



Smart Agriculture Monitoring System with Wi-Fi

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ABSTRACT: Water scarcity and inefficient irrigation practices present significant challenges in modern agriculture, leading to resource wastage, increased operational costs, and reduced crop productivity. Traditional irrigation methods, which rely on manual operation, often result in improper water distribution, affecting soil health and overall farm efficiency. This paper proposes a Smart Agriculture Monitoring System with Wi-Fi that enables real-time monitoring and automated control of water distribution. The system integrates sensors for soil moisture, temperature, and humidity with an ESP8266 microcontroller. A mobile and web application allows farmers to remotely monitor and control irrigation schedules through the Blynk IoT 2.0 platform. The proposed system offers a cost-effective, scalable, and easy-to-implement solution for improving water use efficiency and crop yield.

Keywords: Smart Irrigation, IoT, ESP8266, Soil Moisture Sensor, Blynk.

1. Introduction

Modern agriculture is under increasing pressure to adopt sustainable practices that optimize resource use, particularly water. Traditional irrigation methods, such as manual watering, are labor-intensive and often result in inefficient water usage. Furthermore, the lack of real-time monitoring and control mechanisms restricts farmers' ability to make timely, data-driven decisions. This paper presents a smart, technology-driven solution aimed at improving irrigation efficiency and productivity through automation and remote monitoring. Our contribution lies in designing an IoT-based system that integrates multiple sensors with a Wi-Fi-enabled microcontroller and a user-friendly interface.

2. Recent Works

Numerous systems have been proposed in recent years that utilize IoT in agriculture. Duan and Zhang (2021) discussed the role of smart technologies for sustainable farming. Nambi and

Suresh (2020) emphasized the use of Wireless Sensor Networks (WSNs) for efficient agriculture. Sharma and Nagi (2019) reviewed Wi-Fi-based agricultural systems and highlighted challenges in large-scale adoption. Kumar and Sharma (2020) further elaborated on the future trends of wireless agriculture systems, while Zhang and Li (2020) proposed an IoT-Wi-Fi-based system for real-time monitoring. However, most of these systems rely on expensive components or require continuous internet connectivity. Our approach is designed to work efficiently using local Wi-Fi hotspots without cloud dependency.

3. Proposed Work Explanation

The system is built around the ESP8266 microcontroller, which collects data from various sensors including:

- Capacitive Soil Moisture Sensor v1.2: Monitors soil moisture content.
- DS18B20 Waterproof Temperature Sensor: Tracks soil temperature.

- DHT11/DHT22 Sensor: Measures ambient temperature and humidity.
- 5V Relay Module: Controls the water pump based on sensor input.

Data from sensors is processed by the ESP8266 and transmitted over Wi-Fi to the Blynk IoT 2.0 platform. The mobile app interface allows farmers to set thresholds for soil moisture and trigger automated irrigation when levels fall below the preset values.

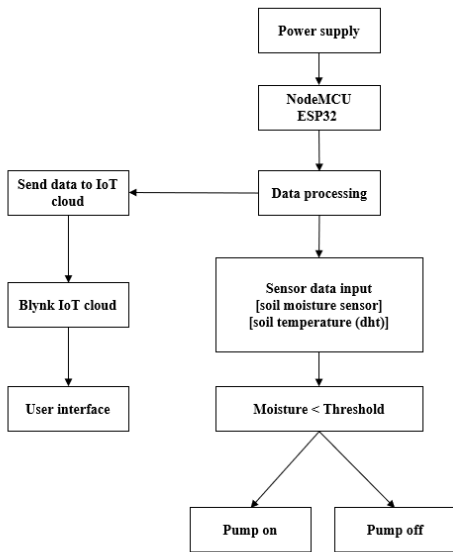


Figure 1: Proposed block diagram

4. Results and Discussion

The prototype was successfully implemented and tested in a controlled agricultural environment. The system effectively monitored sensor data and

controlled water supply without manual intervention. Farmers could visualize real-time data on their smartphones and adjust irrigation settings remotely. Figures and tables below show sensor readings, threshold levels and system responses.

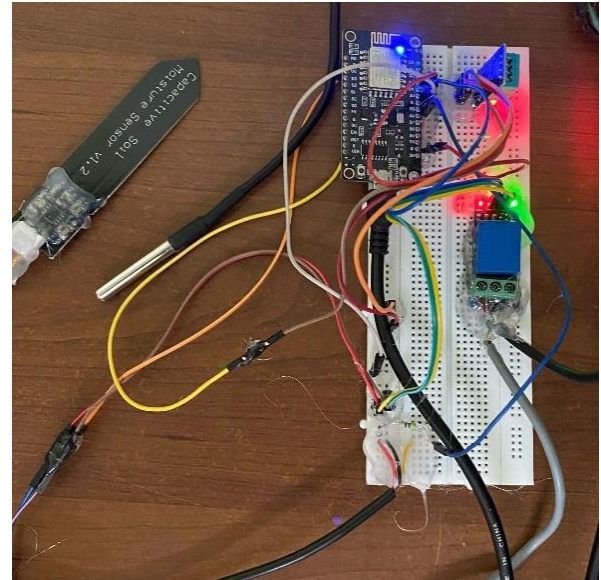


Figure 2: (a) Snapshot of the working module



Figure 3: (b) Snapshot of the working module

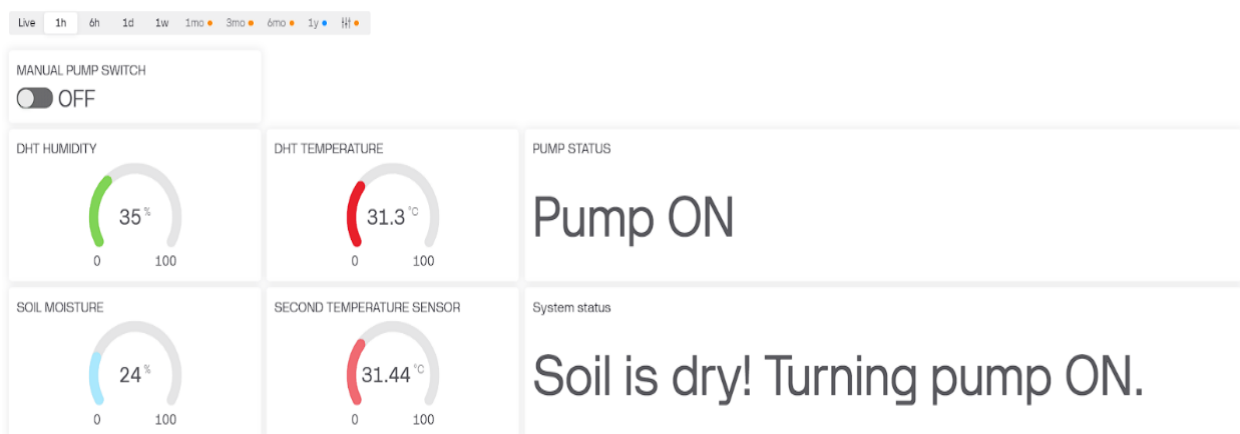


Figure 4: (b) Website

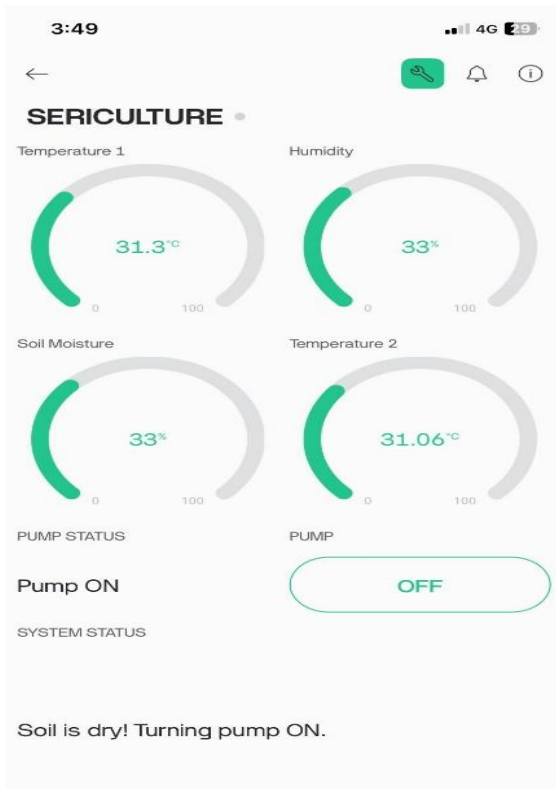


Figure 5: (b) Mobile App

5. Conclusion

This Smart Agriculture Monitoring System offers a cost-effective and scalable solution for addressing challenges in traditional irrigation. The use of ESP8266 microcontroller with Wi-Fi connectivity and Blynk IoT platform enables remote monitoring and control, improving efficiency and reducing resource wastage. By using sensor data for real-time decision-making, farmers can optimize water usage, reduce labor, and enhance crop productivity. The system is easy to implement and suitable for small to medium-scale farms. Future enhancements can include AI prediction algorithms and integration with weather APIs to further optimize water distribution.

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