Micro Project Proposal

Soil Moisture Monitoring for Smart Irrigation

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Introduction

This microproject aims to design and implement a soil moisture monitoring and smart irrigation system using the ESP8266 NodeMCU WiFi Development Board. The system continuously measures soil moisture levels and automatically controls a water pump to maintain optimal soil conditions. This project promotes efficient water usage, reduces wastage, and supports sustainable agriculture practices.

Smart irrigation is an important application of the Internet of Things (IoT) that can address global water scarcity challenges. By integrating low-cost sensors and microcontrollers, this project ensures that crops get water only when required, thus improving yield and sustainability.

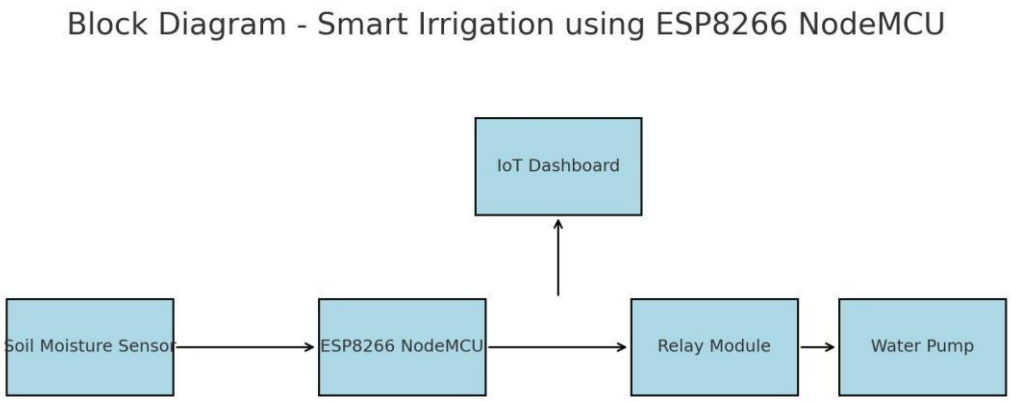
Objective of the Project

- To design a low-cost IoT-based irrigation system using NodeMCU ESP8266.
- To monitor soil moisture levels in real-time using sensors.
- To automate the water supply to crops through relay-controlled pumps.
- To minimize human intervention and promote sustainable agriculture.
- To provide remote monitoring capability through WiFi connectivity.

Literature Review

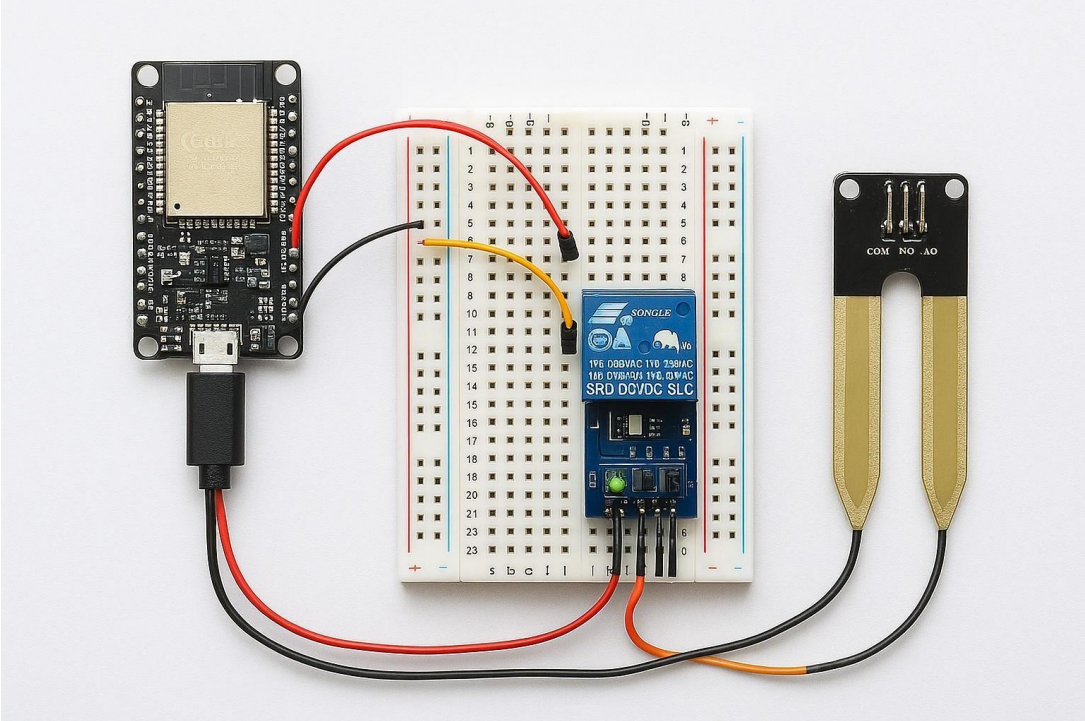
Traditional irrigation systems often lead to excessive water usage due to manual control. Research in precision agriculture highlights the importance of real-time monitoring of soil parameters. Recent works show that IoT-based solutions using ESP8266 and similar controllers provide reliable and cost-effective automation. This project builds upon these ideas, adding practical implementation for small farms and household gardens.

Block Diagram



Explanation: The block diagram shows the Soil Moisture Sensor connected to the NodeMCU, which processes the data. Based on the reading, the NodeMCU drives a relay that controls the water pump. The system can also send data over WiFi to a cloud/dashboard for remote monitoring.

Circuit Diagram



Explanation: The soil moisture sensor is connected to the A0 pin of the NodeMCU. A relay module is interfaced to D1 to switch the water pump ON or OFF. The NodeMCU can be powered via USB or an external 5V adapter. The relay ensures safe operation by isolating the NodeMCU from the pump circuit.

Working Principle

The soil moisture sensor detects the water content in soil and provides an analog signal to the NodeMCU. If the moisture level drops below a set threshold, the NodeMCU triggers the relay, turning ON the water pump. Once the soil moisture reaches the required level, the pump is turned OFF. Simultaneously, the moisture readings can be uploaded to a cloud platform for real-time monitoring.

Applications

- Smart agriculture and precision farming.
- Home gardens and greenhouses.
- Automated irrigation for parks and landscapes.

- Water resource management in drought-prone areas.

Advantages

- Reduces manual intervention in irrigation.
- Saves water by supplying only the required amount.
- Enhances crop productivity through proper watering.
- Low-cost, reliable, and scalable system.

Expected Outcomes

- Real-time soil moisture monitoring using ESP8266 NodeMCU.
- Automatic irrigation by controlling a water pump via relay.
- Improved water efficiency and reduced manual effort.
- Demonstration of IoT-enabled smart agriculture system.

Future Scope

The proposed project can be further enhanced by:

- Integration with mobile apps for user notifications.
- Adding temperature, humidity, and pH sensors for complete soil analysis.
- Implementing solar-powered irrigation for remote areas.
- Using machine learning to predict irrigation needs based on crop type.