IoT Enabled Smart Agriculture System for Better Crops Monitoring and Productivity

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ABSTRACT: *Regardless of how people perceive the agriculture process, the truth is that today's agriculture sector is more data-driven, accurate, and intelligent than ever before. The fast rise of Internet-of-Things (IoT)-based technology altered practically every industry, particularly "smart agriculture," which shifted the industry from statistics to quantitative techniques. Such dramatic innovations are upsetting conventional agricultural systems and opening up new prospects while posing a variety of obstacles. This paper mentions the promise of IoT in agriculture for better crop monitoring which further helps in more crop productivity. Furthermore, several obstacles are predicted to be encountered while merging this methodology with traditional farming practises. The IoT devices and techniques employed in farm operations are thoroughly discussed.*

KEYWORDS: *Agriculture, Crops, Internet of Things (IoT), Irrigation, Smart agriculture.*

1. INTRODUCTION

Without a doubt, the best approach to feed the world's population is to use the Internet of Things in agriculture. But IoT makes even bigger claims. It's one of the few practical methods for feeding a rising population in a sustainable manner. IoT improves crop monitoring and allows for optimum implant power when growing crops. It is clear that linked gadgets and the Internet of Things (IoT) have a significant influence on today's society. Today, it is nearly everywhere, from the household to the industrial sector, smart cities, the health sector, and the fitness sector. It is present in the majority of businesses, and agriculture is no exception. The Internet of Things (IoT) and linked gadgets can have a huge influence on farming techniques, removing the need for horses and bullocks for the farmers. The market is still quite active and IoT is very popular as consumer-connected gadgets. The use of IoT in agriculture encourages high output from a lower to a higher rate, which is a result of effective farming[1], [2].

Achievements for farmer earnings in the sensitive area of technology are maintained by around 75% of crop production. Utilizing the Internet of Things in agricultural operations reduces the need for manual labour through automation, speeds up machine commands through remote and real-time monitoring, and at the same time enables farmers to use resources much more effectively through preventative maintenance & environmental forecasting. When these innovations are used in the agricultural industry, the income will undoubtedly increase, and the farmers will be able to handle more acreage[3].

With the use of smart agricultural techniques, farmers may better manage the process of raising crops and livestock. In this manner, it creates enormous economies of scale, lowers expenses, and aids in the conservation of finite resources, such as water. The amount of fertiliser used and the number of trips made by farm vehicles may both be decreased while production is increased by farmers and growers. When using an IoT system for farming and agricultural needs, selecting the right sensors is crucial. What you want to do with the data you acquire ultimately relies on the kind of information you are attempting to gather. To ensure the success of your IoT solution, make sure the sensors are of excellent quality (Figure 1).
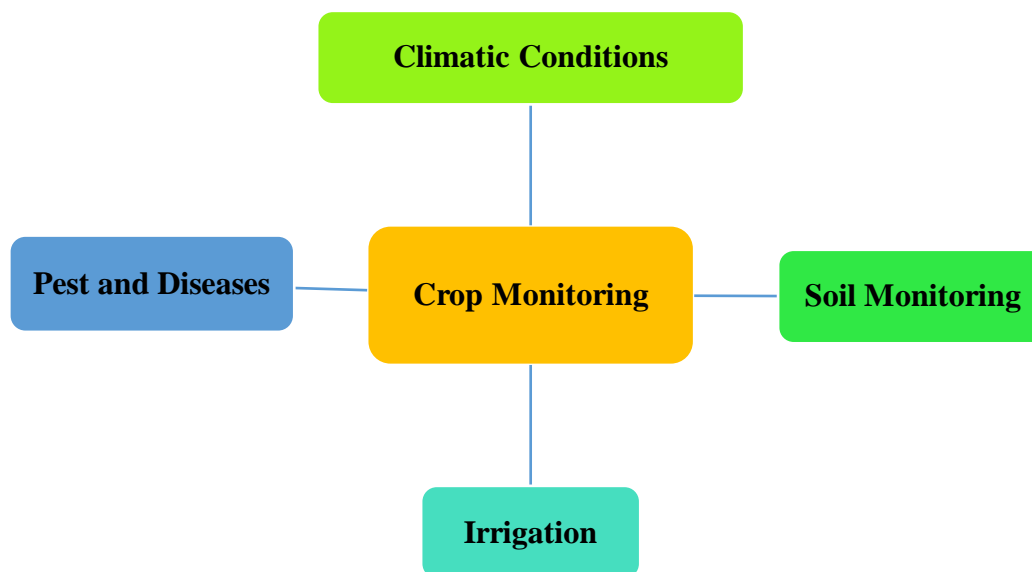
Figure 1: Illustrating the use of IoT in Different Aspects of Crop Monitoring.

1.1. Monitoring of changing Climatic conditions

The weather plays a huge role on agriculture. The amount and quality of crops may be affected by incorrect climatic knowledge. Conversely, farmers may utilise IoT solutions to install sensors in the field, such as temperature, rainfall, humidity, and water level sensors, to get real-time information from the environment. These sensors keep an eye on the condition of the crops and the surroundings where they are grown. In the event that an unsettling environmental circumstance is found, it is either automatically fixed or a notice is issued to the farmer.

To overcome the concerns with cost and accuracy, greenhouses developed an Internet of Things-based meteorological stations. Climate and abiotic elements are continually monitored using the TI CC2650 Sensor Tag and IBM Cloud Platform, which also sends email alerts when values change. In light of this, the scope of this work may be extended to incorporate the application of ML design classification training to classify a plant's health as outstanding, mediocre, or horrible based on the light intensity, humidity, typical temperature, and air pressure. This might serve to further clarify concepts about the health of plant and contribute to ensuring the longevity of the plants[4].

1.2. Monitoring of Irrigation

The subject of a smart irrigation system has been the subject of several studies. To meet the rising demand for food, food production technology must be greatly improved. Many professionals have hard attempted to provide a substitute for irrigated farming. However, none of these attempts have yet produced a workable answer to the current issues with the irrigation system. Crop irrigation is currently done manually and according to accepted customs. Crops that receive less water develop more slowly and take up less calcium. Roots are killed by frequent watering and water is wasted. As a result, precise crop irrigation becomes quite challenging. To enable autonomous supply of enough water from a tank to field crops, a smart irrigation control and surveillance technique is created. Based on data acquired from controlling and monitoring the soil levels of water to limit dryness and overflow, automatic sensor systems can be used to determine if plants need to be watered[5].

1.3. Crop Disease

Human operators commonly control insect infestations through time-consuming and expensive on-site examinations, resulting in inadequate spatial or temporal clarity. Remote monitoring is now feasible because to developments in electronics, remote sensing, and analytics. Monitoring expenses and effectiveness can be reduced by deploying webcam-equipped trappings. Image analysis systems can automatically locate & quantify insect pests collected in nets with little human interaction[6].

1.4. Smart Soil Monitoring for water levels

For both producers and farmers, soil monitoring has become one of the most difficult agricultural fields. Agriculture production is impacted by a number of environmental problems related to soil monitoring. Farming practises and patterns are simple to comprehend if these kinds of barriers have been accurately identified. We are keeping an eye on the soil's moisture content, wetness, fertiliser application, and temperature patterns. The soil moisture environment management system makes use of soil moisture or moisture sensor. The findings of a soil monitoring test report help farmers increase crop output by recommending an appropriate fertiliser method. The sensor is capable of reading both analogue and digital outputs. The decision is based on sensor information that is compared to predetermined threshold values. The soil moisture sensor is used to control the automated functioning of the irrigation system. When the moisture level falls below a specific threshold, the water pump is activated [7].

2. DISCUSSION

The implementation of the Internet of Things in agriculture, as well as other industries, offers hitherto unattainable efficiency, resource and expense reduction, automation, and data-driven operations. Nevertheless, in agriculture, these advantages do not serve as upgrades, but rather as remedies for the entire business, which is confronted with a variety of harmful difficulties (Figure 2).
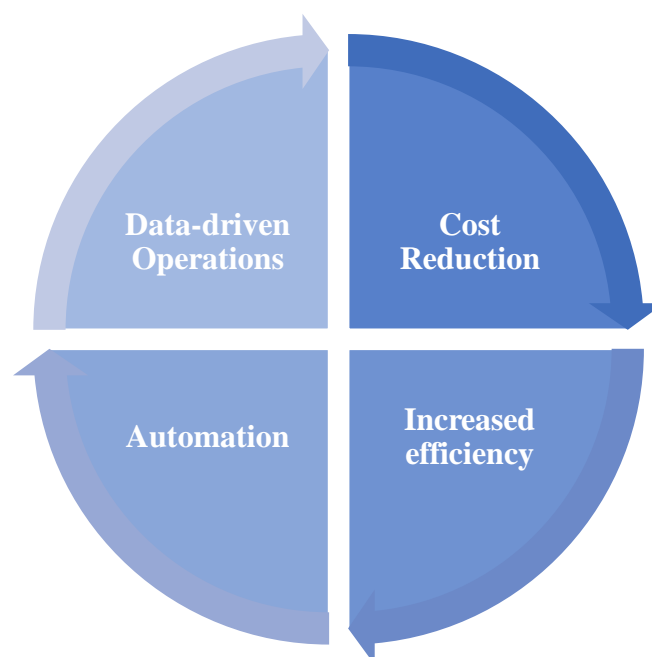
Figure 2: Illustrating the different Benefits of IoT Enabled Agriculture.

2.1. Excelled efficiency

Agriculture nowadays is competing. In spite of poor soil conditions, dwindling land availability, and growing weather variability, farmers must produce more. Farmers can evaluate their products and environmental factors in real-time owing to Internet - of - things agriculture. People can quickly get insight, anticipate issues before they arise, and decide how to prevent them using knowledge. Automation is also introduced through Iot technology in agricultural, such as demand-based irrigation, fertilisation, and robot harvest. Total of 70% of the population will reside in cities by the time there are 9 billion individuals on the planet. These folks ought to be able to eat fresh vegetables and fruits due to IoT-based greenhouses and hydroponics system that enable short food supply chains[8].

2.2. Expansion

Plenty of ag IoT solutions are focused on optimizing the use of resources—water, energy, land. Precision farming using IoT relies on the data collected from diverse sensors in the field which helps farmers accurately allocate just enough resources to within one plant.

2.3. Cleaner process

IoT-enabled smart farming is an effective method of lowering the use of fertilisers and pesticides. Precision farming reduces the usage of pesticides and fertiliser greatly while also assisting farmers in conserving water, energy, and the environment. As opposed to conventional farming practises, this technology enables the production of a cleaner and more organic end product.

2.4. Agility

The enhanced agility of the operations is one advantage of implementing IoT in agriculture. Farmers can swiftly react to any substantial weather pattern, air quality, humidity, as well as the condition of each plant or soil in the fields, according to real-time surveillance and forecast systems. Experts in agriculture are helped by innovative features to save the crop production in the event of extreme weather changes.

2.5. Improved product quality

The use of data in agriculture promotes the production of more and better crops. Farmers are better able to grasp the intricate relationships between crop quality and environmental circumstances because to the use of soil and crop sensors, aerial drone monitoring, and farm mapping. By re-creating the ideal circumstances, they can improve the nutritional worth of the items [9], [10].

3. CONCLUSION

Due to the rising population, there is a greater need for food than ever before, making farming practises crucial to meeting public demand. It is essential to concentrate on more intelligent and effective cultivation methods. Young people are now gravitating toward agriculture and selecting it as a career due to the advancement of new techniques for enhancing agricultural output and management. Through the use of mobile devices and the internet, they may obtain information to simplify the process of cultivating and monitoring crops. Taking these concerns into account, this study emphasises the crucial role of technology, particularly IoT, in making

farming smarter to fulfil future aspirations. We employ gadgets like Bluetooth, the cloud, and wireless sensors, as was already said.

REFERENCES:

[1]   M. Stočes, J. Vaněk, J. Masner, and J. Pavlík, "Internet of things (IoT) in agriculture - Selected aspects," *Agris On-line Pap. Econ. Informatics*, 2016, doi: 10.7160/aol.2016.080108.

[2]   E. Y. T. Adesta, D. Agusman, and Avicenna, "Internet of things (IoT) in agriculture industries," *Indones. J. Electr. Eng. Informatics*, 2017, doi: 10.11591/ijeei.v5i4.373.

[3]   D. Ekpa, O. I. Oladele, and M. Akinyemi, "Poverty Status of Climate Smart Agricultural Farmers in North West Nigeria . -Application of Foster Greer and Thorbecke Model," *Am. J. Rural Dev.*, 2017.

[4]   C. Thaddeus and K. Watanabe, "Environtmental Determinants in the Control of Dengue Mosquito Vector, Aedes Aegypti," 2014.

[5]   S. Bopshetty, M. Yadav, R. Rai, S. Silvister, and P. P. Sagar, "Monitoring and Controlling of Drip Irrigation using IOT with Embedded Linux Board," *IJARCCE*, 2017, doi: 10.17148/ijarcce.2017.64167.

[6]   S. M. Patil and R. Sakkaravarthi, "Internet of things based smart agriculture system using predictive analytics," *Asian J. Pharm. Clin. Res.*, 2017, doi: 10.22159/ajpcr.2017.v10s1.19601.

[7]   M. S. Mekala and P. Viswanathan, "A Survey: Smart agriculture IoT with cloud computing," 2017. doi: 10.1109/ICMDCS.2017.8211551.

[8]   J. Garrity, "Harnessing the Internet of Things for Global Development," *SSRN Electron. J.*, 2016, doi: 10.2139/ssrn.2588129.

[9]   M. Lee, J. Hwang, and H. Yoe, "Agricultural production system based on IoT," 2013. doi: 10.1109/CSE.2013.126.

[10]   A. V. Kanade, A. S. A, and D. Jalamkar, "Development of IoT Controlled Agri-Rover for Automatic Seeding," *Int. J. Pure Appl. Math.*, 2017.