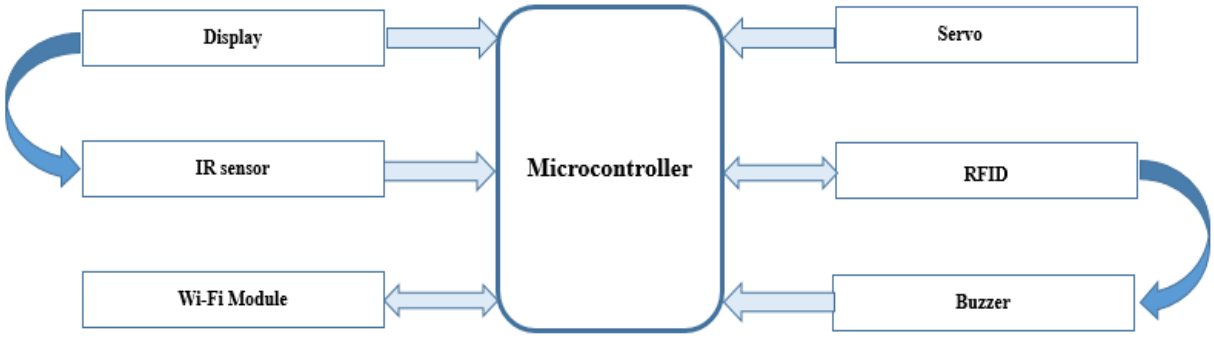

Figure 3. Demonstrate the Block Diagram of Hardware Model of Smart Parking System.

3.2.Instrument.

Under this proposed model author use numbers of module. Which is classified bellow in the Figure 4, mention all the modules.

3.2.1. Microcontroller.

A microcontroller is a tiny integrated circuit that manages only one process in an embedded system. A typical microcontroller has a CPU, memory, and input/output (I/O) peripherals on a single chip. Microcontrollers, often referred to as embedded controllers or microcontroller units (MCU), are used in a wide range of products, such as robotics, office supplies, medical equipment, and vending machines.

3.2.2. RFID.

A small radio transponder, a radio transmitter and a radio receiver create up an RFID structure. The tag conveys 'digital information's', often a register number used to identify the item, back to the reader when it receives an electromagnetic examination pulse from a close RFID reader module. The inventory of products can be tracked using this number.

3.2.3. IR sensor.

An infrared (IR) sensor is a type of electrical gadget that keeps track of and recognizes ambient infrared radiation. In 1800, astronomer William Herchel made the unintended finding of infrared radiation. As he measured the temperatures of each colour of light, he saw that the temperature was highest just elsewhere the red light ('separated by a prism'). The wavelength of infrared radiation is longer than that of visible light, making it invisible to the people eye. Everything that emits heat releases infrared radiation (i.e., everything with a temperature higher than about five degrees Kelvin).

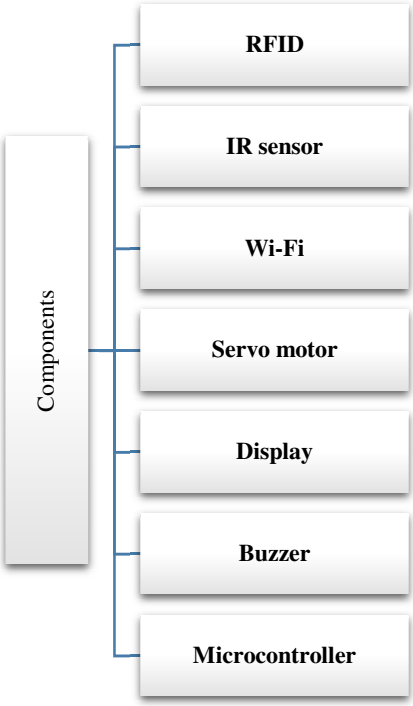

Figure 4. Illustrate all the Components which is Used for Making Smart Parking Model.

3.2.4. Buzzer.

The magnetic field pulls the vibrating disc toward the pole in a magnetic buzzer. The disc vibrates at a frequency like to the determination signal when a wavering signal is delivered through the coil, creating a shifting magnetic field. It is used in the proposed model to notify about the RFID card validity. If RFID card is valid then no buzzer blowing, if the RFID card is invalid then the buzzer blowing long time which is specified by the coding.

3.2.5. Display.

In a liquid crystal display, liquid crystal material is sandwiched between two sheets of glass (LCD). Without any applied voltage between the clear electrodes, the molecules of the liquid crystal are parallel to the glass surface. When power is applied, they veer off course and turn vertically toward the glass surface. They have various optical properties depending on their orientation. Therefore, the degree of light transmission can be changed by combining the motion of liquid crystal molecules with the polarization of two polarizing plates attached to the both outer corners of the glass sheets. LCDs use these characteristics to display images.

3.2.6. Servo motor.

A rotary actuator called a servo motor offers precise angular position control. It consists of a motor and a position feedback sensor that are coupled. The system requires a servo drive to be finished. The drive uses the feedback sensor to precisely control where the motor rotates. Servo motor use in the proposed system as a control unit of barrier because the barrier bar implemented on the servo motor.

3.3.Data collection.

Vehicles parking is one of the primary challenges for transportation and traffic management around the world due to the rising amount of private vehicles usage in metropolitan zones as a outcome of the rapidly expanding economy, negligent regulations, and subsidies. Parking is becoming a barrier to the operation of through traffic, as seen by the synchronization between parking policies and traffic management. Additionally, it is in charge of the ineffective use of resources available, even when policy decisions are made on an as-needed basis. Therefore, it is important to comprehend parking choice behavior and actual parking space demand. Numerous studies have been conducted over the past three decades to assess parking characteristics, gauge parking demand, and examine motorist behavior. Table 1 demonstrate the data of rising condition of vehicles from 2001 to 2015.

Table 1. Demonstrate The Rapidly Increasing Vehicles Data in India from 2001 To 2015.

S. No.	Year	Numbers of vehicles (10^6)
1	2000	55.0
2	2002	57.0
3	2004	70.0
4	2006	99.0
5	2008	130.0
6	2010	160.0
7	2012	175.0
8	2015	210.0

3.4. Data Analysis.

The data of vehicles rising in India is massive, like from the year of 2000 to 2015 the rapidly increasing the number of vehicles in India. In the year of 2000 there are 55*10^6 vehicles recorded in India after six year the rate of register vehicles are crossing the figure of

100*10^6 and in the year of 2015, it crosses the limit of 200*10^6. The analysis of following given graph illustrate by the Figure 5.

4. RESULT AND DISCUSSION

At the time of parking the need the access card for the entry which is based on the RFID technology. Therefore, by the card the aut5hentication process occurs and then if the card is valid then the gate will open for the parking otherwise it remains close. After the implementation of the whole module in right format through the microcontroller then the desired output achieved. After the implementation of hardware module interfacing process start for the online service. After that the user fetch the information about the parking easily from the internet. The smart vehicles parking system offer websites and application of the smart model. The project seeks to provide a completely protected security system that would meet all needs for security against potential enemies while connecting through internet interaction and system management. Comprehensive review based on different sources shown in figure 6.

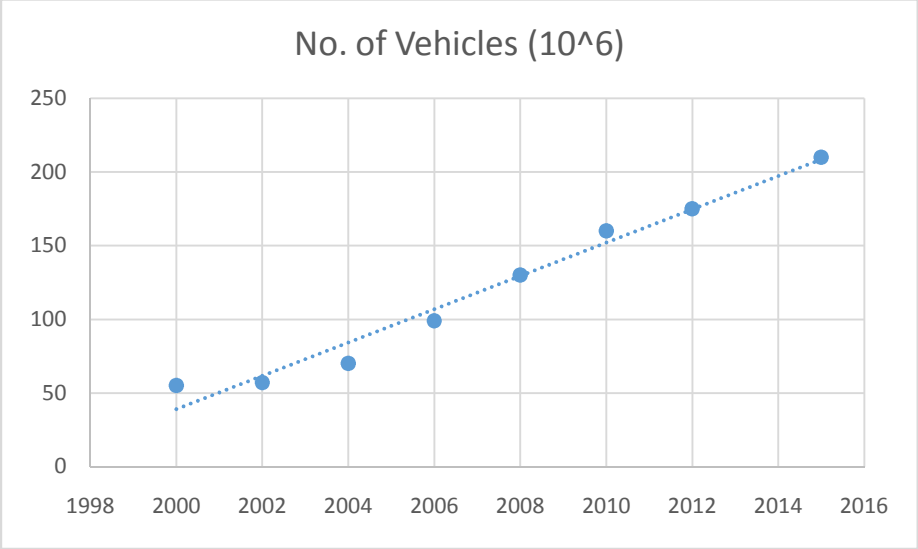

Figure 5. Analysis of the Given Rising Data of Vehicles in India from 2000 to 2015.

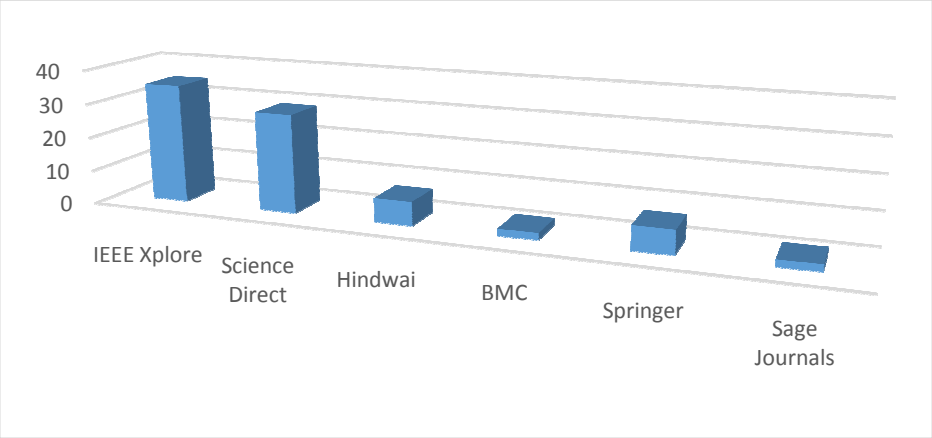

Figure 6. Comprehensive Review on the Smart Parking System Based on Different Sources.

5. CONCLUSION

In most circumstances, the vehicle's Owner always finds the parking spot far from where they're going, thus this is not. Both in the Czech Republic and other nations, the number of automobiles is steadily rising. The Central Auto-Moto Club of the Czech Republic reports that there are more than 5.5 million registered vehicles in the country. Which indicates a 2.4-fold rise in their population since 1989. Difficulties are growing as the number of automobiles increases. The primary objective of this study is to develop a completely automated smart vehicle parking system (SVPS) that should significantly minimize the personnel typically needed in present conventional parking systems and utilize an effective method of using radio frequency identification Network of wireless sensors using (RFID) technology. In this proposed model also use the infrared sensor in parking place for indicates the occupancy of the place. Design of the system based on the microcontroller all the modules are connected through the microcontroller, RFID use for the gate entry and infrared due to show the occupancy of the parking space, wi-fi module use to give internet connectivity to the smart parking system. With the rising of technology and by the adding of camera modules also add the safety modules and enhance the model further there are many future scopes for the further research.

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CHAPTER 11

ENHANCED MODEL OF SMART HOMES AUTOMATION SYSTEM WITH IMPLEMENTATION OF SAFETY AND SECURITY FEATURES USING ARDUINO

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ABSTRACT: ***In the present era, the technology playing major roles in all sectors. The automation is a term which is also much popular in the present scenario. Automation is demand of people in every sector, so Internet of Things (IoT) also in trending. Our lives are much easier now that we have remote controls for our televisions and other technological devices. There is already present a model which is based on the microprocessor and for the safety using Block chain technology. By the help of internet of things concept built any smart system and also implementing over anything. In this paper, proposed a smart system which is based on the Arduino and for security of network use the concept of the cryptography. Cryptography enhances the security of the data and also not allowed the external for access the data and manipulating the data of user. This system also called as an improvised model of the existing system. There are many opportunities to making the career because it is the time of automation and in this field the scope of automation increase with increasing technology and smart sensors.***

KEYWORDS:*Automation, Data, Devices,Internet,Smart Homes Automation.*

1. INTRODUCTION

A smart city is a trend-setting resolution for the future that gathers data using a variety of electronic Internet of Things (IoT) sensors [1]. The information is then used to improve processes during the town by providing insights that may be used to manage resources, services, and assets effectively. In order to monitor and manage traffic and transportation systems, power plants, utilities, water supply networks, garbage, criminal detection, information systems, universities, libraries, hospitals, and other community services, data from residents, devices, buildings, and assets is gathered [2].The IoT revolves on data, but in order for it to be widely accepted, the safety and confidentiality of that information must be maintained [3]. At this time, there is a demand thing. The term "Internet of things" refers to peculiarly recognizable objects and their simulated demonstration in Internet in this day and age [4]. Everyone leads a very busy life and seeks ease in all areas of their lives [5]. 'The Internet of Things' (IoT) is a fairly broad field, hence this study Cover everything up so it can be automated [6]. But, the simplicity people the first area that springs to mind is home automation. A thought the term "home automation" is used to describe how each home appliance operates collectively, and using an internet-connected tablet, Android smartphone or PC, we are in control of the situation. Connectivity [7]. In recent years, home automation has become increasingly popular [8]. Folks favor the convenience of remotely accessing appliances from anywhere in the world to maintain and change their state [9].

Our lives are much easier now that we have remote controls for our televisions and other technological devices. Have you ever considered home automation, which would allow you to use a remote control to operate fans, tube lights, and other electrical items in your house remotely operated Of course, author agree! But are the alternatives reasonably priced? If the response is No, we have already come up with a fix [3]. We have developed a novel Arduino-

based system. Using Bluetooth to automate your home [10]. This technology is incredibly economical and can provide the customer with the to be able to use any electrical equipment without having to purchase a remote control [9]. This undertaking enables the user to use their smartphone to control all of their electronic devices. Time is an extremely valuable resource [11].

In order to ensure that home automation functions normally, it is vital to examine all significant factors that could make the system more complex, one of which is a lack of a GUI environment for the customers Users are unable to comprehend how the system operates since there is no GUI environment [11][12]. Furthermore, there is no damaging device restoration for household appliances. In this proposed system author implement all the appliances and sensors through the Arduino [12]. In this model Arduino consider as the main unit and it control all the unit regarding user instructions. The proposed model has three phase which is hardware module which is connected through the server, which is internet server, and at last the application which is interfacing with the hardware and the internet server [13]. Application is designed for the use of user by which the user handle the appliance accordingly [14]. The application of the Smart home automation are illustrate below in Figure 1.

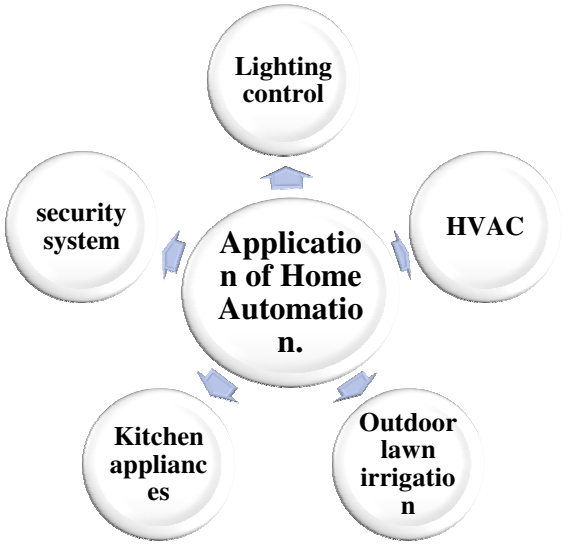

Figure 1. Illustrate the Application of Home Automation.

2. LITERATURE REVIEW

Rizwan Majeed et al. In this paper the author discussed about the home automation with some safety and security features.In recent years, the definition of a smart home has become more widespread. The biggest obstacles to a smart home include intelligent decision-making, secure IoT device identification and authentication, constant connectivity, data security issues, and privacy concerns. The existing solutions only deal with one or two of these issues, but a smart home automation system that is secure and has keen judgment and analytical abilities can also be used as necessary. In this essay, we offer a fresh concept for a clever a house that employs block chain technology and the Provision Vector Machine learning algorithm for smart decision-making technology to guarantee the IoT devices' identity and authentication. New block chain technology is essential for supplying a security for the system [7].

Heetae Yang et al. in this paper author discussed about the adaptation of Internet of things under the home automation. The term "smart" has been used in a variety of contexts to refer to intelligence. One of the leading IoT-era developing technologies, smart home services have transformed household appliances into more intelligent, remote-controllable, and networked devices. However, a smart home service's intelligence and controllability are incompatible. Ideas, under specific characteristics. Additionally, users' desired level of cleverness or controllability in a smart home facility varies depending on the user. Given the variety of prospective customers for smart home services in recent years, giving the spread of the service depends on the inclusion of the right features and functions. The smart home service is examined in this study [8].

Ruili Zheng discussed in their paper about the smart home automation system and wireless based positioning system. The most fundamental housing issues have been resolved by modern home furnishings, but people's rising attention has shifted to how to make homes more technologically advanced and modern. The smart level of modern domestic life and way of life is certain to be the trend of future progress given the rapid advancement of information technology. This essay investigates a clever a wireless sensor network-based home control system that can detect the environment of the home through the Real-time data can be obtained by autonomously controlling typical electrical appliances using the sensor unit and the control unit. Monitoring and alarming capabilities. It contains a arranging module, a communication module, and a server, specifically: The communication module connects the positioning module to the server, and the positioning module is used.

3. METHODOLOGY

3.1.Design and Sample.

The intelligent home system described in this paper allows users to observe and alter the operational state of sensing devices home equipment. Devices includes things like standard heating, ventilation, and lighting. Additionally electrical air conditioning apparatus. Does the product include energy-saving options in addition to reducing waiting times? This shows you which appliances in the house use the most energy. Hotels and office properties can also use energy-saving systems, and they are an affordable option. Easy GUI interface with icon-based notifications Even if you're miles away from home, an app lets you communicate with it are travelling far from home

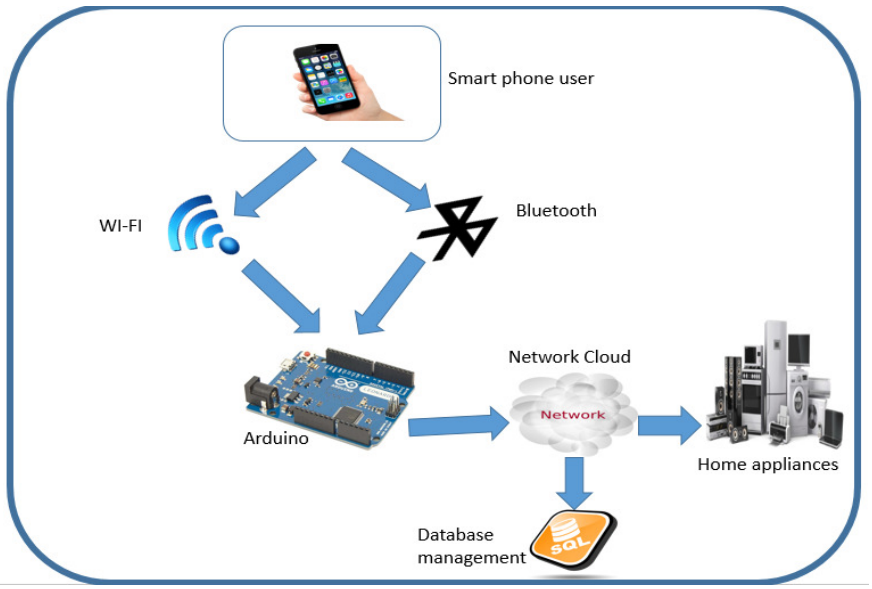

Figure 2: Illustrate the Flow of Working of the Smart Home Automation Model.

For the designing of the system, need some sensors and the home appliances. In this proposed system author use Arduino as a main unit of the system through which all the module are connected. For the designing of the system need smoke sensor Light Dependent Resistor (LDR), voice recognition module, Radio Frequency Identification (RFID), and home appliances and so on. Firstly, we connect a sensor with the microcontroller and interfacing all the components with the microcontroller and by the coding of the components specifies the working of components. Which is according to the user, the coding of the sensors and the components are done on the platform of Arduino Integrated Development Environment (IDE) using C language. This proposed system has three phase which is application for the user, internet server and the hardware module. When the interfacing done between the all of the phase then the system is ready for use. The flow of working system illustrates in Figure 2 which is given below.

Table 1. Demonstrate The Real Time Temperature of Room Which Is Recorded By The Temperature Sensor.

S.no	TEMPRATURE	TIME
1	28.54	08:00 am
2	28.79	09:00am
3	29.89	10:00am
4	30.74	11:00am
5	32.44	12:00pm
6	33.03	01:00pm
7	33.00	02:00pm

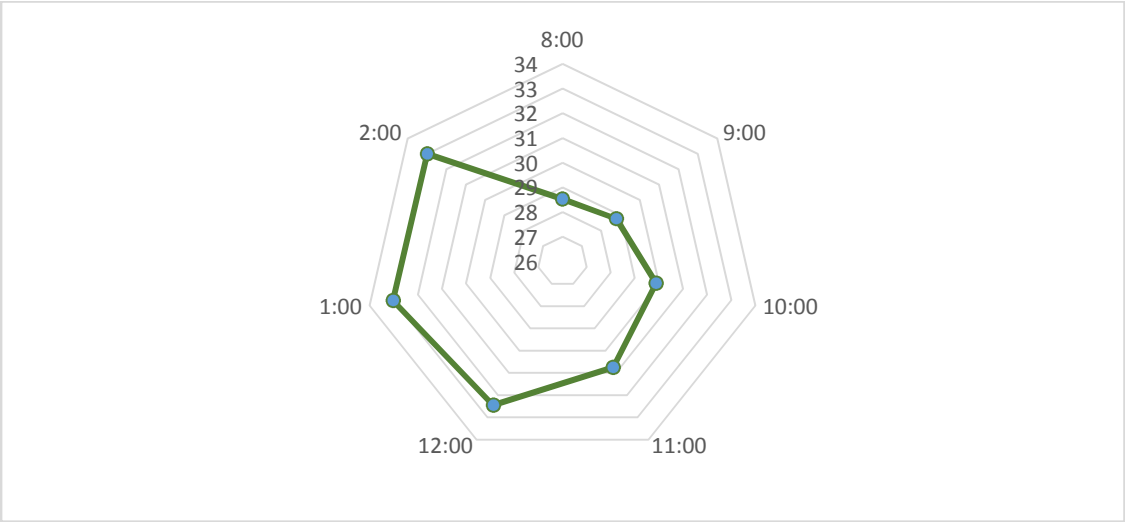

Figure3: Illustrate the Analysis of Real Time Temperature Which Recorded By the Sensors.

Under this proposed system use different components for each, which need to a smart module like dustbin. For making the dustbin smart using Arduino board and servo motor and the ultrasonic sensor. When the use moving toward the dustbin then ultrasonic catch the reflected

sonic wave and send signal to the microcontroller. By the microcontroller servo motor also connected then it takes input from microcontroller and as well as ultrasonic. Then it moving at pre specified range of angle the dustbin is open. So all the smart gadget are connected through the microcontroller and by which all the components data stored in internet database. From where the user perform their task. The hardware module interfaced through the application which is installed in smartphones or laptop by which the user handles all the appliances from anywhere and also take information regarding the appliances power consumption. It provides the all details with single unit and it easy to run (Figure 3).

We all know technology have its own pros. And cons. So, if the real time data of any user updated online, then the chance of hijacking of the data, manipulating of the data is possible. For overcoming of this possibility also using the cryptography concept in the system by which the possibility of data theft, data manipulating are reduced. All the sensors which implemented in the system give real time data like some temperature data recoded which is given below in Table 1.

3.2.Instrument.

Under this smart automation system there are so many components which are used in the system. By which the hardware model ready to work. All the components are classified through the table which is given below in Table 2.

Table 2. Illustrate the Components which is used to Design the Smart Automation System.

S.no.	**Components**
1	Arduino
2	Temperature sensor
3	Smoke sensor
4	LDR
5	Cryptography

3.2.1. Arduino.

The smart home architecture described in this study enables users to see and alter the functional state of detecting devices and household equipment. Things like common heating, ventilation, and lighting are included in gadgets. Further mechanical cooling and electrical assembly. Does the product recall options for expansion that save energy and reduce waiting times? You can see which household appliances use the most energy from this. Energy-saving systems can be used in hotels and commercial buildings, but they're a sensible option.

3.2.2. Temperature sensor

A ‘temperature sensor’ is a device that, typically, measures temperature through an electrical signal using a thermocouple or resistance temperature detector. The most basic type of temperature meter, used to gauge how hot or chilly something is, is a thermometer. In the geotechnical sector, temperature meters are used to track structural changes brought on by seasonal variations in concrete, structures, soil, water, and other materials.

3.2.3. Smoke sensor.

The smoke detector concept dispels the myth that many defenses are overly sensitive. Since mistakes of too miniature defense are frequently more expensive than mistakes of too much defense, the defenses appear over responsive despite being "inexpensive" comparison to the harms they prevent. This sensor use in proposed system to analyze or sense the smoke and send signal to the microcontroller.

3.2.4. LDR.

The activity of an LDR is caused by an optical quirk known as photoconductivity. As more light is absorbed by the substance, its conductivity increases. When light shakes up the neighborhood, the electrons in the object's valence band rush to the conduction band. This sensor used for to glowing bulb automatically from evening. It is directly connected to the microcontroller and work accordingly.

3.2.5. Cryptography.

The study of cryptographic protocols and algorithms within a formal framework is referred to as theory of cryptography. Definitions and evidence of security are the study's two primary objectives. This technique also used in the proposed system to provide the security of the data which is share or stored on the internet database. Without any data security techniques system always having the possibility of the data manipulation or remote hijacking.

3.3.Data collection.

In this system author use numerous of sensors and other components which makes the system smart and capable. All the sensors give real time data to the system which is uploaded on the server for application use. By the help of application user track or fetch every data and handle all the devices, like on or off the devices by the help of mobile application. So by the application user fetch some data which is given below by the Table 3. This is the real time data which is uploaded on the server with each specified time schedule.

Table 3. Illustrate The Real Time Smoke Data Which Is Sense By The Smoke Sensors.

S.no.	Time	Smoke
1	08:00	0
2	09:00	0.5
3	10:00	0
4	11:00	0.8
5	12:00	0.6
6	01:00	0.51
7	02:00	0.58

3.4.Data analysis.

This system is used to make user home smart, it has so many sensors and so many other components are attached through the main unit. The role of main unit play the microcontroller by which all the connection attached and also interfaced. All the sensors provide real time data to the main unit and by the main unit it uploaded on the internet server. By the help of mobile application the real time uploaded data fetched by the user. Real time

data are provided by the temperature sensor and by the smoke sensor above. The analysis of the given data are given below by the Figure 4.

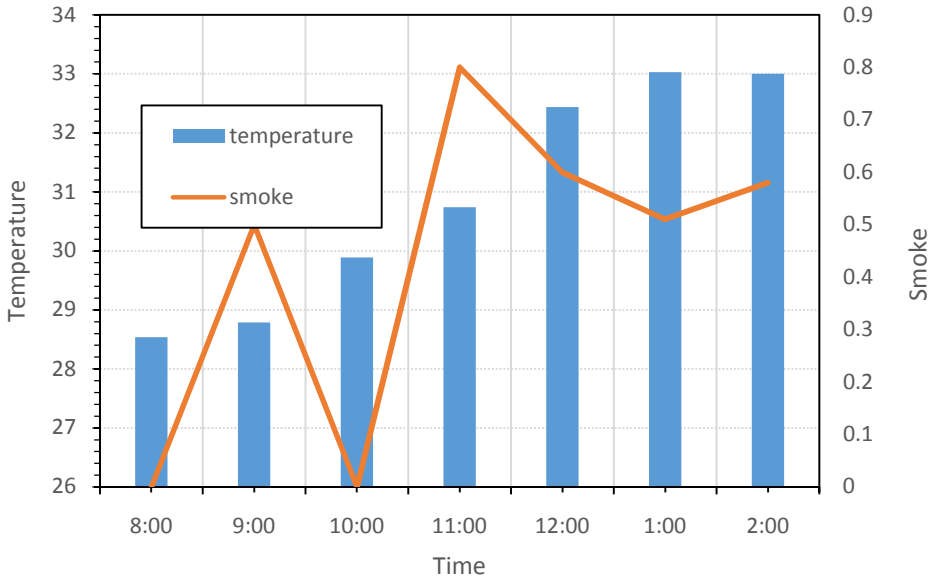

Figure 4. Analysis of the Real Time Uploaded Data of Smoke Sensor and the Temperature Sensor.

4. RESULT AND DISCUSSION

The project's total workflow consists of two ways, as we just explained. The project's functional behavior is assumed in the first scenario. That the user is using each gadget while away from home distantly. This situation presupposes the use of the cloud database of Microsoft Azure. Any demand from the user first registers on the cloud, and in accordance with APIs are called using the user's credentials. In this work for making an application for the system and interface the application with the system by the help of Guide User Interface (GUI). When all the module are attached through the microcontroller then interfacing the components with the microcontroller. After that the hardware model is ready for use after that the hardware model user need a mobile application. For the mobile application use any application developer software for designing the applications. After the designing the application interfacing will done by the using of GUI. Now system is ready for run. The GUI of user home screen are given by the Figure 5 which is given below.

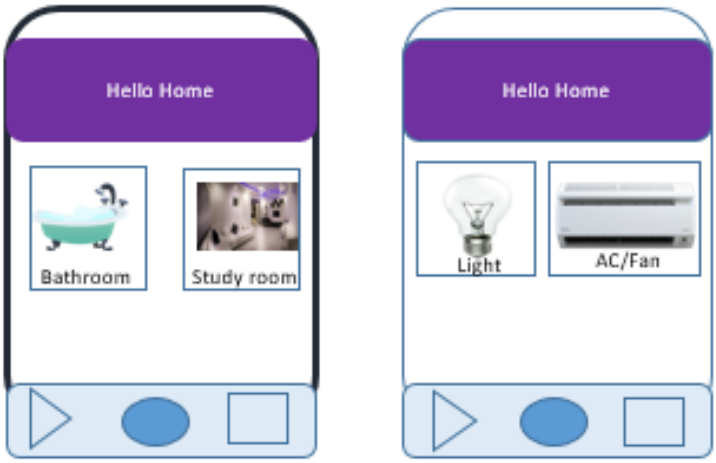

Figure 5.Demonstrate The GUI Interfacing Of The User Home Screen.

5. CONCLUSION

The IoT revolves on data, but in order for it to be widely accepted, the safety and confidentiality of that information must be maintained. At this time, there is a demand thing. The term "Internet of things" refers to peculiarly recognizable objects and their virtual demonstration in cyberspace in this day and age. In order to ensure that home automation functions normally, it is vital to examine all significant factors that could make the system more complex, one of which is a lack of a GUI environment for the customers Users are unable to comprehend how the system operates since there is no GUI environment. Furthermore, there is no damaging device restoration for household appliances. In this proposed system author implement all the appliances and sensors through the Arduino. Author connects all the components and achieve a hardware model by the interfacing between the mobile application and the hardware model achieve smart system or automation. Interfacing between application and the hardware done by the guide user interfacing. For making the mobile application use different platform of software and coding accordingly. There are many opportunities to making the career because it is the time of automation and in this field the scope of automation increase with increasing technology and smart sensors.

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CHAPTER 12

ENHANCED INTELLIGENT IRRIGATION SYSTEM UTILIZING IOT AND MACHINE LEARNING

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ABSTRACT: ***Everyone in the country needs food, hence agriculture is essential to the economy of the country. It's linked to one of the biggest things that ever happened in the country. A country is considered to be rich both financially and socially if it has a sizable farming population. In the majority of countries, agriculture is the principal industry for employment. A large farm frequently needs help with planting when there are many of people there. These large farms may complete and improve their agricultural products by utilizing nearby farming, livestock care, and services.This system's hardware model uses a large number of sensors, along with a camera module and a database of crops. Use of a soil moisture sensor to measure soil moisture makes it evident if a crop needs water or not. The main component of the proposed system, according to the author, is a microprocessor. Using the microprocessor, all the sensors and components were connected. The author uses an open CV camera to observe the crops and has a dataset on the crops. If there is a problem with the crops, the system will send the user a text message and buzzer notification. GSM stands for Global System for Mobile Communication.Due to water, the future potential for smart irrigation is very large. With the new technology, smart irrigation fields have a many of potential.***

KEYWORD:Agriculture, Country, Internet of Things,Sensors, Smart Irrigation.

1. INTRODUCTION

Since agriculture supplies food for everyone in the nation, it is crucial to its economic health [1]. One of the most significant events that occurred in the nation is connected to it [2]. If a nation has a large farming population, it is said to be prosperous both financially and socially [3]. Agribusiness is the primary source of employment in most nations. Whenever there are many of people on a large farm frequently require assistance with planting [4]. These big farms can utilize neighboring resources for farming, livestock care, and facilities to complete and enhance their agricultural goods [5]. With the advancement of human civilization, there have large shifts in agricultural output [6]. Despite this, it is predicted that by 2050, seventy percent of the world's population will reside in cities, up from the current 49 percent. Additionally, the demand for food will increase as earnings do, especially in poor nations. Therefore, these Nations will raise their awareness of the standard of their cuisine also, diet. As a result, customers' preferences could diverge from grains and cereals in the direction of legumes and ultimately meat. Water is a precious yet limited natural resource in agriculture. In a place like India, a significant amount of in use for irrigation is water.

A lot of environmental Temperatures in the air, soil, and humidity all have an impact on crop productivity. The phrase "smart farming" refers to a recognized and superior method of farm management that has gained popularity in modern agriculture. Information and agricultural technology are employed to monitor the wellbeing and output of crops, which also include monitoring the state of the field crops. And more markers. Lastly, the objective of smart farming aims to keep agricultural input costs as low as possible while maintaining the final product's quality [7]. If you utilize a large amount of pesticide or fertilizer applied concurrently, the entire field is considered as a unique entity [8]. Internet of things (IOT) is

most trendy technology in automation and any wireless system, the advantages of the IOT given by the Figure 1.

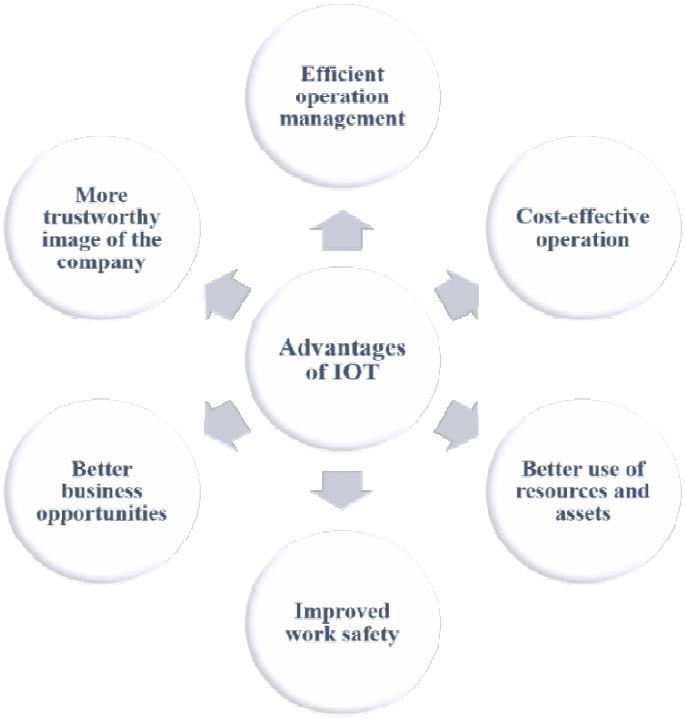

Figure 1: Demonstrate the advantages of the internet of things (IOT).

In India, agriculture is the main source of a livable wage [9]. In several recent decades, a sophisticated, intelligent, and completely automated agricultural system was both necessary and much desired. When our population increased rapidly compared to the natural resources that our nation, India, possesses [10]. For An IoT-based smart irrigation system has been developed for this purpose. Achieved in recent years despite persistent loss threats there are two specifics to the agricultural industry regarding water. There are three types of plastic tunnel farming: low, high, or walk-in tunnels. Sowing, spraying, and harvesting are easy to do in the due to its higher ceilings in high tunnels than that in low & walk-in larger in size. Contrarily, traditional farming is the most unexpected and contributes to the increase in water waste is a problem.Data mining techniques are very advantageous for agricultural occupations. One of these activities is the limiting of association rule usage in agricultural areas [11]. The Internet of 'things has also made it possible for Smart farming is made feasible through a variety of data collection and storage methods. Field parameters for the ideal watering of plants are gathered by current irrigation smart sensor networks systems. Numerous real-world applications, including intelligent farming, intelligent healthcare, clever production and logistics. Within the structure, soil and moisture sensors are used to collect data, and after which they are kept on a central cloud server. The cloud different analytics are carried out employing a server.

2. LITERATURE REVIEW

M. S. Munir et al. [2] discussed in the paper about the Use of Edge Computing and IoT to Create a Smart and Intelligent Irrigation System. Ingenious frugal and cost-effective irrigation techniques have developed to meet the world's population's sweet water needs. The majority of water was wasted owing to ineffective methods of irrigation, therefore water use should be sparing enough to save limited sweet water resources. We used a clever strategy that was capable of utilising ontology. 50 percent of the decision is based on the ontology,

while the remaining 50 percent is based on the sensor values. The final conclusion is derived from the sum of the sensor data as a consequence of a machine learning model (KNN). Additionally, an edge server is added between both the main IoT servers and the GSM module. this strategy integrates Internet of Things with a network of sensors to innovatively track all the data, evaluate the data at the network edge, and communicate just some specific data to the main IoT server. Core IoT server to forecast the amount of water needed for a field of agriculture, and use an Android device to display the results edge of application.

Wei Li et al. discussed in their paper about Review of Remote Sensing and Internet of Things-Based Sensor Networks for Irrigation. The developing world, where agriculture and climatic factors dominate the economy, served as the inspiration for this review study. Making the proper operational decision at the right time is essential for production farming profitability based on the circumstances at hand and past performance. A methodical strategy used in precision farming is intended to increase productivity. By carefully adjusting the agricultural soil care to fulfil the unique requirements in each area while keeping the benefits of agriculture environmental quality. This review paper discusses the creation of a portable wireless automatic irrigation system. The environmental factors in an agricultural area can be remotely measured using sensor networks and decision - making support techniques. Radio the ecological parameters such as are captured via satellite, mobile phones, sensors, internet-based connectivity, and microcontrollers. Temperature, humidity, and soil moisture.

A. Raghuvanshi et al. discussed about the Internet - of - things Smart Irrigation in Smart Farming: Attack Detection Using Machine Learning for Risk Mitigation. Fresh water scarcity is a serious issue for the entire planet, and it will only become worse. In the coming years to continue to deteriorate. Due to the aforementioned difficulties, precision farming and smart irrigation are the only workable answers. Smart irrigation and precision driving have only become possible with the rise of the Internet of Things and machine learning. Agricultural production becomes profitable. The Internet of things has many advantages, including improved productivity, reduced costs, energy maximization, forecasting, and convenience for the general public (IoT). Security risks grow as systems and data processes become more diversified. The development of the Internet of Things is being hampered by worries about security and privacy. This article creates a methodology for identifying and categorizing intrusions into agricultural IoT networks. Privacy and safety are fundamental issues in all Internet of Things (IoT) applications, not only those relating to agriculture. That is The NSL KDD data set is utilized as an input data set for the framework. In the NSL-KDD data set's preprocessing, all symbolic features are transformed into numerical features. Principal component analysis is utilized for feature extraction, and support vector machines, linear regression, and regression trees are employed for categorizing the preprocessed data set. Comparison of machine learning algorithms' performance are assessed based on their accuracy, precision, and recall criteria

3. METHODOLOGY

3.1.Design:

The predicted irrigation system is built with the potential to water plants intelligently by taking into account aspects like crop type, soil type, climate, temperature, humidity, and wetness of the soil.The decision for a specific plant kind, climatic type, and soil type is questioned using ontology, although other variables like temperature, humidity, and soil are still taken into consideration. The sensor network detects dampness. Final judgement50% of whether to water plants or not depends on the ontology result. Based on our trained machine learning (Support vector machine), and the remaining 50% model. Instead of the standard IoT design's three layers (application layer, network layer, and perception layer), our proposed

IoT architecture comprises four layers: application layer, processing layer, transport layer, and perception layer.The physical layer is also known as the perception layer. Indicating that it has sensors for gathering data. It detects temperature, soil moisture content, and air humidity. Sensing data that has been previously gathered and transferred to the processing layer through networks like LAN, 2G, 3G, and wireless technologies. As processing layer stores, examines and analyses enormous amounts of data from stratum of transit. It makes use of technology like databases, Edge computing and cloud computing. The flow diagram of the proposed model given by the Figure 2.

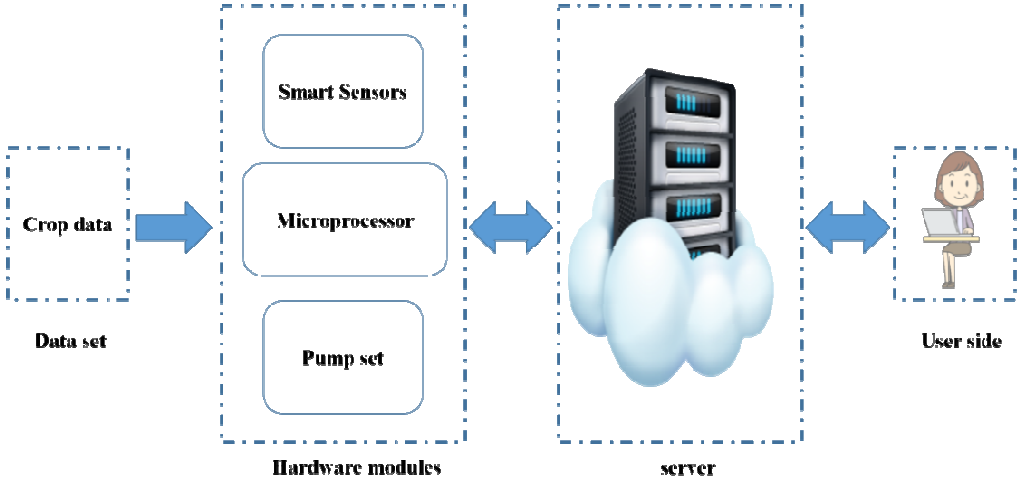

Figure 2: demonstrate the block diagram of proposed system.

In this proposed system there so many sensors used in hardware model and also used camera module with the database of crops. Used soil moisture sensor to detect the moisture in the soil by this it clear crop need water or not. In the proposed system author used microprocessor as the main unit of the system. And connected all the sensors and component through the microprocessor. Author uses open CV camera for the monitoring the crops ant it also has some dataset of crops. If crops having any problem, then the system will be sending a notification by the buzzer and the Global System for mobile communication (GSM) service text message to the user. Proposed system also having the capability of temperature sensing and humidity sensing by the help of humidity sensor and temperature sensor. The block diagram of the hardware model given by the Figure 3.

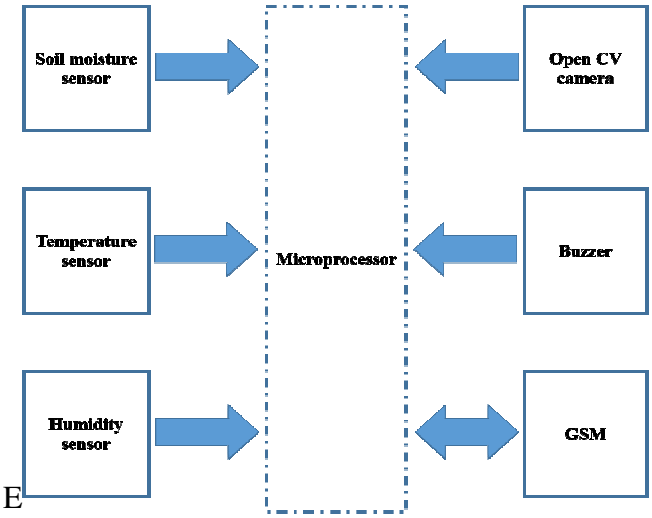

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Figure 3: Illustrate the block diagram of the hardware model.

3.1.1. Microprocessor:

A microprocessor is a form of computer processors where the logic and control for data processing are housed on a single circuit board or a few interconnected integrated circuits. The hardware needed to carry out the operations of an operating system is included within the microprocessor. It is used in the proposed system as a main unit of the system.

3.1.2. Soil moisture sensor:

The volumetric water content of the soil is measured by soil moisture sensors. Soil moisture sensors moisture sensors measure the volumetric indirectly by using another characteristic of the soil, such as electrical resistance, dissipation factor, or interaction with neutrons, as a stand-in for the moisture content. This is done because the direct gravimetric measurement of free moisture in the soil requires removing, washing, and weighing of a sample.

3.1.3. Temperature sensor:

The relative humidity (RH) of the air is sensed, measured, and reported by a humidity sensor, which also establishes how much water vapor is present in a gas mixture (air) or a pure gas. Water absorption and desorption are related to humidity sensing. Both industrial and agricultural goods are monitored using humidity sensors. Equipment like incubators, sterilizer's, and pharmaceutical manufacturing equipment all require humidity sensors.

3.1.4. Open CV camera:

A library of software program with a focus on real-time computer vision is called Open CV (Open CV Library). It was first created by Intel and afterwards sponsored by Willow Garage and Itseez (which was later acquired by Intel). The Apache 2 License for Open-Source Software makes the library cross-platform and freely usable. Open CV now offers graphics processing unit (GPU) for real-time activities as of 2011.

3.1.5. GSM:

The European Telecommunication Standards Institute (ETSI) created the Global System Communication (GSM) standard to define the protocols for 2nd (2G) digital mobile networks used by portable devices such smartphones and tablets. In Finland, it was initially used in December 1991. By the middle of the 2010s, it had over 90% of the market share and was used in over 193 nations and territories, making it the industry standard for mobile communications.

3.2.Instruments:

For the automation of the proposed system author use machine learning concept for 50% and for 50% used IOT concept. For the programing of hardware module author used python programming language. The support vector machine (SVM) library that comes with built-in classes for various SVM algorithms is part of Scikit-Learn. We will utilise the support vector classifiers class, abbreviated as SVC in the Scikit-Learn svm package, since we will be performing a classification task. The kernel type is the only input this class accepts.

3.3.Data collection:

The majority of responders (49%) expressed interest in SMS controllers. About 25% of respondents expressed interest in smart irrigation technology, although they had no preference for any particular model (SMS or ET). Following that, 14 percent supported ET systems, while 12 percent had no interest in either. Participants were questioned about their reasons for not being interested in intelligent irrigation technologies if "neither" was chosen

(n=359). Sixty-six percent of respondents said they were happy with their current irrigation methods. Cost, skepticism regarding water savings, local water limitations, xeriscaping, and the need for further research were other obstacles. The Table 1 which illustrate technology preferences of smart irrigation technology (n=3000).

Table 1: demonstrate the technology preference of smart irrigation (n=3000).

S. No.	SMS-based or ET-based controller	Soil moisture sensor based(SMS) controller	Neither	Evapotranspiration-based (ET) controller
1	25%	49%	12%	14%

3.4.Data analysis:

To determine who was interested in buying SMS and ET irrigation, researchers employed ordered logic models. Several racial and ethnic characteristics were shared by the smart irrigation facilities. Younger, male, higher-income consumers were more inclined to buy SMS and ET systems than other types of systems. Comparing respondents with and without children in the home, it is interesting to note that responders with children in the home were more interested in all of the systems. The percentage of adults living in the home and education level had no bearing on any of the possibilities. Demonstrate the Reasons given by respondents (n=359) for not adopting a smart irrigation system by the Figure 4.

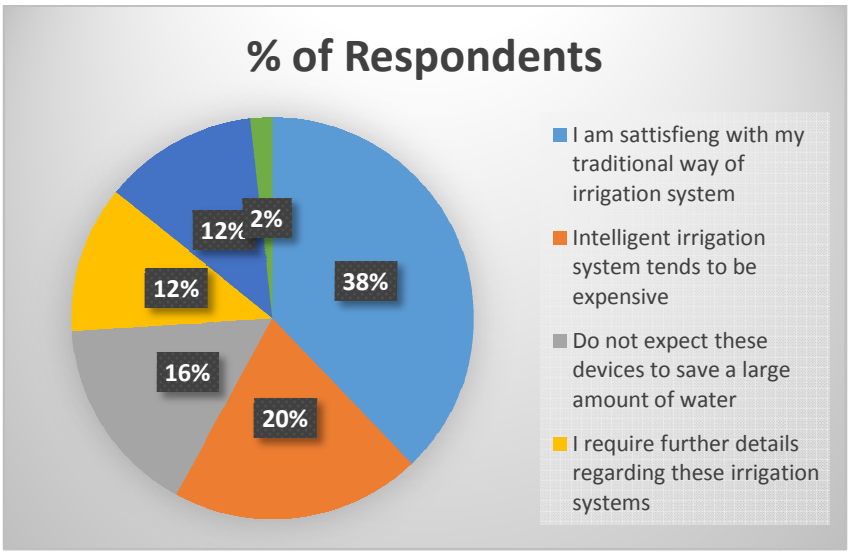

Figure 4: Demonstrate the Reasons given by respondents (n=359) for not adopting a smart irrigation system.

4. RESULT AND DISCUSSION

Our trained ML model interprets the values for moisture, temperature, and soil humidity as well as the encoding result for soil type, weather type, and multiple cropping values. Recognize the crop's individual watering requirements. Hence, with the sensor values and ontology produced a 50% outcome. Our system indicates that the crops should be watered and displays a remark on the farmer's phone.Performance Assessment. On our sample data—which we selected at random from roughly 500 instanceswe have run tests. We provide these

examples as training for the suggested system to forecast class, our Performance Assessment. On our sample data—which we selected at random from roughly 500 instanceswe have run tests. We provide these examples as training for the suggested system to forecast class, our SVM model. Codes for the class labels illustrate by the Figure 5.

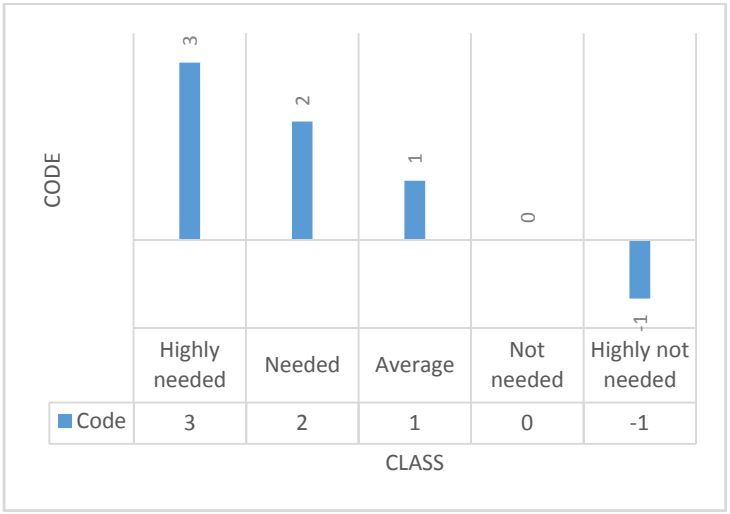

Figure 5: illustrate the code for the class label.

The codes data for the class label which is assigned three for the highly needed the code is. And for the next the code for needed is assigned the value is two and for the average assigned one as a value. Zero is assigned for the not needed and -1 is assigned for the highly not neededthe server that ontology is connected to. Using the sensor values and a decision taken from the ontology area is transmitted to the primary IoT server, whereupon our machine learning Installed is an algorithm. Additionally, our training dataset includes the labels for various classes with encoded data that are text (class label) was changed at front end in the app for android. The codes are displayed by figure 5.

5. CONCLUSSION

Everyone in the country needs food, hence agriculture is essential to the economy of the country. It's linked to one of the biggest things that ever happened in the country. A country is considered to be rich both financially and socially if it has a sizable farming population. In the majority of countries, agriculture is the principal industry for employment. A large farm frequently needs help with planting when there are many of people there. These large farms may complete and improve their agricultural output by utilizing nearby facilities for growing, caring for livestock, and other activities. There have been significant changes in agricultural productivity with the development of human civilization.Ontology is used to query why a particular plant kind, climate type, and soil type were chosen, even while other factors like temperature, humidity, or soil are still taken into account. The sensor network finds moisture. The ontological outcome will determine whether or not to water plants in the final analysis by 50%. Based on the remaining 50% of the model and our trained machine learning (Support vector). Our suggested IoT architecture has four levels instead of the typical IoT design's three (application layer, network layer, and perception layer): application layer, processing layer, transport layer, and perception layer. The perception layer is another name for the physical layer. Demonstrating the presence of sensors for data collection. It measures air humidity, temperature, and soil moisture content.The coding information for the class label, which is given a three since it is very crucial. The value two is given as the code for the following item, while one is given as the value for the average. The server that Ontology is

connected to receive a zero for not needed and a -1 for extremely not needed. Future scope of the fields of smart irrigation is very broad due to water. With the new technology there are huge opportunity in smart irrigation fields.

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CHAPTER 13

ANALYSIS OF USE OF WIRELESS POWER TRANSMISSION IN WIRELESS SENSOR NETWORKS FOR IMPROVEMENT OF EFFICIENCY

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ABSTRACT: ***A wireless sensor network is a group of instruments used to track and transfer different conditions, such as temperature, sound, and pressure, to a different location for additional processing. In this paper, the same author addressed the concept of wireless transmission or the transport of electricity without the recourse of wires or any other type of electrical conductor. The author also put forward a theory that was addressed below on the transfer of electricity generated using microwaves, to reduce transmission, allocation, and many other types of losses. This method is commonly known as Microwave Power Transmission (MPT). The author discussed and correlated several elements between the current wireless transmission of power systems and their relevant historical context as well as the current state of their progress. On a theoretical basis its advantages and disadvantages, and the implementation of wireless power transmission is also included. This work creates a strong framework for future long-distance wireless transmission and distribution system performance appraisal programs.***

KEYWORDS: ***Energy, Power Transmission, Sensor, Topology, Wireless Network.***

1. INTRODUCTION

The wireless device era is the world in which human society continues to evolve and even now, battery charging methods still require wires, so to use them, a charger must be connected to an electrical wall outlet should be connected at one end and the device at the other should be connected to it [1]. The author also has the option of employing the batteries as direct power sources. In wireless sensor network design, it is mostly employed. However, an important limitation is that because these batteries need to be constantly updated, they cannot be mounted in inaccessible places [2]. Wireless electricity is the name given to this new wireless power transfer idea (WiTricity). As solar panels are widely presented and have increased energy density equated to other energy-storage technologies, their adoption for practical applications has expanded. Another approach is the use of solar power for thermoelectric generator wireless sensor networks (WSNs) because of this high density of energy, smaller sensor nodes can develop [3]. But since solar energy is dependent on sunlight, it can hardly be used to generate electricity at night, while the amount that is generated also depends on the season.

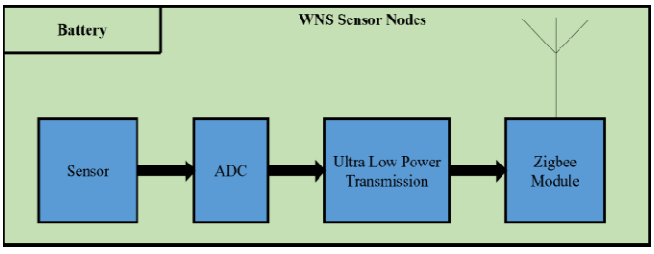

Figure 1: Illustrate the Basic Block diagram of the Wireless Sensor Node.

A wireless sensor network (WSN) is a system of terminals that cumulatively perceive variations in conservation characteristics and can also affect the atmosphere, providing communication between individuals [4]. There is a huge reduction in wiring and connectors and simplicity, which is an immediate advantage of wireless transmission. For a variety of applications, communication systems including Bluetooth, Zig-B, General Packet Radio Service (GPRS), etc. have been created. In the contemporary era, WSNs are a type of real-time system in which various detectors are associated synchronously to a single gatekeeper unit. Both fixed and flowing nodes are possible [5]. They may be cohesive and cognizant of their environments.

Figure 1 illustrates the structure of the system, which comprises a variety of sensors, a sender zig-bee component, and a receiver zig-bee to ensure the right in serial to a microcontroller, which drives feedback signals. "To provide a low-power, relatively inexpensive WSN, this device uses Zig-Bee-modules based on the IEEE 802.15.4/Zigbee Wireless-Personal-Area-Network (WPAN) standard. Zig-bee has been used thanks to its small size, low power, low cost, and prolonged battery life [6]. Three main devices are able zig-bee":

- *Zig-bee Coordinator:*

There is precisely one administrator in each network, which constitutes the main component of a Zig-bee module. This gadget evaluates the RF signals, choosing the one that contains the least amount of data traffic [7].

- *Zig-bee Router:*

It serves as a channel for transferring data from some of the other zig-bees.

- *Zigbee End Device:*

It can interface with the paternal node but cannot transfer information from other gadgets. The director frequently comes with a Personal-Area-Network-Identifier ID loaded into it (PAN-ID). When it connects to the Zigbee network the device receives a network address, which it can use to interface with the PAN. The moment this operation is finished, the machine can start to interact.

The analog information of each sensor is analyzed using the zig-bee analog to electronic conversion function. The analog value of the sensor is processed into digital data and communicated to the CPU for processing. For sensing purposes, sensors seem to be necessary. The type of sensor used may vary depending on the circumstances. The wireless sensor node design is made by communicating across various common nodes to form a wireless sensor network [7].

1.1.Explanation of Different Topologies:

- *Bus-Topology:*

Bus communication is a combination of topologies for a network where nodes are directly connected to a semiconductor bus. Each terminal on the bus network must receive all network traffic, which is created by each station and is of paramount importance for transportation. In a bus network, the hostess is referred to as a station [8].

As with Figure 2, with this routing protocol, when one node sends a message to another node, it does so in the form of a communication link that is visible to all other networks but only accepted and interpreted by the intended receiver is done. Although packet switching is easy

to implement, it has limited forms of communication and traffic congestion. Bus connections, however, work best with a small number of nodes.

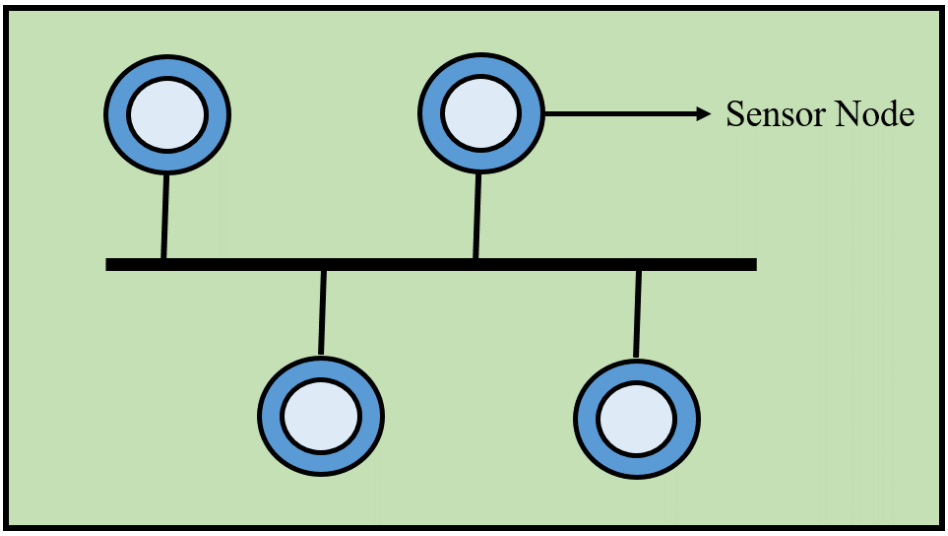

Figure 2: Illustrate the Bus Topology with its Routing Protocol.

- *Tree-Topology:*

A hybrid system architecture known as a tree-topology or star-bus-topology links the star infrastructure together via a bus network. Each node in a tree network can have any figure of families, so they form a hierarchical structure in nature.

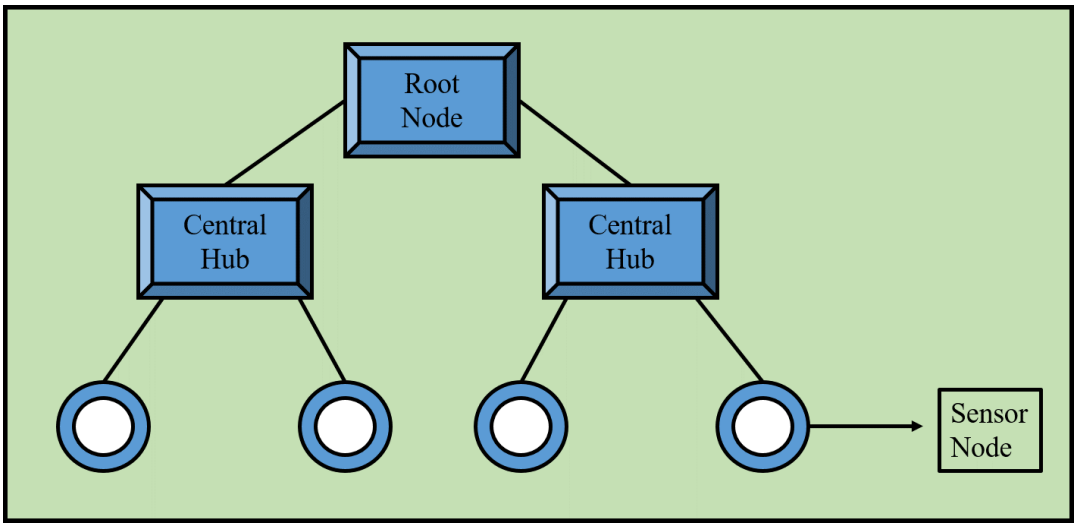

Figure 3: Illustrate the Tree Topology for the Primary Medium of Communication.

According to Figure 3; the primary medium of communication gateway for networking is a central hub known as little more than a root node. The central hub is one step below the root node inside this hierarchy. This inferior level establishes a system of stars and both star and peer-to-peer communication topologies can be compared to tree networks [9]. In a networked system, the path can be a single hop or even several hops. Sensor nodes receive data by sensing their surroundings and sending it in sync. After receiving data messages from its offspring, the base station communicates the information to its parents. Finding the best shortest path tree with the longest run, least latency, slightly higher temporal and spatial complexity, and a variant that is more suitable for the required network deployment.

- *Star-Topology:*

The spoke-hub distribution architecture in computer networks is accomplished by a star topology. In star topology, each host is coupled to the principal hub. In its greatest basic form, transmissions are sent through a singular central hub. One of the most commonly used computer network architectures is the star topology [10].

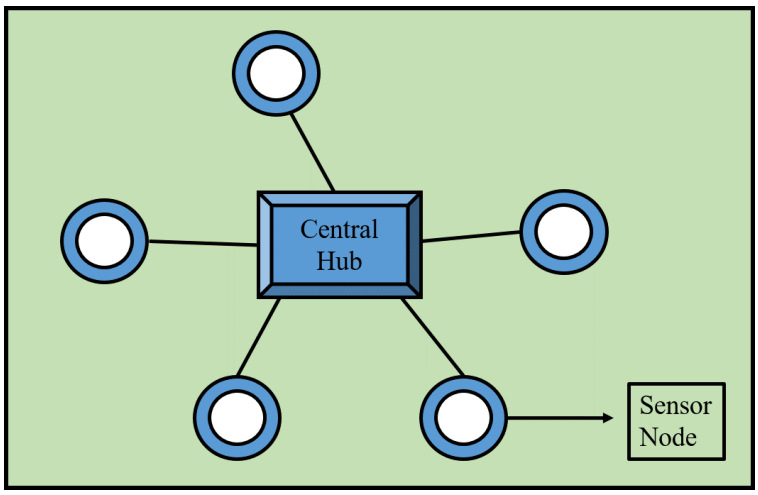

Figure 4: Illustrate the Star Topology for Centralize Communication.

According to Figure 4 nodes in a star, network cannot interact directly with each other because they are connected to a centralized communication center (sink). Make sure all aspects should be used to transmit all communication. The central hub subsequently acts as a "server or sink", with each node acting as a client. However, single-path communication has its limitations.

- *Ring-Topology:*

A ring network is a configuration in which each node is connected to exactly two more nodes, establishing a ring that creates a continuous channel for signals to pass through each node. Data is sent from the source node to the destination node, with each node handling a packet as it goes. In a ring network, each node, therefore, has accurately two nationals for sending communications, as shown in Figure 5. Each message moves through some sort of ring in a clockwise or circumferential fashion [11]. The loop is broken and if one node fails, the entire network will go down.

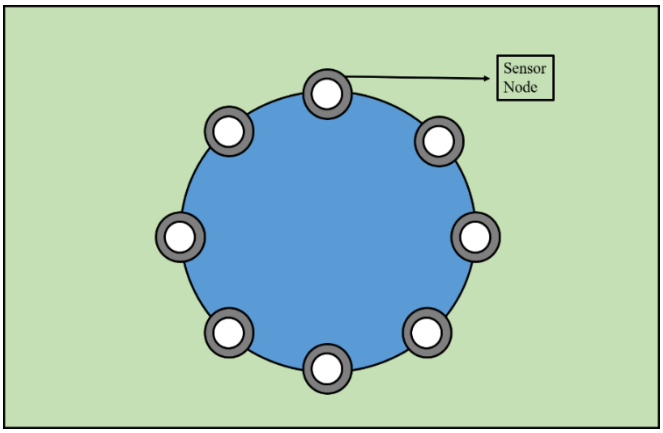

Figure 5: Illustrates the Ring Topology for Low-Risk Communication.

1.2.Introduction of Wireless-Electricity (WiTricity):

The term *Wireless-Electricity* refers to wireless without the use of cables, the transfer of electricity generated from one item to another iPods, PCs, cell phones, and other power-hungry equipment electronics charge automatically via WiTricity, reducing the need to constantly plug them in. We'll start with the essentials of electromagnetism and electricity and exertion our way up to the Wi-Tricity knowledge, which emphasizes the transfer of electrical power, or electrical energy, over distances without wires [12]. Even better, some devices may not require a battery to function according to WiTricity. Wireless electricity is not a new idea and reality, it was established in the 19th century by Nikola Tesla, who communicated wireless power using conduction-based techniques as opposed to resonant magnetic fields. However, radio waves are also not convenient for the transmission of electricity because the radiation they emit is massive, wasting significant amounts of radiation. In addition, lasers require a smooth line of sight, which is extremely difficult to achieve and very dangerous, making them an inconvenient option to attempt [13].

1.3.Use of WiTricity in Wireless-Sensor-Network (WSN):

WiTricity in the WSN view is displayed in the block diagram above. It is commonly employed in situations where node deployment is done in hard-to-reach areas and regular rechargeable batteries are not practical. The converter from alternating current (AC) to direct current (DC) converts the AC mains to DC at the power outlet. It is sent to a recombination circuit after being amplified in several stages of an amplifier. The resonance comes somewhere at the arraigning node and the endpoint rotating at the instrument node performs at the equivalent frequency. As a result, the control signal causes the resonator to create a magnetic field, which is then transferred to a coherent magnetic field on the receiver resonator [14]. As a function, the destination node provides an electromotive force which is converted into a DC signal and used to refresh the inductive charger.

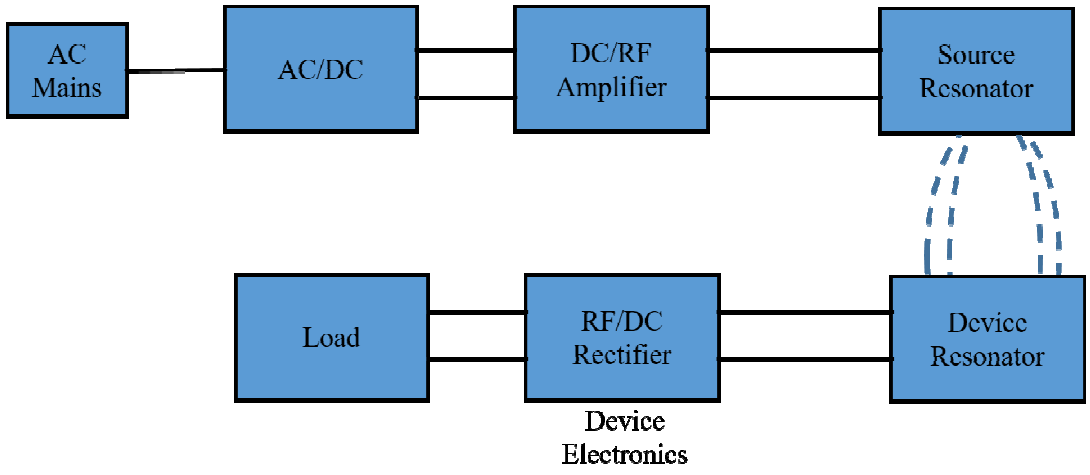

Figure 6: Represents the Wireless Energy Transfer System's Block Diagram.

The block design shown above, referenced in Figure 6, highlights the Wi-Tricity in the WSN concept. It is commonly employed in situations where node fittings are conducted to hard-to-reach extents and regular battery standby is not practical. An AC-converter to DC-converter transfers the AC mains to DC at the charging station. It is sent to a resonant circuit after an amplifier is amplified in several stages [15]. On the same wavelength, both the input reverberation at the arraigning cluster and the endpoint reverberation at the sensor-node act. As a result, the input signal produces a compelling ground in the resonator, which is then transferred to a uniform magnetic field at the receiver resonator. There are two ways to

implement this idea, depending on the need of the application. For uninterrupted charging of neighboring nodes, a charging station can be deployed in certain situations [16]. A single source node potentially charges multiple destination nodes because of the coupling while resonating. Therefore, an alleging location can be built with checking equipment or can be mounted independently of the sensor if the regulator or monitor station is close to an existing linkage. Node-to-node arraigning is also an option in other uses, for example in the military [17]. When a node's battery count drops below a certain amount, it seeks out nodes that appear to have a higher power level before restarting. Transceivers are devices that transfer energy from one node to another.

In this paper, the author has explained wireless sensor networks using wireless power transmission. According to this paper Wireless Sensor Network" (WSN) refers to a wireless network, even without any infrastructural facilities, that uses a large number of wireless sensors to evaluate the system, physical, or environmental elements Ad-hoc is made using. Then the author also sums up the different topologies, such as bus topology, tree topology, star topology, and ring topology are included.

2. LITERATURE REVIEW

H. S. Gu and H. S. Choi stated that earlier it was suggested to use conducting polymers for wireless power transmission. The research group then suggests using the superconductivity WPT technology in electric vehicle applications. The innovation's transmission and receipt resonant coils are covered with magnetic material to increase efficiency. As a result, by shifting the form of the resonant coil, the efficiency can be increased. The authors concluded that a laminated spiral-type coil was used as a resonating coil for wireless power transfer for powered mobility. Applying a superconducting magnet to the resonant coil will also result in high coupling coefficients and Q-factor. As a consequence, wireless power distribution may be implemented with more performance than current wireless power generation techniques. High-Frequency Structure Simulation (HFSS), an electromagnetic-field-analysis tool, was used for numerical simulations [18].

V. V. Nair and J. Choi stated that in the inductive-coupled WPT systems, a wider range of higher-power transfer effectiveness can be reached using magnetic-coupled-resonator WPT systems. The coupling between two near-field resonators changes as does the distance among them, however. The power transfer efficiency will change as a result of coupling modification. Typically, output impedance or frequency tuning is employed to maintain high productivity over a choice of reserves. The industrial, scientific, and medical bands cannot be limited by design requirements, and sensitivity-matching networks comprise vast systems. Therefore, the research work proposes a multi-coil-switching-wireless power distribution organization to preserve High Transfer Efficiency over a Wide Range of reserves. The mechanism the author proposes uses several loop coils of different diameters. One of the loop loops is chosen to send and receive messages based on changes in the reserve between the source and earpiece sides. This technology enables High-Power-Transfer-Efficiency to be realized over a vast assortment of spaces by allowing optimization of the connector quantity with choosy switching roughly like a coil loop at the load and source ends [19].

M. Rozman et al. give their opinion about a state-of-the-art positioning technology for wireless power transfer when charging an electric automobile. With the suggested technology, the wireless charging system can select the most effective coils for transferring current to an electric vehicle (EV) based on sensors that were already activated by its wheels. Our process involves measuring the conversion efficiency of each transmitting coil to determine which is best to use, maintaining a sufficient charge. Selecting only the emitters

with the best transfer capacity, not only increases the charging efficiency but also reduces the energy loss. Findings indicate that the proposed methodology can identify coils with extreme transmitting efficacy rather than using actual power transmission or comparing observed efficiency. This paper suggests that the suggested charger arrangement allows for near-instantaneous monitoring of the status of the receiver coil, increasing battery capacity and saving energy [20].

3. DISCUSSION

The absence of a constant power source imposes restrictions on wireless sensor networks (WSNs). Network nodes are powered by standard commercial batteries, which are often not refilled or replaced. In such a case, the network is considered redundant. Any protocol designed for such a connection must have efficient power requirements. Energy-efficient innovation strategy for WSN has been researched on many fronts, from hardware implementation to protocols for intermediate identity management, routing, data collection, topology management, etc. However, nodes can be maintained by charging or replacing the battery as appropriate. Recharging wireless nodes can be accomplished through energy harvesting directly from the execution environment. These energy harvesting technologies use solar power, speed changes, floor vibrations, harmonic distortion, etc. to power network nodes. The design of protocols that prevent network nodes from burning out of energy is, however, quite challenging due to the variable nature of such power sources and the general absence of a priori information on what is the energy profile. An important technology to overcome these obstacles is wireless power transfer. As an alternative to traditional energy harvesting techniques, inductive charging transfer, or the ability to transmit electrical energy from one storage device to another without using a plug or cable, has been proposed. Wireless power transfer approaches can be roughly divided into radioisotope radio-frequency recharge and non-radioactive electrostatic interaction charging. The potential bonding capacitance in electrostatic induction depends on the accessible location of the device. A difficult design restriction has been imposed because it is challenging to produce a power density high enough to try to charge a portable electrical device of a specific size. The restriction of directing RF-power beam formation is that the charging must be aware of the actual position of the energized receiver.

4. CONCLUSION

In this study, the author has focused on the problem of efficient and energy-balanced wireless transmission in wireless communication. The author created two methods that considered either the energy expenditure of the charger or their charging efficiency. After adjusting several critical components of these processes, it is time to see how efficiently they work in both the actual test setting and the simulation one. This technology does not account for the energy balance between chargers here, which allows some chargers to be used more than others. Overused chargers eventually run out of juice, which prevents some network locations from charging for long periods. In this method, the chargers supply power to the network alternately, resulting in uniform distribution of power across the adapters. The protocol does not adjust for the distance of network devices as it needs to do so. Even though there is a lot of space between the network node and the charger, it still supports energy transfer. This results in a high level of energy loss. Additionally, in the future, this paper will remark that both methods, in comparison with each other, meet their main goals in both practices and are based on assessment through in-depth simulations. Although the Energy Balancing Protocol delivers a consistent amount of energy delivered within the chargers, the charging-directed methodology maintains high battery performance throughout testing.

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CHAPTER 14

ENHANCED INTELLIGENT IRRIGATION SYSTEM UTILIZING IOT AND MACHINE LEARNING

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ABSTRACT: ***Everyone in the country needs food, hence agriculture is essential to the economy of the country. It's linked to one of the biggest things that ever happened in the country. A country is considered to be rich both financially and socially if it has a sizable farming population. In the majority of countries, agriculture is the principal industry for employment. A large farm frequently needs help with planting when there are many of people there. These large farms may complete and improve their agricultural products by utilizing nearby farming, livestock care, and services.This system's hardware model uses a large number of sensors, along with a camera module and a database of crops. Use of a soil moisture sensor to measure soil moisture makes it evident if a crop needs water or not. The main component of the proposed system, according to the author, is a microprocessor. Using the microprocessor, all the sensors and components were connected. The author uses an open CV camera to observe the crops and has a dataset on the crops. If there is a problem with the crops, the system will send the user a text message and buzzer notification. GSM stands for Global System for Mobile Communication.Due to water, the future potential for smart irrigation is very large. With the new technology, smart irrigation fields have a many of potential.***

KEYWORD:Agriculture, Country, Internet of Things,Sensors, Smart Irrigation.

1. INTRODUCTION

Since agriculture supplies food for everyone in the nation, it is crucial to its economic health [1]. One of the most significant events that occurred in the nation is connected to it [2]. If a nation has a large farming population, it is said to be prosperous both financially and socially [3]. Agribusiness is the primary source of employment in most nations. Whenever there are many of people on a large farm frequently require assistance with planting [4]. These big farms can utilize neighboring resources for farming, livestock care, and facilities to complete and enhance their agricultural goods [5]. With the advancement of human civilization, there have large shifts in agricultural output [6]. Despite this, it is predicted that by 2050, seventy percent of the world's population will reside in cities, up from the current 49 percent. Additionally, the demand for food will increase as earnings do, especially in poor nations. Therefore, these Nations will raise their awareness of the standard of their cuisine also, diet. As a result, customers' preferences could diverge from grains and cereals in the direction of legumes and ultimately meat. Water is a precious yet limited natural resource in agriculture. In a place like India, a significant amount of in use for irrigation is water.

A lot of environmental Temperatures in the air, soil, and humidity all have an impact on crop productivity. The phrase "smart farming" refers to a recognized and superior method of farm management that has gained popularity in modern agriculture. Information and agricultural technology are employed to monitor the wellbeing and output of crops, which also include monitoring the state of the field crops. And more markers. Lastly, the objective of smart farming aims to keep agricultural input costs as low as possible while maintaining the final product's quality [7]. If you utilize a large amount of pesticide or fertilizer applied concurrently, the entire field is considered as a unique entity [8]. Internet of things (IOT) is

most trendy technology in automation and any wireless system, the advantages of the IOT given by the Figure 1.

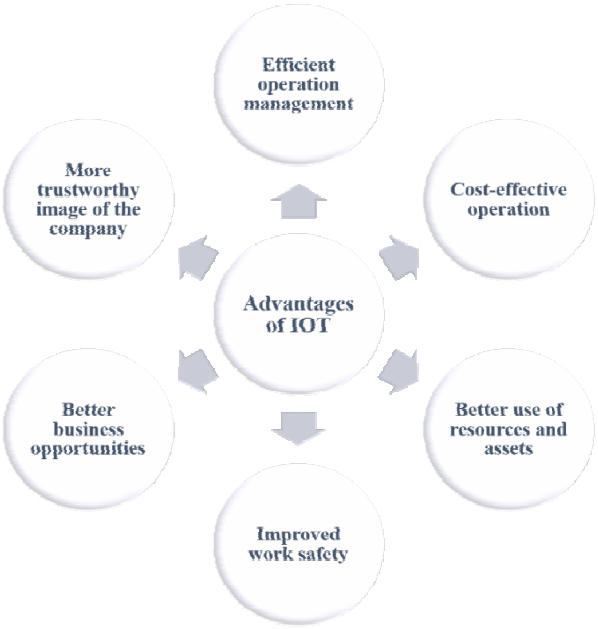

Figure 1: Demonstrate the advantages of the internet of things (IOT).

In India, agriculture is the main source of a livable wage [9]. In several recent decades, a sophisticated, intelligent, and completely automated agricultural system was both necessary and much desired. When our population increased rapidly compared to the natural resources that our nation, India, possesses [10]. For An IoT-based smart irrigation system has been developed for this purpose. Achieved in recent years despite persistent loss threats there are two specifics to the agricultural industry regarding water. There are three types of plastic tunnel farming: low, high, or walk-in tunnels. Sowing, spraying, and harvesting are easy to do in the due to its higher ceilings in high tunnels than that in low & walk-in larger in size. Contrarily, traditional farming is the most unexpected and contributes to the increase in water waste is a problem.Data mining techniques are very advantageous for agricultural occupations. One of these activities is the limiting of association rule usage in agricultural areas [11]. The Internet of 'things has also made it possible for Smart farming is made feasible through a variety of data collection and storage methods. Field parameters for the ideal watering of plants are gathered by current irrigation smart sensor networks systems. Numerous real-world applications, including intelligent farming, intelligent healthcare, clever production and logistics. Within the structure, soil and moisture sensors are used to collect data, and after which they are kept on a central cloud server. The cloud different analytics are carried out employing a server.

2. LITERATURE REVIEW

M. S. Munir et al. [2] discussed in the paper about the Use of Edge Computing and IoT to Create a Smart and Intelligent Irrigation System. Ingenious frugal and cost-effective irrigation techniques have developed to meet the world's population's sweet water needs. The majority of water was wasted owing to ineffective methods of irrigation, therefore water use should be sparing enough to save limited sweet water resources. We used a clever strategy that was capable of utilising ontology. 50 percent of the decision is based on the ontology, while the remaining 50 percent is based on the sensor values. The final conclusion is derived from the sum of the sensor data as a consequence of a machine learning model (KNN).

Additionally, an edge server is added between both the main IoT servers and the GSM module. this strategy integrates Internet of Things with a network of sensors to innovatively track all the data, evaluate the data at the network edge, and communicate just some specific data to the main IoT server. Core IoT server to forecast the amount of water needed for a field of agriculture, and use an Android device to display the results edge of application.

Wei Li et al. discussed in their paper about Review of Remote Sensing and Internet of Things-Based Sensor Networks for Irrigation. The developing world, where agriculture and climatic factors dominate the economy, served as the inspiration for this review study. Making the proper operational decision at the right time is essential for production farming profitability based on the circumstances at hand and past performance. A methodical strategy used in precision farming is intended to increase productivity. By carefully adjusting the agricultural soil care to fulfil the unique requirements in each area while keeping the benefits of agriculture environmental quality. This review paper discusses the creation of a portable wireless automatic irrigation system. The environmental factors in an agricultural area can be remotely measured using sensor networks and decision - making support techniques. Radio the ecological parameters such as are captured via satellite, mobile phones, sensors, internet-based connectivity, and microcontrollers. Temperature, humidity, and soil moisture.

A. Raghuvanshi et al. discussed about the Internet - of - things Smart Irrigation in Smart Farming: Attack Detection Using Machine Learning for Risk Mitigation. Fresh water scarcity is a serious issue for the entire planet, and it will only become worse. In the coming years to continue to deteriorate. Due to the aforementioned difficulties, precision farming and smart irrigation are the only workable answers. Smart irrigation and precision driving have only become possible with the rise of the Internet of Things and machine learning. Agricultural production becomes profitable. The Internet of things has many advantages, including improved productivity, reduced costs, energy maximization, forecasting, and convenience for the general public (IoT). Security risks grow as systems and data processes become more diversified. The development of the Internet of Things is being hampered by worries about security and privacy. This article creates a methodology for identifying and categorizing intrusions into agricultural IoT networks. Privacy and safety are fundamental issues in all Internet of Things (IoT) applications, not only those relating to agriculture. That is The NSL KDD data set is utilized as an input data set for the framework. In the NSL-KDD data set's preprocessing, all symbolic features are transformed into numerical features. Principal component analysis is utilized for feature extraction, and support vector machines, linear regression, and regression trees are employed for categorizing the preprocessed data set. Comparison of machine learning algorithms' performance are assessed based on their accuracy, precision, and recall criteria

3. METHODOLOGY

3.1.Design:

The predicted irrigation system is built with the potential to water plants intelligently by taking into account aspects like crop type, soil type, climate, temperature, humidity, and wetness of the soil.The decision for a specific plant kind, climatic type, and soil type is questioned using ontology, although other variables like temperature, humidity, and soil are still taken into consideration. The sensor network detects dampness. Final judgement50% of whether to water plants or not depends on the ontology result. Based on our trained machine learning (Support vector machine), and the remaining 50% model. Instead of the standard IoT design's three layers (application layer, network layer, and perception layer), our proposed IoT architecture comprises four layers: application layer, processing layer, transport layer, and perception layer.The physical layer is also known as the perception layer. Indicating that

it has sensors for gathering data. It detects temperature, soil moisture content, and air humidity. Sensing data that has been previously gathered and transferred to the processing layer through networks like LAN, 2G, 3G, and wireless technologies. As processing layer stores, examines and analyses enormous amounts of data from stratum of transit. It makes use of technology like databases, Edge computing and cloud computing. The flow diagram of the proposed model given by the Figure 2.

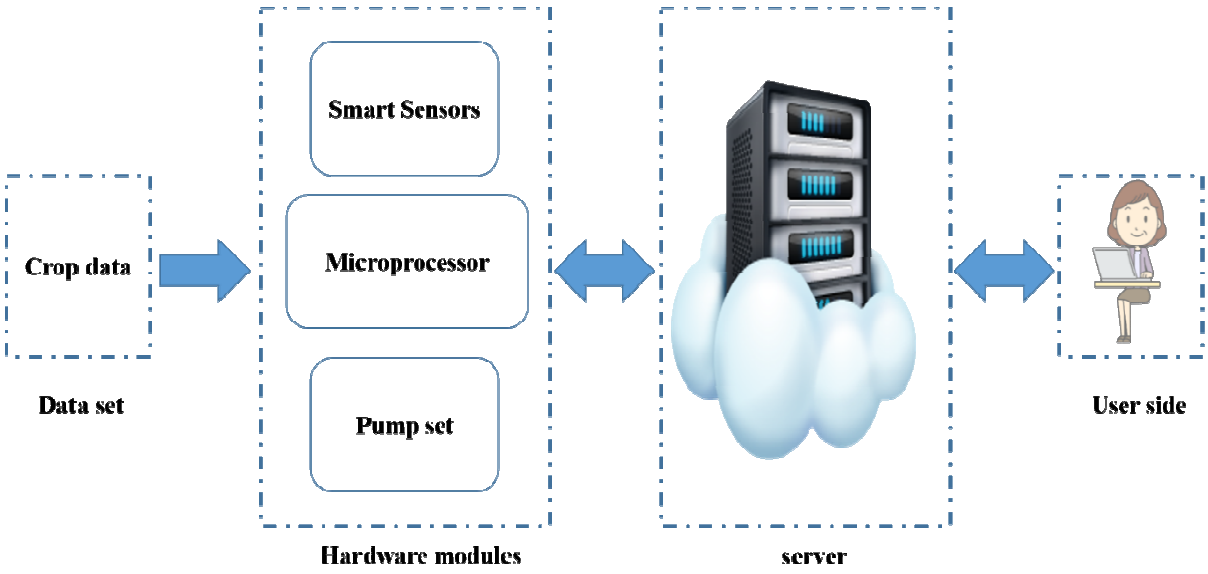

Figure 2: demonstrate the block diagram of proposed system.

In this proposed system there so many sensors used in hardware model and also used camera module with the database of crops. Used soil moisture sensor to detect the moisture in the soil by this it clear crop need water or not. In the proposed system author used microprocessor as the main unit of the system. And connected all the sensors and component through the microprocessor. Author uses open CV camera for the monitoring the crops ant it also has some dataset of crops. If crops having any problem, then the system will be sending a notification by the buzzer and the Global System for mobile communication (GSM) service text message to the user. Proposed system also having the capability of temperature sensing and humidity sensing by the help of humidity sensor and temperature sensor. The block diagram of the hardware model given by the Figure 3.

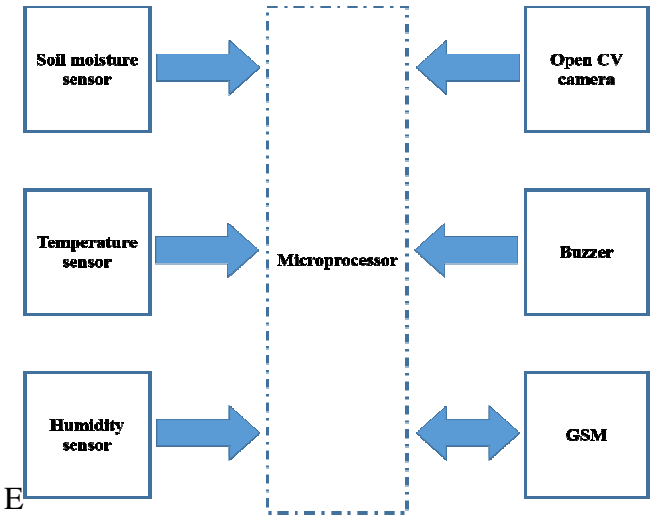

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Figure 3: Illustrate the block diagram of the hardware model.

3.1.1. Microprocessor:

A microprocessor is a form of computer processors where the logic and control for data processing are housed on a single circuit board or a few interconnected integrated circuits. The hardware needed to carry out the operations of an operating system is included within the microprocessor. It is used in the proposed system as a main unit of the system.

3.1.2. Soil moisture sensor:

The volumetric water content of the soil is measured by soil moisture sensors. Soil moisture sensors moisture sensors measure the volumetric indirectly by using another characteristic of the soil, such as electrical resistance, dissipation factor, or interaction with neutrons, as a stand-in for the moisture content. This is done because the direct gravimetric measurement of free moisture in the soil requires removing, washing, and weighing of a sample.

3.1.3. Temperature sensor:

The relative humidity (RH) of the air is sensed, measured, and reported by a humidity sensor, which also establishes how much water vapor is present in a gas mixture (air) or a pure gas. Water absorption and desorption are related to humidity sensing. Both industrial and agricultural goods are monitored using humidity sensors. Equipment like incubators, sterilizer's, and pharmaceutical manufacturing equipment all require humidity sensors.

3.1.4. Open CV camera:

A library of software program with a focus on real-time computer vision is called Open CV (Open CV Library). It was first created by Intel and afterwards sponsored by Willow Garage and Itseez (which was later acquired by Intel). The Apache 2 License for Open-Source Software makes the library cross-platform and freely usable. Open CV now offers graphics processing unit (GPU) for real-time activities as of 2011.

3.1.5. GSM:

The European Telecommunication Standards Institute (ETSI) created the Global System Communication (GSM) standard to define the protocols for 2nd (2G) digital mobile networks used by portable devices such smartphones and tablets. In Finland, it was initially used in December 1991. By the middle of the 2010s, it had over 90% of the market share and was used in over 193 nations and territories, making it the industry standard for mobile communications.

3.2.Instruments:

For the automation of the proposed system author use machine learning concept for 50% and for 50% used IOT concept. For the programing of hardware module author used python programming language. The support vector machine (SVM) library that comes with built-in classes for various SVM algorithms is part of Scikit-Learn. We will utilise the support vector classifiers class, abbreviated as SVC in the Scikit-Learn svm package, since we will be performing a classification task. The kernel type is the only input this class accepts.

3.3.Data collection:

The majority of responders (49%) expressed interest in SMS controllers. About 25% of respondents expressed interest in smart irrigation technology, although they had no preference for any particular model (SMS or ET). Following that, 14 percent supported ET systems, while 12 percent had no interest in either. Participants were questioned about their reasons for not being interested in intelligent irrigation technologies if "neither" was chosen

(n=359). Sixty-six percent of respondents said they were happy with their current irrigation methods. Cost, skepticism regarding water savings, local water limitations, xeriscaping, and the need for further research were other obstacles. The Table 1 which illustrate technology preferences of smart irrigation technology (n=3000).

Table 1: demonstrate the technology preference of smart irrigation (n=3000).

S. No.	SMS-based or ET-based controller	Soil moisture sensor based(SMS) controller	Neither	Evapotranspiration-based (ET) controller
1	25%	49%	12%	14%

3.4.Data analysis:

To determine who was interested in buying SMS and ET irrigation, researchers employed ordered logic models. Several racial and ethnic characteristics were shared by the smart irrigation facilities. Younger, male, higher-income consumers were more inclined to buy SMS and ET systems than other types of systems. Comparing respondents with and without children in the home, it is interesting to note that responders with children in the home were more interested in all of the systems. The percentage of adults living in the home and education level had no bearing on any of the possibilities. Demonstrate the Reasons given by respondents (n=359) for not adopting a smart irrigation system by the Figure 4.

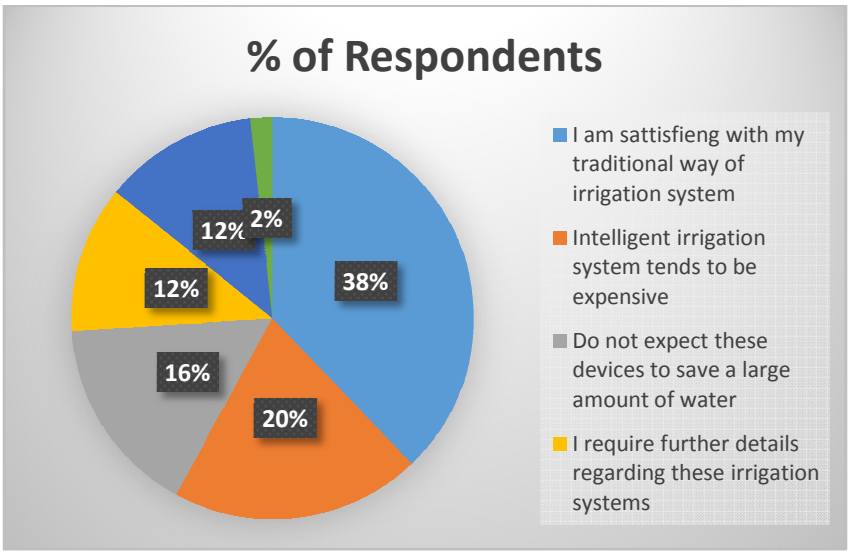

Figure 4: Demonstrate the Reasons given by respondents (n=359) for not adopting a smart irrigation system.

4. RESULT AND DISCUSSION

Our trained ML model interprets the values for moisture, temperature, and soil humidity as well as the encoding result for soil type, weather type, and multiple cropping values. Recognize the crop's individual watering requirements. Hence, with the sensor values and ontology produced a 50% outcome. Our system indicates that the crops should be watered and displays a remark on the farmer's phone.Performance Assessment. On our sample data—which we selected at random from roughly 500 instanceswe have run tests. We provide these

examples as training for the suggested system to forecast class, our Performance Assessment. On our sample data—which we selected at random from roughly 500 instanceswe have run tests. We provide these examples as training for the suggested system to forecast class, our SVM model. Codes for the class labels illustrate by the Figure 5.

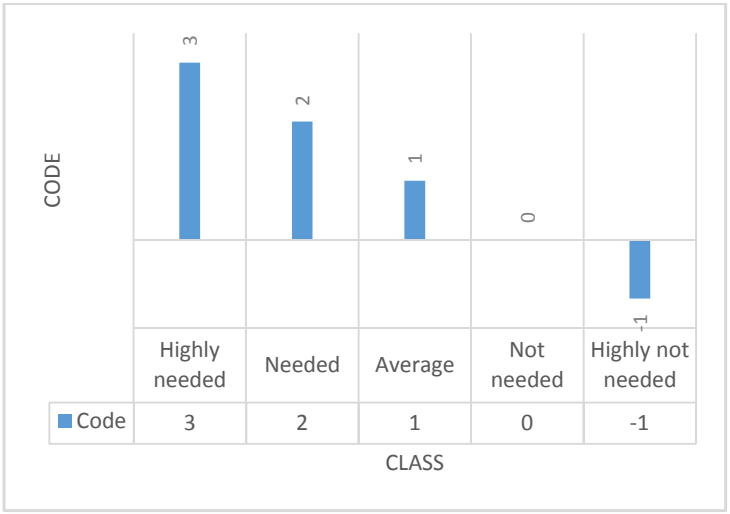

Figure 5: illustrate the code for the class label.

The codes data for the class label which is assigned three for the highly needed the code is. And for the next the code for needed is assigned the value is two and for the average assigned one as a value. Zero is assigned for the not needed and -1 is assigned for the highly not neededthe server that ontology is connected to. Using the sensor values and a decision taken from the ontology area is transmitted to the primary IoT server, whereupon our machine learning Installed is an algorithm. Additionally, our training dataset includes the labels for various classes with encoded data that are text (class label) was changed at front end in the app for android. The codes are displayed by figure 5.

5. CONCLUSSION

Everyone in the country needs food, hence agriculture is essential to the economy of the country. It's linked to one of the biggest things that ever happened in the country. A country is considered to be rich both financially and socially if it has a sizable farming population. In the majority of countries, agriculture is the principal industry for employment. A large farm frequently needs help with planting when there are many of people there. These large farms may complete and improve their agricultural output by utilizing nearby facilities for growing, caring for livestock, and other activities. There have been significant changes in agricultural productivity with the development of human civilization.Ontology is used to query why a particular plant kind, climate type, and soil type were chosen, even while other factors like temperature, humidity, or soil are still taken into account. The sensor network finds moisture. The ontological outcome will determine whether or not to water plants in the final analysis by 50%. Based on the remaining 50% of the model and our trained machine learning (Support vector). Our suggested IoT architecture has four levels instead of the typical IoT design's three (application layer, network layer, and perception layer): application layer, processing layer, transport layer, and perception layer. The perception layer is another name for the physical layer. Demonstrating the presence of sensors for data collection. It measures air humidity, temperature, and soil moisture content.The coding information for the class label, which is given a three since it is very crucial. The value two is given as the code for the following item, while one is given as the value for the average. The server that Ontology is

connected to receive a zero for not needed and a -1 for extremely not needed. Future scope of the fields of smart irrigation is very broad due to water. With the new technology there are huge opportunity in smart irrigation fields.

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CHAPTER 15

A COMPREHENSIVE STUDY ON THE APPLICATION AND CATEGORIES OF WIRELESS SENSOR NETWORKS (WSNS)

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ABSTRACT:A specific type of wireless network, known as a wireless sensor network (WSN), is made up of fast-moving, self-propelled, compact, and low-power devices with sensor nodes called thickets.Wireless sensor networks are intended to give their controllers the ability to monitor, collect data, as well as respond to conditions in a surveillance environment.A WSN appears to be an infrastructure consisting of sensing, computing, and communication components.They can be seen as a bridge connecting the real and virtual worlds. Due to their widespread use, they represent one of the rapidly developing information technologies in recent years. The author mainly focuses on wireless sensor network technologies and their application in different fields such as the health sector, environment, military, and industrial. In this paper, the author discussed the types of WSN architectures and categories of wireless network which is used globally.It concluded that,while wireless sensor network networks can be built without pre-existing infrastructure and add additional equipment as needed, one of the latest technologies is WSN.Technology advances in communication and processing have made it possible to create low-cost, compact, and energy-efficient sensor nodes.

KEYWORDS: Computer, Device, Network, Technology, WSN, Wireless Sensor.

1. INTRODUCTION

A special type of wireless network known as a WSN is made up of several mobile, self-propelled, low-powered, low-power devices known as motes, which include sensor nodes [1],[2]. These networks indisputably consist of a large number of scattered, small, battery-powered embedded devices that have previously been networked to collect, analyze, and provide data to operators [3],[4]. This networking has now enabled order of magnitude computation and processing capacity [5],[6]. Nodes are small computers that make up a network. The sensor node appears to be a wireless, energy-efficient device with multiple functions [7],[8]. Motors have a wide range of industrial uses. Data from the environment is collected through a network of sensor nodes to meet specific application goals [9],[10]. By using transceivers, motors can communicate with each other [11],[12]. A WSN can contain anything between hundreds and thousands of motors. Compared to sensor networks, ad hoc communication will have fewer components [13],[14]. WSNs are currently the most widely used services in industries and commercial sectors because of the low use of processors, developments in telecommunications, and embedding of computer equipment.

Elements of wireless sensor network architecture are employed to monitor a wide range of environmental parameters, including temperature, humidity, pressure, location data, vibration, and sound. Those nodes can be used in real-time algorithms to perform a variety of tasks, including intelligent detection. Finding efficient routing between adjacent nodes, data storage, collection and distribution, data aggregation, target monitoring, monitoring, and administration, synchronization, node location, and ground stations, but also neighboring nodes are some examples of network capabilities. WSNs are currently starting to organize themselves to a sophisticated level. It is reasonable to estimate that in 10 to 15 years WSN

will be used to protect the Internet and the entire planet. This can be quantified as the physical new becoming of the Internet. Many different industries, including healthcare, the environment, transportation, smart military, entertainment, internal security, disaster response, as well as smart space, offer unlimited options for the use of this technology. It is an ad hoc wireless system without the infrastructure that is used by multiple wireless sensors to monitor the system and physical and environmental factors. WSN uses sensor nodes with built-in CPUs to control and monitor the local environment. They are connected to a docking station, which serves as the central processing node for the WSN program. Figure 1 shows the connection between the WSN base station and the online database for data exchange.

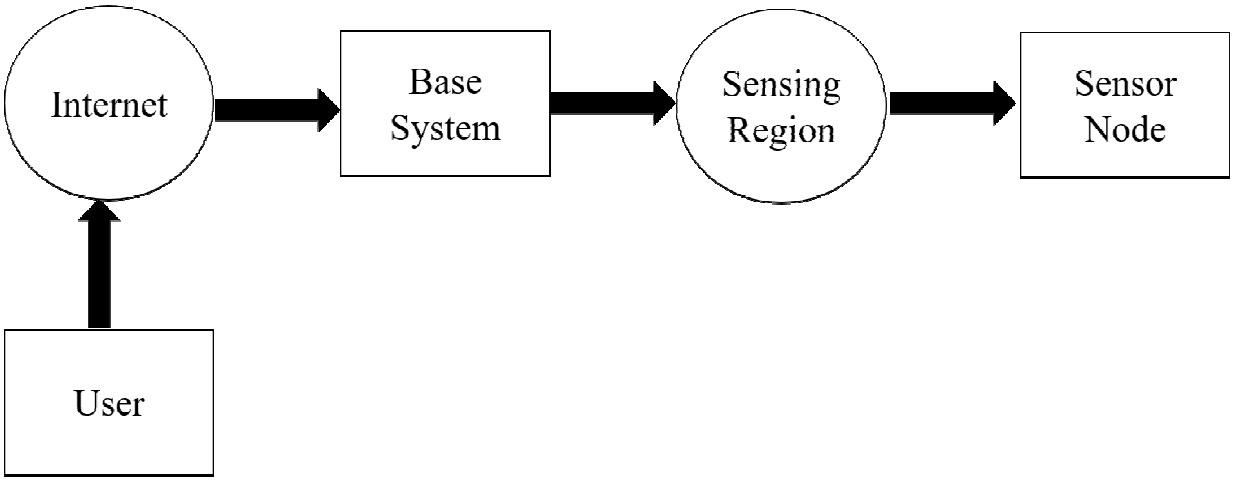

Figure 1: Illustrates the Wireless Network Sensors that can be used for Data Processing, Analysis, Storage, and Mining.

Currently, academia and other stakeholders from the business and government sectors are interested in wireless sensor networks (WSNs). Generally speaking, a WSN can be described as a small network of nodes that control conditions such as data and signals around an application, users, computer system, and other environments. Supports middle-ground conduct. These node resources are so limited and heavily dependent on battery management, storage capacity, multiplication, data/signal size, and bandwidth. These nodes are often maintained especially, left alone in a remote area, and used for data tracking and supervision. Since electromagnetic waves (EMW) are used to signal many or all communication routes, the term wireless has evolved into a broader and generally broader phrase to characterize communications. WSNs have advanced significantly over time and have great potential in many fields, including environmental science, medical technology, telecommunications, educational facilities, agriculture, observation, and military services. Despite the outstanding capabilities of WSNs, it has been claimed that developing them effectively remains exciting and difficult. So far, few programming procedures have been planned for WSN deployments, mainly focusing on the problems of low-level-based (LLB) systems. Several intriguing solutions have also been anticipated using high-level-based (HLB) techniques. These methods include technical LLB specification, WSN, and architectural simplification.

The present paper is a study ofmonitoring and recording conditions at various locations, a system of specialized transducers, and communication equipment from a wireless sensor network.The first section of this paper is an introduction, and the second section is a review of related literature with recommendations from earlier investigations. The next section is the discussion, and the last section is the paper's conclusion, which is stated, provides the findings, and discusses the paper's scope going forward.

2. LITERATURE REVIEW

According to Tarachand Amgoth [15], et al. WSN is among the most promising technologies due to its size, cost-effectiveness, and simplicity of deployment. Since the traditional WSN systems are explicitly planned, it is difficult for the networks to react quickly. The author says that there are machine-learning techniques for energy harvesting, mobile sink scheduling, congestion control, and synchronization. The influence of current research on Machine learning (ML)-based procedures for WSNs has been documented in statistical charts, and recommendations to select a specific ML approach to handle a problem in WSNs have been followed. Finally, the benefits of using ML to address problems with WSNs.

Amin Shahraki [16] et al. have explained how WSNs regularly employ hundreds of resource-constrained sensors that monitor their operational environments, collect data, and send it to a distant server for analysis. The author has reviewed the goals of current WSN clustering strategies as well as the network attributes that are supported by those approaches in-depth.The outcome shows that clustering methods are used to achieve more than 17 different goals, but power consumption is perhaps the most important one. The majority of present clustering approaches are also inadequate to handle heterogeneous and dynamic network infrastructures. In conclusion, WSNs have made use of clustering as a standard topology management strategy.

Haomeng Xie [17] et al. have explained the many sorts of security attacks in WSNs depend on the network levels. The author advocated giving an overview of the WSNs and categorizing attacks in WSNs dependent on procedure stack levels to assess the effectiveness of existing attack detection mechanisms. It is shown that extracting security data is crucial for identifying security anomalies toward security measurement and outlining the benefits and drawbacks of the current detection techniques based on a variety of assessment criteria. In conclusion, the goal of this study was to explore unresolved research difficulties and suggest future research trajectories for reliable and efficient security measurement in WSNs.

Xiaohui Wei et al. have explained that in Underwater Wireless Sensor Networks (UWSNs), a summary of trustworthy data gathering methods has been provided. The author has followed on to explore the traits, difficulties, and aspects related to the creation of dependable techniques in UWSNs. It was discovered that different coding, retransmission methods, and MAC strategies for dealing with bit error and packet collision have been explored independently in the dependable connection approaches. Finally, trustworthy data gathering methods have been thoroughly examined for each model and stage, and a variety of issues have been taken into account and handled.

The above study shows how WSNs frequently utilize hundreds of resource-constrained sensors to keep an eye on their surroundings, collect data, and send it to distant servers for further processing. Depending upon the network levels, WSNs also subject themselves to a variety of security assaults. This study discussed the categories of wireless networks and types of WSN architectures.

3. DISCUSSION

Most wireless sensor networks are built using the Open Systems Interconnection (OSI) architectural paradigm. The WSN design consists of five levels and three cross layers. For most sensor networks, there should be five layers: application, transport, networking, communication equipment, and the physical layer. Voltage control, bandwidth distribution, and job management form the three cross-planes. Those WSN levels are used to integrate various sensors to meet the n/w and increase the overall effectiveness of such cable networks.

3.1.Types of WSN Architectures:

A sensor network is a design that is employed in a WSN. This type of architecture is used in a wide variety of settings, including businesses, educational institutions, public spaces, and physical structures. It is also employed in a wide variety of applications including disaster management, information security, and disaster preparedness. Two different architecture types are used in wireless sensors. Layered system architecture and clustering architecture are two forms of wireless sensor architecture.

3.1.1. Layered Network Architecture:

A base station and thousands of sensor nodes are used in such a network. Here, the convolution layer can be used to organize the nodes in the network. The architecture is divided into five layers in Figure 2. The application layer, the transport layer, the network layer, the data link layer, and the physical layer.

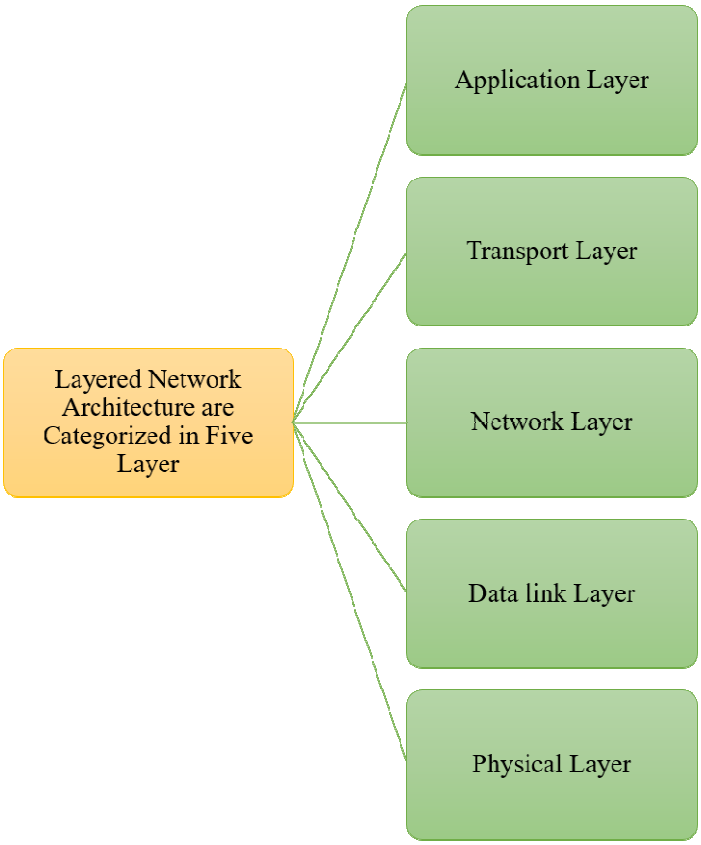

Figure 2: Illustrates the Layered Network Architecture Categorized into five layers.

- Application layer

In addition to providing software for various applications, which convert data into a usable format to retrieve relevant information, the layer is responsible for handling the traffic. Sensor networks have been installed in many applications in many different industries including agriculture, military, environmental, medical, and more.

- Transport layer

When there are too many protocols upstream or downstream to effectively serve this function, the role of the transport layer is to reduce dependency and congestion. These protocols employ various damage detection and loss recovery strategies. If a system wants to

interact with another network, it needs a transport layer. Transmission Control Protocol (TCP) is ineffective over WSN for several reasons, one of which is that it uses more energy than competing protocols to provide reliable loss recovery. The two main types of transport layers are packet-driven, but also event-driven.

- Network layer

The primary duties of the network layer are lightning protection, temporary memory, buffering, and sensors, which lack a common Identity Document (ID) and must organize themselves. The network layer performs a variety of functions depending on the application.

The main goal of a routing protocol is to define a reliable lane and a redundant channel using a common measurement method known as a metric that varies from specification to standard. Several existing protocols can be used for this edge of the system, including flat and multilayer routing, time-driven, query-driven, event-driven, and event-driven monitoring.

- Data link layer

Multiplexing of data frames, data streams, security and error control, and verification of point-to-point (or point-multipoint) dependencies are all tasks that fall within the scope of the data link layer. A large number of small, low-cost, low-power sensor nodes with minimal memory and communication resources make up a WSN. These nodes continuously monitor their surroundings, collect data, and then transmit it to the base station.

- Physical layer

A stream of bits can be transferred over physical media by using the physical layer as an edge. Frequency allocation, carrier frequency generation, signal detection, programming, and encryption techniques are all handled by this layer. That lower rate is recommended for wireless sensor networks with low cost, power consumption, density, focus on certain areas, and communication range to increase battery life.

Support for star and peer-to-peer topologies is provided by Criticality Analysis (CA). The main advantage of using such an architecture in wireless sensor nodes is that each node involves only short-distance, low-power transmission to neighboring nodes, unlike other types of sensor communication networks. This type of networking is versatile and has excellent fault tolerance.

3.1.2. Cluster Network Architecture:

Individual sensor nodes are grouped in this form of architecture, which is dependent on the Leech protocol as it uses them. The Leach Protocol, also known as the "Low Energy Adaptive Clustering Hierarchy", is a computer protocol. Following are some of the salient features of this protocol. The clustering of sensor nodes in this distributed method is called clustering.

The head node of each independently established cluster will prepare a TDMA (Time-Division Multiple Access) plan. It makes the network energy-efficient by using the idea of data fusion. Given its data fusion capabilities, this form of network design is widely employed. Each node in the cluster can communicate with the cluster head to receive data. A copy of the information received by each cluster will be sent to the base station. The cluster setup and the primary selection process of each cluster are both autonomous and independent distributed methods.

3.2. *Categories of Wireless Network*:

The basis of this development is wireless networks, a wireless network is usually defined as any connection that is not connected by a cable and allows the user the ease and mobility desired in Figure 3. Given the wide variety of use cases and applications, it should be no surprise that there will be a wide variety of wireless devices to suit the demands, each with specific performance requirements and each optimized for a particular purpose and environment. The different categories are classified:

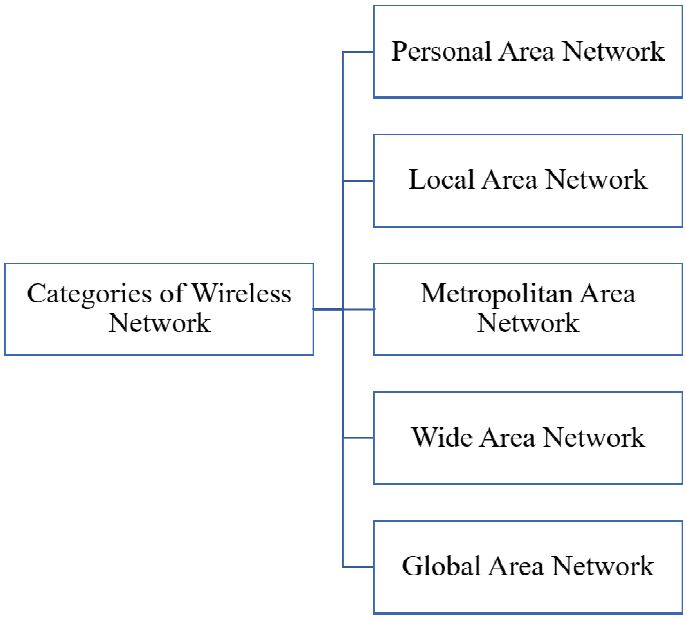

Figure 3: Illustrates the Categories of the Wireless Network which Enable the Desired Convenience and Mobility for the User.

3.2.1. Wireless Personal area Network PAN:

It uses protocols such as Bluetooth and Zig Bee to cover a relatively small area, typically no more than 100 meters for most applications. By connecting your phone to the earpiece or transferring signals between smartphones, Bluetooth makes it possible to make hands-free phone calls. Connects internet of Things (IoT) networks to Zig B stations. When connecting a remote to a television (TV), for example, infrared technology only takes effect within line of sight. Wireless engineers continually make advances in technology by creating new signal transmission methods. These advances provide a longer range and better data rates for each of these wireless communications.

3.2.2. Wireless Local Area Network (LAN):

To connect or connect two or more computers and to form a LAN within a location that is confined in some way, such as a home, building, institution, or business establishment, is called a WSN or wireless computer network (WCN) it allows users to connect or disconnect from WN while moving from one region to another. Wireless LANs can also provide connections to the Internet through gateways, as well as to other areas of the wider cyberspace. The bulk of contemporary wireless LANs are Wi-Fi-branded and manufactured following Institute of Electrical and Electronics Engineers (IEEE) 802.11 regulations. Because of how easy they are to set up and operate, wireless LANs are already widely used in homes. They are also common in the physical identities of companies that provide Wi-Fi access to their employees and customers.

3.2.3. Wireless Metropolitan Area Network (MAN):

Wireless metropolitan networks are now set up in cities around the world to provide access to people outside the workplace or home network. The foundations are similar, even though these networks have a wider communication range than networks in workplaces or homes. Advanced Placement (Aps) can be found throughout the service area on telephone poles or the exterior of buildings. A wireless signal is broadcast throughout the area through APs, which are wired networks connected to the Internet. To reach their desired destination, users can connect to the nearest AP, which then routes the connection through a broadband connection.

3.2.4. Wireless Wide Area Network (Wireless WAN):

Due to the larger size of WAN, as compared to LAN, this type of WN requires technical modification. WNs send data of various sizes, including webpages, calls, and streaming media. Wireless WANs often differ from wireless systems when mobile telecommunications transfer data through cellular network (MTCN) innovations, including 2G, 3G, 4G Volte, and even 5G. Mobile Internet is also known as Wireless WAN (MBB). Through a wireless network operator, these devices can be purchased by the government, geographically, or even internationally (WSP). A user with that type of CN and wireless WAN coupon can connect to the Internet, browse the Internet, or create a Virtual Private Network (VPN) for wireless WAN connections from virtually any location within the WN. The inclusion of wireless WAN capabilities can be simplified by multiple CNs. Some other type of wireless WAN is a large isolated network.

3.2.5. Wireless Global Area Network (GAN):

A WAN would be any network that connects multiple CNs and covers an unlimited amount of space. It is comparable to GAN which would be the internet. LAN and WAN cannot compete with the geographic coverage offered by GAN. One of the major problems for any wirelessly connected device, when a GAN is used to distribute MTCN across multiple wireless LANs, is from one LAN to another, with subscriber communication being transmitted over the first GAN. Is. Mobile broadband (BB) GAN is one of the most popular wireless GAN types. Portable terminals are used here for phone conversations over the BB Wireless GAN, a global satellite Internet network (SIN). Connected to the World Wide Web via CN BB Workstation inside the LAN.

3.3.Application of WSN:

A wide variety of sensors can be used in wireless sensor networks, including low sampling frequency, seismic, electromagnetic, thermal, visible, infrared, radar and acoustic. These sensors are carefully designed to track various environmental exposures. Sensor nodes are essential for continuous sensing, event detection, activity detection, and localized actuator control. Wireless sensor networks are mostly used in healthcare sectors, including the military, environment, home, and other businesses.

3.3.1. Military Applications:

In addition to being the first area of human activity to deploy WSN, the military sector has also sparked interest in sensor network research. A classic example of these early research projects is Smart Dust, developed in the late 1990s to create sensor nodes that, despite their small size, could conduct surveillance operations. Since then, technological advancements have enabled WSNs to support a wide variety of functions. WSN is widely used, in particular, in military activities, with several million autonomously deployed nodes. The

WSN is made up of a significant number of individually deployed nodes and has been used in both special operations and urban warfare operations. In non-combat operations, different WSN deployment methods and scales are used.

3.3.2. Health Applications:

In the healthcare sector, WSNs are used to facilitate real-time monitoring of a patient's life while they are in the same medical institution, such as a hospital or private home. This is made possible by wearable technology and state-of-the-art medical sensors. The most prevalent sensor types appear within each of the three major subcategories for WSN healthcare applications such as wearable monitors, home support networks, and hospital patient monitoring. The next statement discusses WSNs created for these types of healthcare purposes.

- Patient Wearable Monitoring

Applications for health care monitoring can be used with wearable technology that contains biological sensors to provide health assessments of patients in or out of the hospital. Research is being done on this type of health treatment. It provides personalized drug care support using real-time sensors found in cell phones and barcode technology. The created system performs real-time electrocardiogram (ECG) monitoring. Additionally, using real-time sensors, it may be possible to monitor your blood pressure, blood sugar levels, and multiple diagnostics.

3.3.3. Environmental Applications:

WSNs can be used to enhance environmental applications that call for continuous monitoring of ambient conditions in hazardous and distant locations. The three primary subcategories of environmental WSN applications water monitoring, wind enablement, and emergency alerts as well as the common sensor types employed in each are shown. The next section examines WSNs created for various environmental applications.

- Water Monitoring Water

Water monitoring appears to be of significant academic interest to scholars, be it for drinking or oceanographic purposes. A WSN application was created by researchers to assess the purity of fresh, potable water. They created Pipe Sense, a cyber-physical device (CPS) that uses RFID for in-pipe humidity control and monitoring (radio frequency identification). The link may provide information about water usage, water quality, and some other maintenance issues, such as weak points or pipe leaks. The application's in-pipe Radio-Frequency Identification (RFID) sensors collect data and transmit it to database computers, where the technologies help make decisions. In the article, WSN applications for the analysis of the marine environment are demonstrated. The advantage of creating an underwater WSN using wireless sensor nodes on that surface is that it can monitor agricultural pollutants and prevent feed and excrement from harming both animals and plants in the fish farm. Sensor nodes can move around in a confined space to analyze a large area.

- Air Monitoring Air

Air pollution today is caused by many modern human activities and is an important part of human life. WSNs can be employed to monitor air quality in inhabited areas, to prevent the spread of infectious diseases and other hazardous substances without endangering people's health. A WSN-assisted air quality monitoring system called WSN-AQMS has been proposed as a representative example of this type of application. The specific system uses labellum

wasp spots and chemical sensors to detect the properties of gases such as ozone, carbon, and nitrogen dioxide in the air. Wasp continuously monitors air quality and transmits data via the Zig Bee protocol. The Clustering Protocol for Air Sensor Networks is provided by the authors to aid in the operation of this system (CPAS).

- Emergency Alerting

Natural disasters can be avoided or their costs can be reduced with the help of proactive monitoring of their causes. WSN can be used to track common disaster triggers in real-time and send preventive messages to reduce damage or perhaps prevent disaster. Observation of tectonic events, volcanoes, forest fires, and tsunamis are some examples of common usage.

3.3.4. Industrial application:

Most operations performed in industrial settings are time-sensitive, and electromechanical interference is quite common. As a result, communication will achieve maximum throughput, dependability, and immunity to interference and jams. Additionally, operating under strict safety guidelines may be necessary. The characteristics of the specific application determine the physical characteristics, weight, transmission distance, and area of nodes. The physical load and the size of the nodes are not considered fundamental requirements in environmental monitoring. Instead, the structure of the nodes must be extremely durable to withstand harsh environmental conditions. Additionally, the area covered and the communication range should be sufficiently wide. Additionally, since emergency notifications must be sent immediately, communications must be resistant to interference. Additionally, the WSN needs to be tolerant of losing a specific number of nodes.

4. CONCLUSION

In the long term, the widespread use of wireless sensor network technologies is expected to enhance the quality of life in all sectors. Much remains to be done to fully utilize this technology in the future. The next step in building, utility, industrial, residential, marine, and public transportation system automation is represented by smart environments. Smart environments mostly depend on sensory information from the outside world, like any intelligent entity. Sensory information is collected from multiple sensors in different locations using different methods. The dichotomy between mechanical receptors and extrinsic capturers in biological systems captures the need for home automation to carry both extrinsic and intrinsic information. The use of WSN already confers remarkable advantages in several human activity domains. As technology advances, so will the capacity of sensor networks, and so will their production costs. For this reason, the variety of WSN applications is projected to continue to expand. It is implied that a military programmer can monitor cars and classify them based on their nature and degree of friendliness. Such systems require complex sensor stacks with sensor fusion between nodes and must actively use energy-saving strategies.

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CHAPTER 16

AN ASSESSMENT OF PATIENT'S HEALTH OBSERVING USING IOMT (INTERNET OF MEDICAL THINGS): MAJOR CHALLENGES AND SOLUTION

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ABSTRACT: ***Recently, there have been significant developments within the medical sector. The widespread use of cutting-edge information technology (IT) in this sector nowadays is among the key elements that are large to account for such development. Both clinics, as well as large hospitals, need the assistance of different IT-based service platforms including cutting-edge technology to meet the rising requirement regarding the solutions provided by the medical sector. The IoMT (Internet of Medical Things) is indeed one of the most significant techniques which is most often employed within the medicinal industry worldwide. A subgroup of the Internet of Things (IoT) technology is the IoMT. In this article, the authors discussed the patients' health observing utilizing the IoMT along with the major challenges as well as solutions. The traditional medical care paradigm is presently out of date. The need for innovative cutting-edge innovations as well as industry infrastructures has increased with the development of the internet age. This same IoMT technology, a branch of the IoT, is another similar innovation. Employing Wi-Fi (Wireless-Fidelity) or cloud-based technology permits the quick spread of data between the numerous linked gadgets. Both the healthcare sector as well as the patient are the emphasis of this innovation. Implementing such innovation has evolved into a must for the medical sector. This technique enables the best solution output with the least amount of expenditure costs.***

KEYWORDS: ***Healthcare Sector,IoMT, IoT, Medicine, Patient.***

1. INTRODUCTION

Nowadays in this digitized globe, everything (such as multiple systems) and numerous gadgets are connected. Whenever such gadgets are linked to some other via the web, internet technology turns such intelligent gadgets into more sophisticated innovations. The IoT is indeed a vast infrastructure of linked objects which save as well as gather information regarding its immediate surroundings; as just a result, this same IoT is viewed as an ecosystem of linked objects. Inside the existing framework, the IoT is crucial for wirelessly viewing as well as controlling technological equipment. This creates a chance for both tangible as well as virtual products to improve society, technique, as well as trade. Such gadgets, which may be anything from a nano-chip to something like a gateway, interact with each other via detectors, and controllers, including programming. This same IoT has indeed many uses but is expanding swiftly. Owing to these unquestionable benefits, which include reduced price, smaller architecture, diverse networking configurations, reduced care, and many more just about all surveillance solutions in our digitized era are completely dependent on WSNs (Wireless Sensor Networks) [1], [2].

Nearly every element of living, including environmental disruption, precipitation, ecological catastrophes, transportation, forestry, medicine, geolocation, and many more is being monitored by wirelessly detectors and WSN. Some major goals of the detectors within medical solutions are also to govern, analyse, supervise, alert, as well as record the participant's actions. Gadgets enable the medical industry self-reliant as well as independent from direct interference by quickly analysing as well as diagnosing these actions. As just a

consequence, healthcare would advance enormously on a real-time basis. Many IoT-related medical apps have already been put out to make life easier for individuals, medical professionals, including administrators. By supplying real-time intense treatment regarding the person's disease, managing healthcare emergencies, and many others, such apps help to improve the current hospital infrastructure. With the use of IoT apps, patients may monitor but instead send information about their current physiological conditions, including heart rate, glucose levels, cardiac conditions, mental fitness, and many others to something like a specific medical facility or doctor. Medical midpoints or hospitals are indeed heavily employing IoT apps, therefore through determining their location as well as physical condition, they can provide timely services [3], [4].Figure 1 illustrates the devices as well as applications for the IoMT-based healthcare system.

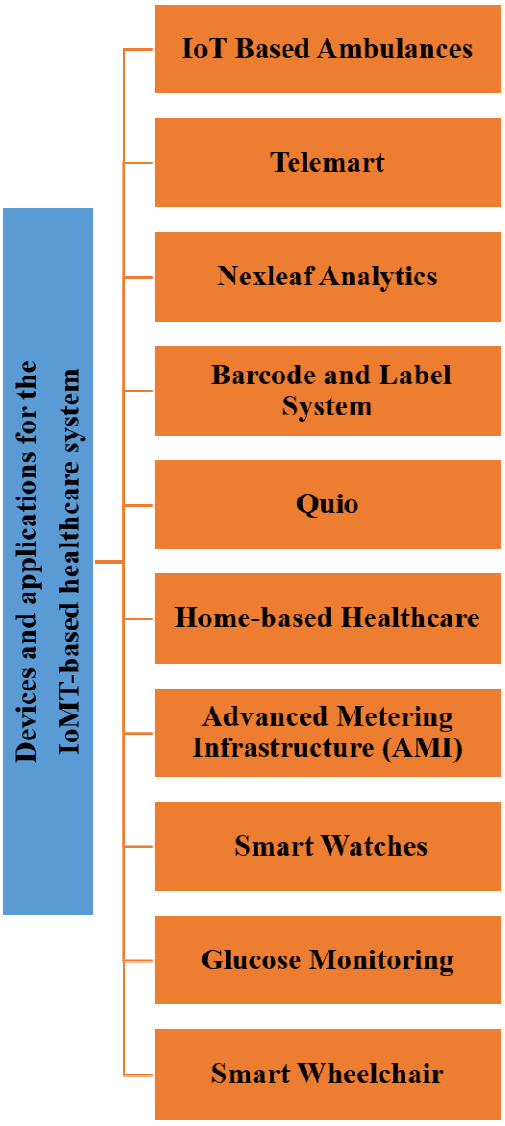

Figure 1: Illustrates the devices as well as applications for the IoMT-based healthcare systems.

IoT technology as well as detectors are among the greatest crucial components from a technological standpoint since these support the medical industry and are therefore closely tied to patient needs. Numerous patients-centric apps are now in use, while solutions are indeed builder-centric since they are utilized to create individual-centric apps. As just a result, technological connectivity has made the Internet of Things (IoT) the highest effective

as well as trustworthy technology again for the medical sector. Even though doctors interact with highly dangerous cases as well as quick decisions are essential to save person's lives, ambulance workers have particularly difficult jobs. But an IoT-rooted ambulance is particularly efficient since distant healthcare personnel may recommend what has to be done for the individual. As just a result, the sufferer receives prompt attention and efficient treatment within IoT-rooted ambulances [5], [6].Figure 2 illustrates the IoMT infrastructure.

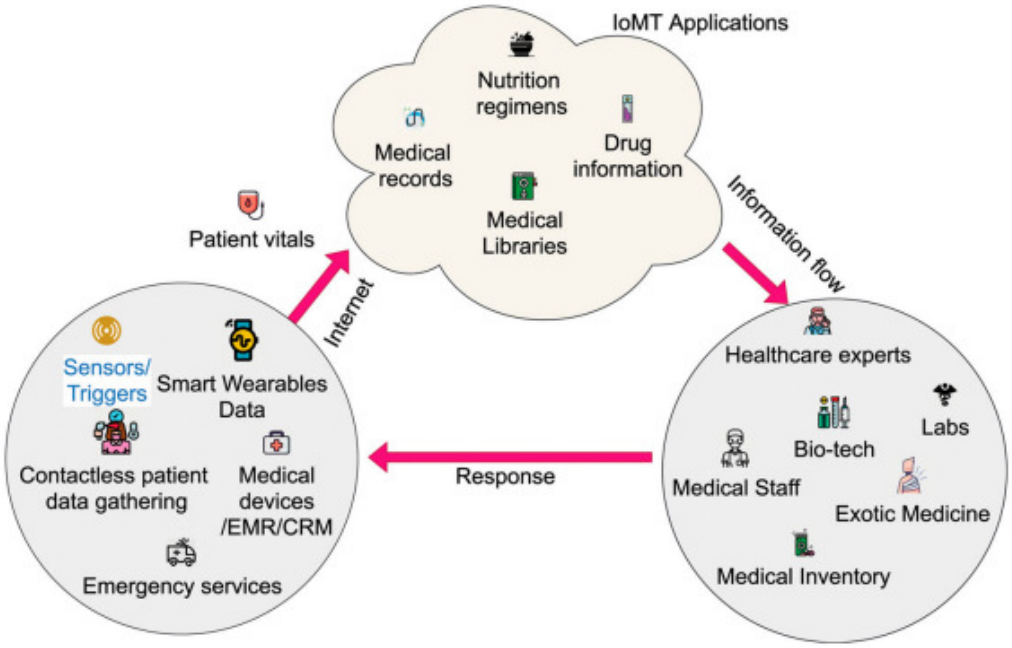

Figure 2: Illustrates the IoMT infrastructure [7]**.**

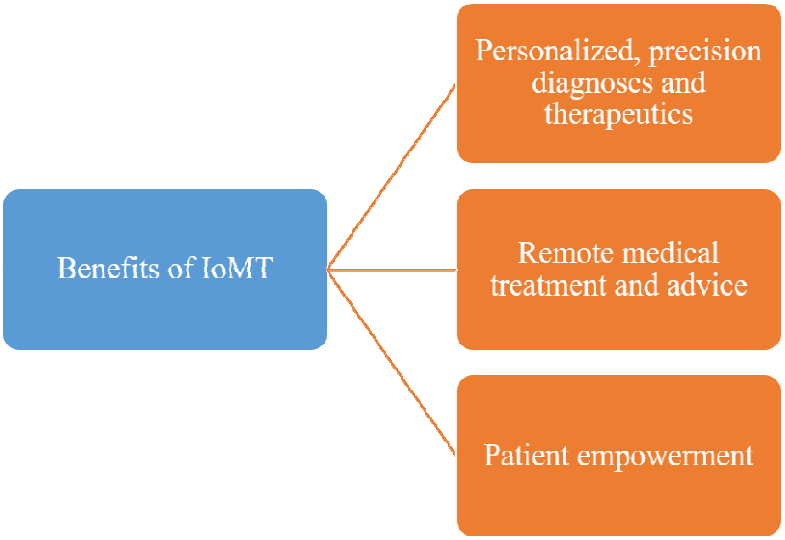

Figure 3: Illustrates the significant benefits of the IoMT.

Telemart has become more useful throughout the IoT these days, for instance, throughout COVID-19, this was difficult for maintaining a 6-feet distance inside a grocery store and many other locations. Walmart previously implemented Telemart to offer consumers a Barcode again for retail entry, after which they are free to start buying. Upon

making a transaction, the consumer receives each of the things while the amount is deducted from their online wallet. As a result, the consumer may pay without standing in the queue at the cash register. Especially in impoverished nations, such technology is highly helpful for both heating as well as vaccinations. This program enables the continual monitoring of a drug's condition in some kind of fridge. Such immunizations are sent to hospitals and hospitals in outlying or country locations [8]. Figure 3 illustrates the significant benefits of the IoMT.

The wireless cloud-based solution is employed by such a system to link various therapy equipment for something like therapy as well as wellness surveillance of persistent illness sufferers. Utilizing the person's real-time dataset even enables healthcare workers as well as smartphone as well as web-rooted healthcare departments to react swiftly. Additionally, it created a framework for medicine administration combining hardware as well as application to strengthen the connection amongst the client as well as the illness monitoring technology. The world health organization (WHO) predicts that the average lifespan of humans would rise beyond this same generation of 70 as just a result of modern conveniences and the accessibility of medication as well as healthcare treatment on such a global scale. Elderly populations would shortly exceed medical rooms, necessitating the provision of medical treatments to elderly patients within home residences. As a result, this is anticipated that by 2040 most medical treatment operations would be replaced by home-based services, as well as people's houses would serve as personal wards. This same IoT-connected home-rooted application is indeed a potential answer [9], [10].Figure 4 illustrates the benefits of the IoMT providers.

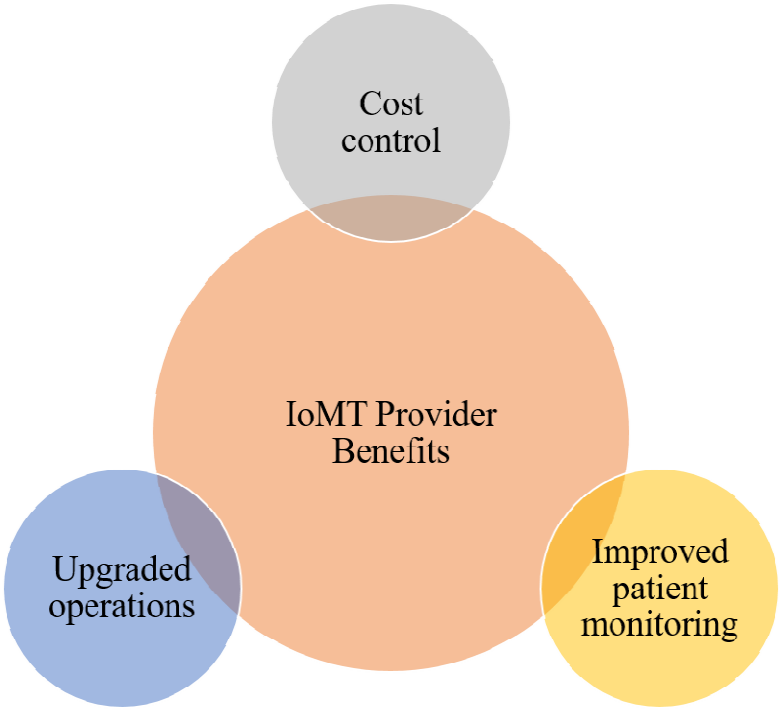

Figure 4: Illustrates the benefits of the IoMT providers.

Wearables were first exclusively used for leisure as well as similar pursuits. Nevertheless, this is now the greatest potent medical instrument owing to the many apps from companies like Google, as well as Facebook, including Google. The seniors who reside independently and without family are the target audience for such a program. Whether using medicine or dealing with significant healthcare difficulties whenever there is no assistance or assistance

available, this application is really helpful. These clinics, medical facilities, as well as other medical equipment must always have access to electricity throughout pandemic situations, therefore smart grids must do this without interruption. This same AMI monitors the availability as well as consumption of power across smart grids, which are made up of detectors as well as actuators. This installation of the AMI through the electrical suppliers allows for remote problem detection, management, as well as prevention. Numerous intelligent meters are used by AMI inside a smart grid, while such intelligent meters are linked to the web via the IoT [11], [12].

Continuous tracking of heart rate, warmth, as well as sugar levels, is a common practice, and COVID-19 has benefited greatly from this. Individuals with diabetes can have other metabolism problems, which include persistently elevated blood glucose. Measuring blood sugar concentrations helps with everyday actions like food, and talking while getting treatment by revealing the trend of blood sugar changes. To create intelligent electrical wheelchairs for the elderly, wounded, but also incapacitated, extensive research was done. Throughout the epidemic, intelligent wheelchairs may travel to any clinic, the marketplace, as well as the medical facility in particular. Numerous detectors which are integrated along with IoT are wirelessly attached to such intelligent wheelchairs [13].Figure 5 illustrates the major kinds of IoMT gadgets used.

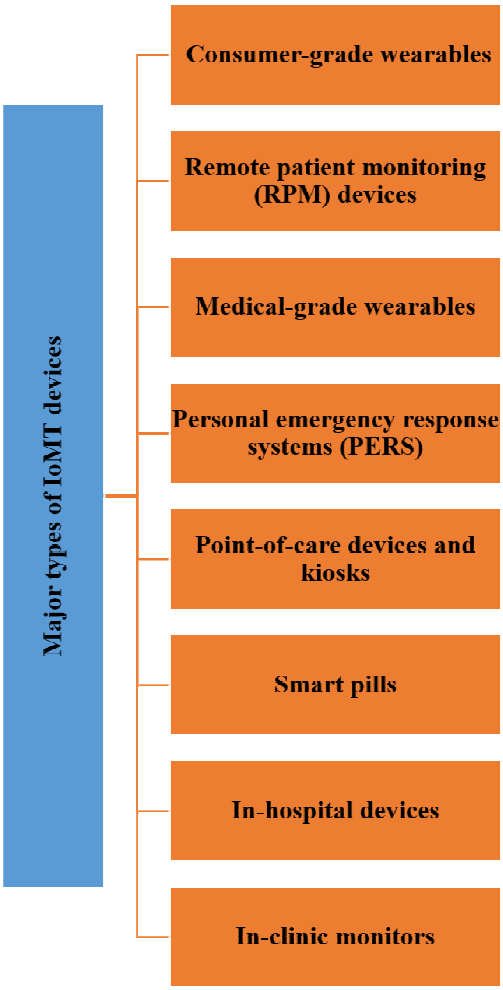

Figure 5: Illustrates the major kinds of IoMT gadgets used.

Preventive, prediction, customized, as well as participative medicine, is indeed a global movement that is currently rising. Such developments are underpinned by the medicine

industry's expanding digitalization. In the context of medicine, this same IoT technology refers to a system of interconnected clinical gadgets which can not only create, but also gather, as well as save information, attach to a system, evaluate this same information, and transfer information from numerous types, including such clinical pictures, physical as well as crucial body signs, as well as genomics information. IoMT, a more recent phrase, is getting utilized more often to refer to linked medical technology equipment. IoT technology along with digitized healthcare services, as well as IoMT would all be utilized interchangeably throughout this article. The IoMT technology combines the IoT with medicinal types of equipment. Upcoming hospital infrastructures would be based upon IoMTs, in which each clinical gadget would be linked to the Web as well as supervised by medicinal specialists. Because it develops, technology promises speedier as well as less expensive medical treatment. There are several examples of IoMTs wherein patients' vitals are gathered using detector gadgets as well as decided to send to IoMT-based software via the Web. The data can subsequently be passed along to the medical professionals as well as personnel, who respond as well as communicate with the required individuals [14], [15].

IoT-based systems are made up of detectors as well as gadgets that are linked to one another through a web of cloud-based ecosystems using higher-speed internet. This large store space provided through cloud-based services receives the unprocessed dataset that has been acquired at such equipment. To acquire a greater understanding of this evidence, information is even further processed and afterward examined. It necessitates the use of new programmes, devices, including instruments that would improve the viewing, interpretation, storage, as well as administration of something like the information. A subcategory of IoT-based technologies known as IoMT consists of interconnected gadgets as well as apps employed within medicinal as well as clinical IT-based applications. Through exchanging data across a secured connection, IoMT gadgets link individuals, clinicians, as well as healthcare apparatus such as surgical hardware, diagnostics tools, including wearing technologies. IoMT, commonly referred to as clinical IoT, employs mechanization, and analytics, including machine-rooted cognition to lessen dependency on person interaction in regular surveillance tasks including healthcare treatments, somewhat like conventional IoT-based devices. IoMT lessens the necessity for pointless physician's workplace as well as surgery centre trips by giving consumers as well as clinicians improved accessibility to a participant's medical records. Expenses for both individuals as well as providers are reduced through IoMT [16].

2. DISCUSSION

The IoMT is indeed a grouping of clinical software as well as hardware that communicates with web computing platforms to link to clinical IT-based systems. Wi-Fi-enabled healthcare gadgets provide machine-to-machine (M2M) connectivity which can be the core of IoMT technology. IoMT-enabled gadgets connect to cloud-rooted infrastructures like Amazon Web-based Services, allowing for the storage as well as analysis of the collected dataset. IoMT is another name for IoT in medicine. IoMT technology instances involve individual tracking prescriptions as well as the whereabouts of individuals committed to clinics, evaluating individuals with persistent or longer-term diseases remotely, including users wearing mHealth gadgets that could relay data to providers. Healthcare equipment that potentially is changed to or used employing IoMT equipment includes inpatient mattresses equipped with detectors that monitor individuals' critical indicators as well as infusing machines which link to analytical panels. Since numerous client smartphones are equipped with RFID (Radio-Frequency-Identification) tags which enable the gadgets to exchange datasets with IT-enabled devices, there are presently extra potential solutions for

IoMT-based gadgets than ever before, similar to the bigger IoT. Healthcare supplies, as well as instruments, may also be given RFID labels such that clinic personnel is always informed of the supply levels. Telemedicine is yet another name for the process of employing IoMT-based tools to electronically examine individuals while they're at residence. Whenever a person receives such sort of care, individuals are spared from visiting a clinic or doctor's workplace every time they possess a clinical inquiry or an alteration within their health.

IoMT-enabled technology has a wide range of effects in the medical field. Whenever IoMT is used at house, just on the physique, throughout the neighborhood, especially at a clinic, the following modifications are most noticeable. With in-home-based IoMT, patients may send healthcare information from their residence to a clinic or the main healthcare practitioner. For example, RPM (Remote Patient Monitoring) involves the utilization of healthcare equipment to send data from newly released individuals to local institutions for assessment whilst also their physicians, including heart rate or oximetry. Identifying problems early on may decrease medical readmissions. Furthering consumer mobility, telemedicine, utilization of communication technology for distant medical facilities, and freshly released individuals to handle small concerns by electronically communicating with their physicians. In addition to telemedicine, the utilization of IoMT-rooted devices may be beneficial for continued treatment away from the clinical environment. The PERS (Personalized Emergency Responding-systems), for instance, may monitor occurrences like a collapse or indeed a heart attack and instantly request aid. PERS may offer protection to vulnerable individuals, including older citizens who wish to remain at house without risking personal protection.

Personal healthcare equipment which is linked to distant surveillance or reporting networks is used within on-body IoMT-based innovation. On-body based-IoMT, as opposed to in-house IoMT, is frequently utilized as individuals go about regular daily activities. Customer on-body IoMT-based gadgets are wearable medical monitoring tools that are available for purchase by anybody to measure wellness parameters for both individual usage including an exchange with medical professionals. Those gadgets may measure a common statistic, like pulse rate, as well as serve as advanced detection systems for potentially significant medical issues. This same Apple Watch, for instance, may alert people to abnormal heartbeats. Similar to consumer gadgets, medical on-body IoMT-based systems provide a greater selection of detector alternatives. For example, diabetic’s individuals may wear sugar monitors to get notifications when their blood glucose concentrations change. To guarantee that sufferers receive prompt as well as precise care, several such gadgets could transmit information straight to the participant's physicians.

IoMT gadgets are used in a larger city or region as part of communal IoMT. Transport organizations, for instance, utilize equipment to monitor individuals whilst they are traveling inside an automobile. Paramedics as well as other immediate rescuers monitor client data from outside clinics using rapid reaction information platforms. Communities IoMT includes technology that offers distant operations in addition to mobility as well as urgent treatment. For instance, nursing professionals may employ point-of-care gadgets within quasi-traditional medicinal contexts like a military clinic, while workstations have the potential to distribute medications to patients in locations with little or no accessibility to conventional networks. To assist in the delivery of medicinal supplies or hospital products, providers can deploy IoMT-rooted gadgets in transportation. For example, detectors may keep an eye on cargo boxes that are temperature as well as more pressure-sensible to guarantee to ensure the integrity is preserved during the transportation procedure. Clinics should continuously monitor the availability but also the efficiency of essential clinical resources, as well as the flow of both staffs as well as residents around the facility. To provide management with a

thorough overview of whatever is happening, medical experts monitor all of such exchanges using IoMT detectors as well as other surveillance devices. IoMT-based technology has certain particular legal, administrative, technological, as well as security problems, mostly due to the environment's large number of parties.

IoMT-based gadgets are revolutionizing patient treatment including medicine even though we understand it, but such movement doesn't seem to be letting back anytime soon. IoMT-based instruments come in distinct varieties, according to previous medical research reports. Such modern innovations are not simply increasing communication between patients as well as healthcare professionals, but are also opening up novel therapeutic options as well as raising customer life quality. Clinicians now are better able to track at-risk individuals as well as render diagnostics faster swiftly as well as correctly owing to IoMT-based devices as well as healthcare IoT-based technology. Additionally, IoMT as well as medicinal-IoT are bringing down operational prices generally as well as extending the accessibility of providers to individuals who would not normally be reachable. Additionally, clinics, as well as health centers, are utilizing IoMT-based technology to run healthcare IT solutions better successfully as well as affordable. Figure 6 illustrates the major challenges of IoMT.

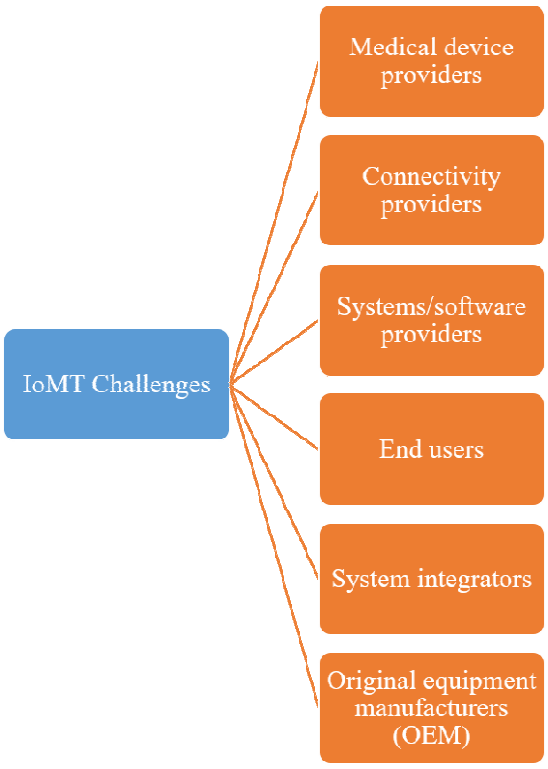

Figure 6: Illustrates the major challenges of IoMT.

IoMT technology is indeed a class that is undergoing significant change because IoMT-based devices have the potential to significantly transform the medical environment. Suppose a day throughout the distance when people may choose to use wearing gadgets that continuously monitor individual critical indicators and notify medical professionals if anything is incorrect. Even better, such gadgets might develop into predicting ones that use AI (Artificial Intelligence) as well as ML (Machine Learning) for identifying the probable future issues based on minute alterations in biological indications. Doctors would be enabled to gradually move their emphasis from the prescription towards the preventative when IoMT-based technologies progress, perhaps enabling individuals to enjoy extended, happier lifestyles. IoMT-based devices throughout biomedical as well as health centre setups,

including such innovative diagnosing processes as well as automaton surgery helpers, would then also proceed to progress their functionality, however, some patients that require in-person healthcare treatment would achieve excellent treatments, faster recovery times, as well as greater resilience levels. Insurers also might decrease premiums for customers who choose real-time tracking. Such advantages will not naturally arise; rather, developments in processing capacity and wireless technology, including element shrinking would be needed to completely propel this sector in the future.

3. CONCLUSION

IoMT-based dataset often travels across the open Web and therefore is subject to higher safety risks than it would be on a personal network protected by a gateway. This same reality that produced information is exchanged by several platforms, opening up numerous assault avenues, and increasing the hazard. The present state of healthcare systems seems fraught with difficulties caused by a lack of essential healthcare personnel, protracted long waits, an increase in treatment demands, as well as budgetary limitations. By reducing the amount of time medical professionals spend on repeated tasks (utilizing AI techniques), IoMT may be able to ease certain restrictions and free them up to concentrate on additional tasks, like visiting additional individuals. Researchers described the IoMT in more depth as well as discussed patient health monitoring by employing the IoMT technology along with the major challenges as well as solutions in this study. The IoMT technology combines the IoT with medicinal equipment to increase individual experience, provide price-effective therapy, speed up hospitalizations, as well as provide even better-individualized health coverage.

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CHAPTER 17

COMPREHENSIVE STUDY OF RASPBERRY PI AND ITS USE IN DIFFERENT APPLICATIONS EMBEDDED WITH INTERNET OF THINGS (IOT)

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ABSTRACT:Thousands of sensors are used in various industries for a variety of purposes, including flow meters, and temperature transmitters. Therefore, recently, there has been a strong demand for low-cost wireless networks. File servers serve as a client in the client model. Multiple child nodes are permitted to connect to the parent node. The Internet of Things (IoT) is a technology that has grown and spread in recent years. In this paper, the author discussed the raspberry pie and its different uses in IoT applications IoT refers to the collecting of sensor data via embedded systems, and thus the system posts the data online. The results show there are various difficulties. Involves, say, IoT and workplace automation facts and Respect, data integrity, encryption techniques, service security automation Domain Scalability, and Interoperability Constraints. In this paper after many literatures reviews study, the author concludes that the Raspberry Pi idea with IoT-enabled industrial workstations and industrial automation. The program makes use of Raspberry Pi as a server and controller, the Python is used as the programming language in the future.

KEYWORDS:Automation, IoT, Embedded, Machine, Network Raspberry Pi.

1. INTRODUCTION

Internet of Things (IoT) is the capacity for objects, animals, and humans to communicate with one another and exchange data via a network without directly interacting with one another or with computers. Machine-to-machine communications (M2M) is a field of machine-to-machine IoT connection that includes a wide range of applications, domains, and protocols. IoT devices are widely utilized nowadays. Some examples are “heart monitoring implants, cars with built-in sensors, farm animals” with biochip transmitters, and field operation equipment used by firefighters in operations of search and rescue. The use of Wi-Fi for remote monitoring of washers and dryers and smart thermostat systems on the market today [1].

The McKinsey Global Institute estimates that by 2025, IoT will have a larger market and may have a $2.7 trillion to $6.2 trillion yearly economic impact. The IoT currently exists in our gadgets, cloud infrastructure, data, sensors, and business intelligence tools; it is not a future or aspirational technological fad. Additionally, Microsoft Corporation offers an innovative and comprehensive strategy for all businesses to benefit from IoT by gathering, storing, and analyzing data. This approach was expanded from a wide range of products, including PCs, tablets, and industrial devices on the edge of corporate networks, to the backend system and services to create tools and a diversified partner ecosystem. Figure 1 illustrates the basic structure of the raspberry pie.

This terrible incident was caused by steel plates unable to support the bridge’s weight. The catastrophe can be avoided if we use smart cement, which is fitted with sensors to monitor fractures, strains, and war pages. IoT should thus be further investigated since an item may digitally represent itself or become more formidable than it. When several objects cooperate, this is referred to as “ambient intelligence”. The Raspberry Pi Foundation in England created

the Raspberry Pi line of single-board computers to be used in classrooms to teach computer science. You only get the Raspberry Pi board when you purchase it. Other parts, such as a power supply, High-definition Multimedia interface (HDMI) cable, memory card, etc., are needed to operate the Microcontroller. Following the provision of these fundamental parts, the operating system has to be implemented on the Micro SD Card slot [2], [3].

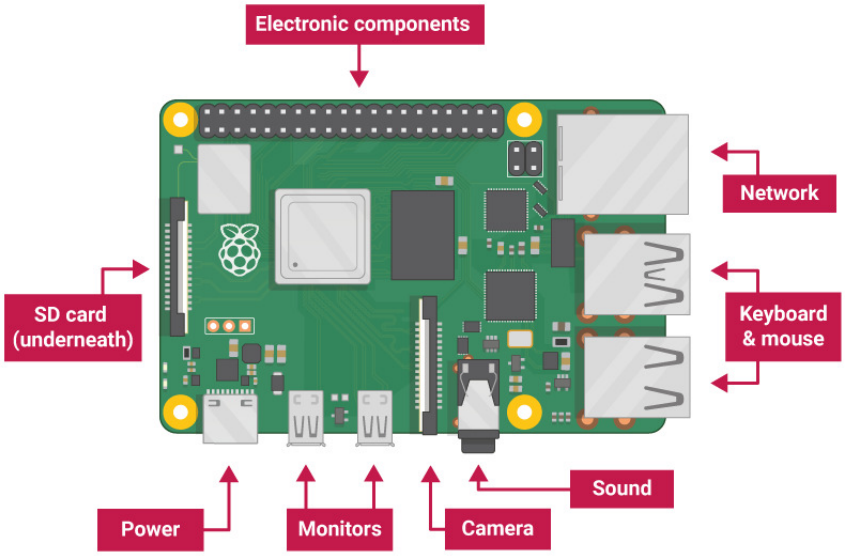

Figure 1: Illustrates the basic structure of the raspberry pie [4], [5]**.**

A single-board computer like the Raspberry Pi is a supercomputer that has the fundamental components of Read-Only Memory (RAM), I/O unit, and a microprocessor but unlike other computers, the hardware cannot be expanded. For instance, it lacks a lot that would allow the RAM capacity to be increased from 1GB to 2GB. The Raspberry Pi is fairly affordable since it is made as a single component and does not include a framework that is open to modification so that more hardware may be added to it. Single-board computers are used in construction activities that demand intensive computation, such as robots, the Internet of Things, image processing, etc. They are not utilized as personal computers.

On a single-board computer, components like memory, a video card, a network card, and a sound card are often integrated on-board. The Micro Secure Digital Card (SD) contains the operating system. The Dyna-micro the first single-board computer created in 1976, is seen in the image. The "ZX81 and Spectrum, the first home computers from the 1980s, and government-backed in-school gadgets like they served as inspiration for the Raspberry Pi Foundation's mission to advance the teaching of computer science". In February 2012, the first Raspberry Pi gadget was made available. Due in part to the $35 pricing, it turned out to be an instant hit [6], [7].

With the addition of a few more components are keyboard, mouse, monitor, and SD storage, it is possible to have a fully operational computer running Raspbian, a working Linux machine based on Debian, it frequently goes by the name Single Board Computer (SBC), which indicates that it has a full operating platform and has enough peripherals (memory, Central Processing Unit (CPU), and power management) to start running right away without the need for additional hardware. The Raspberry Pi may support multiple operating system variations, including the ability to boot using only electricity. Although certain Raspberry Pi models may boot straight from the connection, in general, file-system storage, such as a micro-SD card, is required. There were some SBCs before the Raspberry Pi, but primarily, their progress referred to specialised industrial platforms such as boards for vending

machines. The Raspberry Pi Foundation has made it possible for almost anybody to utilize the SBC. Figure 2 embellishes the raspberry and its different use in alternative applications.

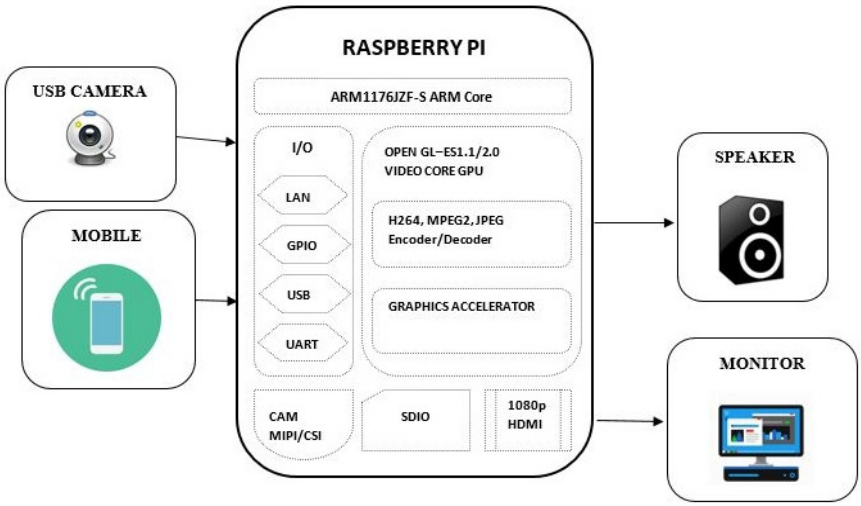

Figure 2: Embellishes the raspberry and its different use in alternative applications [8]**.**

Despite being inexpensive, this low-cost computer may connect users to the real world by presenting General Purpose, Connection pins for input-output (GPIO) devices. It is possible to programmatically manipulate the Raspberry Pi pin header for a variety of functions from the operating system, including interrupts, it is adaptable to connecting a wide range of electronic parts which has increased the appeal of the Raspberry Pi in both industry and education gamers, prototype makers, inquisitive people, and enthusiasts. It has made it possible for individuals to try new the mainboard may be damaged in several ways, for as by improperly attaching sensors to GPIO pins; this is If it's a Raspberry Pi, it won't be as bad, but if it's the family PC, it will be disastrous. Cyber-Physical Systems (CPS) and the IoT have become more and more popular [9], [10].

1.1.Raspberry Pi:

The Raspberry Pi has benefited immensely from a large-scale increase in the need for embedded systems. The urge to study and instrument the fabric of human civilizations is what fuels this need. Spanning from cities to woods, to gather knowledge and generate actions, such as Smart Cities, Smart Homes, and Smart Cars. This is made possible through sensor networks and related communication technologies. The reduction in hardware prices and optimizations serve as the main drivers. According to some predictions, there will be 100 billion IoT devices by 2021, whereby, albeit a rough estimate, shows the enormous possibility and demand for SBC applications.

A moderately cost, lightweight, and small computer board is the Raspberry Pi. This might be connected to flash drives, a computer monitor, a projector, a controller, and even a mouse. The Raspberry Pi comes with software like Scratch that lets users create entertaining videos, games, and animations. Python, the primary core language of the Raspbian operating system, may also be used by programmers to create scripts or programs. The Model B has evolved into the Raspberry Pi B+. The client/server communication script in this work was written in the Python programming language. There are other enhancements like additional USB ports, increased header PIN, decreased power consumption, etc. It is advised to utilize model B+ for educational purposes since it gives more versatility than model A, particularly for embedded applications, requires less power, and has more USB ports than Model B.

In this paper, the author elaborates that Samba is free software that offers clients of a seamless file and print service. This application is considered a great and user-friendly technology since it thinking skills amongst Linux/Unix servers and Screens clients. Two crucial programmers that compensate the Samba server are smb and named. Samba provided name resolution, authentication, authorization, file and print applications, and helps to educate, among other things. In this project, a Raspberry Pi acts as a server for Samba, allowing several PCs to access files remotely.

2. LITERATURE REVIEW

Jabbar et al. in their study embellish that Parking spaces have grown to be a major issue in urban growth. In this situation, the proportion of parking spots available to both teachers and employees on campuses has soon surpassed the number of vehicles on campus. In this paper the author applied a methodology in which they stated that the launch of transport planning for the smart campus may help to address this problem by helping drivers match up with available parking spaces individually, minimizing management expenses, enhancing parking space use, and easing traffic congestion. The findings demonstrate that this project develops a Raspberry Pi-based Internet of Things (IoT) traffic management system that would make it faster for staff and students to discover free parking spots utilizing real-time imaging and location data via a mobile application. The raspberry pi, according to the author, has a significant influence on both the main environment and the Internet of Things [11].

Simadiputra et al. in their study embellish that IoT technology is becoming more important in daily life. As IoT technology developed, it became clear that there was a security and privacy risk associated with IoT devices, particularly the IoT gateway device for smart homes. In this paper, the author applied a methodology in which they stated the preference of smart home users for an economical, secure home assistant gateway device or router. Running security programs on top of smart home gateway applications was the issue with low-performance smart home gateways. The results show the researcher was inspired by this issue to develop a safe and effective smart home gateway utilizing Raspberry Pi hardware, which is a cost-effective smart home gateway device that can run both smart home access points and security applications. In this study, the author concludes that scientists used the Raspberry PI 3B+ model to deploy snort as a malware detection system, open Hab as an IoT gateway application, and well-known encryption techniques for file encryption. The researcher studied the effectiveness of each well-known cryptographic algorithm and assessed Snort's capacity to defend against network threats [12].

Endres et al. in their study embellish that the market for Industry 4.0 technology is expanding globally, but Brazil still leads to different. In this paper, the author applied a methodology in which they stated that to evaluate IoT's use in the food business, a systematic review was conducted. The result shows when choosing works, some platforms used the filter "IoT AND Raspberry Pi AND Cheese." The majority of the Internet of things in the food business, with an emphasis on temperature, humidity, color, product chain traceability, and increased sustainability, may be shown. The author concludes that the biggest challenges in using IoT conventionally are connected to the expensive cost of proprietary architecture, the shortage of skilled labor, and the difficulty in implementing data security. Some options attempt to lower implementation costs, such as the use of Raspberry Pi. The food business offers a great opportunity for the possible implementation of technologies that focus on product quality.

In this paper, the author elaborates on the implementation of transportation planning for the smart campus may assist in resolving this issue by assisting drivers in matching up with available parking spaces individually, minimising management expenses, enhancing parking

space use, reducing traffic congestion, and saving time. The results show that this project builds an Internet of Things (IoT) parking management system on the Raspberry Pi to make it simpler for employees and students to identify open parking spaces using real-time vision and location data through a mobile application. The raspberry pi, according to the author, has a significant influence on both the main environment and the Internet of Things.

3. DISCUSSION

Numerous papers, which highlight the depth and breadth of Raspberry Pi's capabilities are included in this Special Issue. Almost all publications include the Raspberry Pi as the foundation for their work because of its inexpensive "cost of hardware, simplicity of availability, and benefits of a sizable community". Although we try to include a wide variety of services and academic fields that make use of the Raspberry Pi, this list is by no means.

3.1.Dedicated Raspberry Pi Technology Issue:

Unsurprisingly, educational uses for the Raspberry Pi are by far the most common. In a variety of universities and colleges, this encompasses both software and hardware; many of the other pieces in this Special Issue cover particular themes. For instance, we are seeing a shift in designs where computation is pushed toward the edge of the system because of the accessibility of low-cost power. For IoT systems to become more effective and scalable, a major modification called fog computing or edge computing is needed. Only if electricity is utilized effectively via optimized computation and clever monitoring systems will scaling to thousands of devices be feasible. The environment in which we live will be impacted by this. IoT devices that monitor and record parameters might be useful for gaining a better understanding of climate change, pollution, and other environmental challenges.

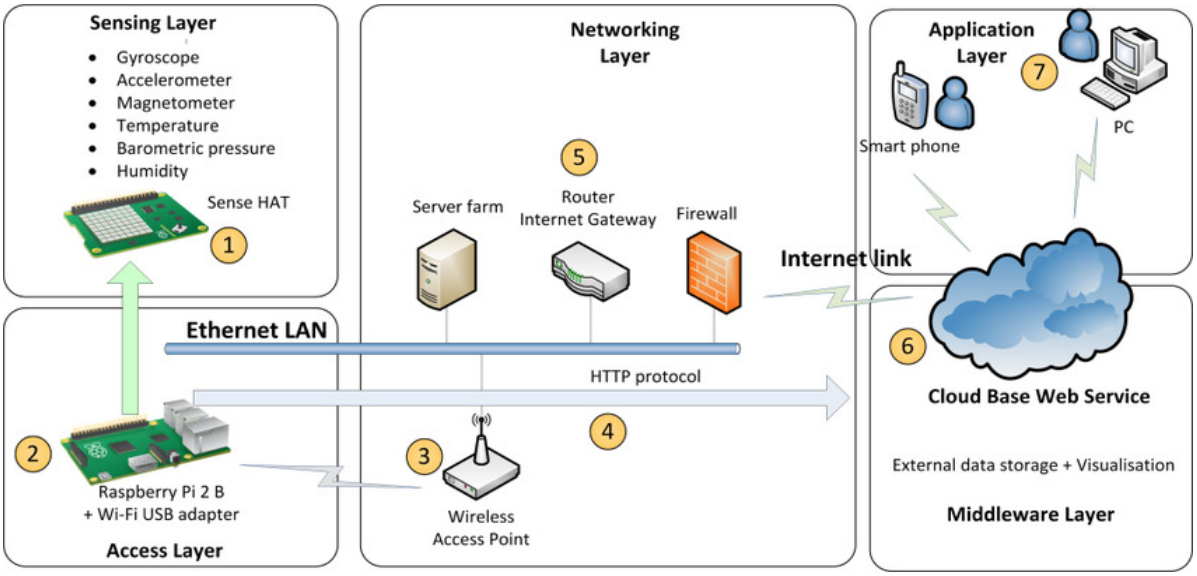

Figure 3: Illustrates the different layers of the cloud that is connecting with the raspberry pi [13]**.**

Alternative networking models, techniques, and procedures are needed to handle the massive production of IoT devices. Network test beds are one research tool in this field. These test beds aid in bridging the gap between the realms of experimental design and pure simulation. Because physical test beds may be expensive, Raspberry Pi-based alternatives are more appealing. All facets of "the digital world and their interactions with physical systems", such as those related to art, industry, medical research, and automotive applications, are included in the Internet of Things. More innovative solutions are needed for relocation, broadband,

mesh communication systems, in-situ image processing, and non-linear and no systems as gadgets are integrated into the architecture of civilizations. Even in remote locations, Raspberry Pi devices are used to monitor and analyse the ultrafine psychomotor activity and circadian rhythm of microscopic marine creatures. The many cloud layers that are communicating with the raspberry pi are shown in Figure 3.

There are several established industrial IoT applications in recent years and RFID technology served as the catalyst whereby microchips send a person's data wirelessly to another communicating reader. In addition, wireless sensor networks are the latest in technology (WSNs), which primarily detect information through networked intelligent sensors and for surveillance. The idea of the "Internet of Things" takes into account various species' extensive presence in the environment of items/things that link wirelessly and wired thus different addressing methods may communicate with one another. To make something new, work with other items and stuff applications, and services, and accomplish shared objectives using IoT Examples of applications include smart cities, smart energy, and grids, smart transportation, and traffic control technologies and command.

A single-board computer called the R-Pi runs Linux based OS that is directly applicable to electronics tasks as it features GPIO (general purpose input/output) pins throughout the boards part of this endeavor, is an intricate design, and fabrication of a solution for industrial automation that makes use of Raspberry Pi access to the internet. There may be partial or complete automation controls and keeps an eye on the sensors linked to the utility grid. This paper serves as an example of how to create a versatile remote-controlled device that is capable of switching any using a Raspberry Pi, which is a low-cost, designed to command the internal machinery of an industrial while the user is not at a workstation, the surroundings, and allowing access to relevant information through the phone. The input from the system will show the condition of whether the system was running or not.

Many people think it's the most flexible technology ever created because of how simple it is to use and how versatile it is. Been Upton created it to create a low-cost tool that will also aid youth and computer enthusiasts in developing their coding skills and technological understanding. The Raspberry Pi's General-Purpose Input/Output (GPIO) pins may be used to connect to screens, keyboards, mice, and other hardware to make amazing things. Raspberry Pi is employed in a variety of projects, from creating fun inventions and games to creating monitoring and security systems. The top uses for the Raspberry Pi will be the emphasis of this essay on its uses. The use of a Raspberry Pi has several advantages. Please refer to the parts below for examples of how well and extensively Raspberry Pi has been utilized.

3.2.Desktop Computer:

A simple desktop may be created using a Raspberry Pi, a micro-SD card, and a battery system. A decent display, maybe an old monitor, and an HDMI cable would also be required. Additionally required are a USB workstation and mouse. The Raspberry Pi 3 is the most recent model, and it has Bluetooth and Wi-Fi as well. Corresponding USB dongles would be necessary if a different model were to be utilized. Your desktop computer is ready for use after everything has been set up and the desired operating system (the most recent version of Raspbian) is installed.

3.3.Server For Wireless Printing:

Installing Common UNIX Printing System (CUPS) and Samba file-sharing software is necessary. Drivers for the administrative console and printer are provided by CUPS. For a

Windows or Mac computer to access the printer across a network, a Pi setup is then required. The USB cable for the printer is required.

3.4.Use Of Media:

According to several estimations, a Kodi media center is one of the primary applications of a Raspberry Pi. As disc images, several Kodi builds have been made available. Among the most common are OSMC and OpenElec. Kodi installation has various restrictions. We should only install secure and legitimate add-ons from the official Kodi repository, according to the advice. A Raspberry Pi running Kodi is furthermore susceptible to a few security flaws. Therefore, it is advised to set up a VPN to encrypt data.

3.5.Game Server:

A unique version of the game Mine craft is pre-installed on Raspbian, the Raspberry Pi's default operating system. But a Raspberry Pi application may also be utilized as a gaming server. It is a fantastic Mine craft gaming server. A superb gaming experience may be had if many Raspberry Pi are utilized, with one serving as a dedicated server.

3.6.A Vintage Gaming System:

As a system for classic video games, Raspberry Pi excels. It is appropriate for use as one of a machine's lightest parts. In particular, The Raspberry Pi Zero is a variant that may be used for gaming applications and can fit in tight areas. The two primary choices are Recalbox and RetroPie. It is also possible to simulate other platforms. It is also possible to set up the Commodore 64 and other well-known 16-bit game consoles [14]–[16].

3.7.Robot Manager:

There are several Raspberry Pi projects for controlling robots. For the Raspberry Pi, a special robotics package that may be used to connect with and operate robots is available. Pi Zero W can only be applied to robots. The Raspberry Pi Zero slim-line model contains inbuilt wireless networking characteristics ideal for portable robotics. It is far lighter than the Model B+ boards of the Raspberry Pi versions 2 and 3, and because of its low profile, it may be positioned effectively without worrying about blocking USB ports.

3.8.Stop-Motion Video:

Stop motion cameras may be created using Python, an appropriate mount a normal tripod for toy- or clay-based cameras, and a well-lit environment. But this procedure takes a long time. To get excellent outcomes, one has to practice a lot.

3.9.Time-Lapse:

Another application that records videos is created using the Raspberry Pi camera module and a different script. Capturing time results with a time delay may be accomplished. A tripod may be employed, and possibly a backup battery solution is also required. The best option for keeping the smartphone solid is a tripod.

- *FM Radio Station:*

Radio broadcasting on FM may also be done using a Raspberry Pi. Pi can only transmit over a small area. Here, a rechargeable battery and soldering abilities would be necessary. Any audio that must be transmitted must be put in advance into the micro SD card [17].

- *Internet Servers:*

Making a web application out of a Raspberry Pi is another fantastic use for it. This implies that, like any other server, it may be set up to host a website. It can also host blogs. The correct software, which is Apache, and the libraries that rely on it, must first be installed. A complete LAMP stack may also be configured with PHP, MySQL, and Apache too. Additionally useful is setting up FTP. After completing all of the aforementioned processes, the webpage is ready for usage and Hypertext markup language (HTML) pages may be stored in the /www/ directory. Once the server is set up, certain web software like Word Press may be utilized.

4. CONCLUSION

Because it can connect with a variety of devices, including Wireless Fidelity (Wi-Fi), scanners, cameras, Light Emitting Diode (LED) lights, microphones, and a wide range of suppliers to construct highly organized and self, the Raspberry PI aids in the development of basic products. Two modules are communicating with two different gadgets in that solution laptop and Raspberry PI. The thriving by employing sensors to construct intelligent systems, such as smart motion detectors, the proportion of consumers who enter and depart the business, thermal warning systems, etc., may be stretched even more to create collaboration. This project also demonstrates the file-sharing capabilities of Raspberry Pi. Because Samba is available as free software and may be used as a server on a Raspberry PI, an administrator can regulate file access to protect a user's or company's personal information. To maintain correct and consistent data, the file must be protected. Small, medium-sized, and big organizations regularly use file sharing. One rationale is that it makes it simple for clients to access and manage the effective file. To proceed, a tone and a notice will be issued whenever a request comes in if it fails well over three times. Message informing the administrator that the programmer could be the offender. In conclusion, the Raspberry Pi might usher in a new age of client-server communications and intelligent software. This article serves as a springboard for explaining Raspberry Pi's various capabilities and possibilities. It also gives a path for scientists who wish to explore this new embedded technology. The Raspberry Pi may also be used in the classroom. Scratch is listed as a tool for learning kid-friendly animation.

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CHAPTER 18

SURVEY ON IMPACT OF IOT IN COMMERCIAL FARMING: MAJOR ISSUES AND SOLUTIONS

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ABSTRACT: ***Now-a-days, among the key industries which strategically contribute to maintaining meal sustainability is agribusiness. Yet as the globe's populace grows, so do the needs for food as well as farming, necessitating a shift from conventional farming approaches to innovative ones. Following the Food and Agricultural Organization (FAO) report, the global populace will reach 9.78 billion around 2040, which means that as a result, there will be a corresponding rise in the requirement for agrarian commodities. With the use of cutting-edge innovations such as the Internet of Things (IoT), as well as Machine Learning (ML) based methods smart Cultivation is substituting traditional agrarian methods as well as ensuring greater profitability and accurate agrarian governance to meet the world's growing meal consumption. This paper provides a review of impacts of the IoT technology in commercial farming along with the major issues and solutions. Scientists working in the area of smart agribusiness have drawn more attention recently. This likelihood of food scarcity gets exacerbated by combined demographic growth as well as urbanization as a result of rising food requirements and greater usage, while cropland is being substituted by roads and residences. The production of agriculture is hindered by various factors, including soil quality in dry areas, which lowers produce growth. Moreover, the volume, as well as the value of crops, are impacted by land susceptibility as well as weather.***

KEYWORDS: ***Agribusiness, Artificial Intelligence, Commercial Farming, IoT, Machine Learning.***

1. INTRODUCTION

The increasing popularity of the online platform during the past few years has benefited people as well as organizations all over the globe in innumerable ways. The capacity to acquire and provide information as well as resources instantaneously became, undoubtedly, the greatest significant gain. The IoT (Internet of Things) technology, which later made a promise to offer similar advantages to commonplace items, gives everyone a method to broaden human vision as well as the capacity to change the world surrounding them. With their large geographic distribution as well as an ongoing requirement for monitoring as well as management, both agri-industrial as well as ecological sectors become excellent prospects for said implementation of IoT technologies. Even as acquired information is fed into machine learning systems to produce forecasts, IoT simultaneously creates additional options outside bottom-level technology, facilitating choice-making among proprietors, administrators, including policy experts. In several stages of the agri-industrial supply cycle, IoT may be deployed.

Agricultural factors including ground quality, weather, as well as the biomass of crops as well as creatures, may all be evaluated [1]. Moreover, it may be utilized to monitor as well as manage conditions like warmth, moisture, noise, as well as impact while the item is being transported. It may be utilized to track as well as forecast item consumption as well as its condition in stores or even in freezers. Moreover, it may enlighten this same buyer on the origins as well as characteristics of the item. The educated, linked, evolved, highly adaptive countryside society may be built with the help of IoT technology used in the agri-industry. Lower-cost digital gadgets may enhance how people engage with the real environment

underneath emerging IoT concepts, while the World-wide web's computational capacity and applications could offer insightful statistics. In conclusion, IoT has the potential to be a crucial resource for everyone involved in an agri-industrial sector in the future, including producers, ranchers, specialists, marketers, businesspeople, customers, including public officials [2]**.**

Commercial cultivation is cultivating a particular grain throughout the whole allotment of ground primarily for industrial purposes, such as agricultural importing as well as exporting. Commercial agribusiness includes a broad spectrum of agricultural production as well as the rearing of livestock for food, industrial resources, or trade. It is undertaken to make money. Commercial agribusiness has to be exceedingly efficient as well as done on a massive level to benefit from the economies of scale. There are a couple of various corporate gardening practices which concentrate on various agricultural sectors. The provinces which engage in commercial agribusiness the most include Gujarat, Punjab, and Maharashtra in India. Some main commercial commodities grown in India include grain, corn, cocoa, sugarcane, bananas, as well as linen. Commercial agribusiness makes substantial use of advanced technology, particularly large machinery, watering methods, synthetic fertilizers, and insecticides. Strong demanding commodities come under the category of commercial agribusiness, which includes commodities that are either sold to foreign countries or used as unprocessed materials by corporations. Commercial cultivation is done primarily for financial gain, and since it uses larger-scale production, it moreover helps the business [3], [4].Figure 1 illustrates types of commercial farming.

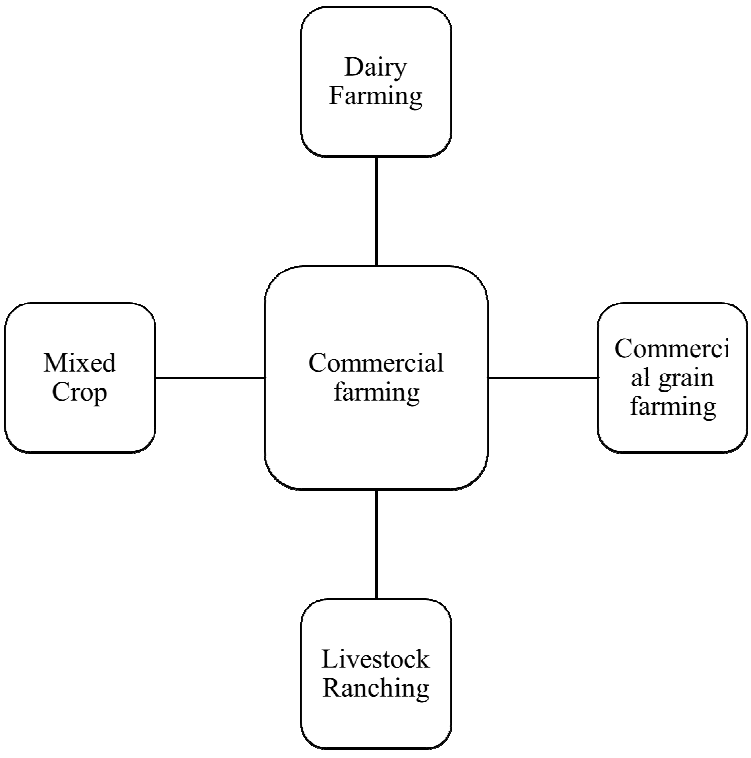

Figure 1: Illustrates types of commercial farming.

Commercial farms, or milking agribusiness, focus mostly on the creation of milking-related mild by-products, even as the term implies. One main goal of dairy ranching would be to raise animals that will provide milking as well as various milk commodities. Rice harvesting is a kind of industrialized agribusiness where cereals like maize, malt, as well as rye have been grown for consumer nutrition as well as trade. It's indeed important to understand how wheat growing is very automated as well as requires sufficient area, people, machines, as

well as device types. The greatest times for producers who practice this kind of seasonally, outside industrial agribusiness is during the sowing as well as collecting periods. A form of cultivation known as cattle agriculture involves the rearing of creatures to generate or supply food.

While goats, as well as chickens, are sometimes maintained in large quantities on ranches, the most common creatures grown under livestock production are cows as well as sheep. This practice of tropical agriculture is quite comparable to industrial growth in that a sizable area of ground is utilized for the production of financial commodities like sugarcane, cocoa, cotton, bananas, coconuts, and so forth., which are then sold on the world marketplace to generate a lot of money. In hybrid agribusiness, a particular commodity or livestock is grown. On the contrary hand, with this kind of industrial agribusiness, livestock, and grains are simultaneously grown on identical pieces of ground. Hence, it is possible to raise food to nourish the livestock while earning money by selling the livestock. Moreover, livestock manure may be used in crop production. Throughout the year long, the animals survive and therefore are growing alongside [5], [6].Figure 2 illustrates the IoT-based model for agriculture management.

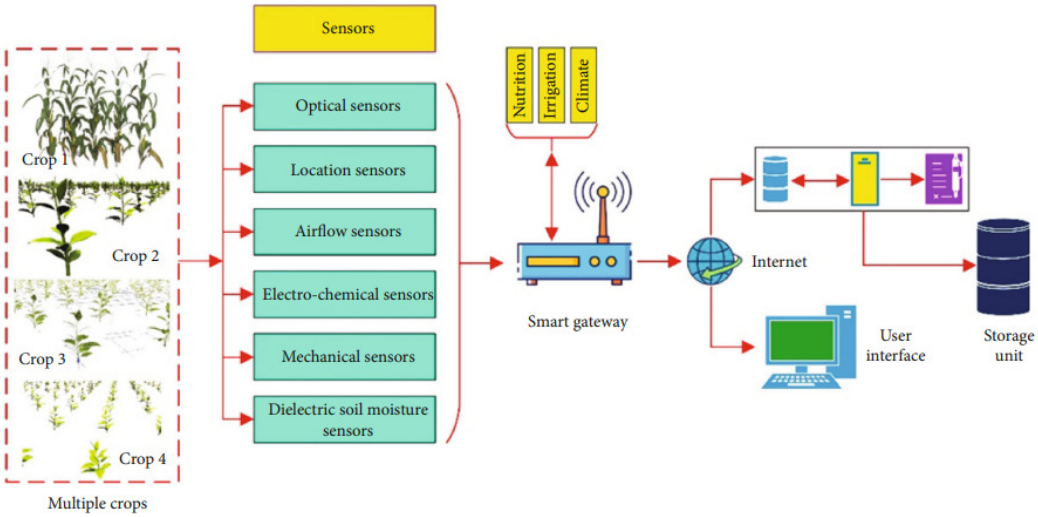

Figure 2: Illustrates the IoT-based model for agriculture management.

The IoT-based gadget monitors the surroundings in real-time and seems to be capable to gather a lot of data that is helpful to growers. Climate, land situation, as well as crop development, are just a few instances, which are discussed. Such information may be utilized to keep an eye on the estate's condition in addition to the productivity of its employees as well as the effectiveness of its equipment. The use of IoT within agriculture allows for more cost-effective administration due to improved output supervision. Farmers may more precisely detect anything aberration inside the harvest, for instance, using intelligent equipment. As just a result, it is simpler to successfully stop whatever infection would reduce production. Moreover, the watering, as well as fertilization processes, might also be cheaper. Even so, the agrarian equipment is equipped with detectors that may provide a wealth of data just on the ground. The ability to set the detectors to provide alerts regarding the perfect harvesting operations is an additional benefit. Loss inside the product is prevented in this manner [7].

It's additionally feasible to regulate several production-related steps using connected phones, including watering, fertilization, and insect management. Eliminating those mechanical operations improves reliability, increases production value, as well as conserves manpower.

Hence, agribusiness assures that the crop meets greater criteria of sustainability. Despite though they are practically separated, producers may carefully track the well-being of agricultural livestock owing to IoT. Hence, if cattle, as well as other sheep, were members of a group, for instance, someone may shorten their searching duration inside the grassland. It's additionally feasible to track the health of such creatures' pregnancies as well as determine whether one is unwell. If that's so, the detector alerts the producers to get in touch with a veterinarian. Improved harvesting provides a further benefit that gives businesses a comparative edge as previously indicated in the issues described prior. Researchers may use preventative upkeep as an example. Whenever instruments are mounted on something like a farm, for instance, the information gathered might promptly alert whenever any physical issue occurs [8].Figure 3 illustrates the key advantages of the IoT in commercial farming.

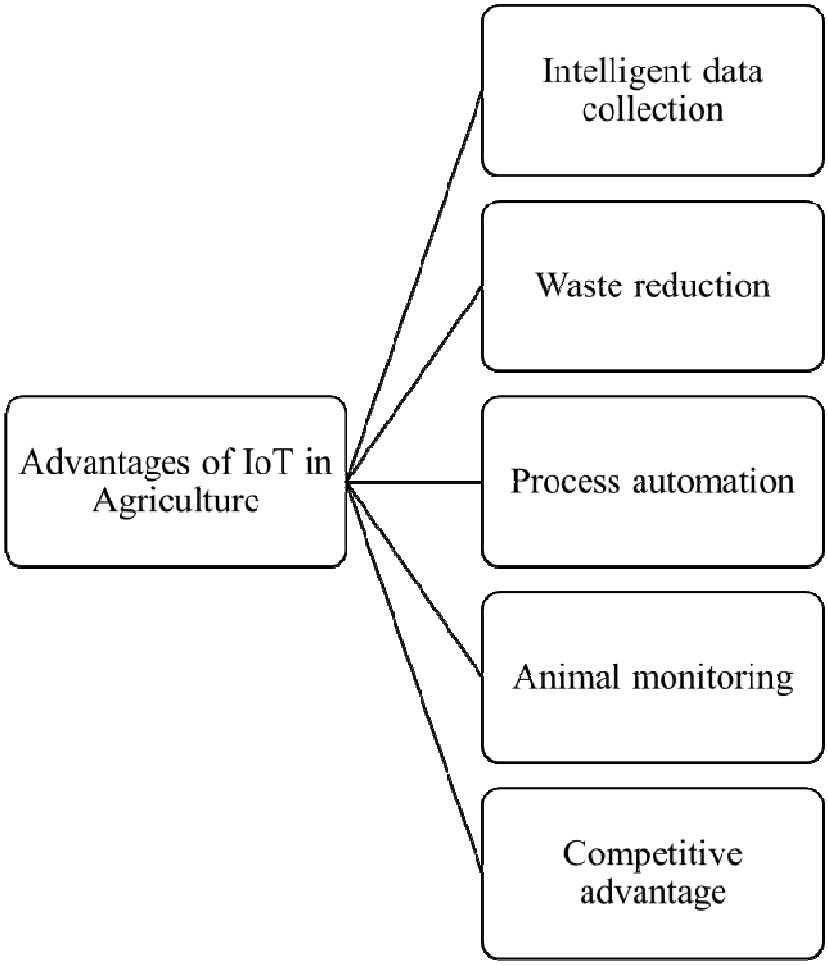

Figure 3: Illustrates the key advantages of the IoT in commercial farming.

2. DISCUSSION

Commercial agribusiness stands apart from traditional kinds of agribusiness that are performed all around the globe in various ways, although some may argue it has certain distinctive characteristics. Commercial agribusiness utilizes higher-yielding plant types, artificial fertilizers, herbicides, insects, as well as numerous other elements to get excellent outcomes or nurture a grain with maximum production. This is another of its unique qualities or traits. In contrast to other forms of agribusiness, commercial gardening produces goods for the market instead of hardly for domestic use. This can be considered definitely of its primary defining characteristics. Commercial agribusiness uses numerous hectares to grow items including cacao, bananas, wheat, sugarcane, as well as many additional commodities. Such

products are made as well as mostly supplied to neighbouring countries. It must be mentioned that industrial cropping requires substantial quantities of either professional as well as uneducated workers. In contrast to individuals performing unskilled jobs, who live in extreme hardship, experts offer a specialized workforce for the said commercial industry. With modern agribusiness, it is also important to use powerful machinery like harvesters, excavators, tracked scrubbers, agricultural implements, as well as crushers. In addition to the capabilities of the manufacturing process, additional technologies are used to satisfy timelines as well as goals [9].

Industrial farms use watering equipment throughout the year. People do not even depend upon rainfall or even other environmental assets, as these other producers might, to maintain farm harvests or livestock healthy all year round. Manufacturers substitute modern equipment, innovation, as well as development stimulants altogether. Commercial agriculture is a form of agribusiness that benefits investment and businesses as well as the agrarian industry since it generates cash. With said revenue, certain farming products are bought, including seedlings, fertilizer, as well as pesticides. It requires a substantial financial investment. The producer is also required to fertilize the plants, purchase saplings or spores, apply herbicides, as well as horseshoes to till the ground. Given that it could be done across such a big territory, this might demand a significant monetary investment. Commercial agriculture provides employment opportunities for locals. These employees will indeed get compensation which would enable individuals to take care of their dependents. Hence, commercialized cultivation promotes the growth of any local business. Commercial agriculture contributes to a decrease in the cost of farmed goods since there is an adequate quantity of commodities just on the marketplace. Economic dynamics of production as well as consumption thus combine to reduce the price of these items [10]. Due to the usage of equipment as well as energy, intensive agriculture increases the aid to communities in the suburban regions of farmland. It helps to develop the community's architecture. Highways typically surfaced to make it easier to move machinery as well as supplies swiftly but also securely. The construction and upgrading of something like the local network is such an advantage of industrial agribusiness. Industrial farmers which depend on it supply energy to the neighbourhood. Authorities in emerging nations build highways, railways, and even water pipelines to reach remote places [11].

Farm owners also help to keep the price of farmed products down. This is due to increased agricultural production, which lowers commodities costs as a consequence of availability as well as consumption forces. Commercial agriculture offers plenty of opportunity to locals as well as those living considerably further afield in places in which the specialized expertise needed is not easily accessible. The residents' nutrition needs are met using the income earned through labouring just on the field. So regional businesses may benefit from commercial agribusiness. Since commercial agribusiness is mostly done for revenue, it aids with international currency policy. For respective nations, Western African nations sell non-traditional agrarian products including cocoa, cotton, and others [12]. The term IoT has gained popularity in recent years. This describes how different gadgets may communicate with one another via the web, including appliances, smartphones, laptops, cars, wearable technology, safety systems, and much more. Smart gadget interconnection is enabling creative fresh approaches towards age-old issues, along with the automating of several tedious chores. IoT gadget expansion started in the last decade and was followed by IoT gadget expansion.

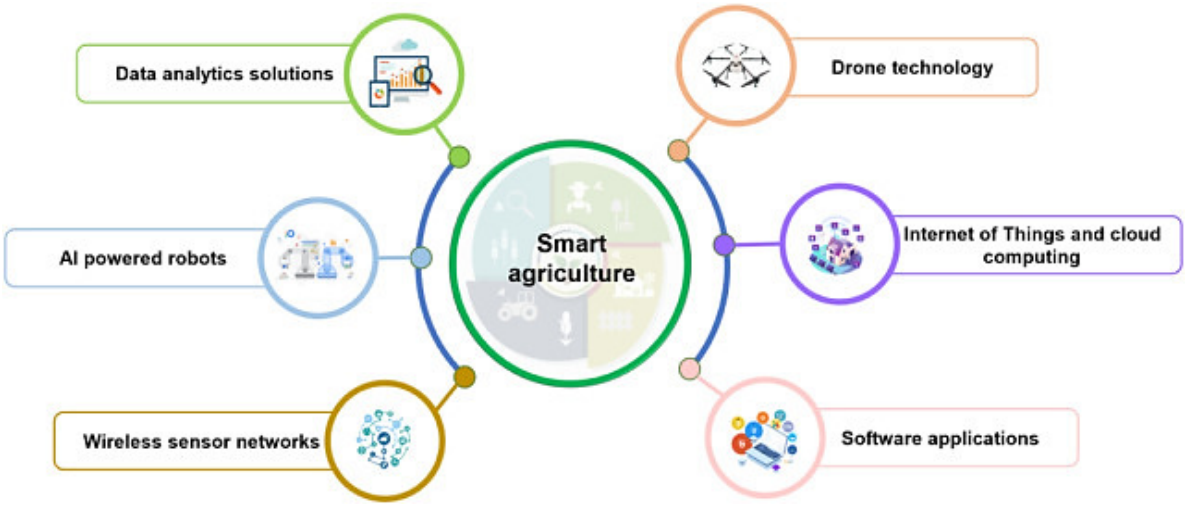

Figure 4: Illustrates the smart farming concept.

To solve numerous issues with commercial food supply related to farming efficiency, climate influence, nutritional insecurity, crop failures, and durability, sustainable farming gives producers a wide range of instruments. For example, producers may access fields online, regardless of location or location, using IoT-based devices made up of wireless sensor networks (WSNs), which can track as well as oversee agricultural activities. Mobile machines may be employed to assist or complete monotonous jobs at fields, while UAVS (Unmanned Aerial Vehicles) outfitted equipped with multispectral imaging may be utilized to gather information from a variety of inputs on farm fields. To aid growers in reaching decisions, business intelligence methods may be utilized to examine the collected information using computing programs. To boost produces of crops, reduce expenses, improve merchandise quality, as well as preserve procedure inputs through the usages of contemporary processes, a broad range of variables associated with ecological attributes, weeding, grain production prestige, moisture monitoring, ground circumstances, fertilizer application, weedkillers, and contaminants, as well as regulated surroundings farming, could be supervised and analyzed.Figure 4 illustrates the smart farming concept (Figure 4). IoT adoption in agribusiness aims to introduce producers to decision-making instruments and automated solutions which smoothly combine information, goods, including commodities to produce great levels of production, safety, as well as profitability. Much research is conducted but also presented about the development of IoT ideas inside the agriculture industry. This creation of concepts as well as computing programs that can carry out activities that need individual intellect, including sensory awareness including choice-making, is very essential. AI (Artificial Intelligence) innovation, especially within the areas of machine learning (ML) as well as deep learning (DL), is considered among the main forces powering the digitalization of agribusiness, along with cloud computing technology, IoT, as well as the big dataset. Such innovations offer the ability to revolutionize real-time surveillance, agricultural gathering, preparation, as well as commercialization while also increasing agricultural productivity. A few sophisticated farming technologies, such as those that can identify weeds, forecast yields, and even identify diseases, have been created. These platforms employ ML as well as DL techniques.

The IoT may be used in the agrarian field through a variety of methods, which will increase production and overall financial payback in complement to its other advantages. It could be put in farming machinery to offer resource-saving operation management. Irrigation seems to be a crucial component of agrarian products. Nevertheless, seeding effectiveness suffers from overapplication. Hence, determining whether locations require additional freshwater. In this

way, IoT gadgets are already in charge of keeping an eye on ground conditions including activating the watering equipment as needed. The identical tools may be utilized to assess pH concentrations as well as other land elements, much like with irrigation management. This allows them to pinpoint the areas which want improvement, such as fertilization.Figure 5 illustrates the key applications of IoT in commercial farming.

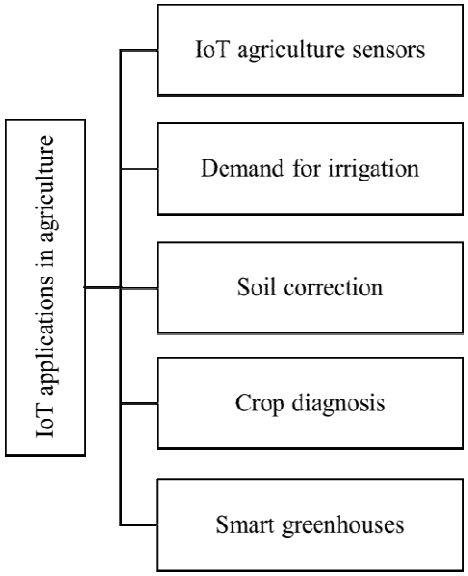

Figure 5: Illustrates the key applications of IoT in commercial farming.

Unmanned aerial vehicle utilization in agriculture has produced a variety of infrastructures and alternatives. Smartphones democratized intelligence collecting as well as improved choice-making because they're connected to the Web as well as include detectors, GPS (Global Positioning System), as well as other features. As a result, it is now easier to make a precise diagnostic of the healthiness of a plant. Robots have resulted in significant labour as well as budget savings since the entrepreneur no more has to drive huge distances for this. In gardens, warmth, moisture, as well as light levels must all be tightly regulated. Usually, this management is carried out physically using coverings, sparse, as well as similar tools. One could integrate any conservatory setting with such a unified platform using IoT gadgets. Implementing this management becomes easier and faster quick as a result (Figure 5).

Among the major industries that contribute to the economic economy of emerging nations is agribusiness. This is also why utilizing modern technologies to enhance agricultural business is essential to the regional budgets of such nations. Agriculture encompasses the provision of nourishment for people but also livestock in addition to supplying the essential resources needed for commercial processes. Across boosting production, effectively assigning, and adjusting to climatic modification, including reducing agricultural waste, intelligent agribusiness tries to solve such issues. Essentially, IoT is used by Intelligent Agricultural as well as crop monitoring to enhance spatial administration practices to increase agricultural output whilst minimizing the usage of fertilizers as well as insecticides. Contrary to Precision Agriculture, makes use of cutting-edge innovations such as Machine Learning (ML) to examine adjustments in troposphere circumstances, sediment characteristics, humidity, as well as other factors to address a wide range of harvest-related challenges. As it enables objects to be connected and controlled autonomously over the web, AI, as well as IoT technologies, enable the interconnection of a range of remote detectors, including floor detectors, robotics, including UAVs. Researchers believe that Smart Agricultural innovation remains in its infancy, notwithstanding how quickly it is growing. IoT applications for

agriculture are still patchy, as well as their value for inclusion in agriculture improvement has not been thoroughly examined.Figure 6 key challenges for IoT implementation in commercial farming.

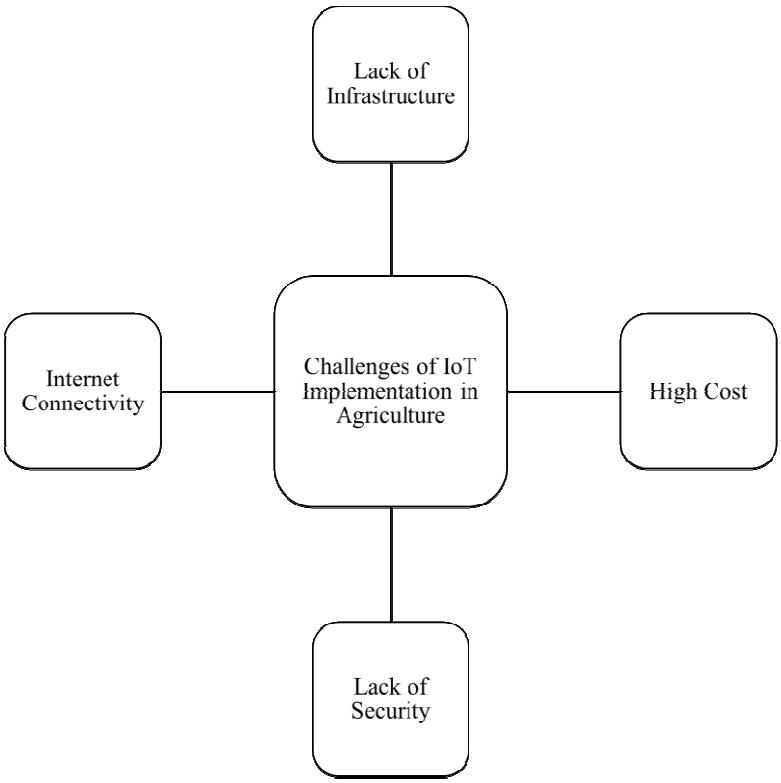

Figure 6: Key challenges for IoT implementation in commercial farming.

3. CONCLUSION

A consistent expansion of the global economy has been made possible by scientific and technological developments as well as significant levels of people resources certification. Due to such a reality, the concept of commercial agriculture has emerged, enabling landowners to electronically observe their agricultural fields using detectors and install autonomous watering equipment. There still are computerized programs built on detectors that enable getting data regarding the product, and environment, as well as an environment that is more precise than data gathered using conventional techniques. The integrity of the outputs, procedures, as well as input resources employed throughout this procedure, are all improved by such a characteristic. Such factors make IoT-based intelligent agriculture greater effective than conventional methods. Additionally, community gardening especially sustainable agribusiness might benefit from IoT-based intelligent agribusiness technologies. Such innovations will render it possible to increase output via environmentally friendly food production in the long term, in addition, to safeguarding the planet by using groundwater wisely and maximizing supplies and remedies. IoT innovations enable the creation of equipment that assists various agriculture procedures. Such technologies include, amongst many others, automatic watering devices, distant surveillance systems, instruments for choice support, including fertilization frameworks. A thorough understanding of IoT implementations in farming must be given to producers as well as academics in light of the aforesaid findings.

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CHAPTER 19

EXPLORING THE ROLE OF CRYPTOGRAPHIC ALGORITHM IN IOT SECURITY AND PRIVACY

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ABSTRACT: ***With the rapid growth of the global Internet of Things (IoT) technology, the whole innovative realm of intelligent gadgets is emerging, with huge safety considerations. The enormous growth in linked gadgets brought on by modern breakthroughs with wireless communication has spurred the IoT movement. Such integrated gadgets collect, process, as well as transmit massive amounts of essential datasets or information over the internet. With IoT connections, transmitting data confidentiality becomes a major issue. There have been built various algorithms in previous years for maintaining the secrecy of the datasets over the wireless network. Yet, due to alterations in modern telecommunication infrastructure, there are some networking flaws related to the adapted protocols for information secrecy. Therefore, data security is still one of the biggest threats, particularly in modern IoT architecture. This paper explores the key role of cryptographic algorithms in IoT secrecy and privacy as well as major issues in the implementation phase.***

KEYWORD: ***Cryptographic Algorithm, Cybersecurity, Encryption Techniques, IoT, Lightweight Technique.***

1. INTRODUCTION

The confidentiality of datasets within the IoT infrastructure is a widely debatable research issue. An IoT is indeed a network concept that turns commonplace objects into intelligent gadgets by using detectors as well as Web technologies. These gadgets enable users to access a broad range of activities by enabling connection at all times and locations. As such, when it is incorporated into human everyday actions, such as home automation, intelligent buildings, smartwatches, e-medicine, and so forth., digitalization is no longer a choice. Since IoT endpoints frequently operate in unsafe conditions, several cybersecurity issues need to be considered under view [1], [2]. To address these issues, several academics have created numerous cryptographic techniques which could be employed to safeguard IoT systems as well as guarantee information confidentiality as well as safety.

Conventional encryption techniques, meanwhile, cannot be applied to this platform's asset-constrained gadgets. In response to the demand for encryption techniques that guarantee safety while using a minimal amount of energy, a notion of lightweight cryptographic methods emerged. Overall key lengths, cycle count, block dimensions, amount of random-access memory (RAM) as well as read-only memory (ROM) used, architecture, as well as processing duration all affect how much energy is used. This construction of lightweight solutions aims to achieve a compromise between several factors, including speed, minimal energy use, as well as the robustness but also reliability of cryptographic techniques [3].

Day by day the objects that people utilize are evolving into global networks of linked objects. Techniques that combine autonomously embedding sensor items with telecommunications capabilities make up IoT. The majority of IoT-rooted applications subsequently have high real-time needs as well as resource constraints. However, the IoT may be impacted by several security threats, including cyberattacks, exposure to copyrighted material, and disruption, including spying in crucial systems like traffic control, intelligent buildings, as well as agricultural robotics. Such necessitates the creation of effective cryptography systems which

are economical regarding power, asset use, safety, as well as processing capacity. Similarly, confidentiality, efficiency, as well as price trade should be considered while constructing cryptographic solutions.Figure 1 illustrates the common element of IoT.

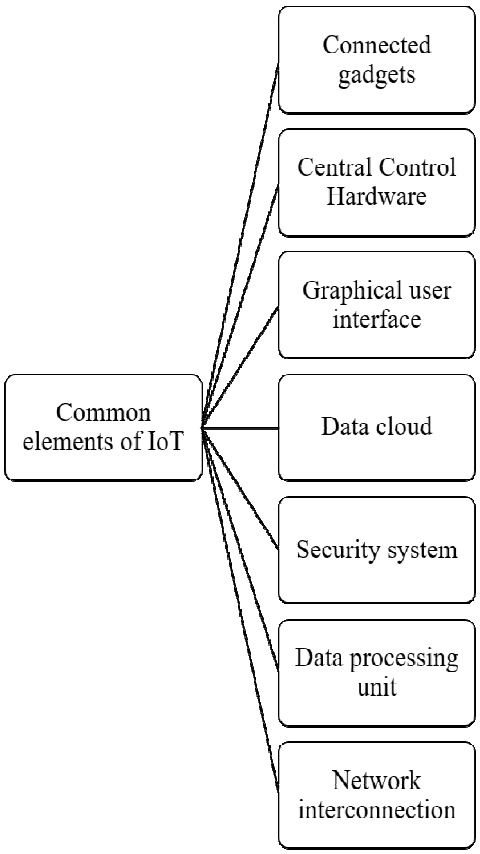

Figure 1: Illustrates the common element of IoT.

Investigators in academics as well as businesses must devote their entire focus to the critical vulnerability problem of confidentiality within IoT. Proposing technologies as well as administrative structures to address confidentiality within IoT is urgently needed. IoT is becoming a crucial component of many technologies, including congestion management, parking management, power usage management, including distant medical surveillance. Customers in all of such apps need to have their private data that relates to daily movements, and routines, including communications with others protected [4], [5]. The centralized administration structure that could cater to both the stated safety concerns as well as needs inside the IoT networking is necessary fulfilling all the protection needs. Software-defined networking is indeed a popular option that enables centralized network setting even by an administrator that oversees the channel. To establish a thorough centralized administration structure for providing cybersecurity via IoT, several possibilities, as well as problems, remain to be resolved. Software-defined networks must be carefully examined to be adapted to offer administration capabilities across an IoT ecosystem [6]. Figure 2 illustrates a few of the most common use cases.

IoT systems having little computing power as well as space may nonetheless communicate securely thanks to lightweight cryptography techniques. Since they frequently possess restricted assets, which include detectors as well as controllers, such gadgets are unable to meet the computing requirements of conventional encryption methods. IoT gadgets may employ lightweight techniques because they strike a compromise between privacy as well as effectiveness [7]. These serve to safeguard data analysis, storage, as well as transfer. They are

essential in guaranteeing the privacy as well as confidentiality of information as well as connectivity within IoT-rooted devices. Because of the rise in Internet-connected IoT gadgets, experts are becoming more and more interested in lightweight cryptographic methods. With a variety of areas, including smart buildings, factory equipment, and transportation infrastructure, IoT gadgets rapidly proliferating. utilizing conventional cryptographic techniques may not generally be possible since such gadgets are frequently backup-powered as well as have low computing speeds.Figure 3 illustrates the key security goals of IoT [8].

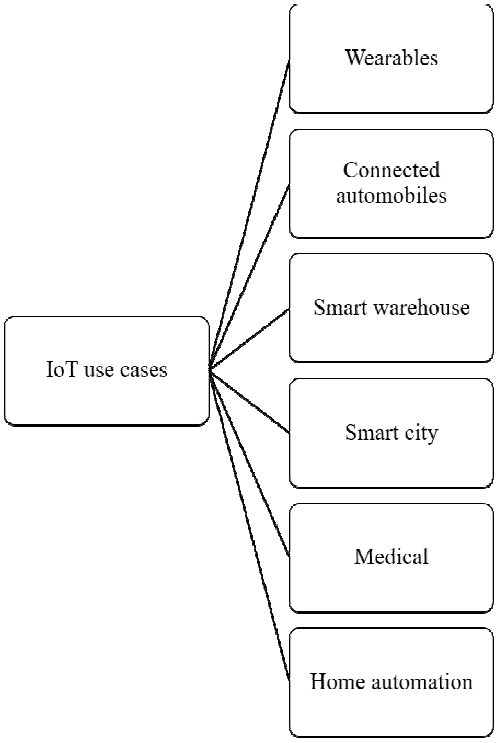

Figure 2: Illustrates a few of the most common use cases.

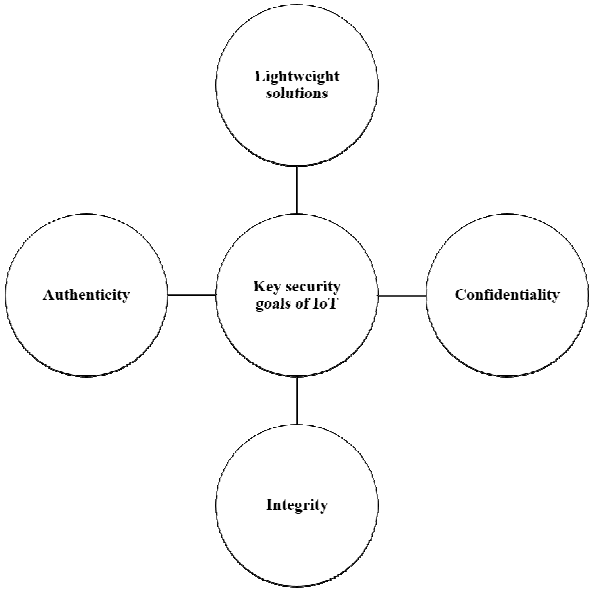

Figure 3: Illustrates the key security goals of IoT.

The absence of standards within IoT constitutes among the main cybersecurity issues. It's challenging to guarantee compliance as well as interchange amongst services since there are so numerous varied gadgets, methods, as well as systems. Assailants may be able to take advantage of these weaknesses as a result. Poor or absent security is yet additional significant issue confronting IoT. This lack of protection in so certain IoT systems makes users susceptible to assaults. IoT gadgets frequently operate on integrated platforms with restricted resources, rendering security a challenge. Assailants may be able to take advantage of these weaknesses as a result. Embedding devices may include specific equipment as well as programming, that can contribute to the difficulties of safeguarding operations [9], [10].

The IoT innovation is now widely used, with numerous assets being limited and small gadgets being widely distributed and constantly talking with one another and World wide web at larger. This lightweight encryption is employed to address this issue concerning confidentiality requirements as well as characteristics of low power availability [11].This age of IoT innovation has come mainly as a result of the rapid advancement of computing as well as Web technologies; digitalization has traditionally had a significant impact on human everyday activities and places of employment. The problem of data protection is garnering more focus primarily as a result of the Web's public data network therefore has to be tackled right now. This same standard software-based privacy defence is often insufficient for system safety [12], [13].

Intruders can target the operational platform as well as take important information. Several commercial situations, including corporate management stability, cutting-edge auto protection, including smart residential protection, need IoT protection technologies. This same greatest option for protecting human individual data, and confidential documents, including assets protection includes encryption as well as decryption technologies, which when used properly, could successfully assure the integrity of the network. Nevertheless, due to the restricted energy, throughput, processing time, as well as compute capacity underlying IoT gadgets, conventional cryptography methods do not perform effectively. Hence, for gadgets with restricted capabilities, especially those which operate on power backup means, it is indeed crucial to adopt a compact cryptographic method that consumes minimal power. Figure 4 illustrates the key challenges in IoT security.

Figure 4: Illustrates the key challenges in IoT security.

2. DISCUSSION

IoT systems frequently use unprotected connections to link onto the web, which leaves companies open to assaults. For instance, any intruder may overhear connections involving any IoT gadget as well as the world wide web, possibly receiving exposure to critical information. Moreover, unprotected connections may be exploited to target similar networked gadgets. IoT systems frequently have low tangible protection due to their tiny size as well as ease of concealment, which makes such susceptible to physiological assaults. An IoT gadget may be physically attacked by being tampered with, stolen, or destroyed. This may lead to record destruction, and network outage, including unauthorized access to critical data. IoT equipment has a serious safety problem since devices create as well as gather a lot of information, which makes them accessible to cyberattacks. Private details, account records, as well as other delicate statistics are examples of such statistics. Whether this information also isn't adequately safeguarded, it might end up in the incorrect clutches and also be misused. Consumers' security must be protected since IoT gadgets frequently gather as well as communicate critical data, including private content, geolocation, as well as various types of statistics. Whether this information also isn't adequately safeguarded, it may be exploited for online fraud, tailored marketing, or even other illegal activities [14], [15].Figure 5 illustrates the key IoT application area.

Several IoT gadgets are challenging or prohibitive to repair or upgrade, leaving them open to assaults. As a result, if a weakness is found, it's unable to be repaired, leaving the system open to intrusion. Moreover, certain gadgets can no longer get vulnerability upgrades or fixes because respective makers no anymore service products. Due to their inability to be updated as well as repaired, such gadgets are susceptible to existing weaknesses including loopholes, making such easy targets for assaults. It may be challenging to verify that gadgets are safe due to very minimal governmental monitoring of such technologies. Many remedies have indeed been put out to deal with such problems.

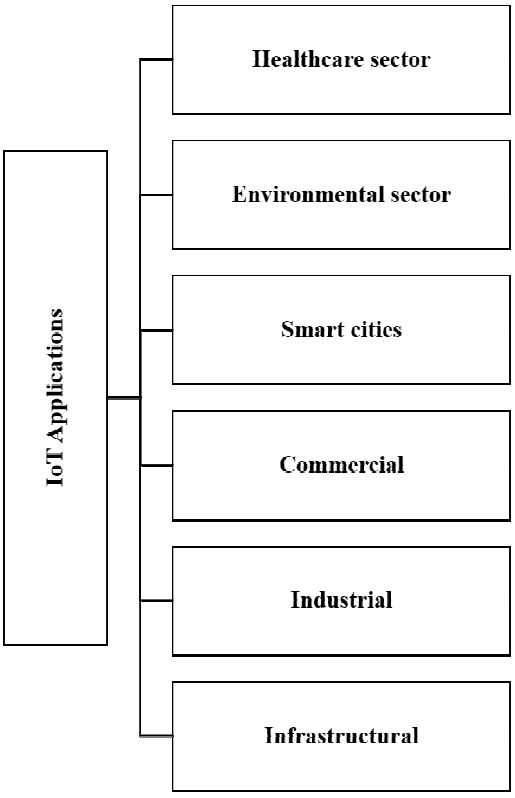

Figure 5: Illustrates the key IoT application area.

IoT gadgets are supposed to perform silently, and frequently without the participant's awareness or involvement. Because of that, it could be challenging to interpret individual activities as well as exert influence over them. For instance, a sophisticated webcam connected to the Internet of Things can be transferring information to a cloud-rooted server without the person's awareness. It might be hard to recognize as well as stop fraudulent transactions as a result of this absence of insight into smartphone behaviour. Intelligent utilities, monitoring webcams, as well as other IoT gadgets frequently run throughout the backdrop, continually gathering as well as transferring information. It might be challenging to identify safety issues since such gadgets are online yet frequently get little operator input [16], [17].

A group of quickly developing telecommunications, data analysis, and insights creation capabilities belong to the IoT sector. This includes the use of real universe detectors, controllers, and combined transmission tools, often amid challenging ecological or economical constraints. It also includes techniques for information preparation as well as consolidation at the networking interface in addition to the internet. Because IoT as a whole additionally encompasses techniques for forecasts, categorization, choice-making, information creation, and numerous other tasks related to people-centered, app-specific requirements. This operating lifecycle of Cyber-Physical Systems becomes ultimately completed when management procedures relying on such choices start to bring about modifications within the actual environment. Figure 6 illustrates the classification of cryptography.

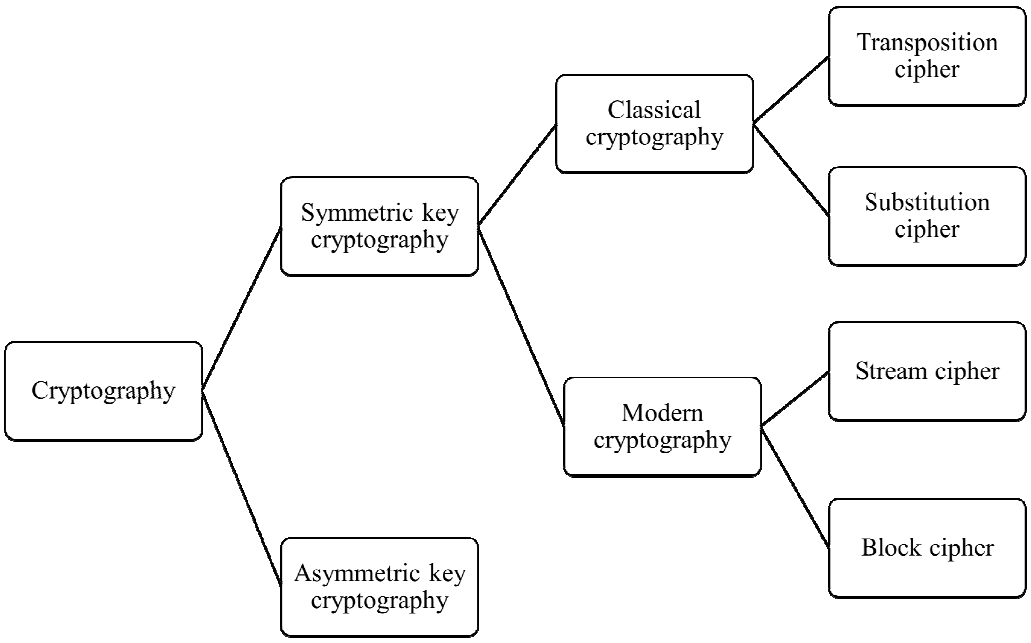

Figure 6: Illustrates the classification of cryptography.

IoT combines devices, applications, detectors, controllers, and other components to provide connectivity options. Analyzing the gathered information also contributes to increasing the framework's effectiveness. Nevertheless, because of the capacity limitations imposed by linked gadgets and the decentralized design, it created several problems. IoT revolutionizes nearby things to enhance someone's life in a variety of industrial sectors that are focused on improving folks' lifestyles, including ecology, medicine, agribusiness, mobility, including smart buildings. To be deemed safe, IoT has to include answers for a variety of issues, including architectural vulnerability administration, credential control, customer

confidentiality, secured initialization as well as file transfer, and identification, including network management techniques. The aforementioned problems have indeed been addressed using a variety of strategies, including a centralized server-client architecture that makes use of cloud storage. Nevertheless, there remain significant gaps in the safety and confidentiality elements; distributed ledger technology may fill these gaps.

Due to several distinctive qualities, including the networking of diverse technologies, massive size, reliability (for example, in the medical as well as commercial areas), interconnection, and continuous transformations, including asset-related applications, the IoT provides several benefits. Heterogeneity describes the utilization of numerous equipment systems and IoT gadgets that may connect through a variety of channels. The potential to link anything via worldwide data as well as telecommunication architecture is referred to as interconnections. This term "security" describes how a platform affects its surrounding surroundings, along with how people's actual security, intrusion prevention, as well as private information, are all affected. Due to a large part of IoT gadgets, the huge size indicates that the number of terminals linked to one another via intranets as well as the global Internet must have increased dramatically. More advancements in effective information processing, and more precise semantics, including information understanding inside programs, are required to keep up with some of this expansion. The connection enables networking interoperability as well as availability. Controlling network compatibility as well as information generation but also consuming ports are all part of interoperability. When data is accessible, it may be accessed at every moment as well as from any location as long as permission is granted and indeed the participant is considered trustworthy. Every condition of a gadget evolves constantly, as well as the quantity of gadgets fluctuates adaptively, whether a gadget is sleeping or getting up, linked or detached, or even when it's located in a given location or moving at a particular pace. Last but not least, activities associated with objects comprise semantic consistency as well as private preservation within gadget limits or boundaries, which can be accomplished through modifying the techniques in the tangible as well as informational realms. Figure 7 illustrates the encryption as well as the decryption procedure utilizing a key.

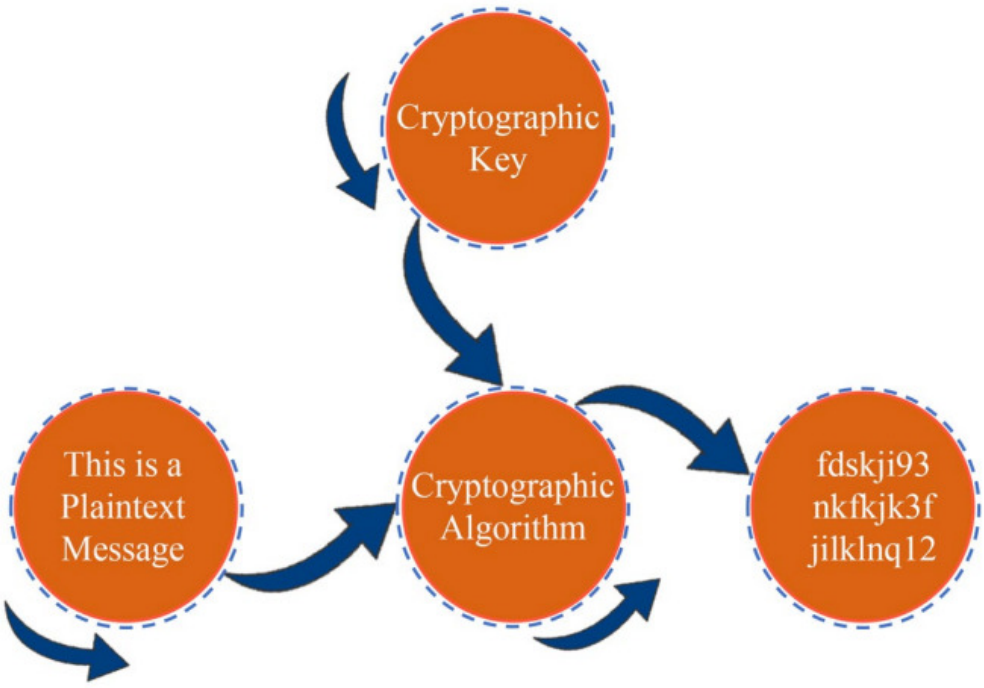

Figure 7: Illustrates the encryption as well as decryption procedure utilizing a key.

3. CONCLUSION

This concept of spontaneous data exchange between diverse low-powered integrated gadgets which connect to the Web to interact alongside one another represents the foundation of said IoT. Both webs, as well as recent developments in integrated technology, have made it possible for the things around people to communicate with one another. IoT infrastructure may be used in industry, power administration, agribusiness, medical, as well as a variety of other industries. This same IoT is a next-generation interconnectivity concept that would allow communication between equipment as well as folk gadgets, allowing operations to be carried out automatically. This paper explores the role of the cryptographic algorithm in IoT security and privacy. This same successful integration of various connectivity infrastructures is necessary again for the IoT future. In summary, the IoT has numerous positive effects but also poses several cybersecurity risks. Such IoT protection issues involve networking protection issues, and gadget flaws, including information confidentiality issues. However, modern state-of-the-art cryptographic algorithms seem to be a significant way for securing confidential data in the IoT network infrastructure.

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