

CODE:

1. AUTOMATED IRRIGATION CONTROL SYSTEM BASED ON ENVIRONMENTAL SENSING

```
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>

// Pin definitions (GPIO numbers)
#define RELAY_PIN 5 // D1 → GPIO5
#define LED_PUMP 4 // D2 → GPIO4
#define LED_DRY 0 // D3 → GPIO0
#define LED_SYS 2 // D4 → GPIO2
#define OLED_SDA 12 // D6 → GPIO12
#define OLED_SCL 14 // D5 → GPIO14
#define SOIL_PIN A0 // Soil Moisture Sensor (Analog)

// OLED setup
#define SCREEN_WIDTH 128
#define SCREEN_HEIGHT 64
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, -1);

void setup() {
  pinMode(RELAY_PIN, OUTPUT);
```

```

pinMode(LED_PUMP, OUTPUT);
pinMode(LED_DRY, OUTPUT);
pinMode(LED_SYS, OUTPUT);

digitalWrite(RELAY_PIN, HIGH); // Relay OFF initially
digitalWrite(LED_PUMP, HIGH);
digitalWrite(LED_DRY, HIGH);
digitalWrite(LED_SYS, HIGH);

// Start Serial
Serial.begin(115200);
Serial.println("System Initialized...");

// Start I2C with custom pins
Wire.begin(OLED_SDA, OLED_SCL);

// Initialize OLED
if (!display.begin(SSD1306_SWITCHCAPVCC, 0x3C)) { // 0x3C = I2C
address
    Serial.println("SSD1306 allocation failed");
    for (;;) // Halt if OLED not found
    }
display.clearDisplay();
display.setTextSize(1);
display.setTextColor(SSD1306_WHITE);
display.setCursor(0, 0);
display.println("System Ready");
display.display();

```

```
    delay(2000);
}

void loop() {
    int soilValue = analogRead(SOIL_PIN); // Read soil moisture (0-1023)
    Serial.print("Soil Moisture Value: ");
    Serial.println(soilValue);

    int threshold = 500; // Adjust based on calibration
    String pumpStatus;

    if (soilValue > threshold) {
        // Soil is dry → turn ON pump
        digitalWrite(RELAY_PIN, LOW);
        digitalWrite(LED_PUMP, LOW);
        digitalWrite(LED_DRY, LOW);
        digitalWrite(LED_SYS, LOW);
        pumpStatus = "Pump ON (Soil Dry)";
        Serial.println(pumpStatus);
    } else {
        // Soil is wet → turn OFF pump
        digitalWrite(RELAY_PIN, HIGH);
        digitalWrite(LED_PUMP, HIGH);
        digitalWrite(LED_DRY, HIGH);
        digitalWrite(LED_SYS, HIGH);
        pumpStatus = "Pump OFF (Soil Wet)";
        Serial.println(pumpStatus);
    }
}
```

```
}
```

```
// Update OLED
```

```
display.clearDisplay();
```

```
display.setTextSize(1);
```

```
display.setTextColor(SSD1306_WHITE);
```

```
display.setCursor(0, 0);
```

```
display.println("Soil Moisture System");
```

```
display.setCursor(0, 16);
```

```
display.print("Soil Value: ");
```

```
display.println(soilValue);
```

```
display.setCursor(0, 32);
```

```
display.println(pumpStatus);
```

```
display.display();
```

```
delay(2000); // Read every 2 seconds
```