How IOT contribute to agriculture development

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Abstract

This paper presents the idea of how internet of things (IOT) innovation has influenced land and farming. In a world increasingly connected by technology, IoT has emerged as a pivotal force, revolutionizing various aspects of our lives. Its impact on agriculture, particularly in the context of land and plant farming. As global population growth and environmental concerns intensify, the demand for more efficient, sustainable, data-driven farming approaches has surged. This paper highlights how IoT empowers farmers and citizens with remote monitoring capabilities, enabling real-time updates and insights accessible through smartphones and other personal devices.

I. INTRODUCTION

a. Background

Nowadays, the advent of the Internet of Things (IoT) has marked a transformative moment in the technological landscape and revolutionizing the way we interact with the world around us. One area where IOT's influence has been particularly pronounced is in the domain of land, plant farming with the interconnectivity of devices and the harnessing of data. This paper explores the multifaceted impact of IoT innovation on agriculture from precision farming to sustainable practices, and reshaping the future of agriculture as we know it. Traditionally, agriculture has been a sector deeply rooted in tradition and manual labor. With the increase of global population and environmental concerns, the need for more efficient, sustainable, and data-driven approaches to farming has become increasingly evident. Entering IoT, a technological frontier that has seamlessly integrated itself into the heart of agriculture in many countries nowadays, offering transformative solutions to age-old challenges. Farmers now can remotely oversee their land and crops, receiving critical updates and insights on their smartphones or their personal devices. This level of connectivity provides an unprecedented level of control and responsiveness. Whether it can help the farmers, IoT-enabled solutions empower the farmers and nowadays citizens to take timely action and mitigating potential risks and losses with plants to grow the plants, to protect the environment and produce a lot of agriculture products.

b. Internet of Things in Farming

The integration of the IoT into farming practices has ushered in a new era of agricultural management and efficiency. Moreover, sustainable farming practices are significantly bolstered by IoT technologies. The continuous monitoring of environmental conditions, facilitated by IoT, assists in pest management and disease prevention.

II. CURRENT STATE OF THE ART

a. Wireless Plant sensor for farming

The examination of the system's prototype architecture reveals its composition of five distinct modules: the **power supply system**, **sensor system**, **output and actuation system**, **control system**, and the **internet communication system** (Monica Subashini M et al., 2018). The sensors incorporated in the design are characterized by their affordability and commercial off-the-shelf nature, ensuring the production of reliable measurements. The objective is to employ a variety of dependable and cost-effective sensors to monitor environmental parameters crucial for crop growth. This is achieved by utilizing high-quality components while maintaining a focus on minimizing the overall bill of materials. In this experiment, the authors will test different sensors and send them to the online server for storage and analysis and control the growth parameters.

However, the utilization of low-cost materials imposes certain limitations on the approaches. While exploring soil moisture, numerous methods are available, but high-cost alternatives typically deliver more accurate results. In contrast, the low-cost method employed here exhibits a lack of precision and is susceptible to external factors such as temperature variations and the ionic content within the soil.

When the authors employed the system to investigate soil moisture, they conducted the experiment twice to ensure reliability. The encouraging news is that both results were consistent, underscoring the authors' meticulous approach to validate the effectiveness of the system's sensor. The authors demonstrated a comprehensive understanding of the materials utilized, documenting their reasons for selecting each component before commencing the experiment. This documentation serves to instill confidence in readers, emphasizing the cost-effectiveness of the materials without compromising reliability. Additionally, the authors exhibited profound knowledge in biology, physics, and technology theories, presenting these concepts in an easily comprehensible manner. They successfully demonstrated the system's adaptability by integrating it with various technologies, optimizing both portability and lifespan. But I think that there still are some flaws in their experiment because they only mention one limitation and it has been solved.

b. Plant Disease Detection

The authors of the article have analyzed the environment using temperature, humidity, and light sensors to collect data from plant leaves. They analyzed all the collected data, including temperature, humidity, and light levels, to identify diseased leaves. Arduino hardware was used to collect temperature and humidity data to determine whether a plant leaf was diseased.

The approaches that they used can be divided into four stages:

- **Leaf input**: Leaves are placed on a conveyor belt and passed through the system.
- **Color sensors**: Color sensors are used to capture the color of the leaves.
- **Arduino Uno**: An Arduino Uno microcontroller is used to collect and process data from the temperature, humidity, and light sensors.
- **Analysis result**: The Arduino Uno uses a machine learning algorithm to analyze the data and identify diseased leaves.

One limitation of this system is that it can only identify whether a leaf is healthy or diseased. It cannot identify the specific type of disease that a leaf is suffering from. This is because the system is trained on a dataset of labeled leaf images, and the dataset may not contain images of all types of leaf diseases. Additionally, the results of the system can be affected by climate conditions, such as temperature and humidity. For example, the color of a leaf can change depending on the temperature, so the system may not be able to accurately identify a diseased leaf if the temperature is different from the temperature that the system was trained on.

Understanding the prevailing conditions in Pakistan, the authors conducted an insightful analysis to demonstrate that IoT agriculture systems can be effectively applied in this context. They specifically aimed to assess the adaptability of robots in the Pakistani environment, leveraging databases from ThingSpeak. Acknowledging the project's pros and cons, the authors exhibit a keen awareness of potential enhancements to the system, aiming for increased precision in results. Overall, the authors believe that their IoT-based agriculture system has the potential to be a valuable tool for Pakistani farmers which can help farmers to identify diseased leaves early, which can lead to better crop yields and reduced crop losses.

c. Framework for wireless sensor networks management for precision viticulture and agriculture based on IEEE 1451 standard.

The authors have tried to test the intelligent data acquisition devices, comprises with a range of hardware to implement the IEEE 80.2.15.4/ZigBee (Fernandes et al., 2013). The authors propose a framework for wireless sensor networks management for precision viticulture and agriculture and it is based on the IEEE 1451 standard, which provides a common communication interface for sensors and networks. They have tested the framework in a vineyard and found that it simplifies the configuration and management of the sensor network, and this framework was able to collect data from a variety of sensors accurately and reliably.

The authors have noted that IEEE 1451 is complex and can be difficult to implement in real circumstances.

The authors believe that the framework has the potential to improve the efficiency and effectiveness of precision viticulture and agriculture. The proposed framework is based on a well-established standard and has been shown to be effective in a real-world setting. However, the framework is mentioned that it is quite complex and difficult to be implemented into real circumstances. Moreover, for what the authors have written in the article, the data, results from the experiment can be used to improve irrigation, fertilization, and pest control practices. This framework also can be used to monitor crop health and identify pests and diseases early and allow farmers to act before the damage to the crop is significant.

d. Smart agriculture with internet of things in cornfields

The authors propose a smart agriculture system that uses wireless sensor networks to collect data from cornfields. The data is then sent to a drone, which relays it to a base station. The authors discuss the limitations of their system, such as the need for many sensors and the cost of drones.

The authors use 3 main ways to approach to implement their system:

- **Wireless sensor networks**: The authors use wireless sensor networks to collect data from cornfields. Wireless sensor networks are a type of network that uses sensors to collect data and transmit it to a central location.
- **Drones**: The authors use drones to collect data from cornfields and relay it to a base station. Drones are unmanned aerial vehicles that can be used to collect data from a variety of sources.
- **Base station**: The authors use a base station to receive data from drones and store it for analysis. Base stations are typically located on the ground and provide a central location for storing and processing data.

The authors discuss the following limitations of their system:

1. The need for many sensors: Wireless sensor networks requires many sensors to be deployed to collect comprehensive data.
2. The cost of drones: Drones can be expensive to purchase and operate.

The authors believe that their system has the potential to improve crop yields and reduce costs. They believe that their system can help farmers to better manage their crops and make more informed decisions about irrigation, fertilization, and pest control. The article provides a good overview of the potential benefits and limitations of using smart agriculture with the internet of things in cornfields. The author's proposed system has the potential to improve crop yields and reduce costs, but it is important to be aware of the limitations of the system before implementing it.

e. Smart Farming: Internet of Things (IoT)-Based Sustainable Agriculture

The authors propose a smart farming system that uses IoT sensors to collect data on crops, soil, and the environment. The data is then sent to a cloud server, where it is processed and analyzed. The system can then provide farmers with recommendations on how to improve crop yields and reduce environmental impact.

The authors use a variety of approaches to implement their system, including:

- **IoT sensors**: The authors use IoT sensors to collect data on crops, soil, and the environment. IoT sensors are small, low-cost devices that can be deployed in a variety of locations.
- **Cloud computing**: The authors use cloud computing to process and analyze the data collected by the IoT sensors. Cloud computing provides a scalable and reliable platform for data processing and analysis.
- **Machine learning**: The authors use machine learning to develop algorithms that can provide farmers with recommendations on how to improve crop yields and reduce environmental impact.

The authors believe that their system has the potential to improve crop yields and reduce environmental impact. They believe that their system can help farmers to make better decisions about irrigation, fertilization, and pest control. The authors also believe that their system can help to reduce the use of pesticides and herbicides. The article provides a good overview of the potential benefits and limitations of using IoT in smart farming. The authors' proposed system has the potential to improve crop yields and reduce environmental impact, but it is important to be aware of the limitations of the system before implementing it.

III. CONCLUSION

Overall, IoT has the high potential to revolutionize the agriculture industry. By using IoT sensors and devices, farmers can collect data on their crops, soil, and the environment in real time. This data can then be used for improving crop yields, reducing costs, and environmental impact. As a result, farmers will have a better living standard. Monitoring crops, automated tasks such as irrigation and fertilization, all these jobs can be done with the power of IoT devices which can make agriculture more efficient, profitable, sustainable. However, it is important to note that IoT is still a relatively new technology and there are several challenges such as high costs, complex that need to be addressed before it can be widely adopted in agriculture.

IV. REFERENCES

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