Micro-Project Proposal

Soil Moisture Monitoring for Smart Irrigation

Team members:	Pooja S Nair , Nidhi T Aneesh, Anvi Elsa Vijo
Semester & Branch:	S3 ER
Department:	Electronics
College Name:	Saintgits College of Engineering

Date of Submission: 17.10.2025

1 Introduction to the Micro-Project

This micro-project proposes the design and implementation of an Internet of Things (IoT)-based smart irrigation system focused on efficient water usage. The primary objective is to create an automated control system that monitors **soil moisture** in real-time and autonomously activates a **water pump** via a **relay** module when irrigation is required. The system will leverage the powerful and versatile **ESP32** microcontroller, utilizing its integrated Wi-Fi capability to provide **real-time data monitoring and remote control via the Blynk platform**. The aim is to conserve water, minimize human intervention, and demonstrate the practical application of IoT in precision agriculture.

2 Block Diagram of a Functional Diagram

The functional design of the smart irrigation system is conceptualized into three core blocks: Input (Sensing), Processing (Control & Communication), and Output (Actuation). The following diagram illustrates the data and control flow among these blocks.

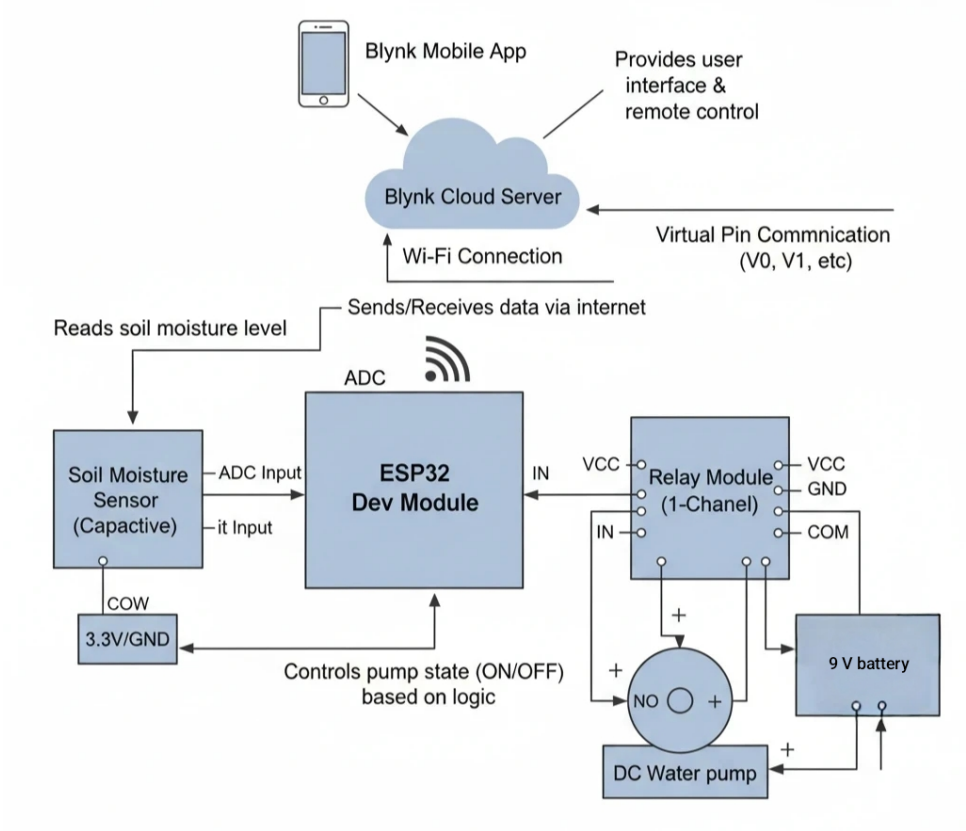

Figure 1: Functional Block Diagram of the Soil Moisture Monitoring System

Explanation of the Blocks:

- **Input Block (Sensing):** This block collects data from the soil via the **Soil Moisture Sensor**, which measures the water content and sends an analog signal to the microcontroller.

- **Processing Block (Control & Communication):** The **ESP32 Microcontroller** is the central brain. It reads and processes sensor data, executes the irrigation logic, and crucially, communicates with the **Blynk IoT Cloud Platform** via Wi-Fi to send moisture data and receive user commands (e.g., for manual pump control).
- **Output Block (Actuation):** This block controls the irrigation hardware. The **Relay Module** is the electronic switch, and the **DC Water Pump** is the actuator that is turned ON or OFF based on the ESP32's commands (which can be triggered automatically by low soil moisture or manually via Blynk).

---

3 Circuit Diagram with Detailed Components

The circuit connects all hardware components to the ESP32 development board. The key components required are: ESP32, Soil Moisture Sensor, Relay Module, and DC Water Pump.

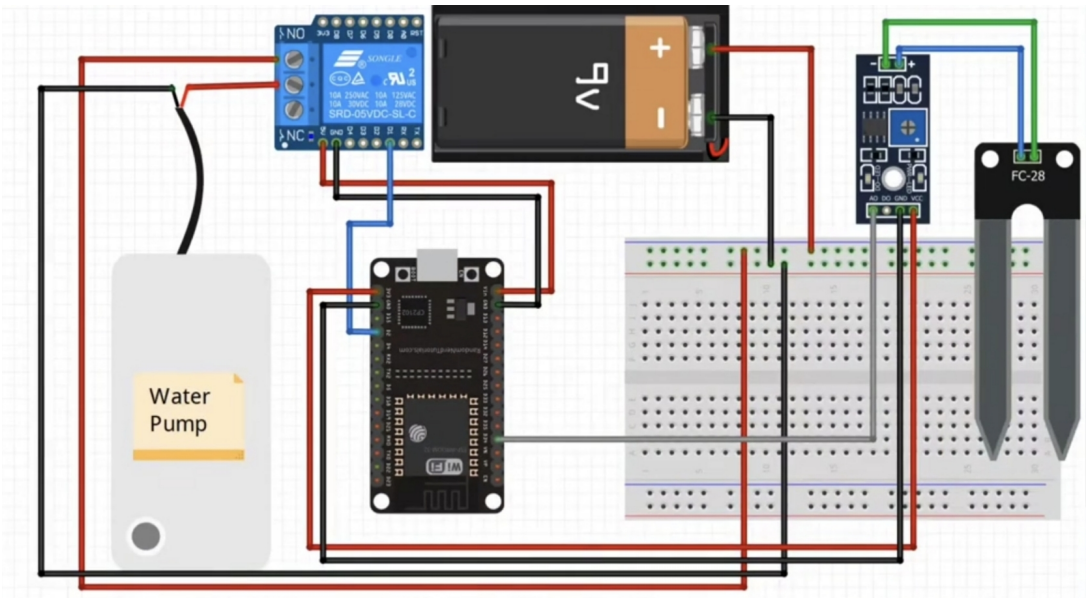

Figure 2: Circuit Diagram of the Soil Moisture Monitoring for Smart Irrigation System

Explanation of the Circuit Connections:

- **ESP32 Microcontroller:** The main control board.
- **Soil Moisture Sensor:** VCC and GND are connected to the ESP32's power pins. The Analog Output (AOUT) pin is connected to an **ADC GPIO pin** on the ESP32 (e.g., VP or A0).
- **Single-Channel Relay Module:** The Signal (IN) pin is connected to a **digital GPIO pin** on the ESP32 (e.g., D2) to control the relay's state. The relay's power (VCC/GND) is connected to a suitable power source.
- **DC Water Pump:** The pump's power circuit is connected to the **Normally Open (NO) and Common (COM)** terminals of the relay module. The relay safely switches the high-current pump circuit based on the ESP32's logic.

4 Expected Outputs/Outcomes of the Project

The successful completion of this micro-project is expected to yield the following outcomes:

- A functional hardware prototype that reliably monitors soil moisture and automatically initiates irrigation when levels are low, conserving water.
- A **real-time dashboard on the Blynk IoT Platform** that displays the live soil moisture data (in raw ADC values or percentage).
- Implementation of a **remote control function via the Blynk app**, allowing the user to **manually turn the DC Water Pump ON or OFF** irrespective of the automatic moisture reading.
- Automated irrigation logic that precisely applies water only when required, demonstrating efficient water management.
- A comprehensive understanding of the full IoT stack, encompassing hardware interfacing (ESP32 and sensors), programming, and **cloud integration with Blynk** for data visualization and two-way control.