“Project Report”

Course Code:	Course Title:
CSE223	Digital Electronics

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Project Title: Garden Irrigation System

Description:

The garden irrigation system project offers a smart and accessible solution for maintaining optimal soil moisture while conserving water. Utilizing an Arduino Uno R3 microcontroller and a YL-69 soil moisture sensor, it continuously monitors soil moisture levels and displays real-time data on a 16x2 LCD screen via an I2C adapter. When soil moisture drops below a set threshold, the Arduino activates a relay to turn on a water pump, ensuring precise and efficient irrigation.

This system emphasizes sustainability by automating watering based on real-time data, minimizing water waste and environmental impact. It demonstrates how technology can enhance gardening practices, making advanced techniques accessible to all enthusiasts, and underscores the potential of integrating hardware and software to improve garden management.

Equipment description:

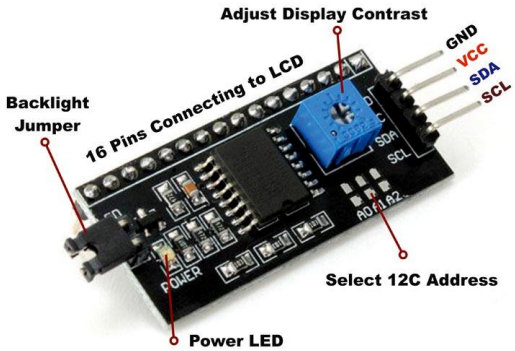
1. Arduino UNO R3

Arduino Uno R3 (China) is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It features the Atmega16U2 programmed as a USB-to-serial converter. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

2. LCD Display 16x2 with male header

An electronic display module commonly used in various devices due to its cost-effectiveness, ease of programming, and ability to display special and custom characters, animations, and more. It shows 16 characters per line on 2 lines, with each character in a 5x7 pixel matrix. The display has two registers: the command register for instructions like initialization and cursor setting, and the data register for storing the ASCII values of characters to be displayed.

3. I2C LCD Adapter module



The Serial I2C LCD display adapter converts a parallel 16x2 character LCD into a serial I2C LCD, controllable with just 2 wires. It uses the PCF8574 chip as an I/O expander for communication with an Arduino or other microcontroller via the I2C protocol. Up to 8 LCD displays can be connected to the same I2C bus, each with a unique address. The default I2C address is 0x27, adjustable to 0x20~0x27 by soldering A0, A1, and A2 pins.

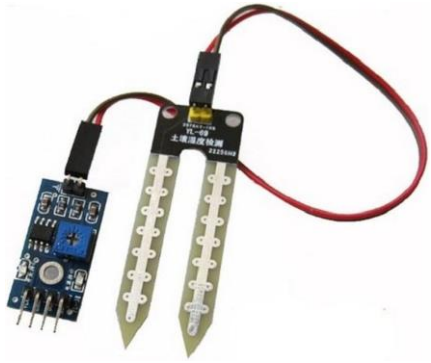
4. 1 Channel 5V Relay Board Module

This is a 1/2/4/8 Channel 5V Relay Board Module. It can handle a maximum load of AC 250V/10A or DC 30V/10A, with a trigger current of 5mA and a working voltage of DC 5V. Each channel can be set to trigger at a high or low level via a jumper. It features a fault-tolerant design, ensuring the relay remains inactive if the control line is disconnected. The module's size interfaces can be directly connected through a terminal block for convenience.

5. YL-69 Soil Hygrometer Humidity & Soil Moisture Detection Sensor

The soil moisture module is highly sensitive to ambient humidity and is used to detect soil moisture content. When soil moisture reaches a set threshold, the DO port outputs high; if moisture exceeds the threshold, DO outputs low. The digital output (DO) can connect to a microcontroller to detect soil moisture levels. It can also drive a relay or buzzer for a soil

moisture alarm. The analog output (AO) provides precise moisture values when connected through an AD converter.



6. Breadboard
7. Wire
8. 5v DC power supply
9. Water pump

Figure: Water pump

Circuit Diagram:

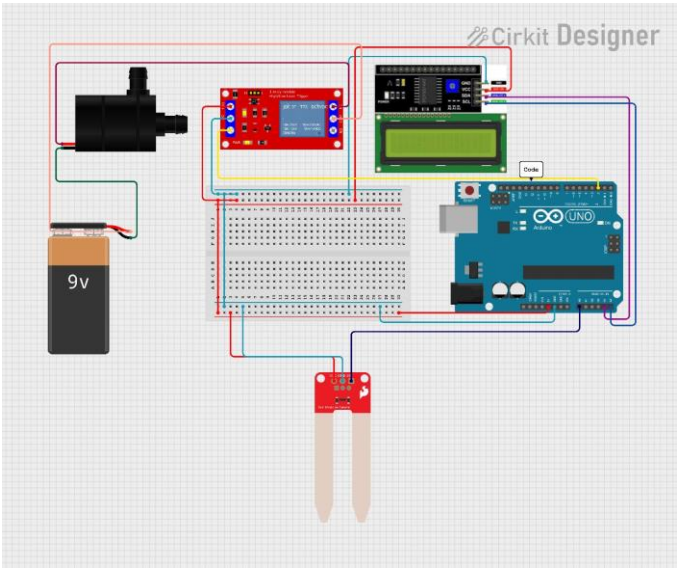


Figure: Circuit design for soil moisture sensor

Working process:

To create a garden irrigation system using the listed components, you will follow these steps:

1. Gather Components:

Gather the components mentioned above

2. Setup Connections:

1. *Arduino to LCD Display with I2C Adapter:*
    1.1. Connect VCC of the I2C adapter to 5V on the Arduino.
    1.2. Connect GND of the I2C adapter to GND on the Arduino.
    1.3. Connect SDA of the I2C adapter to A4 on the Arduino.
    1.4. Connect SCL of the I2C adapter to A5 on the Arduino.
2. *Arduino to Soil Moisture Sensor:*
    2.1. Connect VCC of the soil moisture sensor to 5V on the Arduino.
    2.2. Connect GND of the soil moisture sensor to GND on the Arduino.
    2.3. Connect the analogue output (AO) of the soil moisture sensor to A0 on the Arduino.
3. *Arduino to Relay Module:*
    3.1. Connect VCC of the relay module to 5V on the Arduino.
    3.2. Connect GND of the relay module to GND on the Arduino.
    3.3. Connect the IN pin of the relay module to digital pin 7 on the Arduino.
    3.4. Connect the relay's normally open (NO) terminal to one terminal of the water pump.
    3.5. Connect the common (COM) terminal of the relay to the positive terminal of the 5V DC power supply.
    3.6. Connect the negative terminal of the 5V DC power supply to the other terminal of the water pump.

3. Programming the Arduino:

Libraries:

1. Install the LiquidCrystal_I2C library for the LCD display.
2. No special library is needed for the soil moisture sensor or the relay.

Code Example:

```
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup() {
  Serial.begin(9600);
  lcd.init();
  lcd.backlight();
  lcd.clear();
  pinMode(2, OUTPUT);
  digitalWrite(2, HIGH);
  delay(1000);
  lcd.setCursor(0, 0);
    lcd.setCursor(0, 0);
    lcd.print("WATER Pump is ON ");
  } else {
    digitalWrite(2, HIGH);
    lcd.setCursor(0, 0);
    lcd.print("Water Pump is OFF");
  }

  if (value < 300) {
    lcd.setCursor(0, 1);
    lcd.print("Moisture : HIGH");
```

```
  lcd.print("IRRIGATION");
  lcd.setCursor(0, 1);
  lcd.print("SYSTEM IS ON ");
    lcd.print("");
    delay(3000);
  lcd.clear();
}

void loop() {
  int value = analogRead(A0);
  Serial.println(value);
  if (value > 950) {
    digitalWrite(2, LOW);
  } else if (value > 300 && value < 950) {
    lcd.setCursor(0, 1);
    lcd.print("Moisture : MID ");
  } else if (value > 950) {
    lcd.setCursor(0, 1);
    lcd.print("Moisture : lOW ");
  }
}
```

4. Final Setup:

- Ensure all connections are secure and insulated to avoid short circuits.
- Place the moisture sensor in the soil you want to monitor for moisture level.
- Connect the water pump to a water source.
- Power the Arduino with the 5V DC supply or via USB.

Project picture:

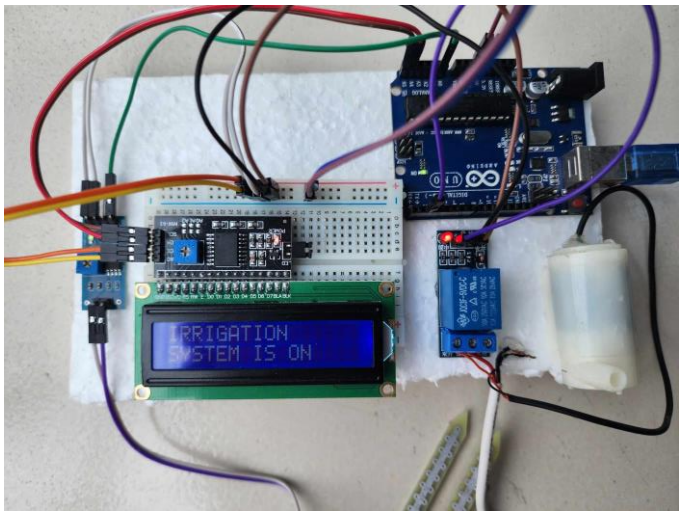


Figure: Irrigation System on

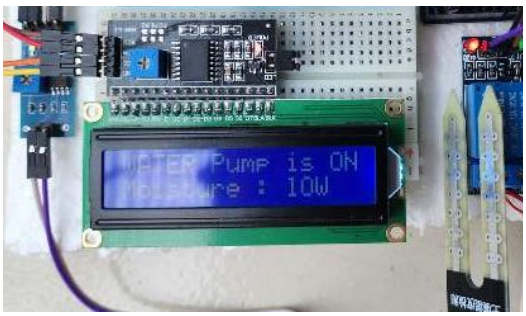


Figure: Low moisture (water pump on)

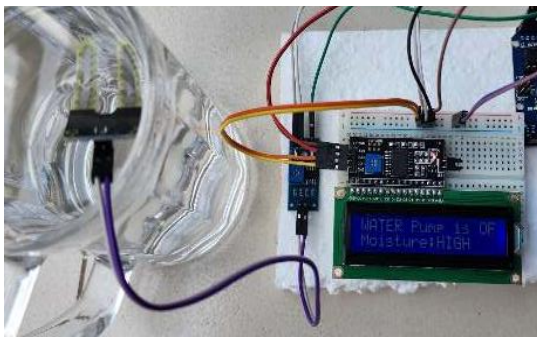


Figure: High moisture (water pump off)

Conclusion:

In conclusion, the garden irrigation system is a significant advancement in gardening and agriculture, offering an efficient solution to watering management. Utilizing the Arduino Uno R3 microcontroller, YL-69 soil moisture sensor, 16x2 LCD display, and a relay module, the system ensures precise and responsive watering tailored to plant and soil needs. It promotes optimal plant growth and vitality while emphasizing sustainability and resource efficiency, conserving water, and minimizing environmental impact. This innovation represents progress toward greener practices, inspiring a more harmonious relationship with nature.