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Smart Agriculture Monitoring System

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ABSTRACT: This project introduces a smart agriculture monitoring system designed to revolutionize traditional farming practices through the integration of sensor technology, microcontrollers, and automation. The system comprises sensors for soil moisture, temperature, and humidity, interfaced with an ESP8266 microcontroller for data processing and control. Real-time data collected by the sensors enables informed decision-making regarding irrigation scheduling, with the system automatically activating irrigation when soil moisture levels drop below a set threshold. A 16x2 LCD display provides visual feedback on environmental conditions, empowering farmers with actionable insights for crop management. Future enhancements include expanding sensor capabilities, integrating machine learning algorithms for predictive analytics, and leveraging IoT technology for broader connectivity and sustainability. This project aims to enhance agricultural productivity, efficiency, and sustainability while fostering global collaboration and knowledge exchange in the farming community

KEYWORDS: Smart agriculture, IOT, ESP8266, Automation

I. INTRODUCTION

In response to the pressing need for sustainable agriculture practices, this project presents a smart agriculture monitoring system that harnesses the power of modern technology. By integrating sensors, microcontrollers, and automation, the system offers a comprehensive solution to optimize crop management and water usage. With real-time monitoring of soil moisture, temperature, and humidity levels, farmers can make informed decisions about irrigation scheduling, thereby enhancing crop health and productivity. The project aims to address the challenges of water scarcity and environmental degradation in agriculture while promoting efficiency and sustainability.

The introduction sets the stage for a detailed exploration of the system's components, functionalities, and potential impact on agricultural practices. It highlights the project's significance in the context of global food security and environmental conservation, emphasizing the role of technology in driving positive change in the agriculture sector. Through the implementation of this smart agriculture monitoring system, the project seeks to empower farmers with the tools and knowledge needed to adapt to changing environmental conditions and maximize crop yield in a sustainable manner.

Paper is organized as follows. Section II describes operational related work of the system. The block diagram and flow diagram represent the step of the algorithm given in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

II. RELATED WORK

In the International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 8 Issue VII of July 2020, Aman Jain's contributions spanned various facets of technology-driven agricultural and household advancements. Through the integration of IoT and image processing, Jain devised a methodology to assess the impact of additive and mineral compositions on crop growth. Collaborating with Abhay Kumar, they introduced a novel approach for capturing and monitoring household objects within a founding network. Additionally, Jain, along with Kartikeya, focused on innovations in mechanical engineering and process control systems, particularly in designing vertical water systems and proposing methods for water management in rural areas. Furthermore, Jain's research extended to developing techniques for measuring humidity and temperature levels in rural fields, showcasing a comprehensive dedication to enhancing agricultural practices and domestic technology applications.

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The Smart Agriculture Monitoring System, inspired by all this literature survey, is like a smart helper for farmers. It uses special sensors and a phone app to make sure crops get just the right amount of water and stay healthy. It also lets farmers check on their fields and control things from anywhere, making farming easier and more efficient.

III. METHODOLOGY

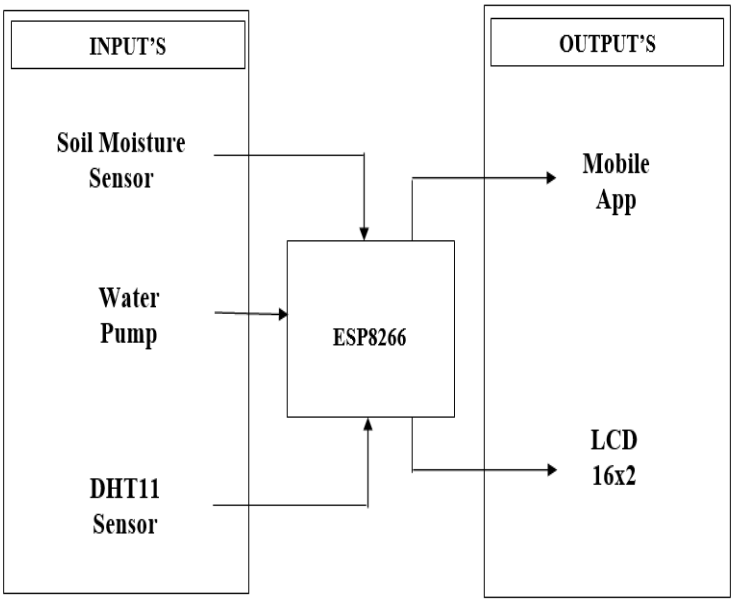

Fig3.1: Block Diagram

The Smart Agriculture Monitoring System is a comprehensive framework crafted for the vigilant oversight of agricultural parameters and the adept control of irrigation processes. It harnesses the capabilities of the ESP8266 Wi-Fi Module to facilitate wireless communication, thereby connecting the system to the internet and enabling seamless interaction with other devices or platforms. At its core, the Soil Moisture Sensor plays a pivotal role, gauging the moisture content in the soil to inform precise irrigation scheduling. This ensures that crops receive the ideal amount of water, eliminating waste. Complementing this, the DHT11 Humidity and Temperature Sensor measures ambient humidity and temperature, providing farmers with essential insights into microclimatic conditions to maintain the perfect growing environment for their crops. Data visibility is elegantly presented through a 16x2 I2C LCD Display, offering farmers an intuitive interface to view real-time metrics regarding soil moisture, humidity, and temperature. The water pump, a crucial mechanical component, is tasked with the efficient delivery of water for irrigation, its operation meticulously controlled by a relay to adjust soil moisture to ideal levels. Enhancing the system's utility, a mobile app for control and monitoring introduces a layer of convenience and accessibility, allowing users—primarily farmers—to manage the Smart Agriculture Monitoring System remotely. This integration empowers them to oversee agricultural operations from any location, ensuring optimal crop growth and resource utilization

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System flow

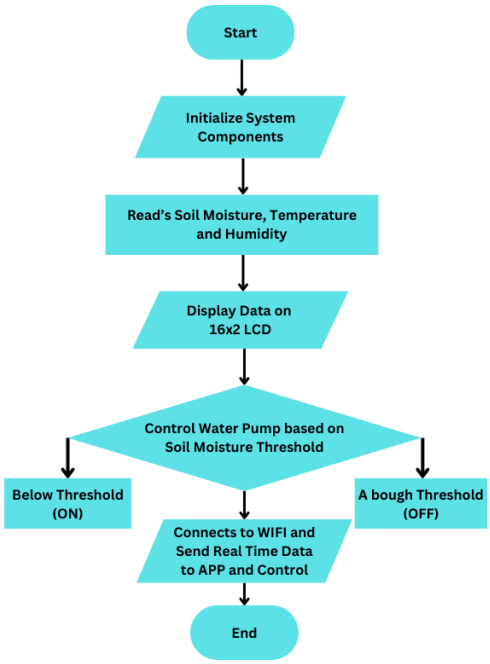

Fig3.2: Flow Chart

our system revolves around monitoring environmental conditions and optimizing water usage. The system first starts by initializing sensors and other components. It then collects data on factors like soil moisture, temperature, and humidity. This data is displayed on a small screen for on-site monitoring by the farmer. The core function involves checking the moisture level against a predefined limit. If the soil is dry (below the threshold), the system automatically triggers the water pump for irrigation. Conversely, if there's sufficient moisture, the pump remains off to conserve water. Additionally, the system can connect to Wi-Fi and send real-time sensor readings to a mobile application, enabling remote farm management and control. This basic structure lays the foundation for more sophisticated smart agriculture systems that incorporate additional sensors, automation capabilities, and even machine learning for data-driven decision making.

IV. EXPERIMENTAL RESULTS

Figures 4.1,4.2 & 4.3 shows the model of. Dimension of the model of Smart Agriculture Monitoring System are length-609.6 mm, breath 457.2 mm and height 500mm.

Fig4.1

Fig4.2

Fig4.3

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Figures 4.4 and 4.5 shows the display interface with 2 different modes. Fig4.4 show app interface. Fig4.5 show LCD Interface.

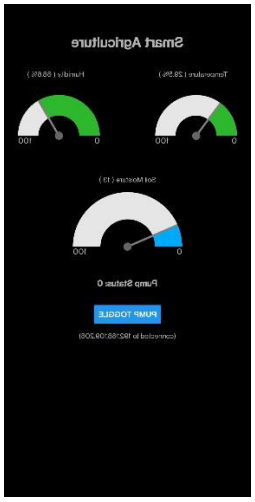

Fig4.4

Fig4.5

V. CONCLUSION

We have successfully demonstrated the application of smart agriculture system in automating farming activities and avoiding water wastages. Our smart agriculture monitoring system revolutionizes farming by integrating sensors, microcontrollers, and automation, optimizing water usage and crop yields through precise irrigation management. With real-time soil moisture, temperature, and humidity data, farmers can ensure plants receive exactly the right amount of water, reducing waste and promoting sustainability. This approach not only boosts productivity but also supports sustainable agriculture by minimizing resource use and environmental impact. Our system represents a significant step forward in combining technology and data insights for more effective and environmentally conscious farming.

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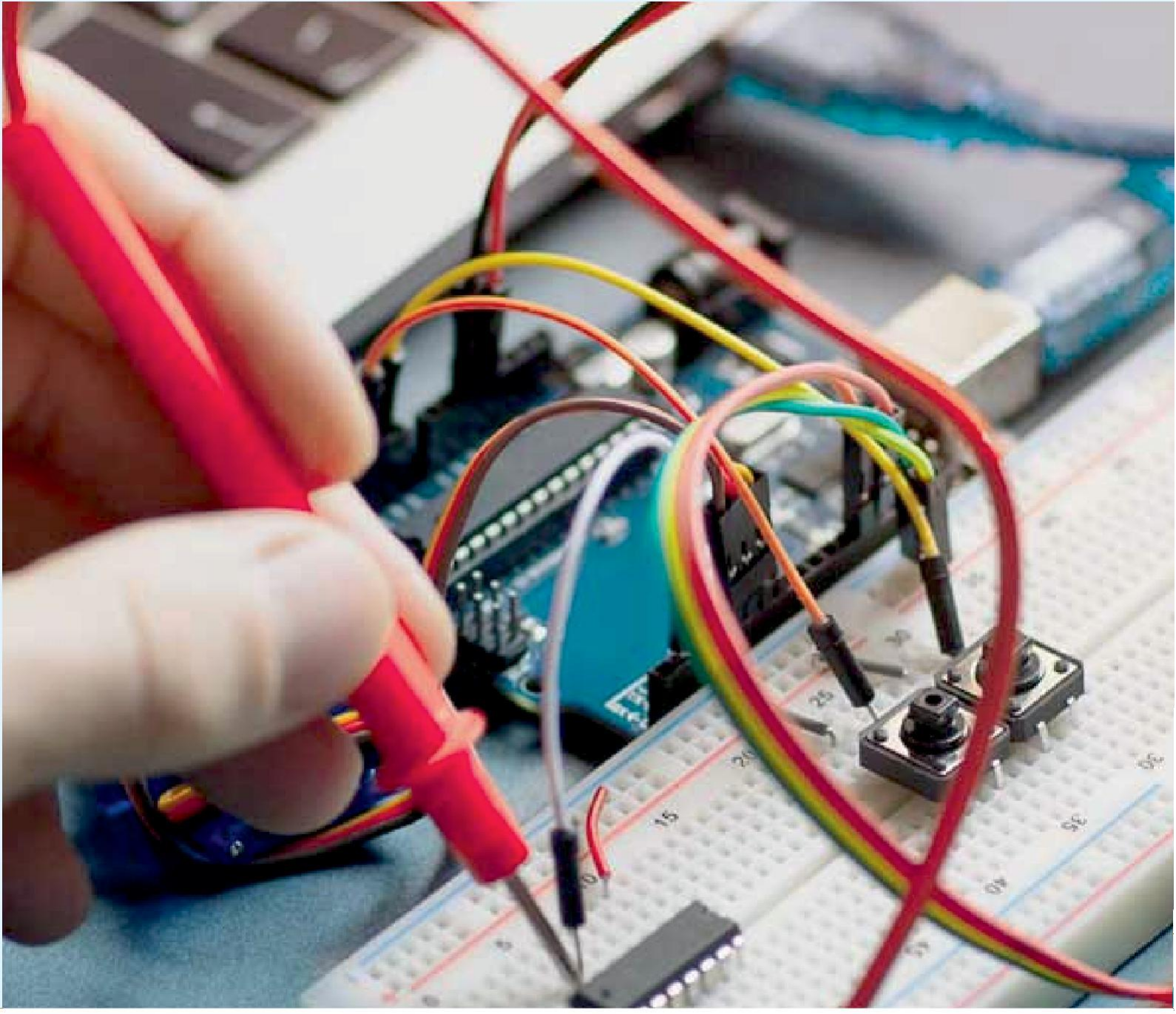

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