PROJECT 9

CLOSE LOOP CONTROL SYSTEM BASED PROJECT

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G11 ES & IOT

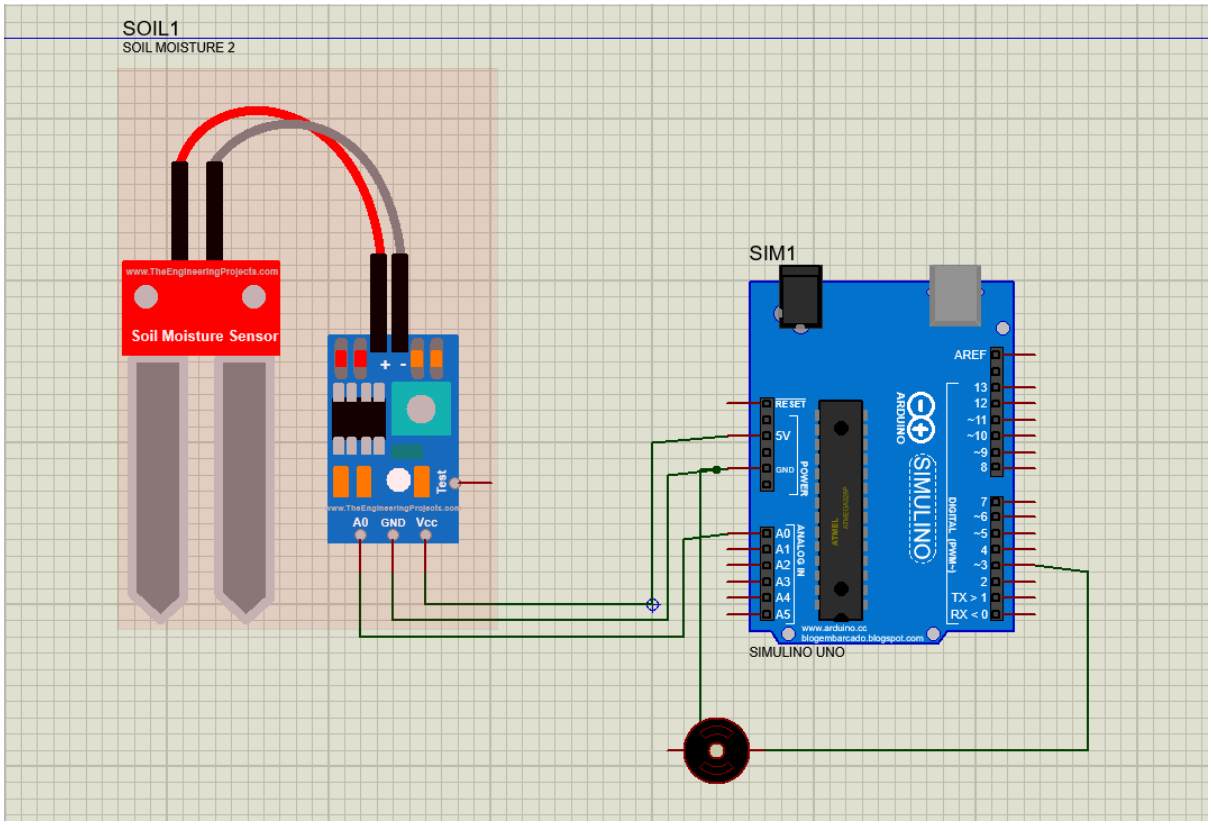
Overview:

A **smart irrigation system** is a closed-loop control system designed to optimize water usage by automatically maintaining soil moisture levels within a predefined range. It uses sensors to monitor real-time conditions and activates the water pump as needed, reducing water wastage and improving plant health.

Components Used:

- Arduino UNO R3
- Moisture Sensor
- Water Pump

Schematic Diagram:



System Workflow:

1. **Initialization**: The system initializes and sets a predefined soil moisture threshold (e.g., 30% - 70%).
2. **Monitoring**: The soil moisture sensor continuously measures the soil's moisture level.

3. **Decision Making**: The microcontroller compares the measured value with the threshold:
    - If moisture is below the threshold: Turn on the pump.
    - If moisture is within or above the threshold: Turn off the pump.
4. **Feedback Loop**: Real-time feedback ensures the system adjusts dynamically to changing conditions.
5. **Optional IoT Integration**: Sends alerts and allows remote control via a mobile app or dashboard.

Arduino Code:

```
#define SOIL_SENSOR_PIN A0
#define PUMP_PIN 3

int threshold = 500;           // Adjust based on sensor calibration

void setup() {
    pinMode(PUMP_PIN, OUTPUT);
    digitalWrite(PUMP_PIN, LOW);
    Serial.begin(9600);
}

void loop() {
    int moistureLevel = analogRead(SOIL_SENSOR_PIN);
    Serial.print("Soil Moisture: ");
    Serial.println(moistureLevel);

    if (moistureLevel < threshold) {
        digitalWrite(PUMP_PIN, HIGH); // Turn on the pump
        Serial.println("Pump ON");
    } else {
        digitalWrite(PUMP_PIN, LOW);  // Turn off the pump
        Serial.println("Pump OFF");
    }
    delay(1000);
}
```

Enhancements:

1. **IoT Integration**
    - Use an ESP32 or ESP8266 for remote monitoring and control.
    - Create a dashboard using Blynk, MQTT, or ThingSpeak.
2. **Solar Power**
    - Make the system energy-efficient by powering it with a solar panel and a rechargeable battery.
3. **Multiple Sensors**
    - Use multiple sensors to monitor moisture levels across a larger area.
4. **Weather Prediction Integration**
    - Use APIs to gather weather forecasts and decide whether to water based on upcoming rainfall.

Applications

- Precision agriculture.
- Home gardens and landscaping.
- Urban green spaces.
- Smart cities and urban farming.
