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An Innovative Automated Model for the solution on problem of Agriculture by using Soil Moisture Sensor

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Abstract: *This research proposes an automatic irrigation system that monitors soil moisture and environmental conditions to control water supply for plants. The system uses a soil moisture sensor and DHT11 temperature-humidity sensor connected to an ESP8266 Wi-Fi module/microcontroller. When the soil moisture falls below a defined threshold, the microcontroller automatically activates water pump via relay, supplying water to the soil. The ESP8266 allows IoT integration, enabling remote monitoring and control through a smartphone or web interface. This system provides a smart, energy-efficient, and low-cost solution for irrigation, reducing water wastage and ensuring proper plant care.*

Keywords: Soil Moisture Sensor, Automatic Irrigation, ESP8266, DHT11, IoT, Relay, Smart Agriculture

I. INTRODUCTION

In today's rapidly evolving technological world, the IoT (Internet of Things) has become aemerging technology for agriculture; water is one of the most essential resources for agriculture and home gardening. Efficient management of water is crucial, especially in areas facing water scarcity. Traditional irrigation methods often lead to overwatering or underwatering, which can harm plant growth and waste resources. With the advancement of technology, automated irrigation systems have become a practical solution for managing water usage effectively.

An automatic irrigation system uses sensors and microcontroller to monitor soil conditions and control water supply without human intervention. In this project, a soil moisture sensor is used to detect the water content of the soil, and a DHT11 sensor monitors environmental conditions such as temperature and humidity. These sensors are connected to an ESP8266 microcontroller, which acts as the Central Processing Unit (CPU). The system also includes a relay module to safely control a water pump that irrigates the soil when needed.

IoT technology into this system allows for remote monitoring and control through a smartphone or web application. Users can view soil moisture levels, temperature, and humidity, as well as manually override the system if require. This approach ensures efficient water usage, reduces human effort, and provides a scalable solution for small-scale and home gardening applications.

Software Requirement	**Hardware Requirement**
Arduino IDE	Microcontroller: Arduino UNO
Blynk Web Dashboard	Wi-Fi Module ESP8266
	Relay Module
	Water Pump
	Power Supply
	Soil Moisture Sensor

	DHT11 Sensor

The primary goal of this research is to design a cost-effective, reliable, and user-friendly automatic irrigation system that maintains optimal soil moisture for plant growth while reducing water wastage. By combining sensor data, microcontroller logic, and IoT capabilities, the system demonstrates how modern technology can contribute to smart agriculture and sustainable water management.

The objectives of this work include:

- Developing a real-time soil moisture monitoring system that reduces the need for manual irrigation.
- Optimizing water usage by irrigating only when the soil requires water, preventing overwatering and conserving resources.
- Designing a cost-effective and scalable solution suitable for both small farms and large agricultural fields.
- Exploring IoT integration for remote monitoring, allowing farmers to check soil conditions and irrigation status via mobile or web applications.

II. LITERATURE REVIEW

Jones (2004) [1] emphasized the importance of proper irrigation scheduling and highlighted the advantages of plant and soil-based methods for maintaining optimal soil moisture while minimizing water wastage. This research laid the foundation for sensor-based irrigation, which adjusts watering based on real-time soil conditions.

Building on this principle, Senthilkumar et al. (2018) [2] designed an IoT-based automatic irrigation system using soil moisture sensors. Their system measures soil moisture and triggers a water pump when moisture levels drop below a predefined threshold. The study demonstrated that sensor-driven irrigation not only conserves water but also reduces human effort and improves crop health.

Kumar and Sharma (2017) [3] implemented a microcontroller-based soil moisture irrigation system, which uses real-time soil moisture data to control the water pump through relay circuits. Their research confirmed that integrating microcontrollers with soil moisture sensors ensures precise irrigation, reduces water wastage, and provides a reliable solution for home gardens and small-scale farms.

These studies collectively show that combining soil moisture sensors with microcontroller and relay systems is an effective approach to automate irrigation. The addition of IoT capabilities further enhances the system by allowing remote monitoring and control, enabling users to maintain optimal soil moisture without manual intervention.

III. PROPOSED WORK

The proposed study aims to design and implement an automated irrigation system using a soil moisture sensor to enhance water efficiency in monitoring of agriculture. The system will continuously measure soil moisture and control irrigation automatically through a microcontroller, turning on a water pump or solenoid valve only when necessary.

This system works using the NodeMCU ESP8266 WiFi module as microcontroller, which is the main part of the setup. In the

Figure 1 of Block Diagram shows power supply provides electricity to run the ESP8266 and other components. A soil moisture sensor is connected to measure the water level in the soil and sends information to the ESP8266. At the same time, the DHT11 sensor measures temperature and humidity from the environment. The ESP8266 processes both the soil and environmental data together. Based on the soil condition, it controls a relay module, which acts like an automatic switch. This relay is connected to a DC pump. A DC battery is used to give power to the pump. When the soil becomes dry, the ESP8266 sends a signal to the relay to turn on the pump, as per dryness of soil water will be take automatically as require and stop water pump automatically by coding in Arduino UNO. When the soil has enough moisture, the system automatically turns pump off by which to save water and energy.

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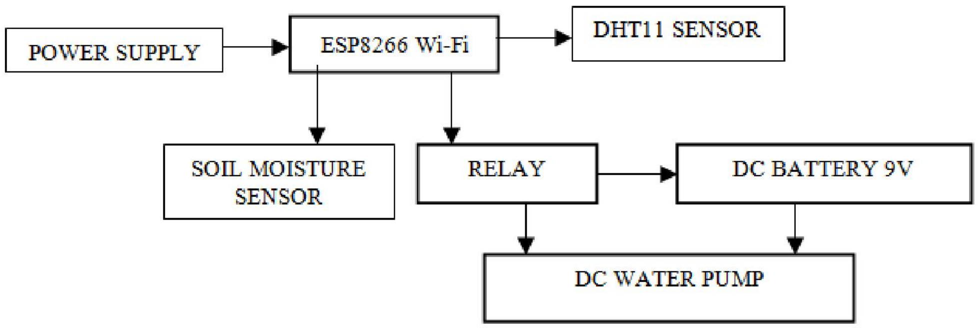

Figure 1: Block Diagram

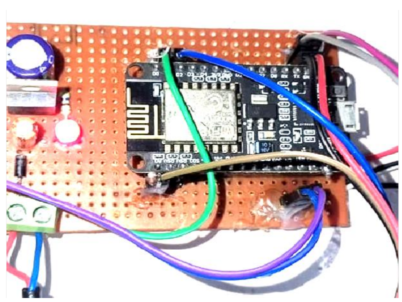

Figure 2: Automated Irrigation System Using Soil Moisture Sensor

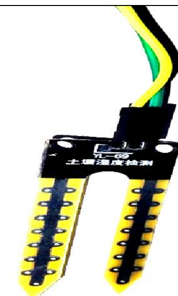

Figure 3: Using a Soil Moisture Sensor

Figure 2 represents an automated irrigation system using a soil moisture sensor. The sensor monitors the soil's water content and sends data to a microcontroller. The controller then operates a water pump or valve to supply water only when needed, preventing overwatering, conserving water, and reducing manual labor for efficient crop irrigation.

Figure 3 shows how a soil moisture sensor is used in an automated irrigation system. The sensor measures the moisture level of the soil and sends the data to a microcontroller. Based on this data, the system decides when to turn the water pump or valve on or off, ensuring efficient watering and preventing water wastage.

IV. RESULTS

The implemented system automatically waters plants when the soil moisture drops below the set threshold, turning OFF the pump once adequate moisture is reached. The system responds quickly and reliably, preventing water wastage. The DHT11 sensor allows monitoring of environmental conditions, which can be used to optimize irrigation timing. With IoT integration, users can remotely monitor soil and environmental conditions, making it suitable for smart agriculture and home gardening applications.

V. CONCLUSION

This research demonstrates a smart, automatic irrigation system using ESP8266, soil moisture, and DHT11 sensors. The system reduces manual effort, conserves water, and provides a cost-effective, IoT-enabled solution for home gardening and small-scale agriculture. Automated control ensures plants receive optimal water, improving growth while allowing remote monitoring for convenience and efficiency.

FUTURE SCOPE

Integration with weather forecast APIs (Application Programming Interface)to avoid watering during rain. Use of multiple soil moisture sensors for large gardens or farms. Adding solar power for energy efficiency. Integration with advanced IoT platforms for automated analytics and notifications. Expanding to a fully smart greenhouse system with temperature, humidity, and soil monitoring.

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