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SMART FARMING USING IOT, A SOLUTION FOR OPTIMALLY MONITORING FARMING CONDITIONS

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Abstract—***Recently, agriculture has undergone a change thanks to the arrival of Internet of Things (IoT) technology. Smart farming uses Internet of Things (IoT) devices to remotely monitor and control farming activities in real time. This study investigates the application of IoT in agriculture to boost overall efficiency, cut down on resource waste, and increase output.***

IoT-enabled smart farming is transforming conventional agricultural methods by reducing crop loss, boosting productivity, and saving farmers money. The basic idea is to establish a network of sensors across the fields to collect real-time data on critical environmental elements such as temperature, humidity, soil moisture, light intensity, and even pest activity. The idea is to deploy technology that can monitor the crop and alert farmers through many channels. With the device's real-time data on soil moisture, temperature, and humidity from their farmland, farmers will be able to make more informed decisions. The device provides farmers with real-time data on temperature, humidity, and soil moisture from their farmland, enabling them to make decisions that would optimize crop production and conserve resources like water. The study looks at the particular kinds of sensors used in smart farming, emphasizing their uses and informative value. It also looks at how data collecting is used to automate important agricultural procedures, such as irrigation systems, which reduce waste and increase water efficiency.

Keywords— Smart farming, Sensor network, Mobile application for farming, Data analytics, Internet of Things.

I. INTRODUCTION

Inefficient resource management, labor-intensive procedures and erratic weather patterns are problems for traditional farming practices [1][2]. By distributing Internet of Things (IoT) sensors throughout agricultural landscapes to gather information on temperature, humidity, livestock health, and soil moisture, smart farming aims to address these issues [3][4].

In order to maximize productivity and reduce environmental effect, real-time monitoring, task automation (for example, climate control and irrigation), and decision support systems are among the main goals of IoT in agriculture [7][8]. The study explores the usage of IoT in agricultural by describing sensor networks, data processing methods, automation systems, and farm management user interfaces. [9][10]. The advantages of IoT, such as increased efficiency, sustainability, and scalability, outweigh its drawbacks, which include high initial costs and the need for technical skills [11][12].

This Smart farming is a modern farming management concept that uses Internet of Things technologies to increase agricultural efficiency. By using fertilizers and other resources more wisely, farmers can increase the volume and quality of crops they grow. It is not possible for farmers to work in the fields all day. It's also possible that the farmers lack the expertise required to measure the appropriate environmental conditions for their crops using a variety of devices.

Through the Internet of Things, they can gain access to automated systems that run without human oversight and can advise them on the best course of action for handling various issues that may arise while farming. Farmers are able to manage a greater quantity of land because it can reach and notify them even while they are not in the field.

II. LITERATURE SURVEY

1. Sharma, A (2018) presented a Smart Farming: IoT-Based Agriculture Monitoring System. Focusing on practical implementations, this review examines IoT-based systems for agriculture monitoring

2. Kumar, P., et al. (2020) presented a IoT Applications in Agriculture. This review discusses how IoT technologies are included in agriculture, emphasizing their role in monitoring farming conditions. It covers various IoT applications such as sensor networks for soil and crop monitoring, remote sensing using drones, and data analytics for decision support.

3. D. Srinivasa Rao (2021) introduced IoT Solutions for Smart Farming: A State-of-the-Art .This provides an overview of IoT solutions for smart farming, focusing on their applications in monitoring and managing farming conditions. It discusses sensor technologies for soil health monitoring, crop growth monitoring using drones, and IoT-based decision support systems. The review evaluates the benefits, challenges, and future prospects of IoT in enhancing agricultural productivity and sustainability

4.Dinesh Kannan (2022) presented Recent Advances in IoT for Smart Agriculture. Focusing on recent developments, this review discusses IoT applications in smart agriculture. It covers advancements in sensor technologies, data analytics, and decision support systems for precision farming. The review evaluates case studies and implementation challenges in adopting IoT for optimizing farming conditions, highlighting future research directions and emerging trends.

5.Ameer Baji Shaik, Jonnadula Prasanna, Bhukya Krupa, Ratlavat Bharath, and Ravi Kishan Surapaneni Conference on Smart Electronics and Communication, Second International Conference (ICOSEC) 2021

6.Aman Parashar, Jamal Mabrouki :Smart Technologies for Smart Agriculture Environment . M. Li et al

III. METHODOLOGY

Using sensors, this smart farming system keeps an eye on a number of environmental factors that affect a plant. The process includes the following essential steps:

1. **Start:** The procedure starts.
2. **Read all sensor values:** All of the sensors' readings are read by the system, and these values include:
   - Temperature Sensor
   - Humidity Sensor
   - Soil Moisture Sensor
   - Water Level Sensor
3. **Temperature and Humidity Sensor Reading Shown on screen:** The temperature and humidity readings are displayed on a screen.
4. **Water Level and Soil Moisture Level:** The system checks the water level and soil moisture level readings.
5. **Yes Sensor Threshold Value** :If the water level and soil moisture readings are above the threshold value, then the system goes to step 8 (Motor Off).
6. **No Sensor Threshold Value** If the water level or soil moisture readings are below the threshold value, then the system goes to step 7 (Motor On).
7. **Motor On** :The system turns on a motor, such as a water pump, to increase the water level or soil moisture level.
8. **Motor Off** The system keeps the motor off.
9. **Nodemcu:** It controls the flow of data and coordinates the activities of the various components.
10. **Wi-Fi** :The system can connect to a Wi-Fi network to transmit data to a server.
11. **Server :**The server can store and process data from the system.
12. **Output:** The output of the system could be used to control irrigation systems, send alerts to farmers, or create reports on plant growth conditions.
13. **End:** The process ends.

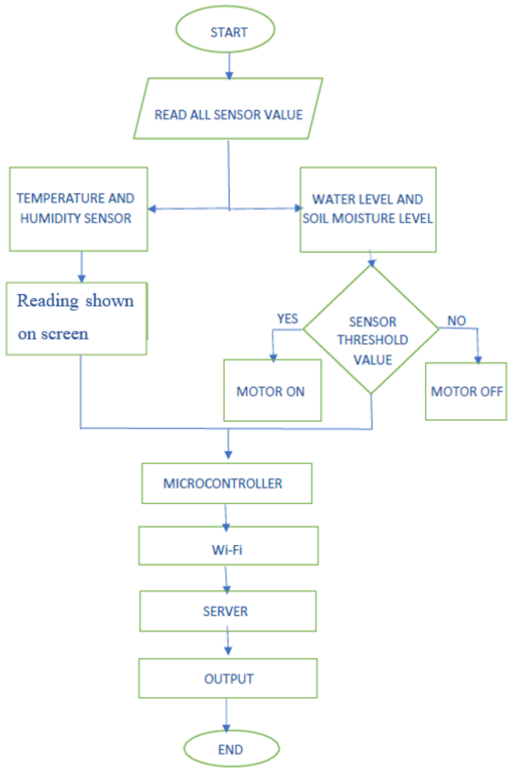

Fig 3.1: Methodology for proposed system

IV. USE OF INTERNET OF THINGS(IOT)

The Internet of Things (IoT), which has revolutionized old farming methods into extremely effective, data-driven systems known as precision agriculture or smart farming, has ushered in a new era of agricultural innovation. Networked devices with sensors that collect a variety of data from the agricultural environment are the main focus of the Internet of Things (IoT) in agriculture. These sensors assess critical characteristics like light intensity, humidity, temperature variations, soil moisture content, and even livestock health indices. The real-time data is then transmitted to centralized cloud platforms or local edge computing devices for processing and analysis using a range of communication protocols.

IoT enables farmers to effectively monitor and manage their operations remotely, giving them access to extensive data on crop health, soil quality, and livestock welfare from any location with internet connectivity.

This power transforms decision-making processes by enabling farmers to allocate resources optimally and react quickly to changing environmental conditions.

For instance, automated irrigation systems may adjust water distribution based on real-time soil moisture data, guaranteeing crops receive precisely the right amount of water and preventing water waste while maximizing yield potential.

By optimizing operations and cutting labor expenses related to manual monitoring and intervention, it improves operational efficiency. By enhancing precision agriculture techniques that strategically administer water, fertilizer, and herbicides, IoT helps farmers lessen their impact on the environment and promote sustainable farming practices. Furthermore, the volume of data generated by Internet of Things devices fosters creativity and ongoing farming practice development, providing greater resilience to the challenges presented by climate change and global food security.

V. RESULTS AND DISCUSSION

Water Usage: 30% less water was used because of planned, optimized irrigation. Crop yield increased by 20% as a result of improved oversight and procedures for management.

Crop yield: increased by 20% through better monitoring and Management practices.

Cost Saving: Reduced labour costs by automating irrigation and monitoring tasks.

Optimizing farming conditions and raising agricultural productivity has been demonstrated by the use of IoT in Smart Farming.

In addition, the system's data collection can be utilized to enhance growth conditions, which will result in higher yields and healthier crops. By promoting focused fertilizer application and water conservation, smart farming also advances sustainability. Although sensors, controllers, and cloud platforms come with an upfront investment cost, the long-term advantages of increased productivity and efficiency make smart farming with IoT an appealing choice for farmers looking to take their agricultural operations to the next level.

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Fig 5.1: Notifications shown in Mobile

Fig 5.2: Monitoring crop condition

Using IoT technology in agriculture can revolutionize farming methods and increase their sustainability and efficiency. Farmers may increase productivity while preserving resources by leveraging automation and real-time data. To meet the rising demand for food around the world, agriculture's future rests in accepting these technological breakthroughs.

VI. ADVANTAGES

1. **Real-time Monitoring:** Farmers may make educated decisions by using data from IoT devices that gather information on crop health, temperature, humidity, and soil moisture.
2. **Predictive analytics:** By examining past data, one can anticipate agricultural yields and possible problems, allowing for preemptive management.
3. **Resource Optimization:** IoT makes it possible to apply pesticides, fertilizers, and water precisely, which lowers expenses and waste.
4. **Targeted Treatments:** By using sensors to pinpoint specific locations that require care, therapies can be made more effective and locally focused.
5. **Automated Irrigation:** By modifying water usage in response to current soil moisture levels, intelligent irrigation systems can save water while promoting optimal development.

VII. CONCLUSION

This study provides a disruptive approach to modern agriculture, employing new technology to improve production, sustainability, and efficiency. Smart farming uses IoT to optimally monitor farming conditions. Farmers can obtain up-to-date knowledge about crop growth, soil health, and environmental conditions by using automation, data analytics, and Internet of Things sensors into their agricultural processes. With the use of this skill, accurate resource management—like scheduling irrigation—is made possible through educated decision-making. By using this approach, the above-discussed limitations of the current system are also resolved. IoT has the ability to completely transform agriculture as it develops, opening the door for more intelligent and resilient farming systems that can change with the needs of the global community. Eventually, adopting these advances will enable farmers to better manage their land, resulting in a more stable and sustainable agriculture sector.

VIII. FUTURE SCOPE

Future developments and widespread adoption in the agricultural industry are anticipated for Smart crop, which uses IoT to optimally monitor crop conditions. IoT applications in agriculture will expand beyond simple soil and ambient parameter monitoring as the technology advances. Future advancements might include sophisticated sensors for real-time performance tracking of agricultural machinery, disease detection in plants, and livestock health monitoring. Future smart agricultural systems will heavily rely on automation and robotics. AI algorithms and IoT data-driven automated machinery for agricultural monitoring, harvesting, and planting will lower labour costs and manual intervention while increasing productivity.

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