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Role of IoT Technology in Agriculture

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Abstract: Today, the agriculture sector uses various kinds of technology, techniques and instruments. New technology called the Internet of Things is essential to enhance productivity, performance and minimize time, costs and human intervention. Different types of sensors are used in the automation of farming activities such as water management, soil control, crop management, animal tracking, etc. Intelligent greenhouse protects plants from harsh weather conditions. The computer connected to the Internet, sensor, camera, microcontroller, etc. are used to monitor all these operations by remote smart system. The economic situation of the country is affected by growth in the agriculture sector. This paper concentrates on the IoT function of intelligent agriculture.
Keywords: Smart Farming, IoT in Agriculture, IoT farming Technology.

1. INTRODUCTION

Agriculture is the backbone of the country and a major part of India's economy. Much of the country's population is dependent on agriculture and nation revenue is from agriculture, just as India and other countries. For us farmers grow much, like fruits, vegetables, clothing cotton, maize and much more. Now a day there are numerous methods and techniques for agriculture. Accordingly, to feed the increasing population of the Earth, the planet would need 70 percent more food by 2050 than it did in 2006, according to the United Nations Food and Agriculture Organization. In order to meet this demand, farmers are moved from conventional agriculture to intelligent agriculture. In order to increase productivity, increase profit in less time and costs for global marketing, and other features as minimizes human action on farming; many agricultural industries now rely on smart farming's IoT Technology. The powerful and common technology is the IoT (Internet of Things). IoT comprised various sensor types, electronic devices, components of networks and software. IoT enables people, without human intervention, toexchange their information in networks. The Internet of Thing is recognized as the necessity to use latest technology and techniques to increase production, quality and reduce problems in agriculture that farmers are facing. Farmers will learn a lot about the new technologies and agricultural technology through IoT every day.

Internet of Things (IOT)

IoT is the most effective and relevant way of solving problems. The Internet of Things, Different component blocks including various sensors, software, network components and other electronics create IoT. The data are also increased in their precision. Without human interference, IoT will share data across the network. We will represent in natural way stuff such as real people in the internet, like sensors, car drivers, etc. For transmission of data via a network, an IP address is given. Reports shows that the number of devices linked by 2016 will rise by 30% compared to 2015 and also says that by 2020 this figure will rise to 26 billion. For the following reasons, IoT technology is more efficient:

1. “Global Connectivity through any devices.”
2. “Minimum human efforts”
3. “Faster Access”
4. “Time Efficiency”
5. “Efficient Communication”

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Smart Agriculture Using IOT

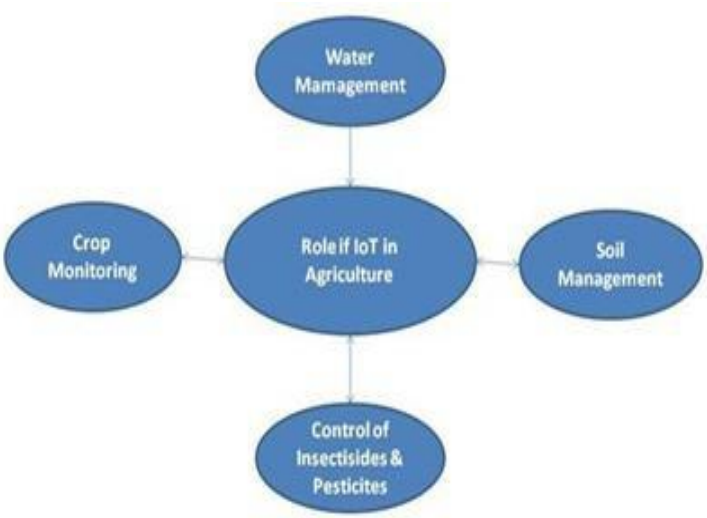

Figure 1: Role of IoT in Agriculture

India's key economic development is agricultural production. Climate change is the main barrier in conventional agriculture. Increased flooding, heavy storms and hot waves, lower precipitation etc, are the consequences of climate change. This significantly reduces productivity. The environmental effects of climate change, for example, are also posed by seasonal change in plantlife cycles. The use of advanced technologies and techniques called the Internet of Things isneeded to increase productivity and minimize barriers in agriculture. Today, the IoT is evolvinginto an agricultural industry that allows farmers to face the enormous challenges facing them.Using IoT, farmers will gain enormous information and insight on recent trends and technology. In 2022, the demand for intelligent agriculture is projected to hit $18.45 billion at a CAGR of13.8%. BI forecasts that in 2020, a CAGR of 20% will ship 75 million IoT equipment for agricultural applications. IoT devices can be very helpful for increasing agricultural production and yield, because the soil acidity, temperature and other variables can be monitored by them. Supervision of animal productivity and welfare will also be helped by smart agriculture. IoTsensors can provide farmers with crop yield information, rainfall, pesticide infestation and soil nutrition are invaluable for development. They provide accurate information that can be usedover time in order to enhance farm technology. Internet of things would bring significant transformations to the agricultural supply chain with its real time, accurate and mutualcharacteristics, providing vital technologies for a smooth agricultural logistics flow.

The key advantages of using IoT in enhancing farming are as follows:

1. "Water management can be efficiently done using IoT with no wastage of water using sensors."
2. "IoT helps to continuous monitor the land so that precautions can be taken at early stage."
3. "It increases productivity, reduce manual work, reduce time and makes farming more efficient."
4. "Crop monitoring can be easily done to observe the growth of crop."
5. "Soil management such as PH level, Moisture content etc can be identified easily so that farmer can sown seeds according to soil level."
6. "RFID sensors and chips help to detect plant and crop diseases. RFID tags are exchanged overthe internet and give the reader the EPC (information). The farmer or scientist may from a distance access this information and take the appropriate measures, Plants will automatically be vaccinated against future diseases."
7. "In the global market, crop sales will increase. Without limiting geographical areas, farmers can easily link to the global market."

Livestock Monitoring

IoT Technology allows farmers to track animal health, food preferences, place and reproductive cycle and so on. Connected wearable sensors may track blood pressure, heart rate, breathing rate, digestion, temperature and other vital conditions that alarm a farmer at the first sign of disease. IoT may also help farmers monitor when they are ready to give birth during a cow's reproductivecycle. IoT devices inform the farmer of the cow's condition. IoT wearable sensor systems also track the position of an animal, helping farmers to identify a sick animal quickly and handle them correctly.

IoT in Smart Farming

Intelligent agriculture with IoT technology is a new concept of agricultural management that increases productivity in the field. Farmers can make good use of fertilizers and other means by using smart farming to increase the quality and quantities of their crops. Farmers cannot be physically present on the field 24 hours a day.Farmers may also be unable to use various instruments in order to calculate their crops' optimal environmental conditions. IoT provides you with the automated device that works without human supervision and can alert you of the right decision to address various types of problems you may encounter during agriculture. The farmer is able to contact and alert the farmer even though the farmer isn't in the field and can handle more land so that his yield is improved.

Benefits of Smart Farming

The advantages of this technology would include: remote control for farmers, water and other natural resource preserved, good management, better cattle production, accurate agricultural and farmer evaluation, high quality and better livestock production.

Shortfalls of Smart Farming

Agriculture is mostly a natural occurrence, and nature is predicted or regulated by the peoplewho allow rain drought to be available for sunlight. Regulation of pests, etc. So still implementing the agriculture IoT scheme.

- Intelligent agriculture constantly requires Internet access. This requirement was not met by the rural portion of the developed countries. The internet is also slower.

•Fault sensors or data processing engines can lead to defective decisions that can lead to water, fertilities and other waste.

•Smart agricultural machinery requires farmers to understand the use of technology and to learn how to use it. This is the biggest obstacle in the broad adoption of smart agriculture.

2. NETWORKS ANAYTICS AND MANAGEMENT

Big Data Analytics and Machine Learning

Big data are a large quantity of critical data generated by agricultural sensors. Big data analytics provide various and effective methods of crop tracking at various levels. There was a successful systematic study of large-scale data analysis for agriculture. Neural networks are very well known for their high-speed optimal solutions. The detection of intrusion was carried out using advanced neural network concepts and technologies. On the other hand, it is the recognition module and data training that are the most important aspect of the neural network. A hydroponic IoT framework has been developed with the use of deep neural networks.

A wide-ranging data analysis has been used to find important and valuable knowledge from several data formats. Farm data are used to manage crop disease and plant growth. Big data analysis also provides support services and optimal cost analysis for agricultural development. The proposed networking framework includes these components: I) Farmer/User experience, ii) big data analysis and iii) sensing and surveillance; iv) storage, and v). This platform allows the IoT backbone access and assists with the collection of soil fertility, temperature, moisturization and online crop surveillance information, etc.

Communication Networks and Protocols

IoT's farm network is made up of different long-term modes of communications and short-range networks. Different IoT network technology helps to design crop or field monitoring sensors and equipment. The IoT framework and applications for farm networks are the foundation of communication protocols. They are used to share all agricultural information or expertise across the network.

Robotics

Multiple agribots for smart farming, by the the pace of work by advance techniques, have been created to minimize the number of farmers. Agribots performs basic functions such as weeding, spraying, sowing, etc. The IoT is used to monitor all these robots to boost crop production and efficient use of resources. For characterization and ground mapping, a multi-sensor robotics approach was suggested.

Agricultural Water Management Using IOT

In agricultural operations, agricultural water is an indispensable feature. In recent years, however, farmers have experienced many disadvantages due to changed conditions, such as deepening of the phenomenon of climate change, changes in demand and use patterns of agricultural domestic water supplies, as well as rising water supply costs. The need to recognize agricultural water as a commodity was increased in the Fourth industrial revolution and due to changes in internal and external conditions in the use and management of agricultural water the importance of management of demand for agricultural water was emphasized. However, the practical use of agricultural water is difficult to reliably quantify and track. Most socioeconomic characteristics were neglected in the study of the supply and demand of agricultural water with a focus of engineering aspects. Existing control of agricultural water concentrates primarily on supply side to increase supply. However, demand management is urgently necessary such as changes in internal water use patterns as a result of crop conversion, increasing water demand in the non-agricultural sector, and rising organic water management costs in agricultural supply facilities. In 1992, the Dublin Water and Sustainable Development Principles identified freshwater scarcity and abuse as a hindrance to sustainable development and the environment,the International Conference on Water and the environment. Several debates have been heldsince the declaration of the Dublin Principles concerning the socially effective distribution and use of water, including domestic and international agricultural water. However, it is considered that the economic characteristics of agricultural water do not represent a lot in domestic agricultural water management. In Korea, there is no explicit agricultural water market andfarmers are not paying for agricultural water. Furthermore, the value of farmers and non-farmers of farm water cannot be estimated and real use can only be measured and monitored accurately. In particular, the study of the supply and demand of agricultural water frequently failed in the form of engineering aspects that reflected socioeconomic characteristics. Therefore, it will be a necessary precondition for developing reliable and efficient agricultural water managementpolice to examine the economic characteristics of the supply and the demand of agricultural water.

Necessity of Agricultural Water Management

Over the last years, irrigation water demand has changed to a structure in agriculture, irrespectiveof the season, thanks to the development of agricultural facilities and the development of ground-water film cultivation technology. These changes are especially apparent in crops, not rice, and the demand for groundwater is on the increase. In particular, when the supply of water is inadequate, the construction of the paddy field is used as a method of drainage. The managementof the increase in groundwater demand will thus become an important problem when it comes to avoiding the depletion of groundwater and its distribution among households.

Smart agricultural water management systems track water supplies and infrastructure status in real time using the advanced sensor network and provide managers and users with gathered and processed information in real time. This allows managers to provide high-quality water efficiently and enables consumer to save water by controlling demand based on information collected. Furthermore, the two-way network will incorporate and handle decentralized water supplies from a supply and demand perspective, thus delivering water to regions that do not have water resources, thereby addressing the water imbalance between regions.

2. NETWORK ARCHITECTURE AND FRAMEWOK

IoT Agricultural Network Architecture

The IoT network in agriculture is the major factor in IoT. The design of the IoT agricultural network suggests a description of physical elements and their working principles and techniques for the specification of the IoT agricultural network. Because of the popularity and interoperability of the IP, the majority of IoT applications are typically based on these layer architecture (network layer, application layer, physical, Mac layer and transportation layer).

IoT Smart Farming Agricultural Framework

The use as transmission media is possible with regulated technology such as CAN and wireless systems such as LoRa, Zigbee, NB-IoT and Bluetooth. Meanwhile, a large network component (WAN) is further broken down into sub-components of mobile networking technology. In 2016, 5G Technologies has announced that the agricultural control process will be revolutionized by high-speed transfers of data, network control and energy consumption. Four generations of technology are used for cellular networking technologies. The data acquisition component also sends control commands not only to system administration but also transmits related agricultural information in the data visualization component. A popular platform is used by the application ofdifferent farming models and algorithms for decision-making, storage and statistical analysis on agricultural data.

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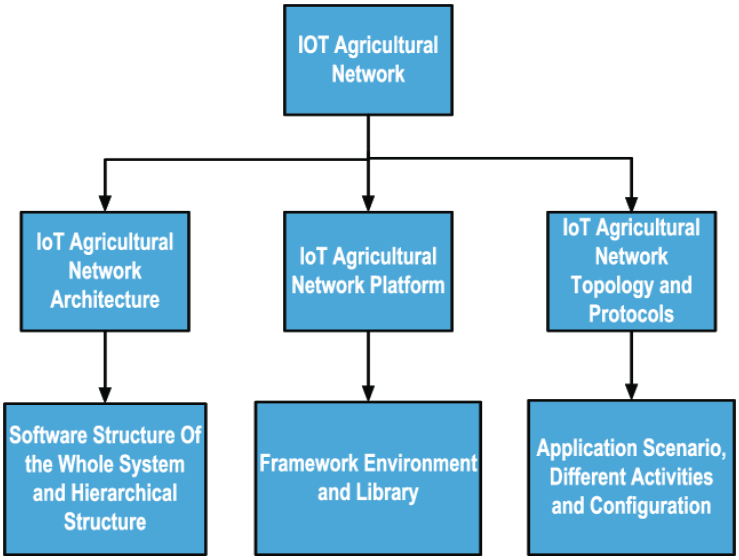

Figure 2:IoT Agricultural Network

The part was divided in: i) edge, (ii) cloud, and (iii) big data. In order to determine the internal links between data gathered through data mining and other instruments, big data technology conducts predictive analysis. It facilitates additional data-based operations, including the processing of images, statistical analysis, simulation, prediction, alerts and modeling, and a variety of processing technologies. Cloud Computing provides IoT agricultural applications with software, hardware, infrastructure and platform services. The Cloud Platform enables farmers to store images, texts, videos and other agricultural data cheaply, which reduces the cost of farmers' storage. The direct use of raw farm information for decision-making based onfarmers' technical knowledge is also a difficult task.In contrast, farmers may also make suggestions and evaluate reliably on the basis of quantitative analysis. There is therefore a clever and reliable crop-monitoring tool available only in the Cloud although the cloud platform is helping farmers with their advanced technologies, there are some constraints because the Internet and low-power technology are lacking. Edge computing is one of the most recent network edge computing models. Further, by improving data transfer rates this platform reduces the device load and protects agricultural data, since edge-computing processing is more than just cloud computing.

3. MONITORING DIFFERENT THINGS

Climate Conditions Monitoring

In agriculture, the most important weather conditions are in order to monitor possible activities. The most common means of tracking climatic conditions in agriculture are the weather stations. Temperature, humidity, wind direction and air pressure are among the weather parameters monitored. The weather stations around the field collect environmental data and transmit them tothe cloud server. To map the weather conditions and provide new insight into the actions needed to improve agricultural productivity, the collected data are being used.A weather-related approach called Climate Smart Agriculture (CSA) is developed by the Food and Agriculture Organization of the US (FAO), which helps the consumer turn farming systems by recognizing climatic conditions. The IoT technology is used to track weather changes through the integration of sensors and devices in a wireless sensor network oil Patterns Soil monitoring in agriculture for both industry and farmers has been one of the most challenging activities in the region. There are many environmental problems affecting cultivation in the field of soil monitoring. If data are correctly identified for such problems, agricultural trends and processes can easily be understood. The controlled soil trends include soil humidity, humidity, fertilization and temperature. Soil moisture and sensors of moisture are used to measure soil moisture. Additional crop yields increase due to sufficient fertilization in the field. The test report on soil monitoring increases crop production and suggests a suitable fertilization solution for farmers. In addition, IT technologies protect the field against fertilization and crop losses by means of the detection of polluted soils.

Pest and Crop Disease Monitoring

Crop diseases are the root cause of revenue and loss of production. The IoT boom has turned farming into a digital framework, which makes informed decision-making possible. Early planting disease prediction helps farmers generate

extra income through the protection of crops from pesticides in many ways, IoT shield crops from animal attacks and detect various illnesses. There was an IoT surveillance system in which wheat, rabbit and weed diseases were monitored. Crop raiding is the major problem since the cultivated land has contracted into various haunts of wildlife. In a surveillance and repelling scheme has been introduced to protect crops from the attack by wild animals. Early identification of cultivable diseases is a major challenge in agriculture. As a group of experts is needed to diagnose costly and time-consuming crop and leafdiseases.

Irrigation monitoring system

IoT innovatively upgrades the existing irrigation system. By monitoring weather and soil conditions, a farmer can optimize the irrigation system in several ways. The irrigation system of IoT is tracked in four ways, including the region's weather forecasting, monitoring and monitoring, Ethernet connection and wifi. This modern irrigation system promotes farmers'monthly irrigation costs and limits their water sources through the installation of a number of sensors. Intelligent irrigation management system presented the use of machining training and open-source technologies that senses different soil and meteorological parameters. To contact users with HTTP and MQTT protocols a low-cost IoT irrigation system has been created. The quality of the water is followed by wireless communication monitored sensor nodes. Ph, dissolved ph, temperature, conductivity and oxygen physical and chemical limitations are measured by the IoT technology. Collected water management system information is accessed via cloud storage services on the Internet. Several IoT irrigation platforms to monitor water consumption on the field were recently built. WSN was used to establish a basic irrigation system. Users can monitor the irrigation process through cellular technology in a more advanced way. Similarly, a device is suggested to move user data sensors to a database system using cellular technologies.

4. METHODOLOGY

Smart Agriculture System using IoT Technology

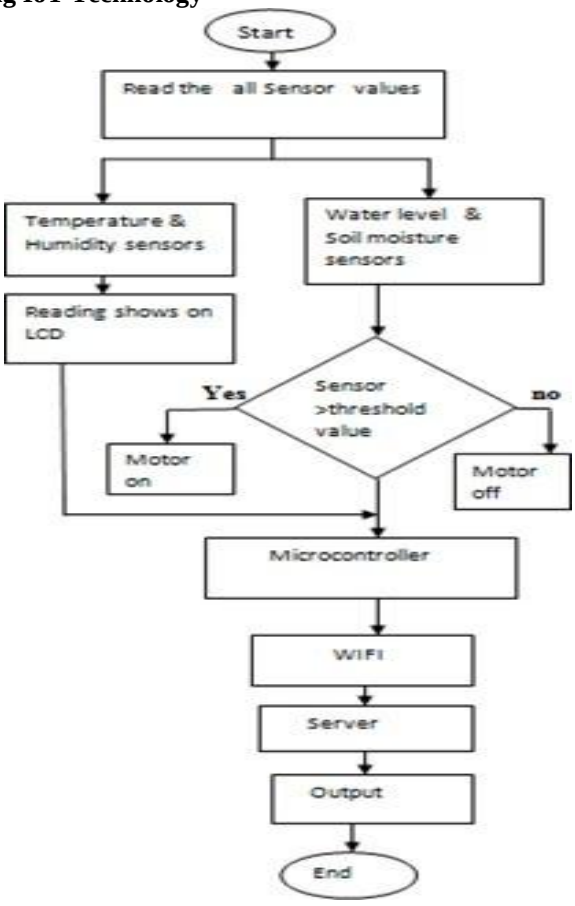

Figure: 3 "Smart Agriculture System using IoT Technology"

The module can also be rebuilt as an independent Wi-Fi link. IOT module use 3.3v electricity – do not follow 5 volts of self-discipline magnetism. In addition, data processing does not sound 5V tolerant sources of information when using follow-up 3.3v, so you need to adjust levels to talk to a 5V microcontroller.

4. SECURITY CHALLENGES

Smart IoT-based agricultural security consists principally of three fundamental requirements: authentication, access control and stakeholder confidentiality. However, external threats should be covered in the sensor network layer and the network layer data collection should be secure. Allow specific entities to provide access to application layer data only to authorized users. Physical security, which is the safety of hardware and information acquisition, is the most common security problems on the perception layer. Physical safety is crucial here because all instruments are used in an open space. That is why the use of an IOT-device in a number of environments does not suffice for a single security protocol. The information leakage is another important security issue; the location and sensitive data are this information. Safety measures include data encryption, jamming, blocker tags and frequency modification of tags.In order to understand hardware limitations when implementing encryption algorithms, policy detection for intrusion, distribution key and routing policies the different sensor nodes have to be distinguished from the RFID tag. Data is passed from the terminals to the IoT concept gateway, which also transfers data over the course of the operation to other networks, for example cloud facilities. Sensor node severs like ID, data filtering, encryption, data flow management system, etc. Security policies are different. Cheating, wiretapping, replaying and manipulation are also defense risks. Confidentiality, authentication and completeness can also be used during data acquisitions.

5. CONCLUSION

Researchers across the globe are investigating technical solutions to improve farm efficiency by implementing IoT technology, complementing existing services. In this paper, the state-of-the-artresearch on IoT in agriculture has been discussed. In this context, we discuss the architecture, platform and topology of agricultural networks that help access the IoT backbone and enhance productivity for farmers.

Agriculture will have a key role to play in the next few years. Consequently, intelligent farming is necessary. The Internet of Things will enhance smart agriculture. In different areas, IoT works to improve time efficiency, management of water, crop supervision, soil control, insecticide and pesticide control, etc. Overall, scientists are exploring technological solutions to increase agricultural production through the use of IoT technology to complement existing services.

In the growth of nations, agriculture plays an important role. Smart agriculture with the Internet of Things is therefore required. It allows farmers with minimum efforts to grow various types of crops in their fields. Enhance quality, the world economy, competitiveness and other characteristics. Because of their phones and IoT, farmers may obtain necessary information or data about their crops etc.

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