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IoT-BASED SMART AGRICULTURE SYSTEM

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ABSTRACT
The IoT-based Smart Agriculture System presented in this project utilizes an ESP32 microcontroller to gather data from soil moisture, water level, and DHT11 temperature and humidity sensors. The collected data is then transmitted to the Blynk app for remote monitoring and control. The soil and water sensors provide analog data, which is converted to digital signals using the microcontroller's analog-to-digital converter. The DHT11 sensor records temperature and humidity values. Additionally, a relay module enables remote operation of devices like water pumps and lights. The Blynk app serves as the interface for real-time data display and control, making it an efficient and scalable solution for smart agriculture.
Keywords: IoT, Agriculture, ESP32, Soil Moisture Sensor, Water Level Sensor, DHT11, Relay Module, Blynk App, Remote Monitoring, Control.

1. INTRODUCTION
A smart farm is a farm that utilizes advanced technologies and contemporary communication methods for its management. India is an agricultural country. These days, farmers frequently engage in manual irrigation of the fields, which may lead to potential increases in water consumption or delays in water reaching its intended destination, ultimately contributing to crop desiccation. Real-time temperature and humidity monitoring are crucial in many agricultural disciplines. Nonetheless, the traditional approach of using wired detection control proves to be rigid, leading to a variety of constraints in its application.

This project addresses the issue by implementing irrigation automation, which serves as a critical solution. The primary objective of our project is to simplify supervision and eliminate the need for continuous monitoring. Our system enables the implementation of smart agriculture, incorporating IoT-based agricultural monitoring. The Internet of Things (IoT) is bringing about a transformation in the agricultural sector, effectively addressing the substantial challenges and formidable obstacles faced by farmers in their daily work. To assess soil moisture levels, a soil moisture sensor is inserted into the ground to determine soil wetness. When the soil moisture level is low, routine monitoring of the relay unit connected to the motor switch becomes crucial. The motor is activated when the soil is dry and deactivated when the soil is moist.

1.1. LITERATURE SURVEY
1. Divya J., Divya M, Janani V : Agriculture is a cornerstone of India's economy, vital for its people's sustenance. The objective of this project is to create an embedded system for soil monitoring and irrigation, reducing the necessity for manual field oversight while providing information via a mobile application. This method is designed to assist farmers in enhancing their agricultural yields. This project employs pH, temperature, and humidity sensors to assess soil conditions.
The data collected enables farmers to make informed decisions regarding the choice of crops to plant. Data from the soil sensor is transmitted to the field manager via a Wi-Fi connection, and crop recommendations are

generated using the mobile app. Additionally, an automatic irrigation system activates when soil temperature levels rise. Images of crops are captured and sent to the field manager for pesticide recommendations.

2. H.G.C.R. Laksiri, H.A.C. Dharmagunawardhana, J.V. Wijayakulasooriya : Developing a cost-effective IoT-based smart irrigation system is a pressing need for Indian farmers. Research centres on creating a weather-responsive, low-cost smart irrigation system. It begins with the development of an efficient drip irrigation system capable of automatically adapting water supply according to soil moisture levels. Furthermore, it integrated IoT communication capabilities, allowing remote monitoring of soil moisture and manual water flow adjustments. The system also includes temperature, humidity, and raindrop sensors, facilitating real-time online monitoring of these variables. Field weather data is securely stored in a remote database. Furthermore, a weather forecasting algorithm is utilized to enhance water distribution by considering current weather conditions, thus guaranteeing efficient crop irrigation.

3. Anushree Math, Layak Ali, Pruthviraj U : Agriculture holds paramount importance in India, emphasizing the need for prudent irrigation to maximize crop yield. This project concentrates on the deployment of a smart drip irrigation system. The system is built on an open-source platform and employs various sensors to offer real-time data on factors affecting plant health. Water is supplied to the plants at scheduled intervals by controlling a solenoid valve, guided by data from the RTC module. A web interface allows for manual or automated plant watering control. A Raspberry Pi camera provides live streaming of plant health status on the webpage. The controller assesses water flow data from a wireless network-connected water flow sensor to detect pipe leaks and even incorporates weather forecasting to optimize water usage.

4. Dweepayan Mishra, Arzeena Khan, Rajeev Tiwari, Shuchi Upadhaye : Agriculture is a significant contributor to India's economy and its overall prosperity. Crop cultivation is pivotal for higher yields and better-quality produce. Traditional irrigation methods often lead to fluctuations in field moisture levelsdue to inconsistent water distribution. To address this, it proposes a site-specific programmable water management system that enhances water efficiency and agricultural productivity.

This setup includes an Arduino kit, a moisture sensor, and a Wi-Fi module. Data is collected from the experimental system and sent to a cloud-based framework. Cloud services analyze the data and initiate required actions, diminishing the requirement for manual labor and enhancing water utilization and crop yield.

2. BLOCK DIAGRAM AND OPERATION FLOWCHART

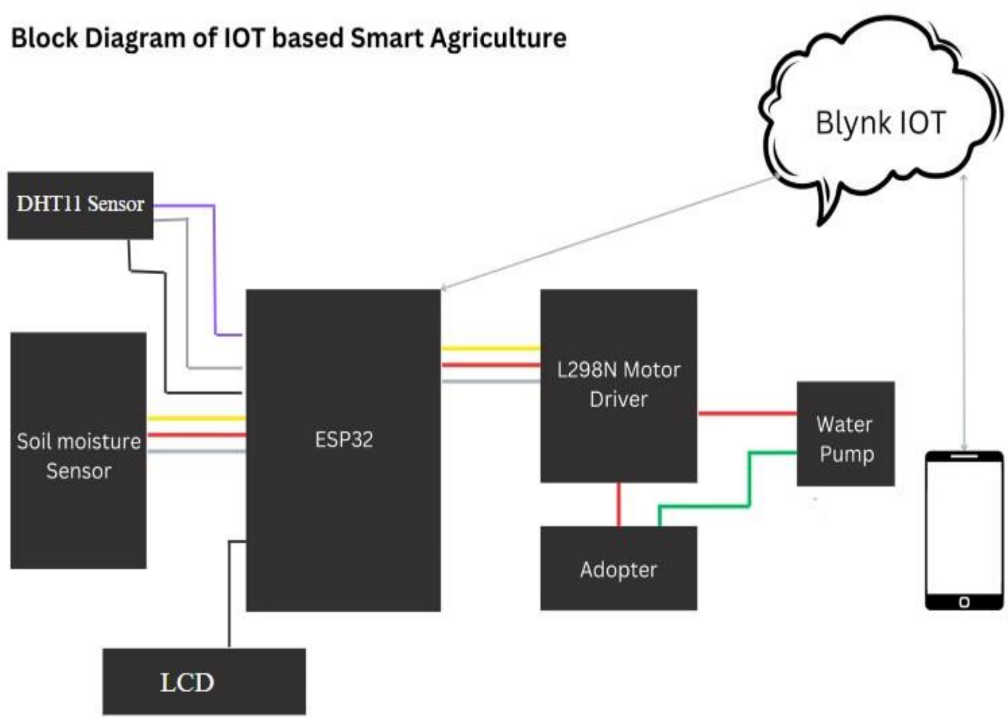

Fig. 2.1 Block Diagram of proposed system

The proposed IoT-based smart agriculture system integrates ESP32/NodeMCU, soil sensor (FC-28), DHT11 sensor, and the Blynk app to revolutionize traditional farming practices. By leveraging IoT technology, the system continuously monitors and collects real-time data on soil moisture, water level and temperature, humidity. This data is transmitted to the Blynk app, allowing farmers to remotely access and visualize crucial information about their crops. With automated features like precise irrigation control based on sensor readings, the system optimizes resource usage and enhances overall farm efficiency. Compared to traditional agricultural systems that rely on manual observation and guesswork, the IoT-based smart agriculture system offers significant advantages. It provides farmers with accurate and timely insights into crop conditions, enabling data-driven decision-making for enhanced productivity and reduced resource wastage. By automating critical tasks like irrigation, the system minimizes labour requirements and ensures that crops are receiving the right amount of water at the right time. Overall, this technology-driven approach holds the potential to revolutionize agriculture, making it more sustainable, efficient, and capable of meeting the challenges of modern farming practices. This project represents a leap forward in sustainable and efficient farming practices.

CIRCUIT CONNECTIONS

1. ESP32/NodeMCU Connections:
Connect VCC to 3.3V power source.
Connect GND to the ground.
Utilize GPIO pins for data connections.

2. Soil Sensor (FC-28) Connections:
Connect VCC to a 5V power source.
Connect GND to the ground.
Use the analog output pin for data.

3. DHT11 Sensor Connections:
Connect VCC to 3.3V power source.
Connect GND to the ground.
Connect the data pin to a GPIO pin.

4. Blynk App Integration:
Create a Blynk account and set up a new project.
Obtain the authentication token from the Blynk app.
Integrate the token into the Arduino code for communication.

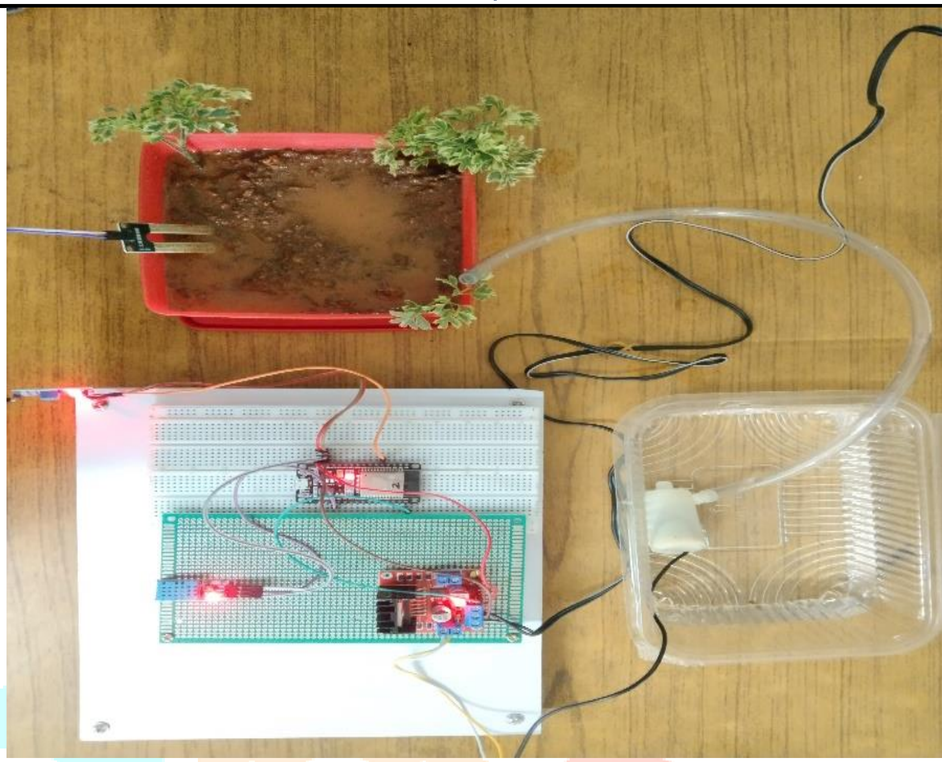

Fig. 2.2 Circuit Setup

OPERATION FLOWCHART

The operation flow of the IOT based Smart Agriculture System is illustrated in a detailed flowchart.

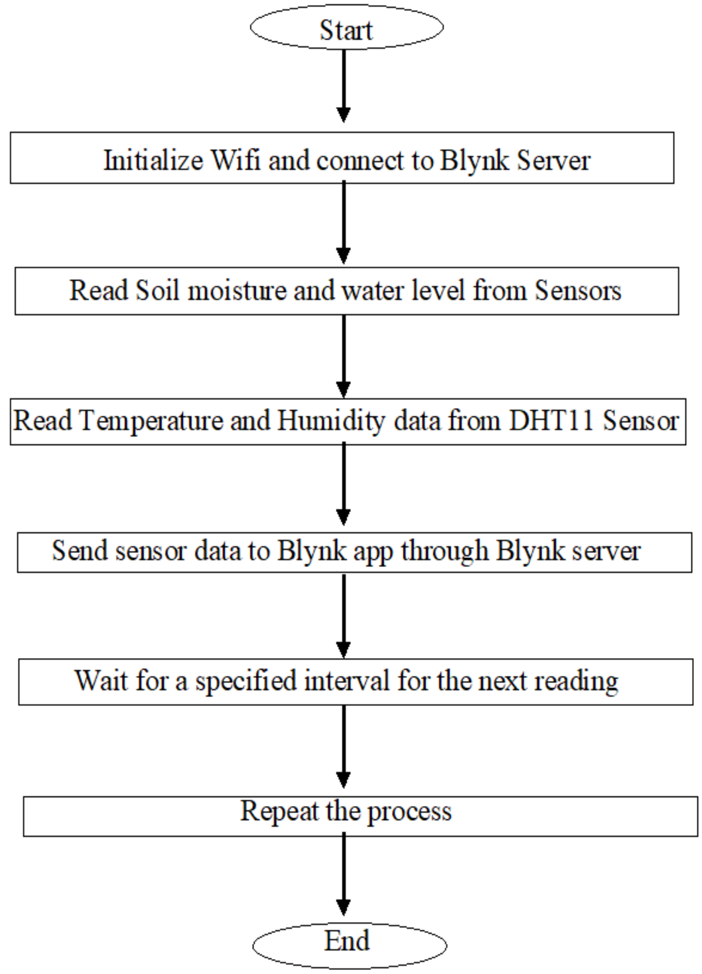

Fig. 2.3 Flow chart of the system

3. RESULTS AND DISCUSSIONS

The analysis of the IoT-based smart agriculture system underscores its substantial influence on farm management and productivity. Through the utilization of the FC-28 soil moisture sensor and the DHT11 temperature and humidity sensor, the system delivers real-time monitoring of essential environmental parameters. This precise data concerning soil moisture levels equips agricultural practitioners with the tools to fine-tune irrigation schedules and tailor water consumption to the unique needs of plants. This, in turn, curbs water wastage and advocates for sustainable agricultural practices. Moreover, the system empowers users to remotely track the movement and whereabouts of vehicles and equipment, thereby enhancing farm logistics and enabling swift responses to potential challenges. With the user-friendly Blynk app serving as the interface, individuals gain the ability to access sensor data, facilitating well-informed decisions and the adaptation of farming strategies based on these data-driven insights. The data-centric approach and the system's potential for scalability set the stage for amplified crop yields, improved resource efficiency, and more effective farm management, highlighting its capacity to usher in a new era in modern agriculture.

Fig. 3.1 Blynk output

CONCLUSION

IoT-based smart agriculture system represents a technological leap in farming practices, integrating the ESP32 microcontroller, FC-28 soil moisture sensor, DHT11 sensor, and the user-friendly Blynk app. The system provides real-time monitoring, precise control, and data-driven decision-making, leading to the optimization of agricultural practices. The system's ability to monitor soil moisture, temperature, and humidity empowers farmers to create ideal growth conditions, leading to higher crop yields and increased farm productivity. Precision irrigation conserves water and enhances sustainability. The Blynk app enables remote real-time monitoring, improving farm management and resource utilization. However, there are challenges, including setup costs, internet reliance, data security, and technical expertise. Overcoming these demands careful planning and commitment to cybersecurity.

As agriculture faces the dual challenge of meeting global food demands while preserving resources, the IoT-based smart agriculture system offers a promising, efficient, and sustainable future. By blending human expertise with technology, farmers can optimize practices and foster a prosperous and sustainable agricultural landscape.

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