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IOT BASED SMART IRRIGATION SYSTEM

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Abstract- With its cutting-edge IoT-based Smart Irrigation System, this project showcases how Blynk IoT integrates seamlessly for intuitive control and real-time monitoring. To collect vital environmental data, the system makes use of DHT11 temperature/humidity, and soil moisture sensors in conjunction with a relay module. The ESP8266 module, which maintains a secure connection between the Blynk app and the Smart Irrigation System, is essential to this setup. Users may remotely monitor sensor data, change irrigation parameters, and get immediate notifications using the Blynk interface. Precise irrigation scheduling is made possible by the DHT11 and soil moisture sensors, and the relay module regulates the water pump. The Blynk app functions as a central control center, providing an easy-to-use dashboard for remote pump activation, scheduling modifications, and real-time monitoring. With the Blynk IoT platform, this project places a high priority on user empowerment while offering a practical and effective solution for contemporary, sensor-driven agriculture.

KEYWORDS: *IoT, Smart Irrigation System, User-Friendly Control, Sustainable Agriculture.*

I. INTRODUCTION

More effective and sustainable agricultural methods have been made possible by the application of Internet of Things (IoT) technology in agriculture. Using the Blynk IoT platform, this project presents a sophisticated Internet of Things (IoT) Smart Irrigation System that prioritizes human engagement while utilizing state-of-the-art sensors. With the use of a relay module, DHT11 temperature/humidity, and soil moisture sensors, this system attempts to completely transform conventional watering techniques.

Using the ESP8266 module to provide a secure connection to the Blynk app is essential to the system's functionality. Users may remotely get quick notifications, change irrigation settings, and access critical data using this connection's real-time monitoring features. These features improve energy efficiency by coordinating irrigation operations with real farming needs.

Furthermore, data-driven irrigation scheduling is made possible by the accuracy provided by the DHT11 and soil moisture sensors, which optimizes water use in response to current environmental conditions. By managing the water pump, the relay module makes sure that the user's choices are followed, and the water is distributed effectively.

The importance of accessible and user-friendly control in contemporary agriculture is highlighted by this initiative. The Smart Irrigation System that is being shown here improves accuracy and efficiency and establishes itself as a useful and user-friendly answer to modern farming problems by using the Blynk IoT platform.

II. METHODOLOGY/EXPERIMENTAL

A. Synthesis

Smart Irrigation System using NodeMCU, Temperature and Humidity Sensor, Soil Moisture Sensor, and Blynk IoT

Experimental Design:
The study utilized an experimental design to develop and evaluate the Smart Irrigation System. The experiment involved deploying sensors, including the temperature and humidity sensor, and soil moisture sensor, in a crop field. The sensors were connected to the NodeMCU microcontroller, which served as the central hub for data collection and transmission. The Blynk IoT platform was integrated into the system for real-time monitoring and control.

Sensor Calibration and Integration:
The temperature and humidity sensor and soil moisture sensor were calibrated to ensure accurate readings. Calibration procedures were performed following the manufacturer's guidelines and best practices. The calibrated sensors were then integrated with the NodeMCU, establishing the necessary connections and protocols for data retrieval.

NodeMCU Programming:

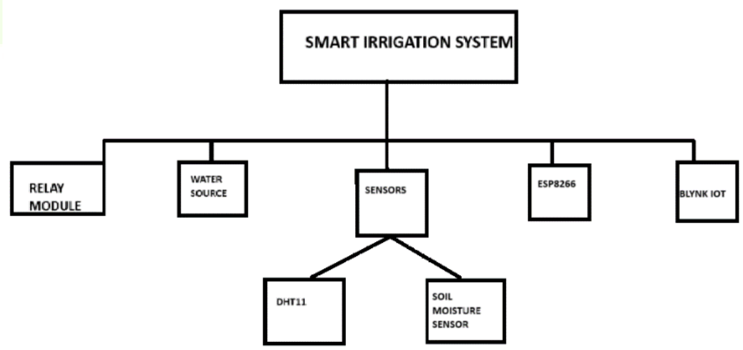
The NodeMCU microcontroller was programmed using an appropriate programming language (e.g., Arduino IDE). The programming code included instructions to read sensor data at regular intervals, process the data, and transmit it to the Blynk IoT platform via a stable internet connection. The code also incorporated functionalities to handle motion detection events and trigger alerts when necessary.

Blynk IoT Integration:
The Blynk IoT platform was utilized to establish connectivity between the NodeMCU and the farmer's mobile device. The Blynk mobile application was downloaded and installed on the farmer's smartphone or tablet. The NodeMCU was registered on the Blynk platform, and the necessary authentication credentials were generated. The Blynk mobile application was configured to display sensor readings, receive notifications, and allow remote control of irrigation systems.

Experimental Deployment:
The calibrated and integrated system was deployed in the crop field. Sensors were strategically placed to capture representative data from different areas. The NodeMCU was connected to a stable power supply, ensuring uninterrupted operation. The system was tested and validated to ensure proper functionality and data transmission to the Blynk platform.

Data Collection and Analysis:
Sensor readings, including temperature, humidity, motion events, and soil moisture levels, were collected in real-time using the Blynk mobile application. The data was logged and stored for further analysis. Statistical analysis and visualization techniques were applied to interpret the data, identify patterns, and gain insights into crop health and environmental conditions.

System Evaluation:
The performance of the Smart Irrigation System was evaluated based on various criteria, including data accuracy, system reliability, real-time monitoring capabilities, remote accessibility, and user-friendliness. Feedback and observations from farmers or relevant stakeholders were also considered to assess the system's practicality and effectiveness in real-world agricultural scenarios.



B. Algorithm

Smart Irrigation System using NodeMCU, Temperature and Humidity Sensor, Soil Moisture Sensor, Relay module, water source and Blynk IoT

Initialize:
Set up the NodeMCU microcontroller and connect it to the necessary power supply. Establish a stable internet connection for data transmission.

Calibrate Sensors:
Calibrate the temperature and humidity sensor, and soil moisture sensor according to the manufacturer's guidelines. Ensure accurate readings by adjusting sensor settings if necessary.

Sensor Integration:
Connect the temperature and humidity sensor, and soil moisture sensor to the NodeMCU microcontroller. Establish communication protocols between the NodeMCU and the sensors to retrieve data.

NodeMCU Programming:
Develop the programming code using an appropriate language (e.g., Arduino IDE).Set up a loop to continuously read sensor data at specified intervals. Process the sensor data to ensure compatibility and consistency. Transmit the processed data to the Blynk IoT platform using the internet connection.

Blynk IoT Integration:
Download and install the Blynk mobile application on the farmer's smartphone or tablet. Register the NodeMCU on the Blynk platform and generate authentication credentials .Configure the Blynk mobile application to display sensor readings and receive notifications.
Enable remote control functionalities for irrigation systems through the mobile application.

Deployment:
Strategically place the sensors in the crop field to capture representative data. Connect the NodeMCU to a stable power supply to ensure uninterrupted operation. Test the system to verify proper functionality and data transmission to the Blynk platform.

Data Collection and Analysis:
Collect sensor readings, including temperature, humidity, motion events, and soil moisture levels, in real-time using the Blynk mobile application.
Log and store the collected data for further analysis.
Apply statistical analysis and visualization techniques to interpret the data and identify patterns related to crop health and environmental conditions.

System Evaluation:
Assess the system's performance based on criteria such as data accuracy, system reliability, real-time monitoring capabilities, remote accessibility, and user-friendliness.
Gather feedback and observations from farmers or relevant stakeholders to evaluate the system's practicality and effectiveness in real-world agricultural scenarios.

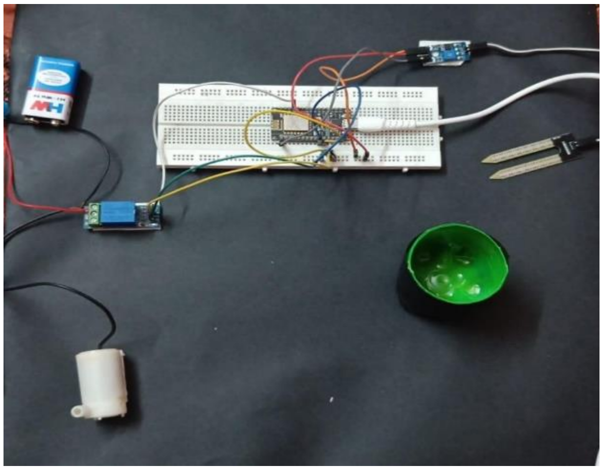
C. Design and Method

Hardware Setup:
Utilize a NodeMCU development board as the central controller. Connected a temperature and humidity sensor (e.g., DHT11 or DHT22) to monitor environmental conditions. Employed a water pump controlled by a DC motor for irrigation. Connected a soil moisture sensor to measure the soil's moisture level.

Blynk IoT App Integration:
Integrated the system with the Blynk IoT app for remote monitoring and control.
Utilized the Blynk app's gauge widget to display soil moisture readings on a scale of 1 to 100.

Software Programming:
Programed the NodeMCU firmware using Arduino IDE and Installed necessary libraries for sensor interfacing and Blynk integration.
Establish a connection with the Blynk cloud platform using an authentication token. Obtain sensor readings and transmit them to the app using Blynk's virtualWrite() function.
Map the soil moisture value to the gauge widget's range for visualization. Activated the water pump when the soil moisture falls below a predetermined threshold (e.g., 30).
Implemented a delay to control the watering duration.

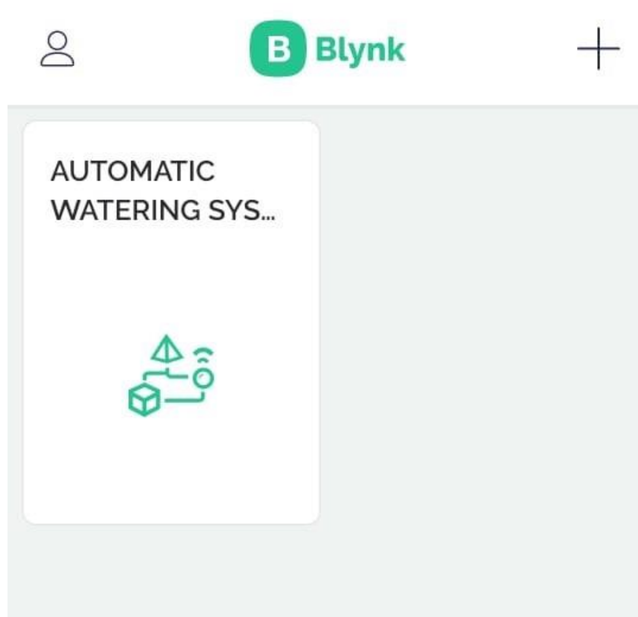
Experimental Method:
Conduct field trials to assess the system's performance. Monitor and display temperature, humidity, and soil moisture readings in real-time on the Blynk app.
Evaluate the activation of the water pump based on soil moisture levels below the threshold.

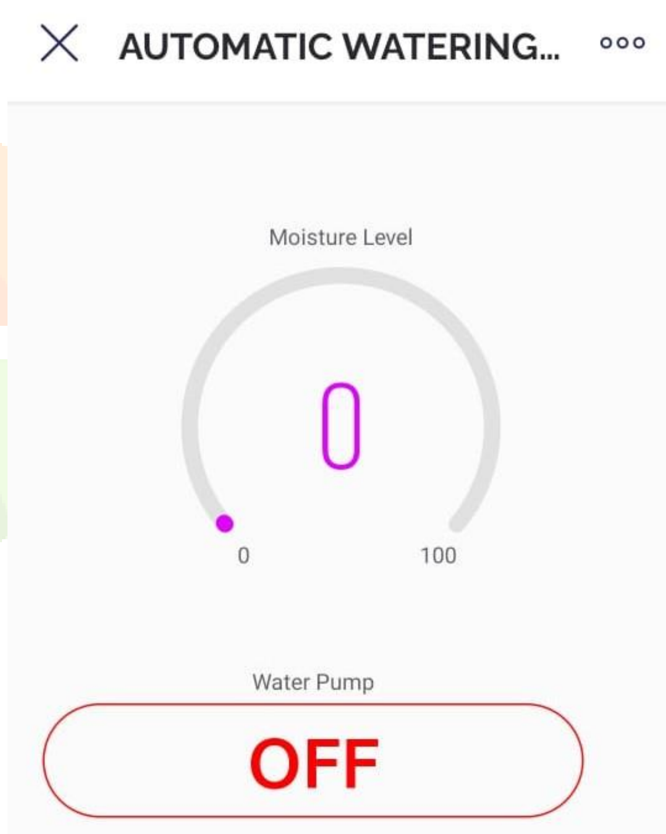


III. RESULTS AND DISCUSSIONS

The research paper presents the findings of the study on a Smart Irrigation System employing a NodeMCU, temperature and humidity sensor, soil moisture sensor, relay module and Blynk IoT platform. The experimental setup involved placing sensors in an agricultural field and connecting them to a NodeMCU microcontroller, which then transmitted data to the Blynk IoT platform. The capacity of the sensor to accurately monitor temperature and humidity contributed to the maintenance of optimal growth conditions, according to the results. The motion sensor was effective in alerting farmers to possible threats or unlawful entry by sensing movement. The soil moisture sensor provided real-time data on soil moisture levels to help with watering tactics. The connection with Blynk IoT allows farmers to view sensor data, get alerts, and control irrigation systems from their cellphones.

This approach made it simpler to make data-driven decisions, improve crop yield and health, and strengthen field security. All things considered, the Smart irrigation system and Blynk IoT demonstrated that they may function effectively together as an agricultural application's real-time monitoring, control, and analysis tool.





IV. FUTURE SCOPE

Future objectives for this project include expanding the number of environmental sensors and researching state-of-the-art machine learning techniques to enhance prediction abilities. This evolution aims to enhance response to changing conditions, optimize irrigation systems, and further the development of sustainable precision agriculture.

V. CONCLUSION

In summary, the use of sensor integration, Blynk connectivity, and Internet of Things-based Smart Irrigation System has shown to be a significant breakthrough in precision agriculture. The combination of the DHT11, soil moisture sensor, relay module has simplified real-time environmental monitoring. This has made it possible for irrigation operations to make decisions based on data. Customers now have an easy-to-use interface for remote monitoring and control, ensuring accessibility and adaptability to changing agricultural conditions, thanks in large part to the Blynk IoT platform.
The system's capacity to precisely manage the water pump while optimising energy use through intelligent activation based on human presence has shown measurable improvements in resource conservation and energy efficiency. The ability to use less water without sacrificing crop output highlights the system's promise for ecologically friendly and sustainable agricultural methods.

Farmers have various requirements, and the Blynk app provides a comprehensive solution that complies with modern agricultural practices. Because of its ability to increase user participation and have positive impacts on resource optimization, the IoT-based Smart Irrigation System is seen as a feasible and practicable option for the future of precision agriculture.

The system's ability to forecast and adapt may be enhanced by future additions and modifications, such as the installation of more environmental sensors and advanced machine learning algorithms. The remarkable outcomes of the project stimulated further investigation and advancement at the intersection of sensor technologies, user-focused platforms, and the Internet of Things to ensure the ongoing advancement of sustainable agricultural methods**.**

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