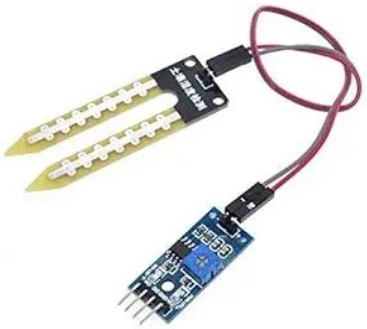
Experiment No. 09:

Write a code and build a model to Interfacing Soil Moisture Sensor with Arduino

Basics about Soil Moisture Sensor:

A soil moisture sensor is a device that measures the amount of water in the soil, crucial for various applications like agriculture, environmental monitoring, and scientific research. These sensors typically work by measuring properties like electrical resistance or dielectric constant, which are correlated with soil moisture content.



A soil moisture sensor measures the volumetric water content in the soil. It helps determine whether the soil is dry, moist, or wet. These sensors are often used in agricultural automation systems to help in irrigation management.

The sensor typically comes in two parts:

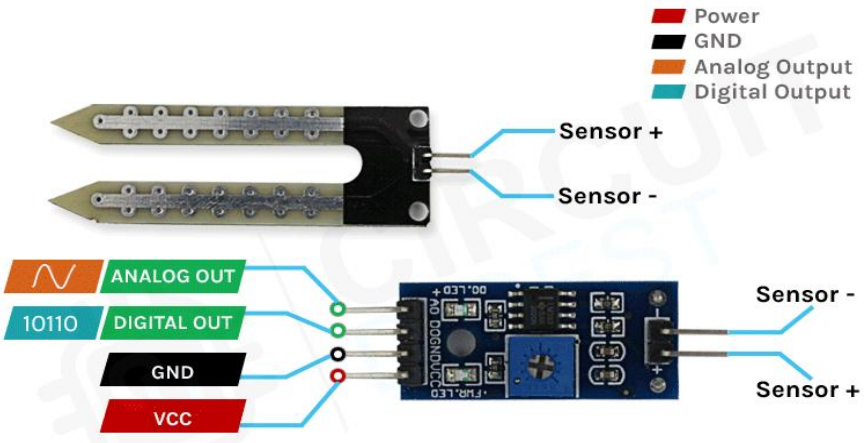
- **Probes** that go into the soil
- **Analog/Digital Signal Converter Module** that reads the moisture level and sends it to the Arduino.

Features of Soil Moisture Sensor:

- ✓ Low cost and easy to use
- ✓ Analog and Digital outputs
- ✓ Detects soil dryness or wetness accurately
- ✓ Operates on 3.3V to 5V
- ✓ Adjustable sensitivity via onboard potentiometer (for digital output)
- ✓ Corrosion-resistant probes (in some versions)

Layout and Pin Configuration:

Sensor Pin	Function
VCC	Power supply (3.3V or 5V)
GND	Ground
A0	Analog output (0–1023)
D0	Digital output (HIGH/LOW)



Working Principle:

- ✓ The sensor uses two conducting probes that measure the **resistance** of the soil.
- ✓ Dry soil offers high resistance → lower current flow → lower analog reading.
- ✓ Wet soil has low resistance → higher current flow → higher analog reading.
- ✓ The analog pin of the sensor gives continuous moisture level data, while the digital pin outputs HIGH/LOW based on a preset threshold.

Advantages:

- · Simple integration with microcontrollers
- · Cost-effective for precision agriculture
- · Real-time soil monitoring
- · Adjustable threshold for digital alert

Disadvantages:

- · Probes may corrode over time
- · Sensitive to environmental factors (temperature, salinity)
- · Limited sensing depth
- · Not suitable for long-term outdoor use without protection

Applications:

- ✓ Smart irrigation systems
- ✓ Greenhouse automation
- ✓ Soil moisture monitoring in agriculture
- ✓ Water-saving garden projects
- ✓ Home automation for plant care

1. Aim of the Experiment

To build a soil moisture monitoring system using Arduino and a soil moisture sensor and provide visual feedback using an LED when soil is dry or moist.

2. Objectives

- ✓ Learn how soil moisture sensors work.
- ✓ Interface the sensor with Arduino.
- ✓ Read analog data to evaluate moisture levels.
- ✓ Control an LED to indicate soil dryness based on sensor input.
- ✓ Activate the logic only when the push button is pressed.

3. Required Hardware Components

Sl. No	Component	Quantity
1	Arduino Uno (or compatible)	1
2	Soil Moisture Sensor	1
3	10KΩ Resistor (Pull-down)	1
4	LED (Any color)	1
5	220Ω Resistor (for LED)	1
6	Jumper Wires	As required
7	Breadboard	1
8	USB Cable	1

4. Circuit Diagram & Hardware Setup Connections

Connections:

Push Button:

One terminal to **5V**

Other terminal to **Digital Pin 2** and **GND** via **10KΩ** pull-down resistor

LED:

Anode (long leg) to **Digital Pin 4** via **220Ω resistor**

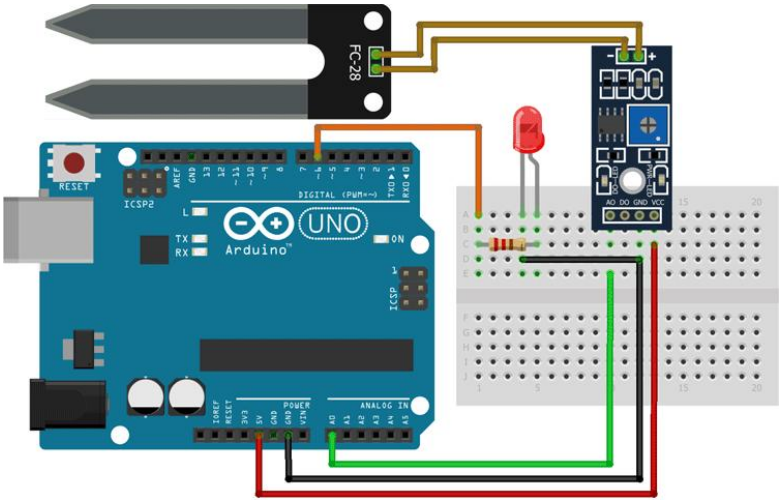
Cathode (short leg) to **GND**

Soil Moisture Sensor:

VCC to 5V

GND to GND

A0 (Analog Output) to **A0 (Analog Pin) on Arduino**



Steps to Setup Hardware:

- Connect the soil moisture sensor pins (VCC, GND, A0) to the Arduino.
- Place the sensor probe into the soil for testing.
- Connect the push button with pull-down resistor to pin 2.
- Connect the LED to pin 4 with a 220Ω resistor.
- Ensure all connections are secure on the breadboard.

5. Code for Arduino (Upload using Arduino IDE)

```
// Moisture Sensor Arduino Code
#define ledPin 6
#define sensorPin A0
void setup() {
  Serial.begin(9600);
  pinMode(ledPin, OUTPUT);
  digitalWrite(ledPin, LOW);
   Serial.print("Wellcome to Mostutre Sensor Experiments: ");
}
```

```
void loop() {
  Serial.println("Mostutre Sensor: ");
  Serial.println("Please Dip the Mostutre Sensor into Bowel: ");
  Serial.println(readSensor());
  delay(500);
}
//  This function returns the analog data to calling function
int readSensor() {
  int sensorValue = analogRead(sensorPin);  // Read the analog value from sensor
  int outputValue = map(sensorValue, 0, 1023, 255, 0); // map the 10-bit data to 8-bit data
  analogWrite(ledPin, outputValue); // generate PWM signal
  return outputValue;             // Return analog moisture value
}
```

6. Connecting and Running the Experiment

Hardware Connection Steps:

- ✓ Complete the wiring as per the schematic.
- ✓ Connect Arduino Uno to your PC using USB cable.
- ✓ Launch Arduino IDE.
- ✓ Copy and paste the above code.
- ✓ Click **Verify ( )** to compile the code.
- ✓ Click **Upload (→)** to upload the code to the Arduino.
- ✓ Open Serial Monitor (baud rate: 9600) to see moisture readings.
- ✓ Press the push button to activate the reading logic and observe LED output.

6. Working Procedure

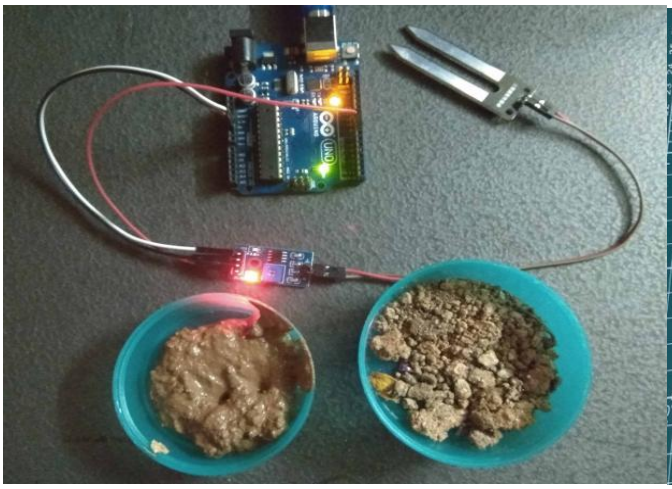
- When the **push button is pressed**, the Arduino reads the analog value from the sensor.
- If the value is **below the threshold** (indicating dry soil), the **LED turns ON**.
- If the soil is wet (higher reading), the LED remains OFF.
- Sensor readings can be monitored in the Serial Monitor.

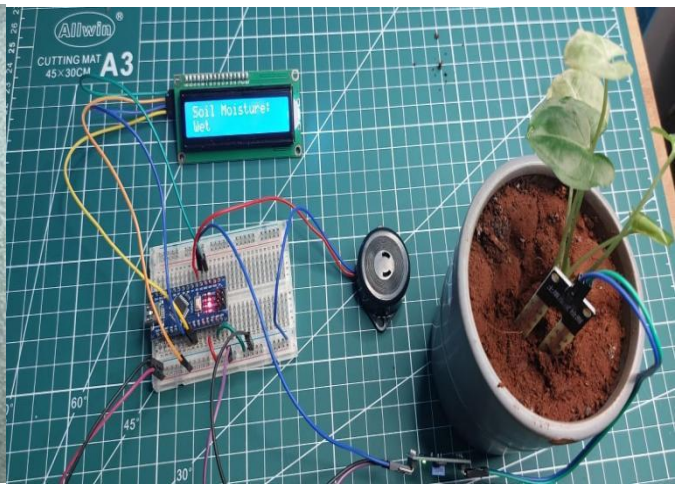
8. Expected Output

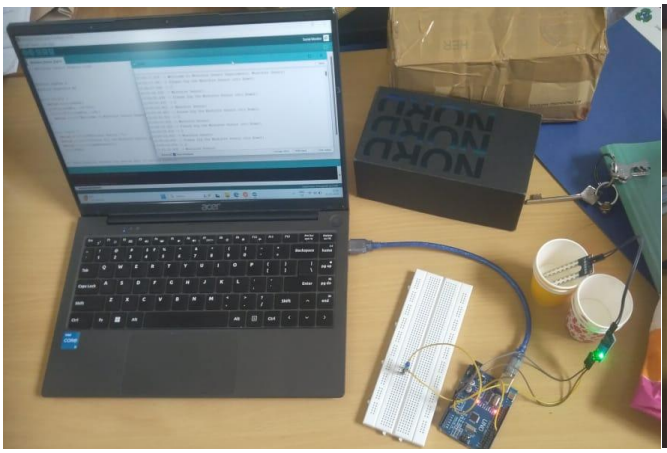
· **Dry Soil**: Analog value < 400 → LED ON
· **Moist Soil**: Analog value ≥ 400 → LED OFF
· **Serial Monitor Output Example**:

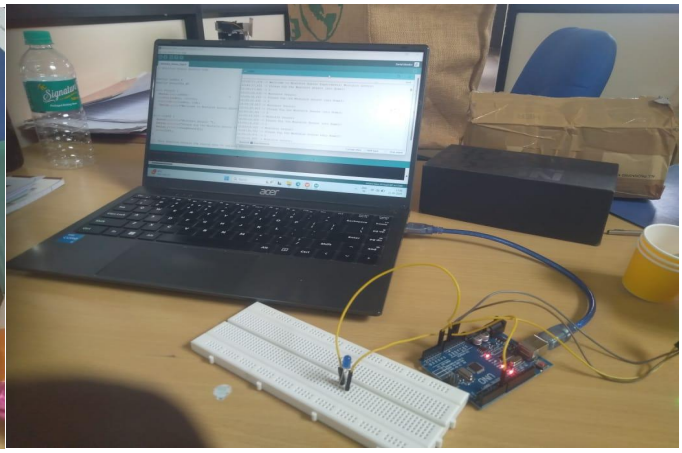
Soil Moisture: 310

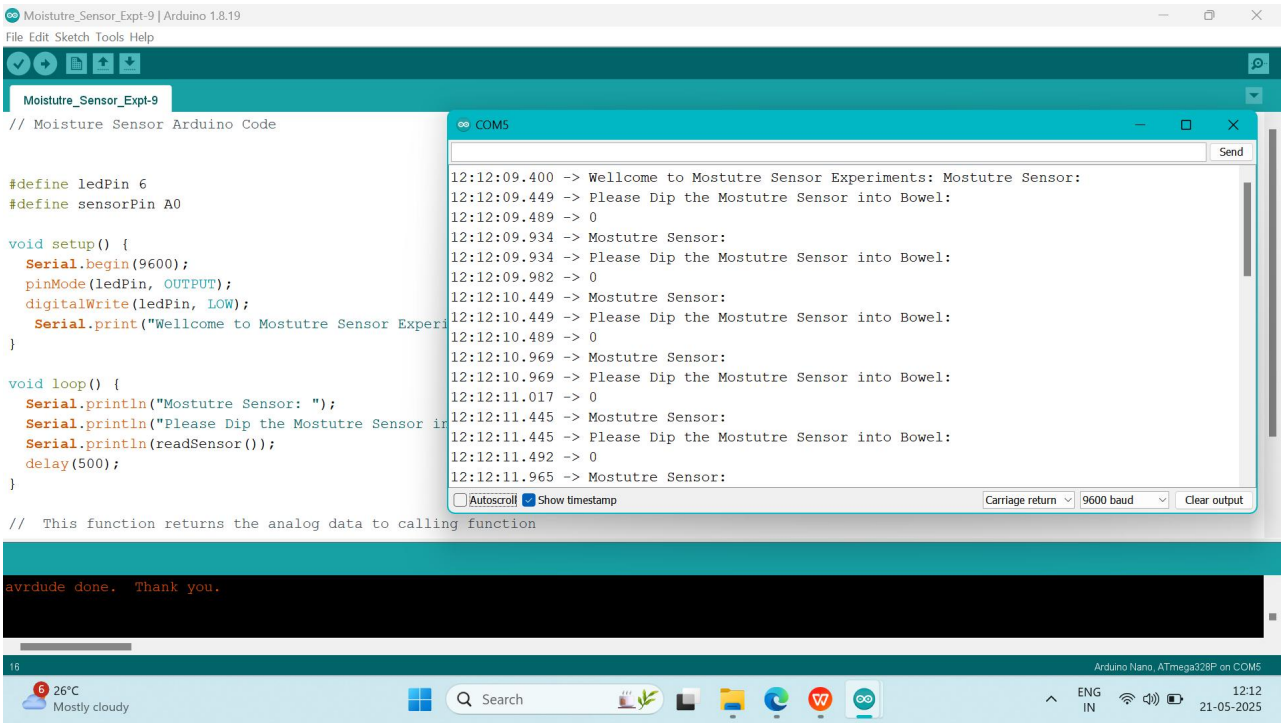
Soil Moisture: 295











Conclusion:

This experiment shows how a soil moisture sensor can be effectively used with Arduino for real-time soil monitoring. Such systems are vital in automating irrigation in agriculture and reducing water wastage. With the addition of control logic and feedback mechanisms like LEDs or buzzers, this system can be extended into a full-fledged smart irrigation system.