Smart Irrigation System Using Arduino

Project Overview

A **Smart Irrigation System** automatically waters plants based on **soil moisture levels** using a **moisture sensor** and **water pump**. This system helps **conserve water**, improve **plant health**, and reduce **manual effort**. It can also be enhanced with **temperature and humidity monitoring** for better control.

Objectives

✅ **Monitor soil moisture using a sensor.**
✅ **Automatically turn the water pump ON/OFF based on moisture levels.**
✅ **Display real-time data on an LCD screen.**
✅ **Use temperature and humidity data for climate-based irrigation.**
✅ **Optimize water usage for plant health.**

Components Required

1. **Arduino Uno** – Main microcontroller.
2. **Soil Moisture Sensor** – Detects soil dryness.
3. **Relay Module (5V)** – Controls the water pump.
4. **Water Pump (5V/12V)** – Pumps water when needed.
5. **DHT11/DHT22 Sensor (Optional)** – Measures temperature and humidity.
6. **16x2 LCD Display (I2C Module)** – Displays sensor readings.
7. **Jumper Wires & Breadboard** – For connections.
8. **5V or 12V Power Supply** – To power the circuit and pump.

How the System Works

1. **Soil Moisture Sensor** continuously monitors soil moisture.
2. If the soil is **dry**, the **relay activates** the **water pump** to irrigate the plants.
3. Once the soil reaches the **desired moisture level**, the **pump turns off**.
4. The **LCD display shows** real-time moisture, temperature, and humidity readings.

Circuit Diagram

Soil Moisture Sensor to Arduino

Sensor Pin	Arduino Pin
VCC	5V
GND	GND
A0 (Analog)	A0

Relay Module to Arduino

Relay Pin	Arduino Pin
VCC	5V
GND	GND
IN (Signal)	D7

Water Pump to Relay Module

Pump Pin	Relay Pin
+ (Positive)	NO (Normally Open)
- (Negative)	COM (Common)

DHT11 Sensor to Arduino (Optional)

DHT Pin	Arduino Pin
VCC	5V
GND	GND
Data	D6

Arduino Code for Smart Irrigation System

```
#include <DHT.h>
#include <LiquidCrystal_I2C.h>

#define SOIL_MOISTURE_SENSOR A0
#define RELAY 7
#define DHTPIN 6
#define DHTTYPE DHT11

DHT dht(DHTPIN, DHTTYPE);
LiquidCrystal_I2C lcd(0x27, 16, 2);  // LCD with I2C module
```

```
void setup() {
  pinMode(SOIL_MOISTURE_SENSOR, INPUT);
  pinMode(RELAY, OUTPUT);

  lcd.begin();
  lcd.backlight();
  dht.begin();

  Serial.begin(9600);
}

void loop() {
  int moistureLevel = analogRead(SOIL_MOISTURE_SENSOR);
  float temperature = dht.readTemperature();
  float humidity = dht.readHumidity();

  Serial.print("Soil Moisture: ");
  Serial.println(moistureLevel);
  Serial.print("Temperature: ");
  Serial.println(temperature);
  Serial.print("Humidity: ");
  Serial.println(humidity);

  lcd.setCursor(0, 0);
  lcd.print("Moisture: ");
  lcd.print(moistureLevel);

  lcd.setCursor(0, 1);
  lcd.print("Temp:");
  lcd.print(temperature);
  lcd.print("C ");

  if (moistureLevel < 400) {  // If soil is dry, turn on pump
    digitalWrite(RELAY, LOW);
    lcd.print("Pump ON ");
  } else {   // If soil is wet, turn off pump
    digitalWrite(RELAY, HIGH);
    lcd.print("Pump OFF");
  }

  delay(2000);  // Wait before next reading
}
```
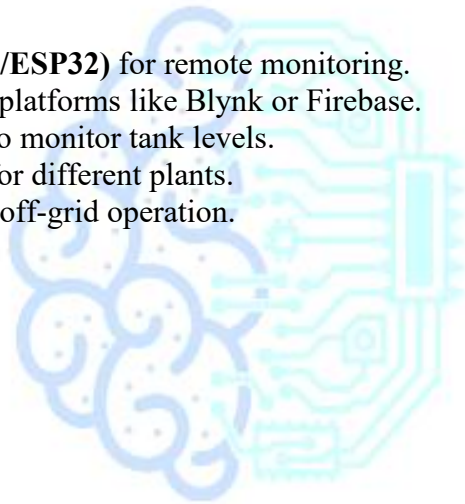
How to Use the Smart Irrigation System

1. **Connect the components** as per the circuit diagram.
2. **Upload the code** to the Arduino using the Arduino IDE.
3. **Place the soil moisture sensor in the soil** near the plant roots.
4. **Power the system** using a 5V or 12V power supply.
5. The **LCD will display real-time moisture, temperature, and humidity**.
6. If the soil is **dry**, the pump **automatically starts** watering.
7. Once the soil is **moist enough**, the pump **stops**.

Features & Benefits

✓ **Automated irrigation** based on soil conditions.
✓ **Saves water** by only irrigating when needed.
✓ **Real-time monitoring** of moisture, temperature, and humidity.
✓ **Prevents overwatering** for healthier plants.
✓ **Expandable system** – Can control multiple zones.

Future Enhancements

Integrate Wi-Fi (ESP8266/ESP32) for remote monitoring.
Send notifications via IoT platforms like Blynk or Firebase.
Add a water level sensor to monitor tank levels.
Use multiple soil sensors for different plants.
Solar-powered system for off-grid operation.