IOT-BASED SURVEILLING SYSTEM FOR MULTIPLE AGRICULTURE LAND USING WSN

Abstract

Nowadays, Wireless Sensor Networks (WSN) play a vital role in many fields like transport, medicine, the military, mobile phones, home appliances, agriculture, and so on. In the agricultural field, WSNs are widely used to improve crop quality and monitor farming productivity. The Mesh topology is used to easily deploy the sensor in the looping arrangement. Enhancing the mesh topology can lead to heightened bandwidth, improved reliability, and optimized power consumption, thereby advancing the intricate sensory capabilities of wireless sensor networks. It helps the farmer to monitor their agricultural land in different locations. The nodes in different locations will communicate with the other nodes without any internet requirements. It can communicate via radio frequency. In this application, the sensor gathers different types of data like soil moisture, water level, power supply, and need for fertilizers in real time. Each node can transmit the data and receive the data. The sensor information will be displayed on the Internet of Things (IoT), webpage then the farmer can know the exact situation of monitoring land via the Internet.

Keywords: Internet of Things (IoT), Node MCU, Wireless Sensor Network (WSN), Node MCU ESP 8266.

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I. INTRODUCTION

1. **Overview of IoT-Based Surveilling Systems:** The recent convergence of the Internet of Things (IoT) and Wireless Sensor Networks (WSN) has brought about a transformative impact across diverse sectors, notably reshaping the landscape of agriculture. IoT-based surveillance systems have emerged as a viable remedy to tackle the limitations encountered by conventional agricultural monitoring approaches, it holds great promise. These systems leverage advanced sensor technologies, connectivity, and data analytics to monitor multiple agricultural lands in real-time, enabling precision farming, resource optimization, and proactive decision-making.

2. **Background and Motivation:** The Background and Motivation behind developing an IoT-based surveillance system for multiple agricultural lands using WSN stems from the need for enhanced monitoring, resource optimization, and productivity in agriculture. By leveraging WSN and IoT technologies, farmers and agricultural stakeholders can overcome the limitations of traditional surveillance methods, optimize resource allocation, implement precision farming techniques, and make informed decisions based on real-time data. The integration of sensors, connectivity, and data analytics enables continuous monitoring, early detection of issues, and timely interventions to mitigate risks and improve agricultural outcomes.

3. **Objectives:** To describe the develop a robust and scalable IoT-based surveillance system that enables continuous and real-time monitoring of multiple agricultural lands. The system should collect data on various environmental parameters, such as soil moisture, automation of fetching water, and measure the level of fertilizers in the tank. It enables farmers to make data-driven decisions for optimizing irrigation schedules, fertilizer applications, and other farming practices. It helps the farmer see their land locations in one IoT webpage. This objective aims to increase resource efficiency and reduce operational costs.

4. **Significance of Wsn in Agricultural Area:** Wireless Sensor Networks (WSN), enable real-time monitoring systems of various environmental parameters in agricultural lands. WSN can cover vast and geographically dispersed agricultural lands effectively. By deploying sensor nodes strategically across the fields, WSN provides comprehensive coverage, making it possible to monitor large-scale agricultural operations and remote areas that are otherwise challenging to access. WSN can be seamlessly integrated into the Internet of Things (IoT) ecosystem, enabling data sharing, cloud-based analytics, and remote monitoring. The combination of WSN with IoT and big data technologies enhances agricultural surveillance capabilities and potential applications. WSN's significance in agricultural surveillance lies in its ability to provide real-time data, support precision farming, enable early threat detection, reduce labor and costs, and contribute to sustainable agricultural practices.

II. INTRODUCTION TO IoT IN AGRICULTURAL LAND

1. **Introduction:** IoT (Internet of Things), in agricultural land refers to the integration of advanced digital technologies, sensors, and connectivity to improve farming practices, optimize resource usage, and enhance overall agricultural productivity. By deploying IoT

solutions in agricultural settings, farmers can collect real-time data, analyze it, and make informed decisions to address various challenges and capitalize on opportunities in farming. IoT in agriculture relies on robust communication networks to transmit data from the sensors to a central data repository or cloud platform. The data collected from the sensors is stored in cloud-based platforms, making it easily accessible and scalable.

2. **IoT In Smart Farming**: In the realm of smart agriculture, IoT plays a pivotal role, especially within IoT-driven agricultural surveillance systems, catalyzing a shift from conventional farming methods to streamlined, data-centric, and ecologically viable agricultural processes. IoT technology offers a range of capabilities that empower farmers with real-time data, precise control, and intelligent decision-making. IoT-based agricultural surveilling systems can be easily scaled up or down to accommodate different farm sizes and configurations. They are also adaptable to various farming practices, crop types, and environmental conditions.

3. **Integration of Wsn In Iot-Based Agricultural Systems:** Within the IoT ecosystem, wireless sensor network (WSN) protocols serve as a vital link connecting IoT sensor nodes to a central gateway, forming a single component among various technological stacks that constitute IoT. As a subset of this broader framework, WSN facilitates data exchange across multiple IoT devices, often functioning independently of internet connectivity. The integration of Wireless Sensor Networks (WSN) in IoT-based agricultural systems is a fundamental aspect that enables the seamless collection, transmission, and utilization of real-time data from agricultural environments. WSN acts as a crucial component in the IoT ecosystem for agriculture, providing the foundation for data acquisition and enabling smart decision-making.

4. **Implementation of Mesh Topology in the System:** The implementation of mesh topology in agricultural land plays a crucial role in Wireless Sensor Networks (WSN), providing several benefits that enhance the efficiency and reliability of the surveillance and monitoring processes. In a mesh topology, each sensor node can communicate directly with multiple neighboring nodes, forming a network of interconnected nodes. Node MCU ESP8266 has Inter-Integrated Circuit (I2C), which means it has three slaves and one master. In this system, the slave node in the MCU shares the data with other slaves in different locations all the slaves share and exchange the data with each other and transmitted the data to the one master node which is located in any one of the lands without any internet requirements.

III. DATA ACQUISITION AND PROCESSING

1. **Deployment of Sensor Motes:** Strategically positioned across agricultural expanses, sensor nodes are meticulously deployed, forming a looping arrangement for comprehensive coverage. It gathers data from the environment through sensor nodes and data can be displayed on a farmer’s web screen. The sensor nodes are programmed to collect data at regular intervals or event-driven triggers. Here are some of the parameters analyzed, for example, measuring soil moisture content, level of water in the water tank, and need for fertilizer. The nodes may collect data every few minutes, hourly, or when specific environmental thresholds are crossed (e.g. if the water storage drops below a certain level or soil moisture drops below a set value).

2. **Data Processing and Analysis:** Data processing and analysis are crucial components of an IoT-based surveillance system for multiple agricultural lands using Wireless Sensor Networks (WSN). After collecting data from the deployed sensor nodes, the system processes and analyses the data to derive meaningful insights and support data-driven decision-making. The processed and analyzed data can be integrated with decision support systems. Decision support systems use algorithms and rules to provide farmers with actionable insights, recommendations, or alerts. These insights aid in optimizing resource allocation and making informed decisions for farm management.

3. **Network Management:** The network management system involves continuous monitoring, control, and maintenance of the WSN to ensure its reliability, performance, and security. The system ensures that sensor nodes form a robust mesh topology, ensuring connectivity among the nodes. Topology management may include dynamic routing algorithms that adjust the communication paths in response to node failures or changes in the network. If any slave nodes failed, the other neighboring node takes care of the failed nodes.

4. **Energy Management:** Operating within constrained battery parameters, the Node MCU ESP8266 leverages effective energy management while boasting built-in Wi-Fi functionality and seamless integration of a cutting-edge ultra-low power 32-bit MCU microcontroller. The system monitors the energy levels of sensor nodes and implements energy-saving techniques. The Node MCU ESP8266 can be programmed to wake up at specific intervals to collect sensor data and transmit it to the central server. After data transmission, the node can enter a low-power sleep mode until the next wake-up time. Implementing these energy management techniques into this system can optimize energy usage, extend the battery life of the sensor nodes, and maintain effective and reliable monitoring capabilities for precision farming and sustainable agricultural practices.

IV. CONCLUSION AND FUTURE ENHANCEMENT

1. **Conclusion:** This system provides, an efficient way to reduce manpower in the agricultural field. This proposed system monitors multiple agricultural lands within a single monitoring system. Combining the power of the Internet of Things (IoT) and Wireless Sensor Networks (WSN) for monitoring agricultural environments goes beyond traditional methods, introducing new ways to improve the effectiveness and reliability of monitoring systems. It provides innovative solutions for automation, efficiency, and precision in farming. And also, it enables real-time information about the land. The Wireless Sensor Network (WSN), with the Internet of Things (IoT), helps agricultural lands share information about the lands. Farmers can use their mobile phones, Web-app to analyze data and gain insights about their land and crops. This helps them make smarter decisions and develop efficient strategies, leading to a more sustainable and productive future for agriculture.

2. **Future Enhancement:** Leveraging the fusion of the Internet of Things (IoT) and Wireless Sensor Networks (WSN) in agricultural settings empowers farmers with predictive analytics, enabling more informed harvest decisions, minimizing waste, and amplifying productivity across various facets such as fertilization and irrigation, ultimately bolstering the quality and yield of farming endeavors. As we look to the future

of agriculture, there's a lot of potential in using Artificial Intelligence and Machine Learning to help farmers make smarter decisions. By analyzing data and providing insights, these technologies can give farmers a better understanding of their land and crops, and help them develop more efficient strategies for growing food. For example, an AI-powered monitoring platform could help farmers customize their approach to cultivation, based on factors like soil quality, weather patterns, and more. Of course, there are also challenges to implementing these technologies, such as ensuring that they're accessible to all farmers, regardless of their resources or technological know-how. However, by working together to address these challenges, we can build a more sustainable and productive future for agriculture.

