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Literature Review of Smart and Precision Agriculture by Applying IOT Module

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Abstract: ***The hottest topic in the internet industry is the Internet of Things. The IOT is a term used to describe a network of physical objects or things that may communicate with one another while still being connected to the Internet and are equipped with sensing, actuating, and computing capabilities. The concept of a smart object is made possible by embedded micro-controllers, actuators, and sensors.***
Wherein these intelligent objects gather data from the development environment, process it, and carry out the necessary actions. As a result, the Internet of Things will offer previously unthinkable advantages and assist people in living affluent, sophisticated lives.
IoT (Internet of Things) has emerged as a significant area of scientific study due to its potential uses. There is much debate and research surrounding the significance and applications of these technologies, but there is far less of it in the fields of agriculture and forestry.
In this work, IoT applications in forestry and agriculture have been researched and evaluated. This paper also offers a brief overview of IoT technologies, agriculture IoT, various possible application areas where IoT may be used in the agricultural industry, advantages and benefits of IoT in agriculture and farming, and a literature evaluation.
Keywords: Precision Farming, IoT, Sensors, Smart Agriculture, IOT Devices.

I. INTRODUCTION TO INTERNET OF THINGS

IoT is a technology that primarily addresses the connections between people and things, things and things, and people to people. IoT is a revolutionary technology that represents the exchange of information and computing in the future.
Infrared sensors, GPS, radio-frequency identification, remote sensing, mobile communication, and other communication networks are all used to communicate with intelligent sensors in this system. It describes a group of things connected by a auto-configurable wireless network.
IoT's primary goal is to create a massive network by fusing several sensor technologies, including GPS, RS, RFID, laser scanners, and networks, in order to understand how information is shared among items all over the world. Millions and trillions of networked and embedded smarts-devices, or "smart objects," can be included in the IoT. The Internet, which connects all linked devices and systems, allows these smart objects to communicate information they collect about themselves, their environment, and other smart devices that are connected to them to other devices and systems.
In spite of being agriculture based economy, India’s agriculture sector is losing ground reality, and has a high degree of impact on the ecosystem's ability to produce. There is an increasing need to find a solution in order to revitalize agriculture and return it to a path of higher growth. A large-scale agricultural system requires a lot of maintenance, expertise, and management. The Internet of Things (IoT) is a network of connected devices that may send and receive data over the internet and complete tasks without the need for human intervention. Crop yields are boosted thanks to the abundance of data analysis factors available in agriculture. The modernization of information and communication is aided by the usage of IoT devices in smart farming as shown in figure 1 below.
Applications for IOT can be found in many fields, such as intelligent agriculture, marketing, infrastructure monitoring, supply chain management, supply chain optimization, smart farming etc. Al most all the physical objects can be separately interconnected and can be addressable as per with their agreed-upon protocol in order to achieve a thorough perception, intelligent processing, and dependable transmission between WiFi enabled sensing devices or tools and systems. This can be done depending on the requirements of various applications.

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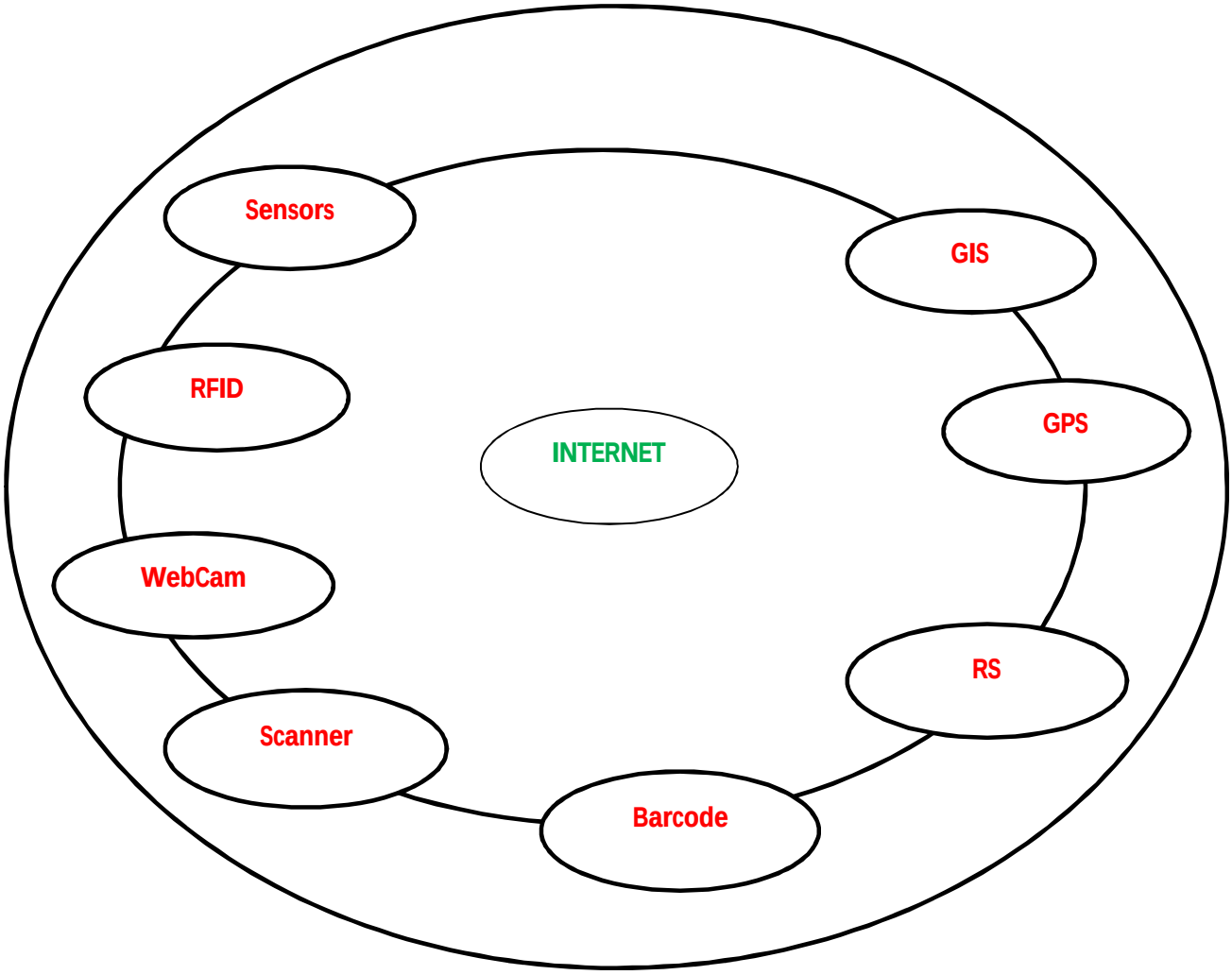


Figure 1: A Conceptual Model of IOT

II. PROBLEM DEFINITION

The presented article focused on agriculture, a fundamental business that is strongly tied to a country's welfare and its citizens' means of subsistence. The agriculture industry in India is declining day-to-day, which affects the ecosystem's ability to provide food. To restore vitality and put the area back on a higher trajectory, it is imperative to address this issue.

The global recession has reemerged, causing flows in almost all sorts of economies. To maintain global food security, the agriculture sector must become more capable and unstoppable. In terms of technological facilities, size of farm, policy framed by government, trade, etc., Indian farmers suffer undue harm. The IOT Technology can help Indian farmers with some of their issues.

The creation of a "agricultural information network" is crucial as agriculture throughout the world becomes more industrialized. The expansion of agricultural information networks has become a global trend in agriculture. Agricultural information network is seems to be a major concern in promoting agriculture and agriculture based development and its transformation with regard to the development of agriculture in India. The agricultural information system in India is plagued by numerous issues. For instance, this situation cannot supply high-caliber information to meet farmers' needs for productivity because hardware is prioritized over software. In addition, Indian farmers do not effectively use information, and information's effects on rural areas, agriculture, and farmers are not very notable. The requirements and the consumption of agricultural product could be predicted quantitatively, however, the variations in crop and production due to weather changes, changes in farmland used for cultivation, insect damage, crop disease, etc., could not be accurately predicted. As a result, the supply and demand of agricultural products have not been properly managed. It is necessary to leverage the IoT to support smart-agriculture in order to reverse this situation and support the rapid expansion of the agricultural information network.

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III. APPLICATIONS OF IOT IN AGRICULTURE SECTOR

IoT supports a number of applications in the field of digital agriculture, including soil and plant monitoring, crop growth observation and selection, precision agriculture, irrigation evaluation assistance, greenhouse environment monitoring and control systems, food supply chain monitoring, etc. The following well-known technologies are employed in IoT applications in agriculture:

1) *Sensor Technology in Agriculture:* Huge variety of various sensors, including temperature & moisture sensors, ultra-sonic sensors, rain sensor, meteorological sensors (which monitor the current state of the atmosphere), biosensors, gas sensors, and others, are used in agricultural products.
2) *RFID Technology:* Is widely employed in the tracking and identification of animals. It aids in the intelligent management, monitoring, identification, and tracing of animals.
3) *Radio Technologies in Agriculture & Farming:* ZigBee, a sophisticated wireless sensor networks, provide self-organizing WiFi data transfer. It has been frequently employed for data transmission in large-scale farming.
4) *Intelligent Irrigation Technology:* IRT Based on the "superficial wellspring underground cables, field, pipes for automatic irrigation" technology and the satellite positioning network, Intelligent irrigation technology can collect various properties of water, irrigation, electricity, and data about time to automate the irrigation of agricultural land and by adopting a thorough analysis of IT software to monitor day-to-day irrigation.
5) *Quality and Safety of Agriculture Based Products:* In the production-circulation-sales agricultural and industrial chain, documentation and monitoring of the chain can help to comprehend the complete regulatory process.
6) *Precision-Seeding and Spraying Methods:* Depending on the technology combined with GPS navigation, seeding, and fertilization at a variable rate, it can achieve identical implementation of the spraying, planting seedlings, and fine-tuning the utilization of pesticides, seeds, and other materials.

It is possible to achieve indistinguishable execution of the spraying, planting, and fine-tuning the utilization of pesticides, seeds, and other agriculture based materials depending on the technology incorporated with GPS navigation, sowing, and fertilization at a variable rate.

IV. ADVANTAGES OF IOT IN AGRICULTURE

Using IoT in the agriculture sector has several benefits, some of the prominent advantages are as follows:

1) *Enhanced Efficiency:* It will increase the effectiveness of agricultural inputs including soil, pesticides water, fertilizers, soil, etc.
2) *Reduction in Cost:* The price of production will go down.
3) *Profitability:* Farmers will become more profitable as a result.
4) *Sustainable Development:* Enhances sustainability.
5) *Safety of Food:* It will assist in achieving the food safety programme.
6) *Fortification of Environment:* It is crucial to protecting the environment.

V. LITERATURE REVIEW

A. *Bo Y, Wang H (2011)*

Studied applications of cloud network and IoT in Agriculture **[6]**. The numerous IoT and cloud network applications in the fields of agriculture and tree plants are covered in this study. The essay claims that the IoT is crucial to smart-agriculture. The fundamental IoT technologies, such as RFID, photo-acoustic electromagnetic sensors, and laser scanners, can be leveraged to achieve significant advances in agriculture. Specifically in the transfer of agricultural information, precise irrigation, intelligent agriculture control, the safety of agricultural products, and many others. In addition, this study focuses on certain IoT applications for forestry. IoT has a significant impact on the management, tracking, and identification of wood in forests. His paper brings to a close conclusion that the amalgamation of IoT with cloud computing technology has become a trend.

B. *Dlodlo N, Kalezhi J (2015)*

Possible IOT applications in agriculture and farming for sustainable development of rural areas have been identified in this research work. This paper **[2]** discusses many business and industrial prospects in the agriculture and agriculture-based industries, and the advantages that can be produced by utilizing the IOT. The rationale of this literature is to encourage a approach for IoT adoption in rural and agricultural development. The literature claims that designers can leverage IoT technology to create nation-specific innovations based on the agriculture industry. Technology advancement will raise people's standards and aid in the reduction of poverty.

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C. Mohanraj I, Ashokumar K, Naren J (2016)

Numerous issues pertaining to the agricultural realm were addressed in this research work **[7]**. A framework for an architecture was also created to address these issues. The language of this study suggests that cultivators should be inculcating on the proper timing throughout various points of crop growth. The research work fabricate a knowledge base. There are numerous crop specifics in this knowledge base. These crop-specifics speak to the gathering of knowledge, market accessibility, flow of geospatial data, and data on weather forecasting. Monitoring module features include checking for disasters, planning for irrigation, calculating crop profits, and monitoring different stages of plant growth. Utilizing the evapotranspiration method, a plant's daily water requirement is determined. Based on the created algorithm, this approach is used. In the end, a comparison study of numerous applications with developed systems was prepared. This system has features, such as, efficiency, knowledge-base, dependability, and monitoring modules.

D. Tongke F (2013)

The significance of cloud network & computing in the IoT and the significance of these technologies in the agriculture and farming system are explained in this research effort **[8]**. This paper discusses how cloud computing and IoT are closely intertwined. IoT receives significant computing tools with cloud network & computing; according to the manner the relationship between the two was explicated. A cloud of agricultural information is put up in this research project. The IoT and RFID are combined to create a smart agriculture system in this cloud of agricultural information. IoT components produce a lot of data, including data from RFID, sensors, wireless communication, and other sources. The agricultural information cloud manages this substantial volume of data. In order to achieve dynamic resource allocation and load balancing, resources in term of hardware tools are incorporated into the available resource pool in the agricultural information network, which increases resource utilization effectiveness.

E. Karim F, Karim F, Frihida A (2017)

In this study, a precision farming application prototype applying a wireless-sensor-network and an IoT based cloud is put forth. In this study **[9]**, an alarm-system for IoT-based water stress management of various plants was introduced. The procedures taken to create a Decision-Support-System for agricultural community to be able to guesstimate the amounts of water needed were outlined in the first section of this study. In order to manage irrigation, the farmers will get benefit from a specially designed dashboard programme in a graph format, which will allow him to track changes in soil conditions in real time. On the other hand, the application will send an SMS notification when a critical-level is satisfied in order to prevent water-stress. The same application can be enhanced to become a very ultra-modern one by integrating the evapotranspiration method to determine a plant's daily water needs in the decision support system.

F. Zhao JC, Zhang JF, Feng Y, Guo, JX (2010)

A "Greenhouse monitoring system" that combines wireless communications and the Internet is suggested in paper **[10]**. The "greenhouse monitor system," created using the Internet of Things, has a clear degree of control and monitoring precision, is very simple to use, has an intuitive user interface, and provides instantaneous monitoring of the various environmental parameters in the greenhouse. This system possesses some qualities, such as, high performance, dependable operation, and ease of improvement.

G. Patra L, Rao UP (2016)

This paper **[11]** elucidates the Internet of Things' architectural mechanisms, illustrates some application domains where it can be used, and discusses some challenges that must be addressed along with security-related concerns, like extensive deployment, unique identification, data security, standardization, effective spectrum usages, interoperability , gathered object safety, and energy utilization. As sensing, actuating, and RFID technologies evolve, the IOT is gaining pace. It tries to smoothly combine the actual world and the virtual world. Real and virtual worlds coexist seamlessly.

H. Jayaraman PP et al. (2015)

A platform popularly known as Phenonet is created by using an open-source-platform called OpenIoT. In this research effort **[12]**. Phenonet is essentially an application case for semantically improved digital agriculture. In a variety of use cases, this article illustrated the uses and effectiveness of Phenonet. The researchers showed how an OpenloT platform can assist in managing the difficulties that the Phenonet application runs into. The fundamental idea of gathering, validating, processing, annotating, and stockpile data collected from highly-intelligent sensors in the field has been put forth in project Phenonet. The relevant semantic inquiries, justifications, and experimental findings are discussed.

I. Khattab A. et al. (2017)

This paper presents a precision agriculture application and a tailored IoT-based agricultural architecture. This IoT design **[13]** is cloud-based. Different applications of precision agriculture can use this project. A three-layer architecture was suggested by the research. The first layer gathers environmental data and provides resources for necessary actions. A gateway layer makes up the second layer. This layer provides a network or Internet connection between the front-end and the back-end so that data can be processed and stored there. To evaluate and demonstrate the performance of this architecture, researchers created a prototype. The performance evaluation results show how effective the suggested architecture is.

VI. CONCLUSION

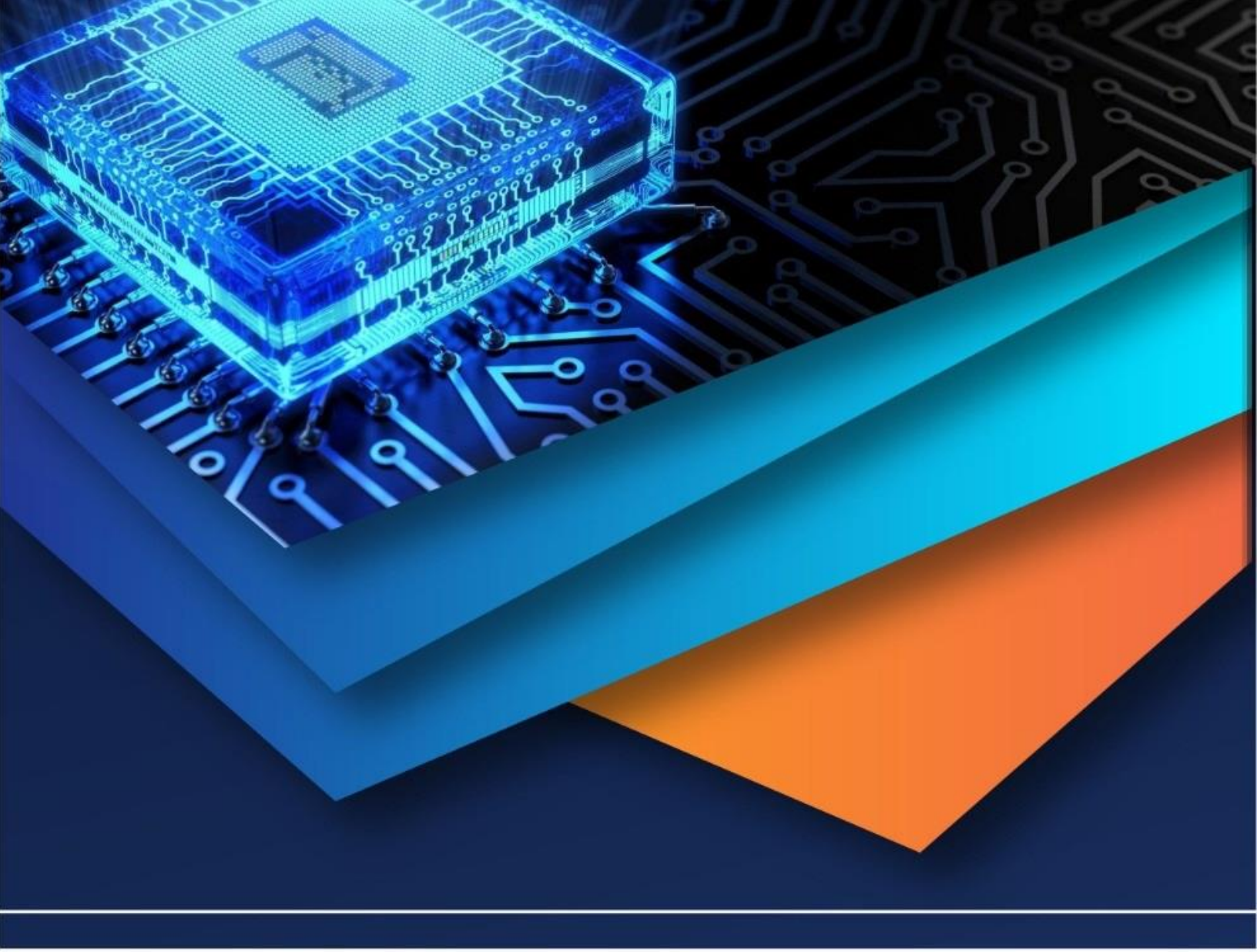
India's growth has consistently been hampered by problems with agriculture, rural areas, and farmers. The only way to deal with these three issues is through agricultural modernization. India's agriculture is still a long way from being modernized. The challenges may be resolved with the application of IoT to modernize agriculture. Cloud services, SOA and visualization-technologies can produce vast amounts of data used in agricultural production based on IoT and cloud computing capabilities. RFID and IoT technology can be used to develop factories that can automatically control agricultural productivity. A fantastic application of contemporary technology and IoT The effective application of IoT and new technology can accelerate the modernization of the agricultural system. The problems affecting farmers, agriculture, and rural areas could be effectively resolved by using smart IoT in agriculture.

The analysis above suggests that agricultural scientists and information technology professionals should be encouraged to share ideas. Particularly those people who comprehend farming and how IT might innovate and advance modernization in the industry. Modern farming can enhance agricultural management and productivity, accomplishing the objectives of energy conservation and environmental safeguard. Through intelligent analysis and improved management, farmers using IoT in agriculture would definitely be able to take hold of the current choice of agricultural soil, farmers may know which crops are most suitable for the farming at a particular time and other environmental information of farmland or agricultural land through clever analysis and improved management, of farming.

Meanwhile, the situation that follows may be observed: Farmers must be able to operate on computers or mobile phone, or on any intelligent systems, to understand cultivation, watering, seeding, reaping, etc., then they could easily complete hard farm work. Professionals have a chance to actively investigate the technical advancement of contemporary agriculture thanks to the ongoing and swift development of micro-electronic and network technology. The growth of contemporary, smart agriculture around the world, which lays the groundwork for industrial development, is greatly aided by making the use of IOT.

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