Module Code & Module Title
CS5068NI– Cloud Computing & IoT

Automatic Irrigation System

Assessment Type
50% Group Report

Semester
2024 Autumn

Group Members

London Met ID	Student Name
23049065	Aakriti Chaudhary
23049073	Akshat Raj Dali
23050339	Nischal Man Shrestha
23048470	Nobel Kumar Aryal

Assignment Due Date: 20 Jan 2025
Assignment Submission Date: 20 Jan 2025
Submitted to: Mr. Sugat Man Shakya
Word Count: 3319

I confirm that I understand my coursework needs to be submitted online via Google Classroom under the relevant module page before the deadline in order for my assignment to be accepted and marked. I am fully aware that late submissions will be treated as non-submission and a mark of zero will be awarded.

Similarity Check

Document 7.docx

Islington College,Nepal

Document Details

Submission ID
trn:oid:::3618:79615411

Submission Date
Jan 20, 2025, 8:26 AM GMT+5:45

Download Date
Jan 20, 2025, 8:28 AM GMT+5:45

File Name
Document 7.docx

File Size
21.6 KB

34 Pages

3,319 Words

17,333 Characters

19% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Match Groups

- 68 Not Cited or Quoted 18%
  Matches with neither in-text citation nor quotation marks
- 2 Missing Quotations 1%
  Matches that are still very similar to source material
- 0 Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- 0 Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

1% Internet sources
1% Publications
18% Submitted works (Student Papers)

Integrity Flags

0 Integrity Flags for Review

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

Match Groups

- 68 Not Cited or Quoted 18%
  Matches with neither in-text citation nor quotation marks
- 2 Missing Quotations 1%
  Matches that are still very similar to source material
- 0 Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- 0 Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

1% Internet sources
1% Publications
18% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Submitted works	
	Middlesex University on 2022-04-29	1%
2	Submitted works	
	University of Wolverhampton on 2024-10-07	<1%
3	Submitted works	
	Asia Pacific University College of Technology and Innovation (UCTI) on 2024-12-01	<1%
4	Submitted works	
	University of East London on 2024-12-19	<1%
5	Submitted works	
	Open University Malaysia on 2024-04-13	<1%
6	Submitted works	
	Asia Pacific University College of Technology and Innovation (UCTI) on 2024-05-20	<1%
7	Submitted works	
	Universiti Malaysia Perlis on 2018-05-24	<1%
8	Submitted works	
	South Bank University on 2016-04-29	<1%
9	Submitted works	

9 Submitted works

Institute of Research & Postgraduate Studies, Universiti Kuala Lumpur on 2023-0... <1%

10 Submitted works

Higher Education Commission Pakistan on 2024-03-25 <1%

11 Submitted works

Universiti Malaysia Pahang on 2017-06-21 <1%

12 Submitted works

Caledonian College of Engineering on 2014-06-02 <1%

13 Submitted works

The British College on 2025-01-07 <1%

14 Submitted works

University of Liverpool on 2016-04-17 <1%

15 Submitted works

Federal University of Technology on 2023-05-22 <1%

16 Submitted works

University of Wales Institute, Cardiff on 2024-01-06 <1%

17 Submitted works

De Montfort University on 2013-04-16 <1%

18 Submitted works

Liverpool John Moores University on 2017-04-08 <1%

19 Internet

www.slideshare.net <1%

20 Submitted works

Universiti Teknologi Malaysia on 2018-06-11 <1%

21 Submitted works

University Tun Hussein Onn Malaysia on 2022-06-24 <1%

22 Submitted works

Engineers Australia on 2019-07-08 <1%

23 Submitted works

Universiti Malaysia Pahang on 2019-12-05 <1%

24 Submitted works

University of Wollongong on 2019-05-18 <1%

25 Submitted works

Asia Pacific University College of Technology and Innovation (UCTI) on 2024-11-30 <1%

26 Submitted works

Asia Pacific University College of Technology and Innovation (UCTI) on 2024-11-30 <1%

27 Submitted works

International Islamic University Malaysia on 2016-01-14 <1%

28 Submitted works

Liverpool John Moores University on 2024-04-12 <1%

29 Submitted works

29 Submitted works

Swinburne University of Technology on 2019-05-12 <1%

30 Submitted works

Universiti Teknologi MARA on 2018-12-08 <1%

31 Submitted works

Universiti Teknologi MARA on 2021-04-19 <1%

32 Submitted works

University of Sydney on 2024-05-31 <1%

33 Submitted works

University of Warwick on 2023-03-16 <1%

34 Internet

arkajainuniversity.ac.in <1%

35 Submitted works

universititeknologimara on 2025-01-03 <1%

36 Submitted works

Asia Pacific University College of Technology and Innovation (UCTI) on 2024-05-21 <1%

37 Submitted works

Conroe Independent School District on 2024-01-14 <1%

38 Submitted works

Coventry University on 2018-05-01 <1%

39 Submitted works

39 Submitted works

Federal University of Technology on 2023-06-13 <1%

40 Submitted works

PSB Academy (ACP eSolutions) on 2018-07-24 <1%

41 Submitted works

RMIT University on 2019-10-21 <1%

42 Submitted works

RMIT University on 2022-12-02 <1%

43 Submitted works

Universiti Malaysia Perlis on 2017-11-30 <1%

44 Submitted works

Universiti Teknologi Malaysia on 2025-01-18 <1%

45 Submitted works

Caledonian College of Engineering on 2018-12-17 <1%

46 Submitted works

College of Science and Technology, Bhutan on 2019-06-09 <1%

47 Submitted works

Heriot-Watt University on 2022-11-24 <1%

48 Submitted works

MCAST on 2015-06-08 <1%

49 Submitted works

College of Science and Technology, Bhutan on 2019-06-09 <1%

50 Submitted works

Universiti Putra Malaysia on 2022-07-14 <1%

51 Submitted works

Universiti Teknikal Malaysia Melaka on 2019-05-30 <1%

Acknowledgement

We would like to sincerely thank our module leader and tutor, Mr. Sugat Man Shakya sir for giving us this opportunity to work on the IoT project. We were truly grateful for his priceless mentorship regarding the IoT project. His valuable guidance, support, encouragement and insightful feedback help us to successfully complete this IoT project.

We would also like to thank our Islington College for supporting us by providing devices needed for our project. Furthermore, we would like to thank our families, friends and team members for their financial and emotional support during the development process. In the end, we would like to thank everyone who supported us throughout the process. Without their continuous support and encouragement this project would not have been possible. Their generous support helped us to successfully implement and complete our project.

Abstract

The Automatic Irrigation System automates the irrigation process to optimize the usage of water in agriculture. The system uses Arduino UNO microcontroller, soil moisture sensor to monitor the moisture level of soil and temperature-humidity sensor (DHT11) to monitor the environmental condition. On the basis of soil moisture level, a relay-controlled dc water pump is turned on ensuring that plants get adequate amount of water. An LCD is used to show real-time data given by sensors for appropriate irrigation. The system has great potential to solve issues related with manual irrigation techniques and water scarcity as well as increases crop production and encourage environmentally friendly farming methods.

Table of Contents

Table of Figures

Table of Tables

1. Introduction

IoT technology has made the life of humans easier and convenient, also revolutionized many industries too. Among these industries, IoT technology has great impact on agriculture sector is being revolutionized too. There are various IoT devices that are used in agriculture for the easy monitoring and management of crops, improving the efficiency and productivity in farming practices. Although there are many IoT devices that are efficiently improving the farming practices, but agriculture is being affected a lot due to lack of proper irrigation.

In this IoT project, we developed an automated system that tracks the moisture content of the soil, temperature, humidity and irrigates the plant according to their requirement. This project will help in reducing the cost of manual irrigation, wastage of water, and increase in crop production. For the complete development of this project, we had use Arduino UNO, Temperature and Humidity Sensor (DHT11), Soil Moisture Sensor, LCD 16*2, Relay, DC Water Pump, Breadboard, Resistor, Battery and Jumper Wires.

1.1. Current Scenario

In Nepal, a majority of people rely on agriculture as their primary source of food, money, and jobs. Around two-thirds of Nepal’s population is engaged in agriculture, which employs around 62% of the country’s total population and accounts for about one-third of its GDP (Pradhan, 2023). Crops were not growing as predicted in most regions, still because of inadequate irrigation systems and a failure to irrigate plants at the appropriate times based on their water requirements.

1.2. Problem Statement and Project as a Solution

Agriculture, which is considered one of the strong pillars of the economy in Nepal, faces challenges like proper irrigation, unpredictable rainfall, scarcity of water, and shortage of labour. Most of the time, such scenarios lead to low crop production, economic loss, and food insecurity in the nation.

To avoid these challenges, automatic irrigation system will play a significant role in Nepalese agriculture. With the help of a micro-controller, sensor, and actuator, this automated irrigation system will enhance the utilization of water, reduce labour costs, improve agricultural output, and ensure food security.

Specifically, it will track the moisture level in soil, weather condition, and water requirement of plant to precisely control the irrigation schedules that guarantee efficient delivery of water. Also, remote monitoring and control enables farmers to efficiently handle the fields from any distant location.

1.3. Aim and Objectives

1.3.1. Aim

The fundamental goal of this project is to develop an automatic irrigation system using the concept of IoT.

1.3.2. Objectives

The following points given below are the main objectives of this project.

- To track the moisture level of soil, environmental conditions using sensors for effective irrigation.
- To irrigate the plants that are in need of water by monitoring the moisture level.
- To reduce the cost of manual irrigation by automating the process.
- To reduce the excess use of water through efficient and targeted irrigation.
- To enhance crop production by maintaining suitable soil moisture levels.

2. Background

2.1. System Overview

The IoT based automated irrigation mechanism has been developed to enhance the water efficiency in agriculture by monitoring the real-time soil moisture data and automatically irrigating the plants according to their need. The system architecture includes various hardware components such as microcontroller, sensors, actuators and many more.

The Arduino UNO is used as a microcontroller which processes all the environmental data collected from two sensors i.e. soil moisture which analyze the moisture level and DHT11 that provides real-time data of temperature and humidity. The system is developed by interconnecting multiple hardware devices. Arduino UNO, sensors, Liquid Crystal Display, relay, water pump, power supplier and many more.

The sensors collect real-time data such as amount of moisture in soil, humidity and temperature range from the environment. The collected data are sent to the Arduino board for processing. The information obtained after processing data is sent to the relay and also displayed in the LCD. The relay activates and deactivates the switch according to the information provided by microcontroller so that the plants get the water in proper amount.

2.2. Design Diagrams

2.2.1. Block Diagram

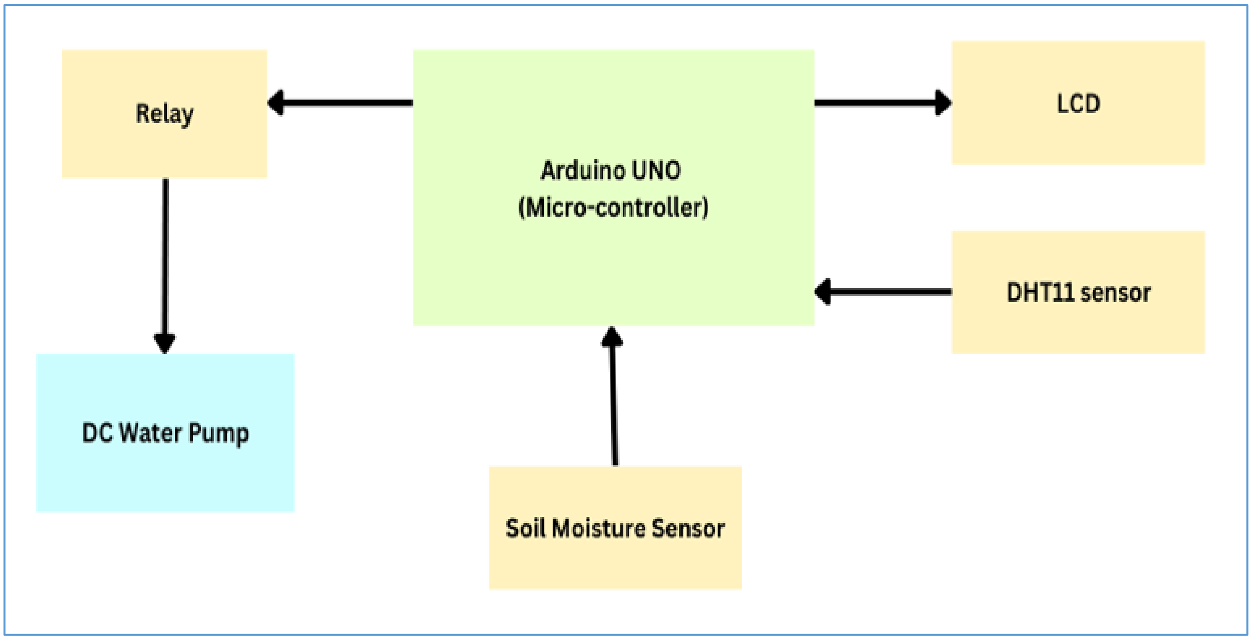

Figure 1: Block Diagram for Automatic Irrigation System

2.2.2. Hardware/System Architecture

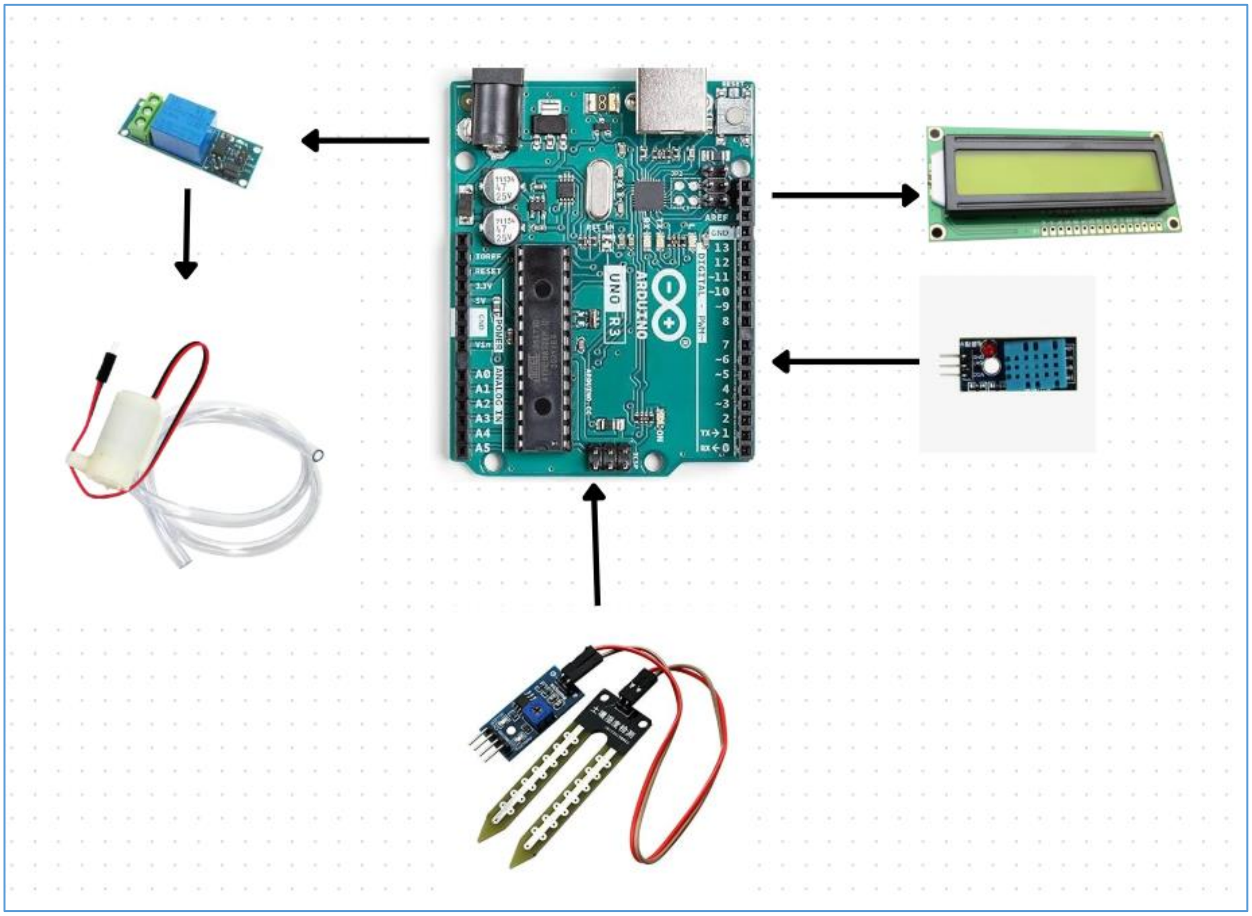

Figure 2: System Architecture for Automatic Irrigation System

2.2.3. Flowchart

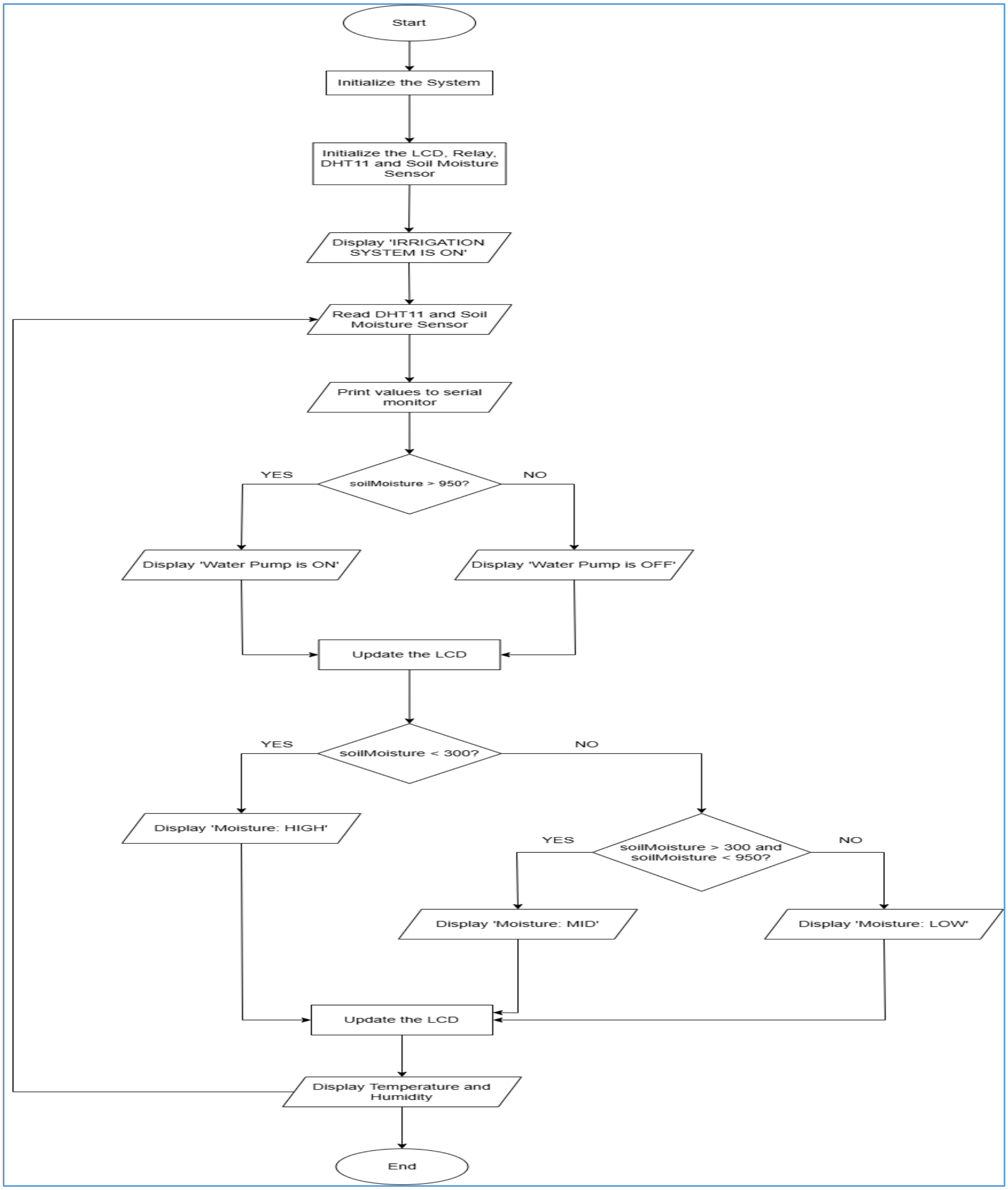

Figure 3: Flowchart for Automatic Irrigation System

2.2.4. Circuit Diagram

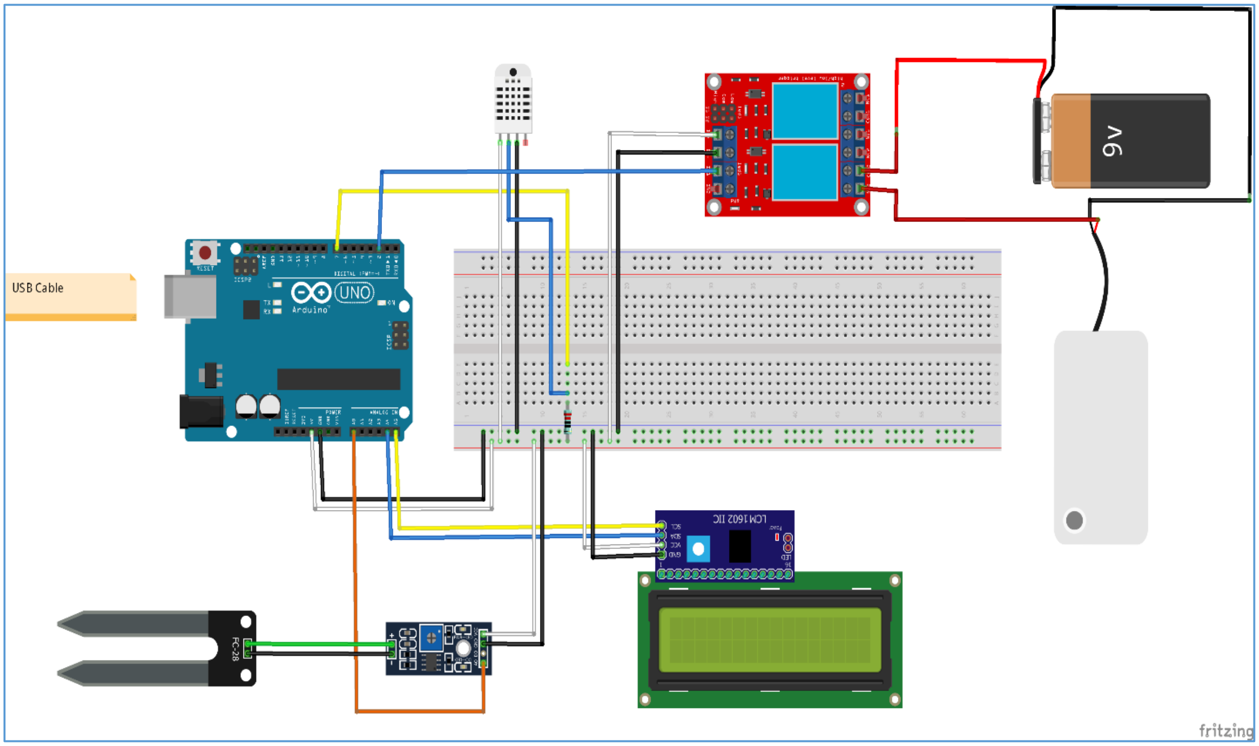

Figure 4: Circuit Diagram for Automatic Irrigation System

2.2.5. Schematic Diagram

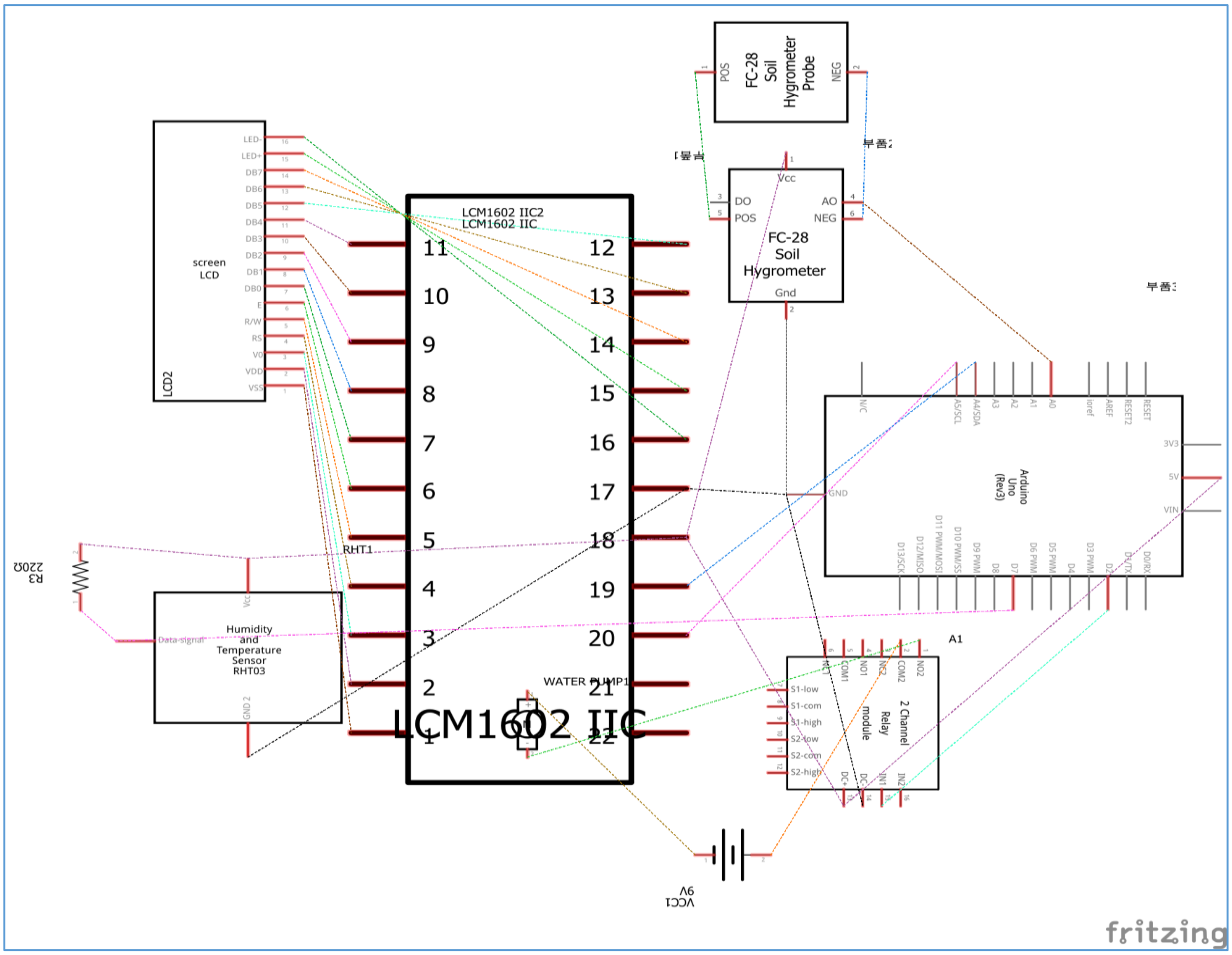

Figure 5: Schematic Diagram for Automatic Irrigation System

2.3. Requirement Analysis

2.3.1. Hardware Components

- **Arduino UNO**

The Arduino Uno is used as a control centre for the system since all commands are initiated by it. The system gathers information from the soil moisture, and DHT11 to take measurements on the state of the soil and climate conditions, respectively. Through the collected data, with greater than a certain value, it determines whether watering is needed and sends a signal to the relay module to adjust the water pump (Store, 2025).

Read more…

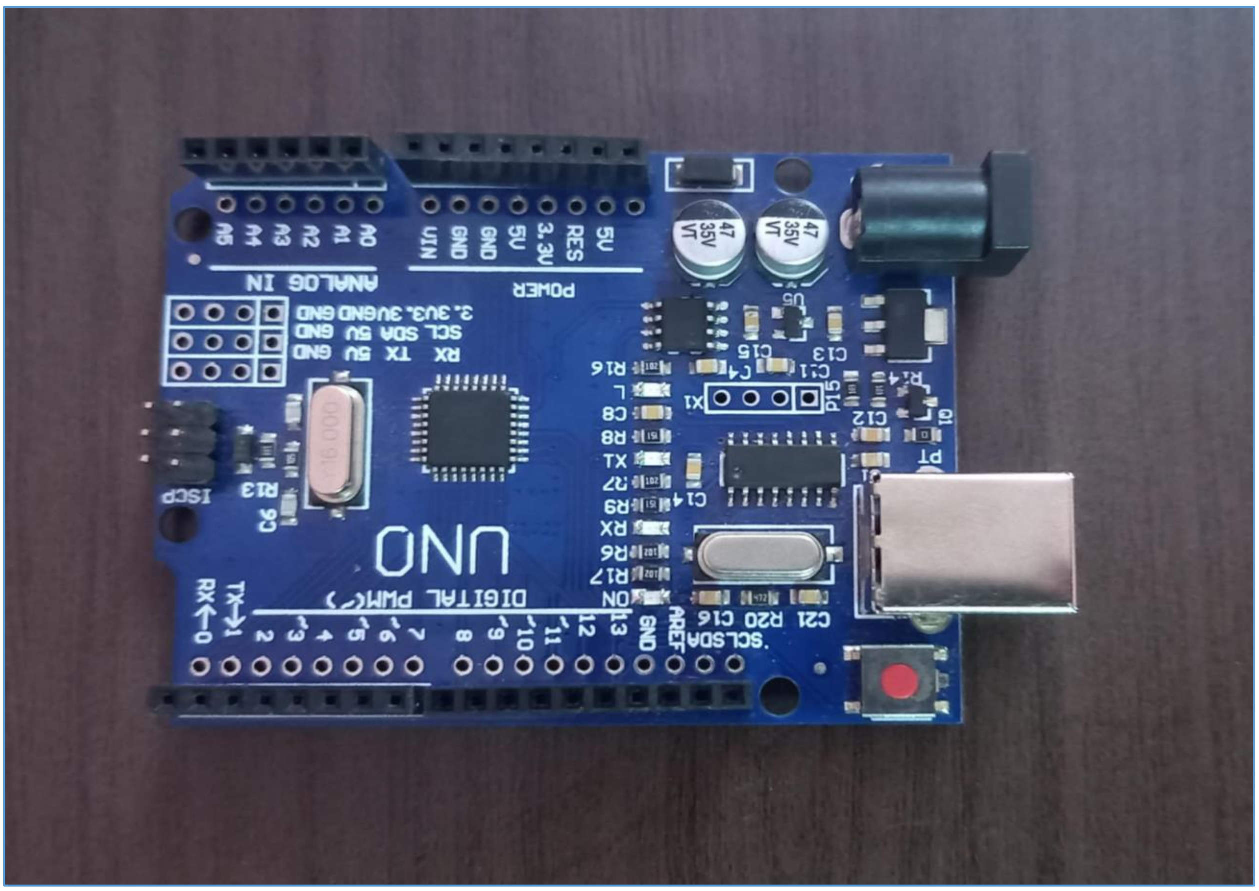

Figure 6: Arduino UNO

- **Soil Moisture Sensor**

On the basis of energy conversion, soil moisture sensor is a passive sensor in our project because it requires an external power supply to operate and determine the moisture level in the soil. It sends the electrical signals into the soil and detects the moisture level present in it.

On the basis of nature of output signal, soil moisture sensor in our project is an analogue sensor because it produces continuous output signal proportional to the moisture level of soil. The Arduino reads the signal from the sensor and turns it into a number between 0 and 1023. This number helps determine the moisture level, which is then categorized as "Low," "Mid," or "High."

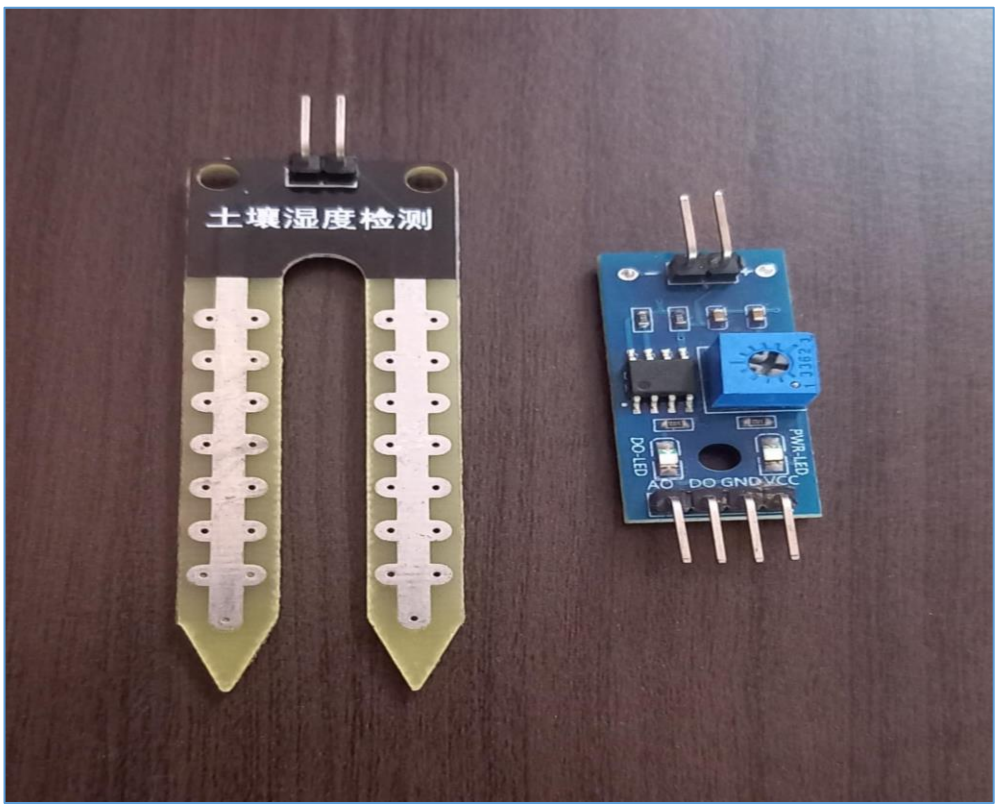

Figure 7: Soil Moisture Sensor

- **DHT11 Sensor**

On the basis of energy conversion, DHT11 sensor is an active sensor in our project because it does not require an external electrical signal instead, it determines the real-time data of temperature and humidity from the environment.

On the basis of nature of output signal, DHT11 is an analogue sensor in our project because it produce continuous output signal proportional to the real-time data taken from the environment.

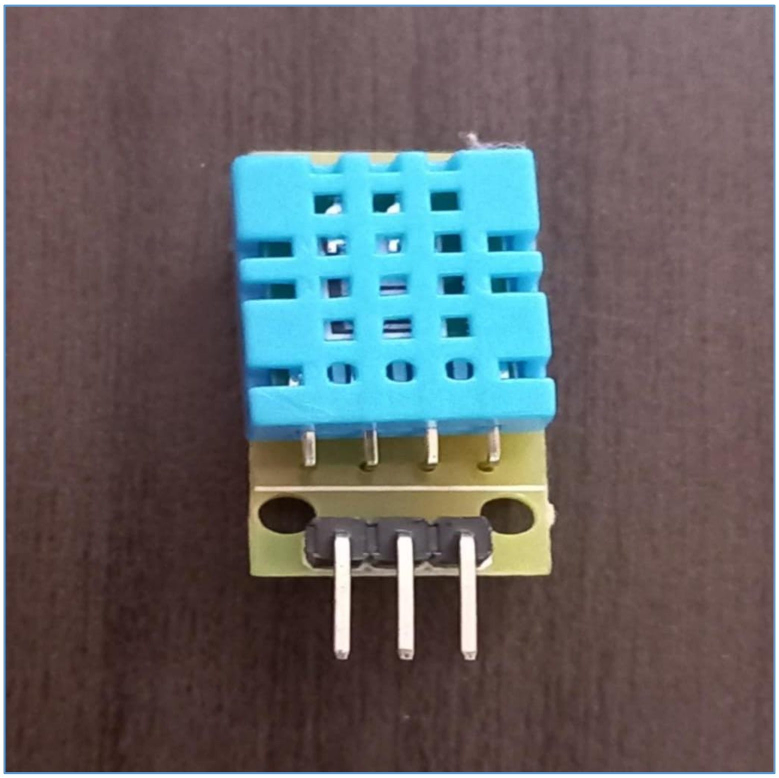

Figure 8: DHT11 Sensor

- **Liquid Crystal Display (LCD)**

  The LCD serves as the system interface since it displays information concerning its state. It displays pertinent matters such as the status of the soil concerning the humidity, temperature and moisture level, and the activity of the irrigation system in watering the plants. It is very useful since it makes the monitoring of the system performance to be done with much ease (TechTarget, 2025).

  Read more…

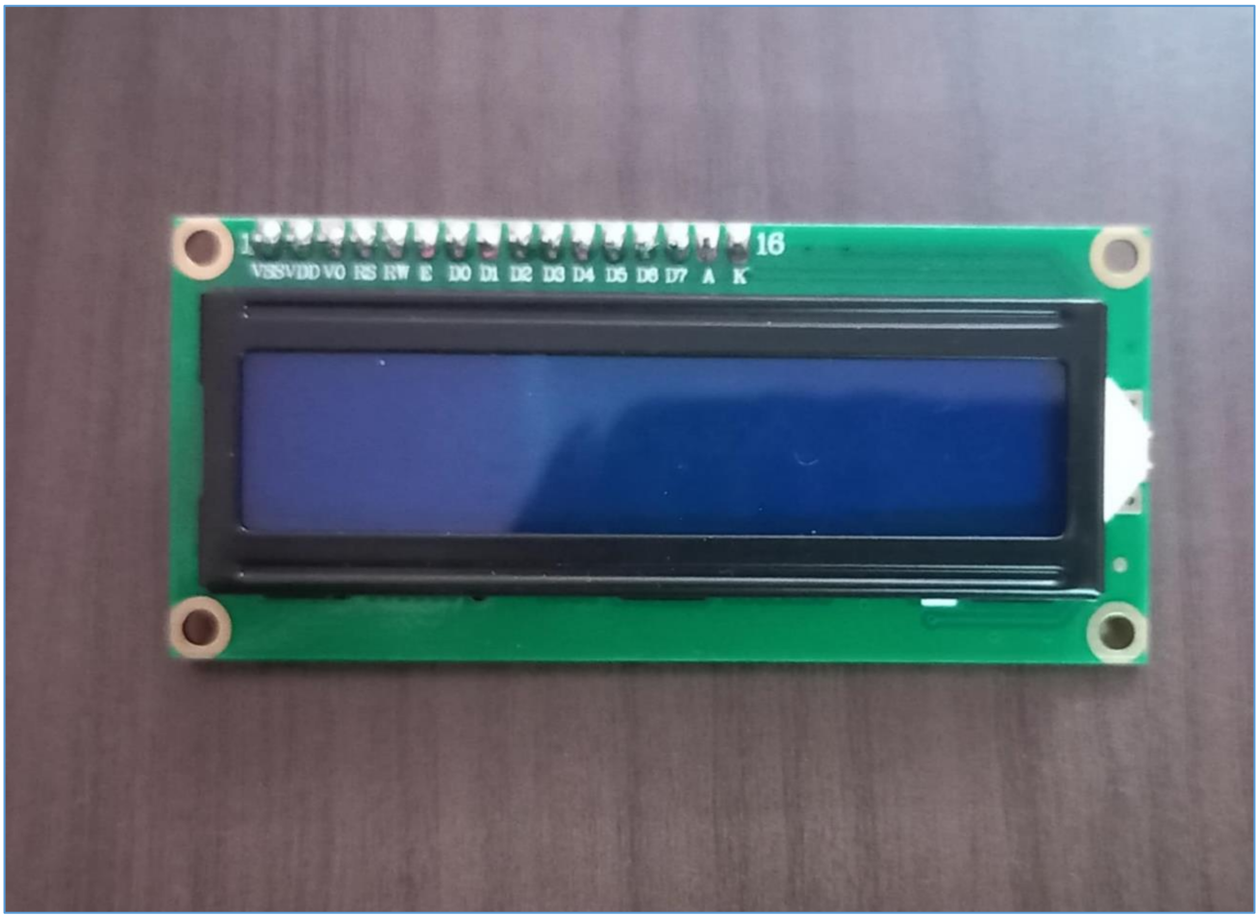

*Figure 9: Liquid Crystal Display 16*2*

- **Relay Module**

In a way, for the DC water pump, it is possible to take the relay module as an analogue switch. When the Arduino is sure that the soil is no longer wet it switches the relay to turn on the pump. Actually, at the appropriate moisture level, the relay switches off the pump so that the soil does not get flooded and water is used to the optimum (Kapoor, 2023).

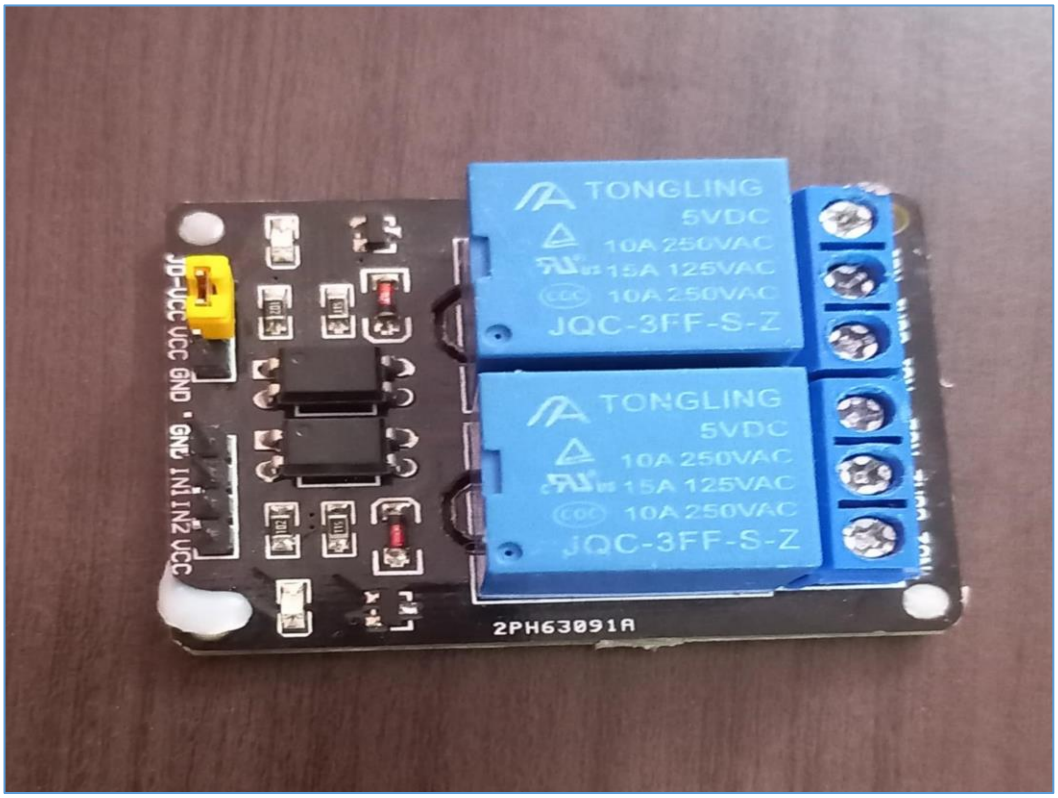

Figure 10: Relay Module

- **Breadboard**

The breadboard is a temporary construct designed to allow the different parts to be connected and placed in a specific order for a specific purpose. It is very convenient to plug and play sensors, wires and other components without using a solder to guarantee flexibility for changing components or trying out another combination (Sparkfun, 2025).

Read more…

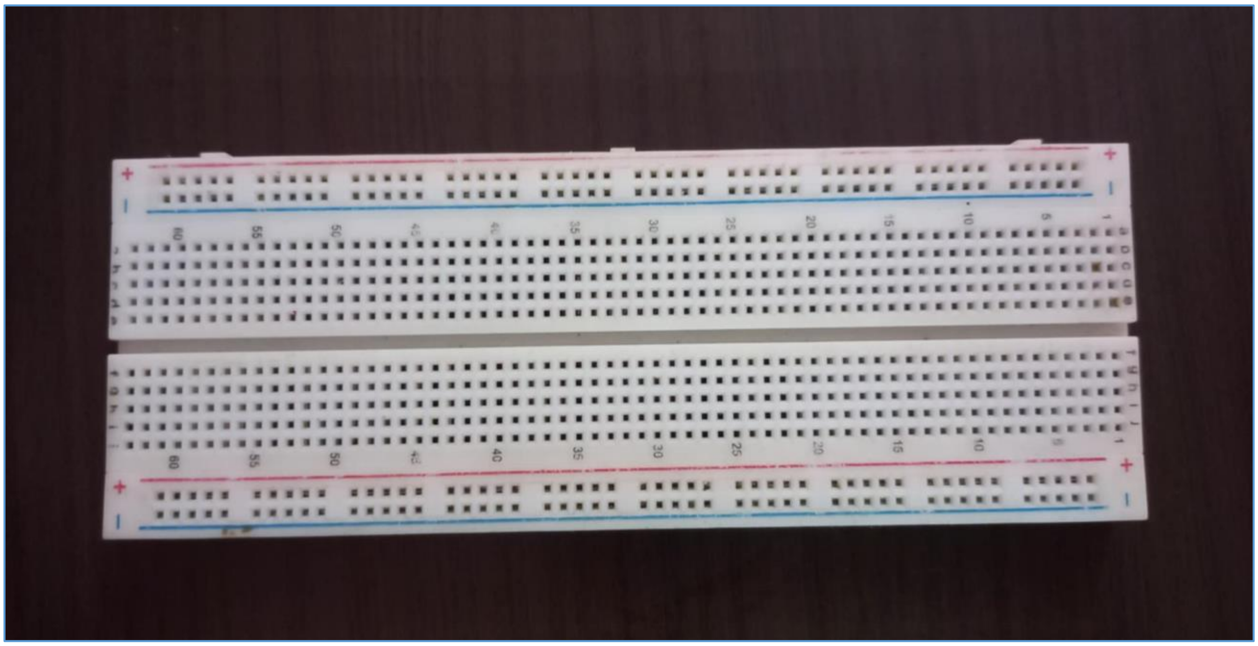

Figure 11: Breadboard

- **Resistor**

It makes sure that the right amount of current flows to each component, like the LCD, sensors, or LEDs, so they don’t get overloaded or damaged. By keeping everything running safely and smoothly, the resistor quietly does its part to protect and support the system.

Read more…

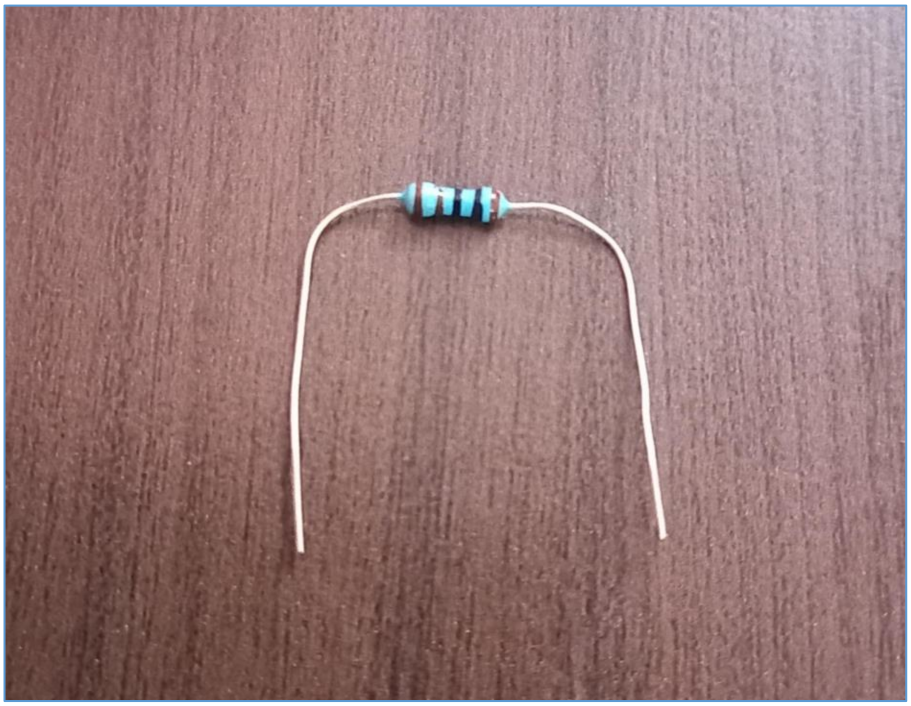

Figure 12: Resistor

- **DC Water Pump**

On the basis of output movement, dc water pump is a rotary actuator in our project because it uses electrical energy to spin the motor inside the water pump. The rotational motion inside the water pump creates the suction effect to move the water through the system.

On the basis of source of energy, dc water pump is an electrical actuator because it uses electrical energy (i.e. voltage) to power the water pump. The electrical energy is converted into mechanical energy which powers the rotating part ensuring that it pumps the water.

Figure 13: DC Water Pump

- **Jumper Wires**

Jumper wires are the connectors that link all the components together. They carry signals and power between the Arduino, soil moisture sensor, DHT11, relay module, LCD, and other parts, ensuring the system functions as a whole. Without jumper wires, the components wouldn't be able to communicate or share power, making them essential for the setup.

Read more…

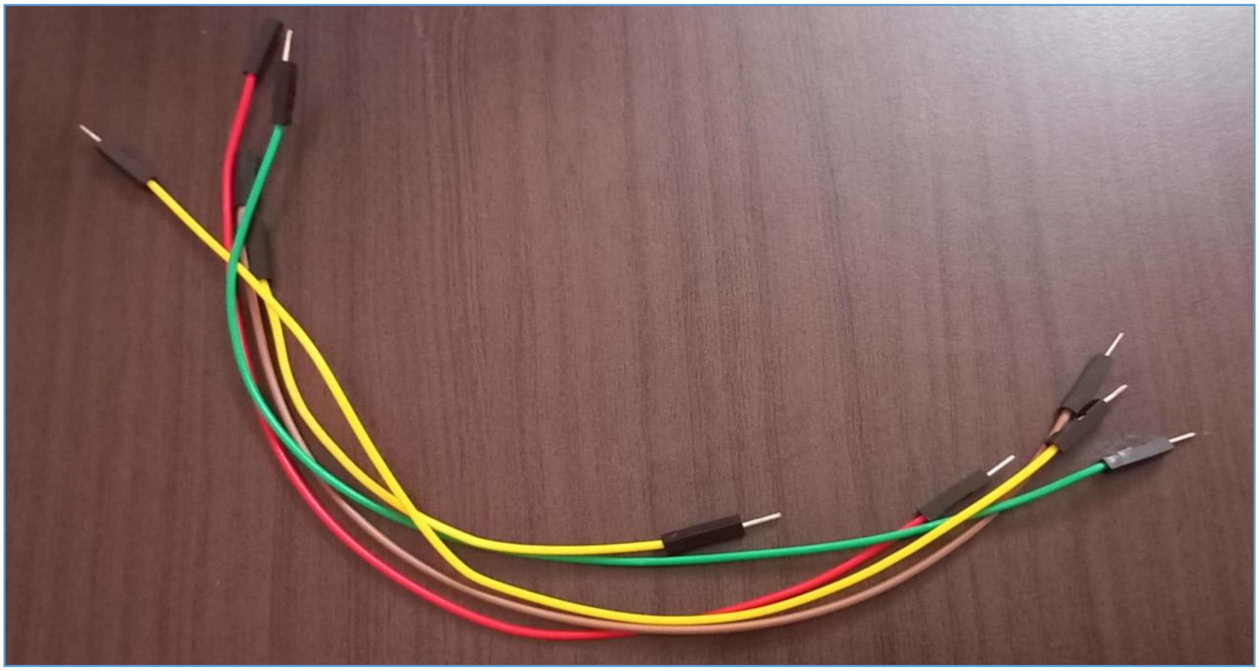

Figure 14: Jumper Wires

- **Battery**

The battery is the source of power to the whole system with the Arduino, sensors, relay module and the water pump. It makes sure that the system is reliable in the lack of the external power source (Vovyopump, 2024).

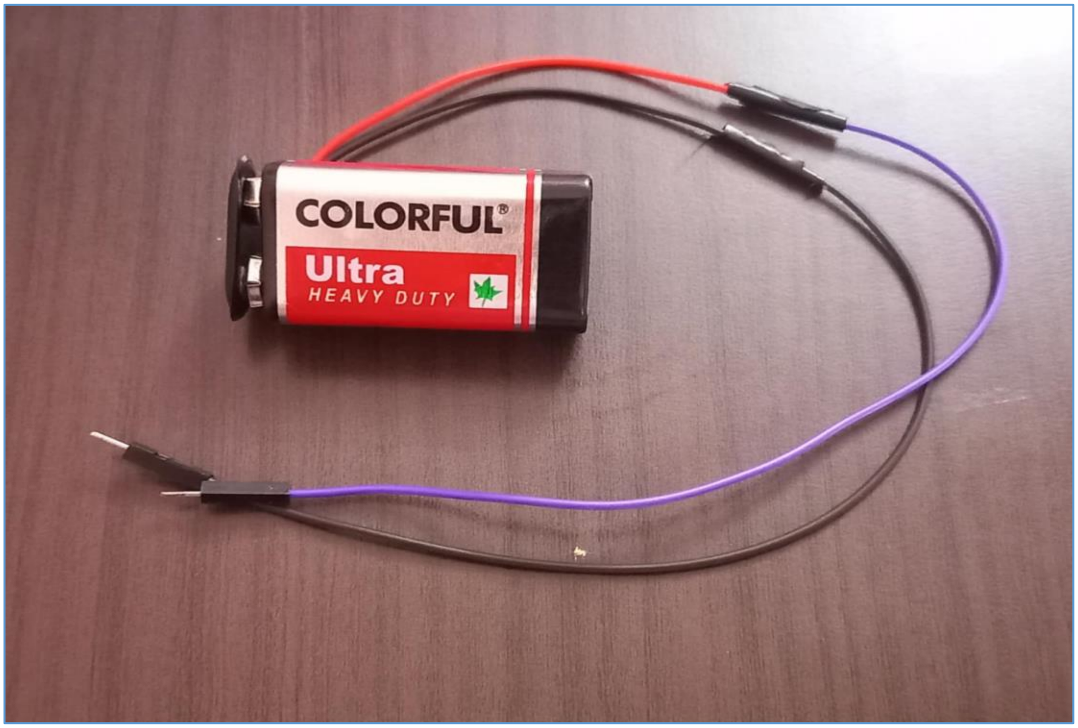

Figure 15: Battery

2.3.2. Software Components

- **Arduino IDE**

The code that powers the system is written in the Arduino IDE. Arduino is designed to read the data from the DHT11 and soil moisture sensor, make decisions based on that data, and control the relay to turn the water pump on or off. The Arduino can follow instructions and automate the watering procedure once the code has been written and uploaded to it using the IDE.

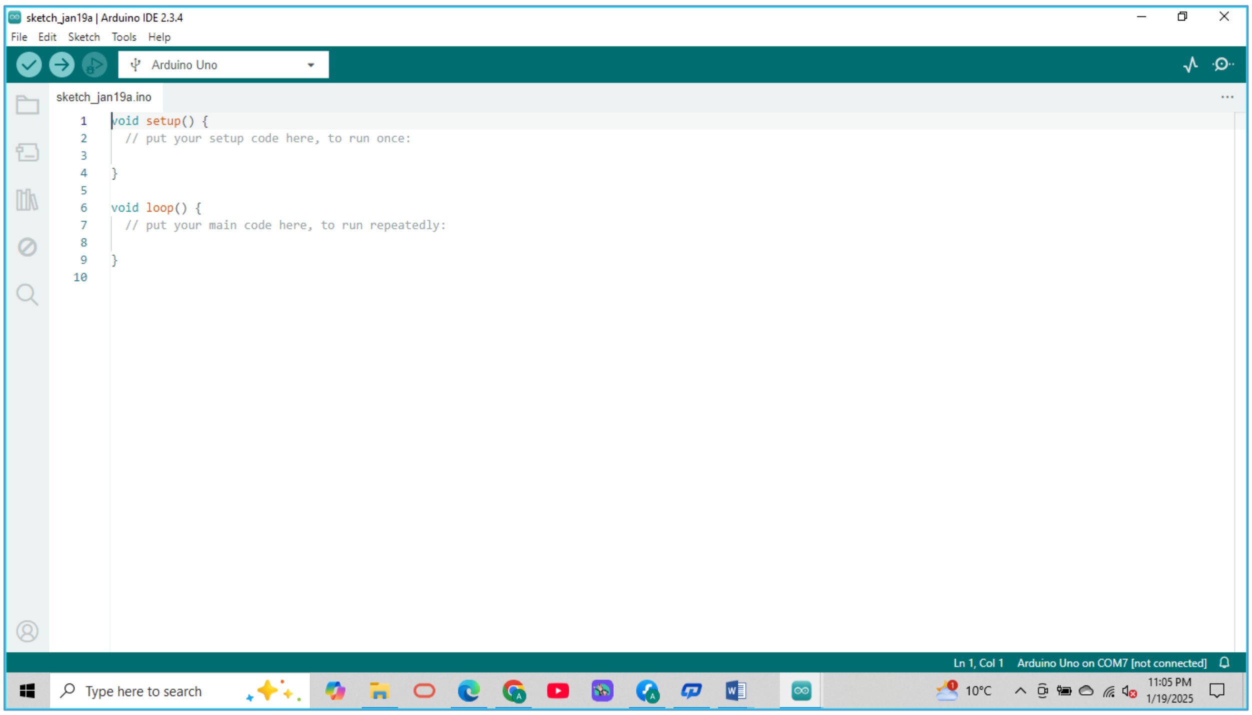

Figure 16: Arduino IDE

- **Draw.io**

To make the process clearer to see, we built a flowchart using Draw.io. It demonstrated how the Arduino receives data from the soil moisture sensor, interprets it, and uses the relay to determine whether to turn on or off the water pump.

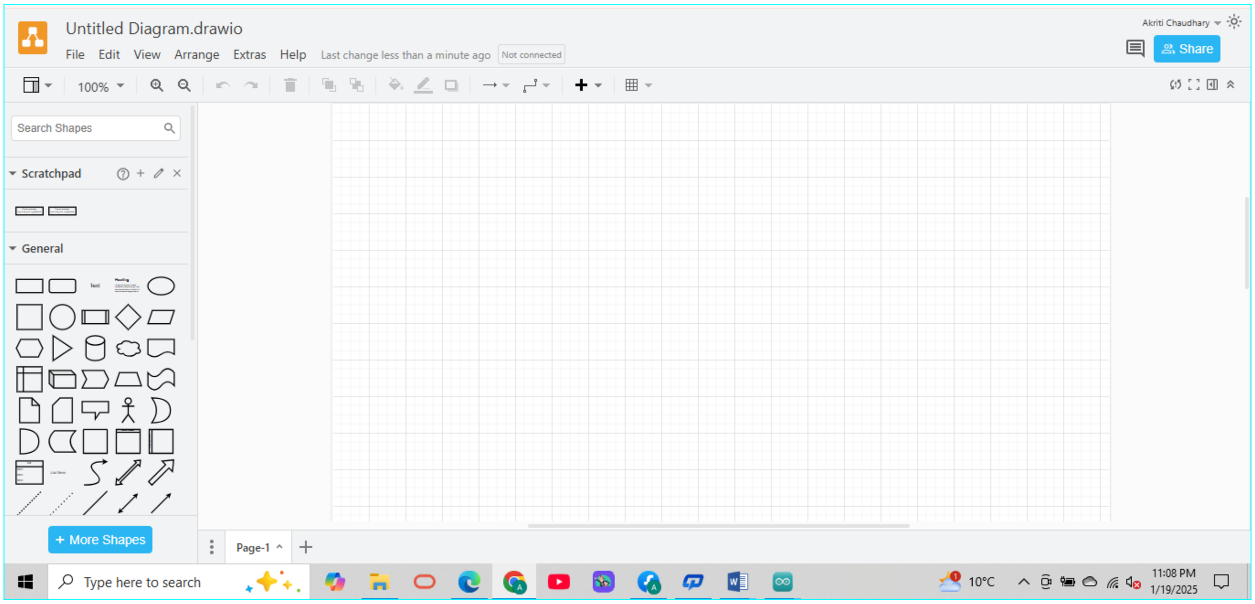

Figure 17: Draw.io

- **Fritzing**

We created a clear schematic and layout using Fritzing that showed how to connect each component. You can visually arrange components like the Arduino Uno, soil moisture sensor, relay, and LCD on a breadboard or circuit diagram by dragging and dropping them. It's quite convenient. This ensured that the irrigation system was properly set up and made it simple to identify where the cables go.

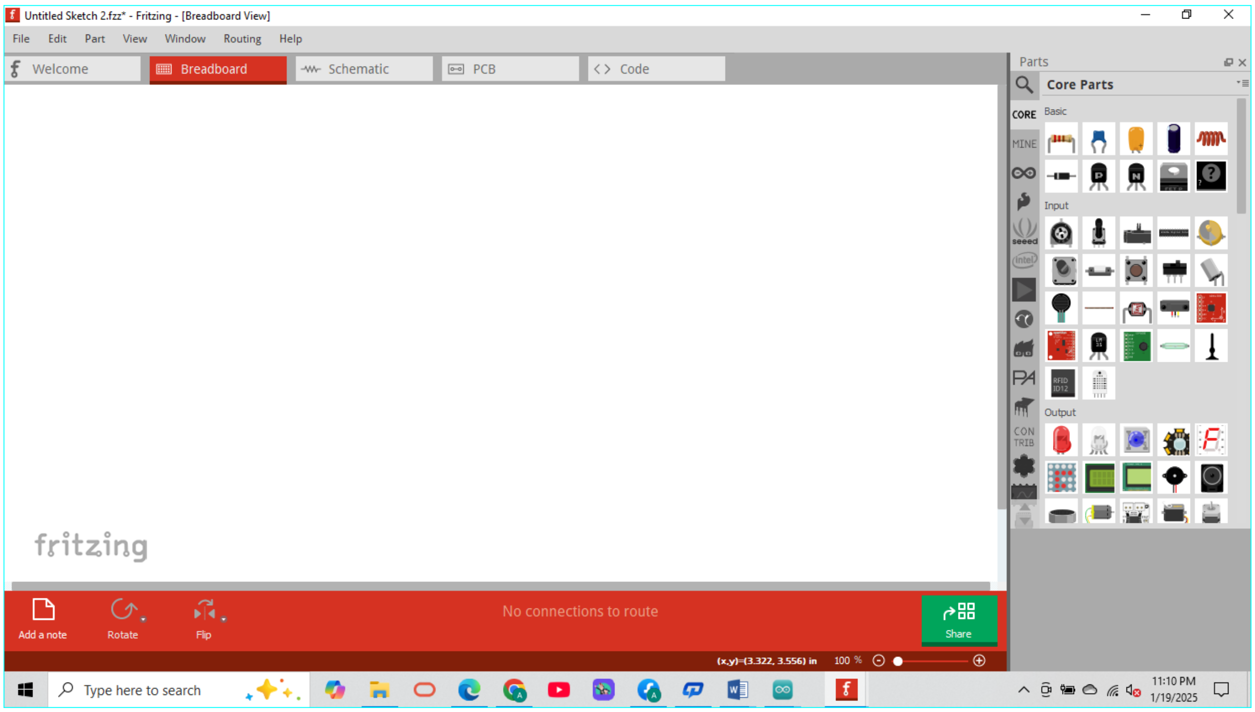

Figure 18: Fritzing

3. Development

3.1. Planning and Design

During planning and design stage, we researched about various IoT project but at the end we as a team decided to develop an automatic irrigation system for our IoT project. We decided to make this system for our project by addressing it as a solution for our country as agriculture is considered as the major pillar of Nepal's economy.

We listed necessary hardware and software components needed for our project. We also designed block diagram, system architecture, flowchart, circuit and schematic diagram which helped us to understand how data will flow in our system. After making various designs, we equally divided tasks for each team members to ensure efficient and timely execution of the project.

3.2. Resource Collection

In this step, we wrote a 'Letter of Approval' to the resource department of our college. This letter explained our project's requirement, specifically about getting necessary hardware devices and equipment required for the complete development of the system. We got the hardware devices such as Arduino UNO, DHT11, Liquid Crystal Display, soil moisture sensor, water pump, jumper wires, and so on from the college upon the approval of Shishir Subedi sir. Some devices such as resistor, battery were bought by team.

3.3. System Development

Phase 1:

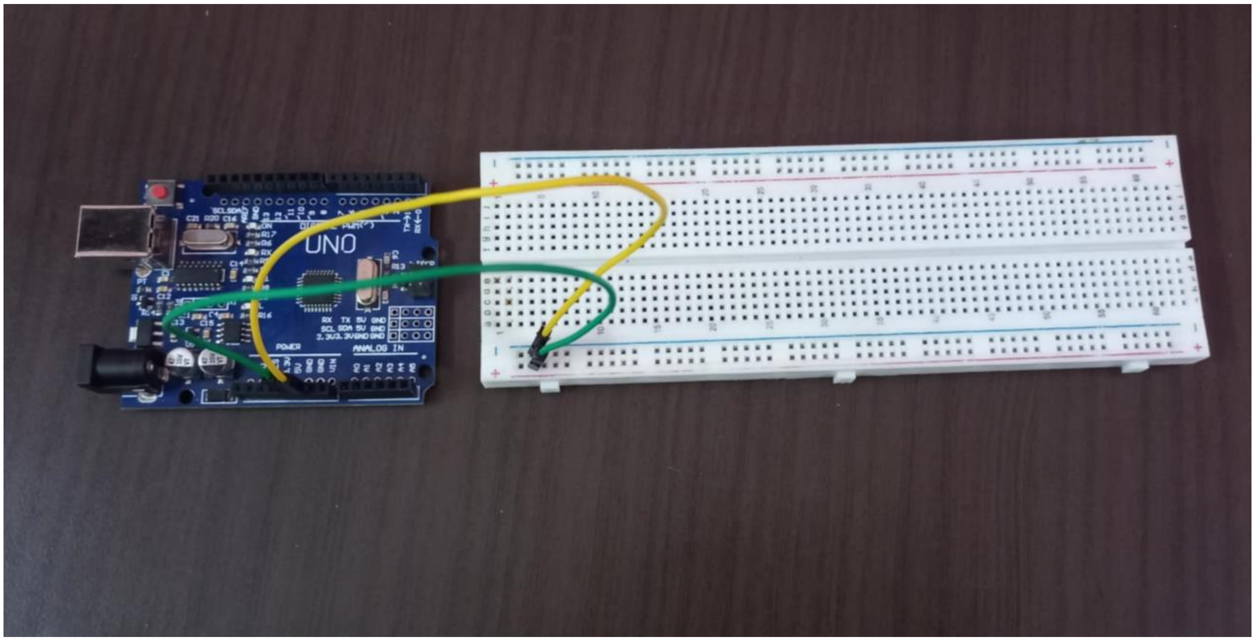

Figure 19: Connecting Arduino UNO and Breadboard

In the first phase of system development, the foundation of circuit is set up for the system by connecting Arduino to the breadboard. The connection of pins between Arduino UNO and breadboard is given below in table.

Arduino UNO	Breadboard
VCC	+ve rail
GND	-ve rail

Table 1: Wiring Instructions for Connecting Arduino UNO and Breadboard

Phase 2:

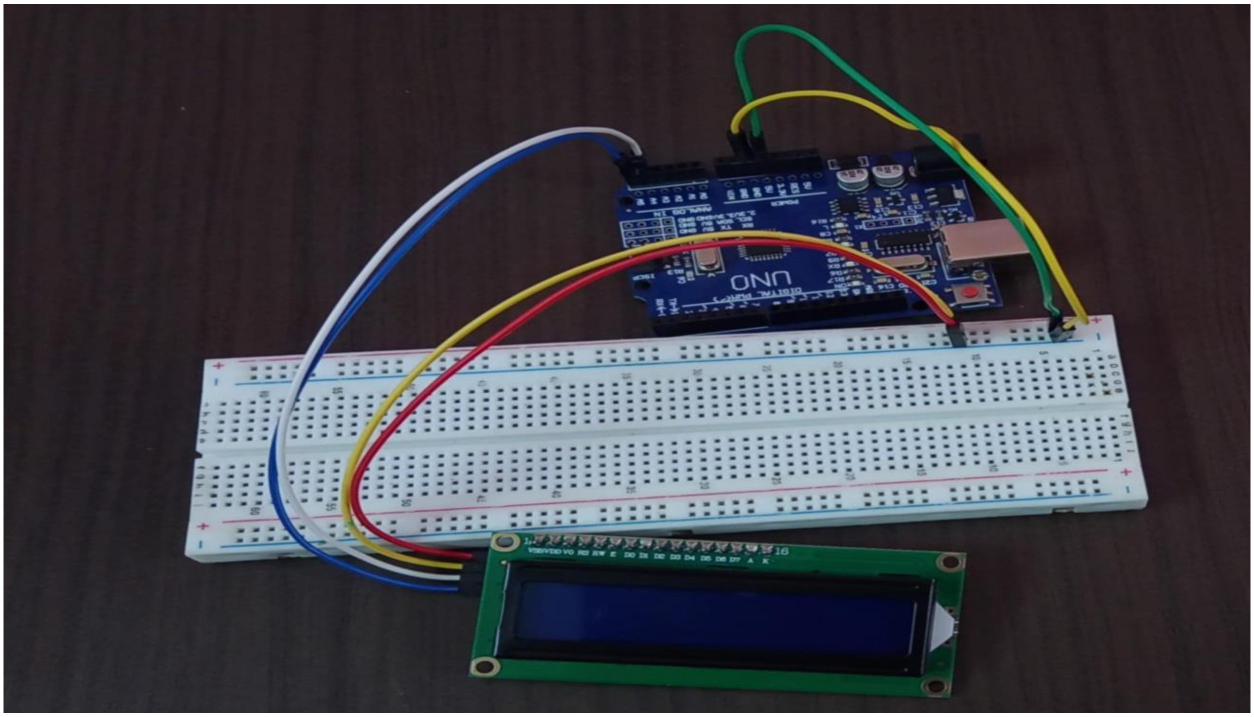

Figure 20: Connecting LCD to the Arduino UNO and Breadboard

In the second phase of system development, LCD is connected to Arduino and breadboard for displaying the level of moisture, temperature and humidity. The pins that we used to connect LCD to Arduino and breadboard are given below in table.

LCD	**Arduino UNO**
SDA	A4 pin
SCL	A5 pin

Table 2: Wiring Instructions for Connecting LCD to the Arduino UNO

LCD	Breadboard
VCC	+ve rail
GND	-ve rail

Table 3: Wiring Instructions for Connecting LCD to the Breadboard

Phase 3:

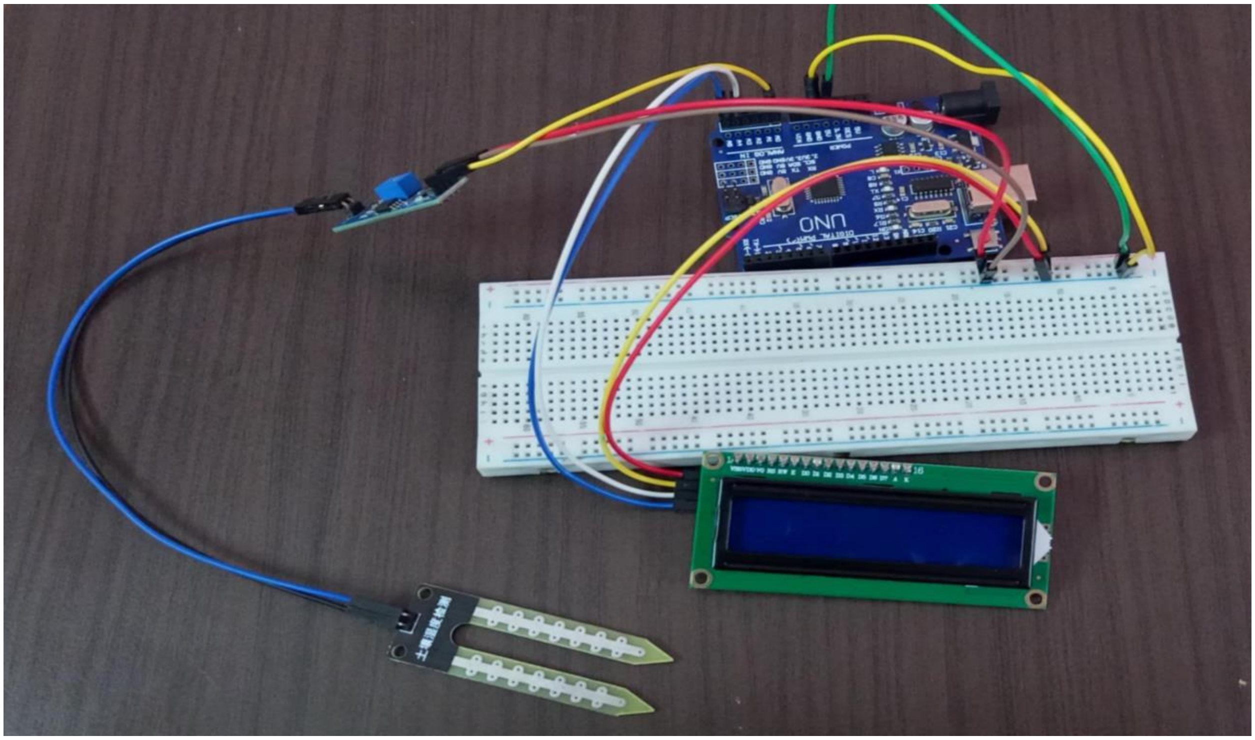

Figure 21: Connecting Soil Moisture Sensor to the Arduino UNO and Breadboard

In this phase, soil moisture sensor is connected to the system for tracking the moisture present in the soil. The connection of pins is shown in the table given below.

Soil Moisture Sensor	Breadboard
VCC	+ve rail
GND	-ve rail

Table 4: Wiring Instructions for Connecting Soil Sensor to the Breadboard

Soil Moisture Sensor	Arduino UNO
AO (Analog Output)	A0 pin

Table 5: Wiring Instruction for Connecting Soil Sensor to Arduino UNO

Phase 4:

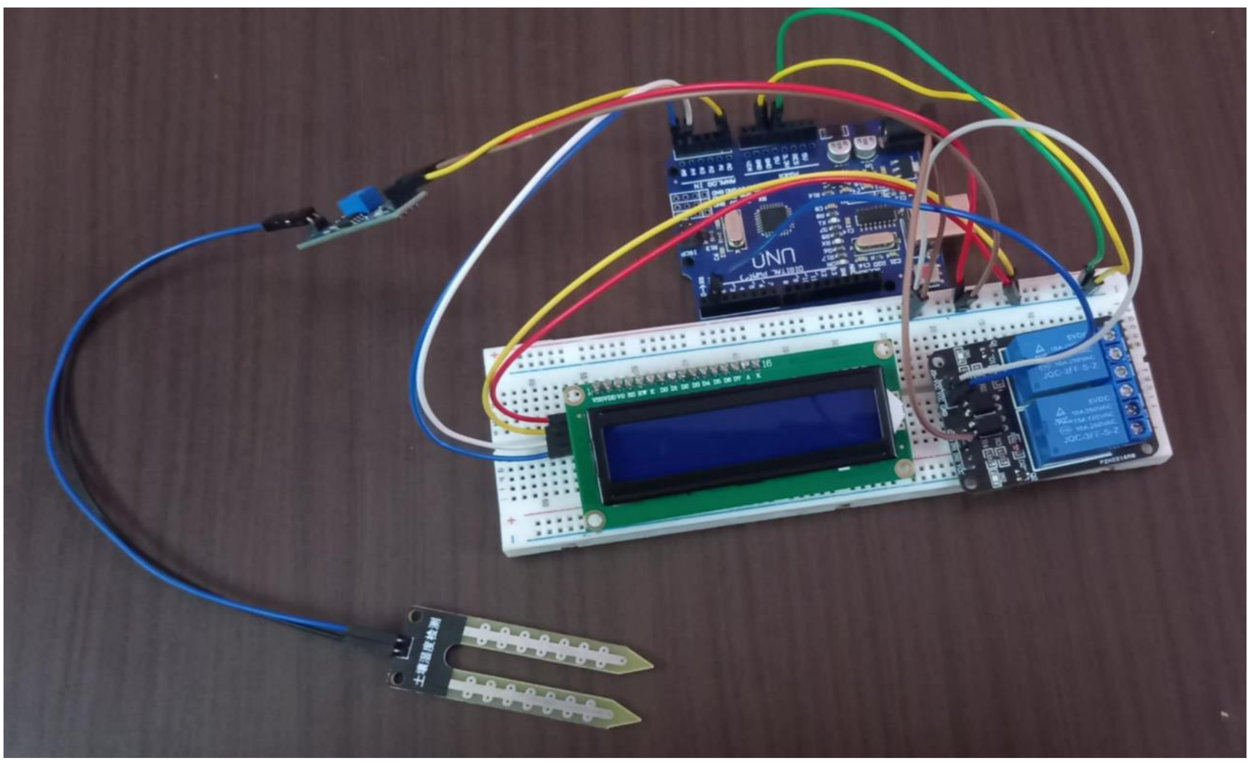

Figure 22: Connecting Relay to Arduino UNO and Breadboard

In this phase relay module is connected to the system. It acts as a switch which controls the water pump according to the moisture level. The connection of pins for relay module and other devices is given below in the table.

Relay Module	**Breadboard**
VCC	+ve rail
GND	-ve rail

Table 6: Wiring Instructions for Connecting Relay to the Breadboard

Relay Module	**Arduino UNO**
IN1 (Input pin 1)	Digital pin 2

Table 7: Wiring Instruction for Connecting Relay to the Arduino

Phase 5:

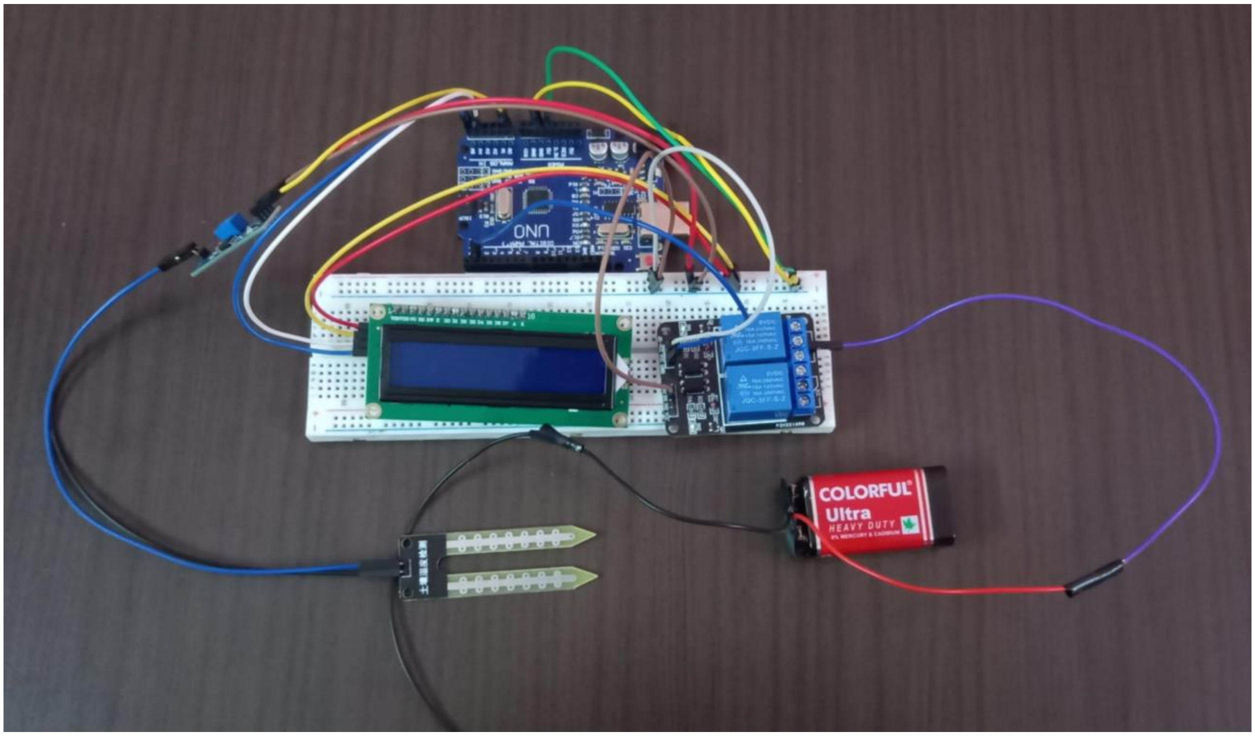

Figure 23: Connecting Battery to the Relay Module

In this phase, a power supply i.e. battery is connected to the relay module. The terminal of battery is connected to the COM pin of relay module.

Phase 6:

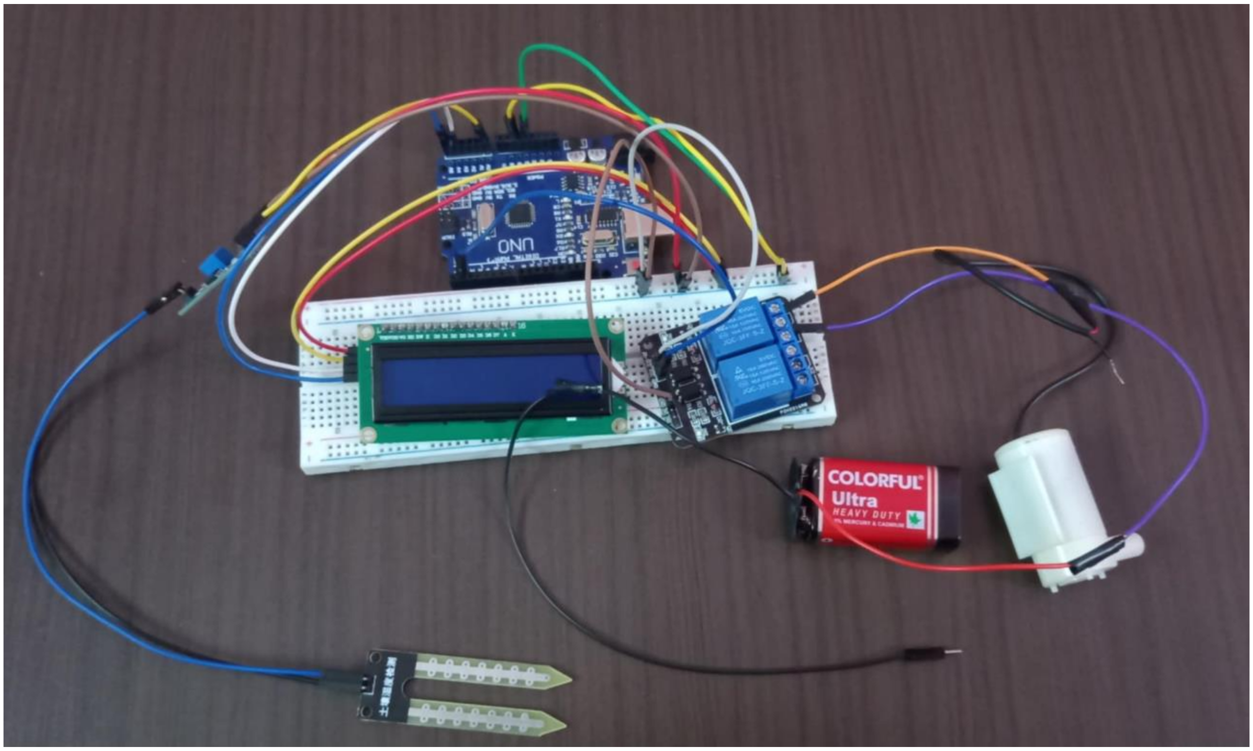

Figure 24: Connecting Water Pump to Battery and Relay

In this phase, water pump is connected to the relay module and battery. The battery supplies power to the water pump. The positive terminal of water pump is connected to the NO pin of relay module and the negative terminal of water pump is connected to the negative terminal of the battery.

Phase 7:

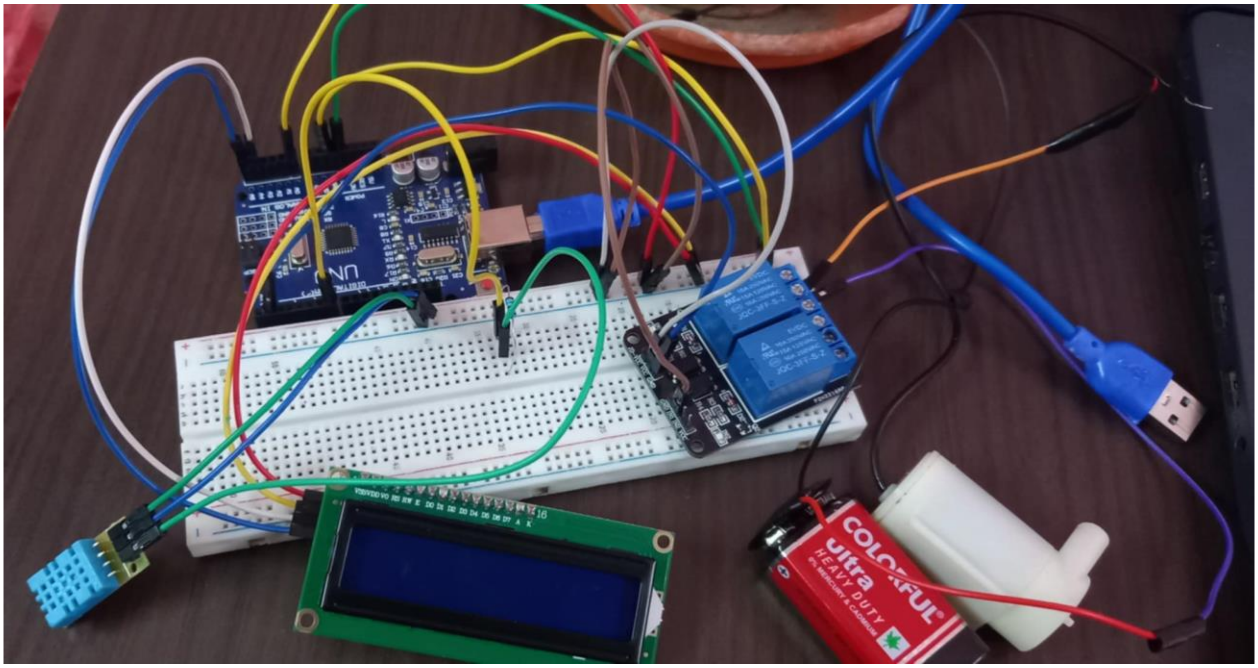

Figure 25: Connecting DHT11 Sensor and Resistor to the System

At the end of the system development, we connected DHT11 sensor and a 10K Ohm pull-up resistor. The digital pin 7 is connected to the one of the pin in the breadboard using jumper wire. The one end of resistor is connected to the +ve rail and the other end is connected to the digital pin 7 in the breadboard. The connection of DHT11 pins are given below in the table.

DHT11 Sensor	**Breadboard**
VCC	+ve rail
GND	-ve rail
Data pin	Digital pin 7

Table 8: Wiring Instructions for Connecting DHT11 Sensor to the Breadboard

4. Results and Findings

4.1. Results

After various planning, design and development process, we implemented an automated irrigation system for our IoT project. The system that we had developed monitors continuously the need of water by plants, and supply water precisely in proper time.

A moisture monitoring sensor monitors the soil conditions for identifying the water requirement of plants. Also, we had added temperature and humidity sensor for enhancing the system's performance. When the moisture content in soil drops below the threshold, the system activates the water pump to deliver the exact amount of water needed by plants ultimately reducing the water wastage and cost required for labour.

4.2. Findings

To ensure that the system works properly, we did the various tests. The tests that we did are given below.

4.2.1. Test 1: To test that the soil moisture sensor works properly

Objective	To test that the soil moisture sensor works properly.
Action	Soil moisture sensor was tested.
Expected Result	Soil moisture sensor should detect the value of moisture level present in the soil.
Actual Result	Soil moisture sensor detected the value of the moisture present in the soil.
Conclusion	Test was successful.

Table 9: Table for Test1

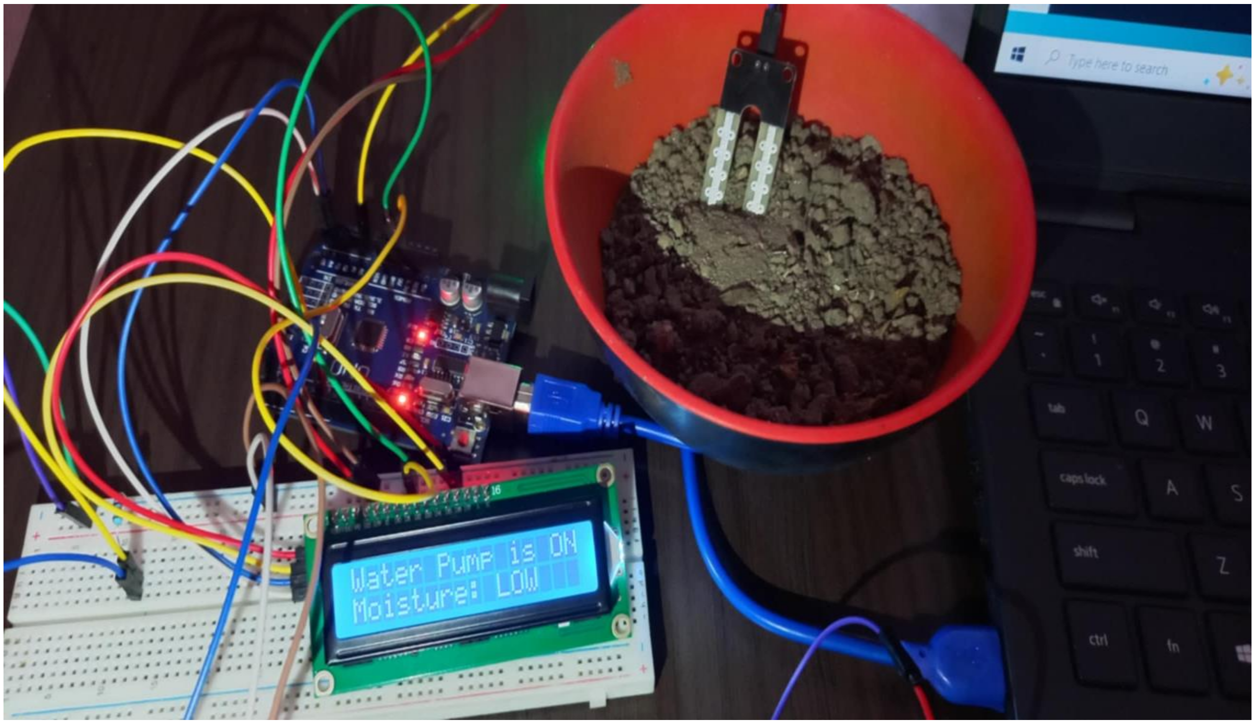

Figure 26: Soil Moisture Sensor Detecting Moisture When the Sensor is inside the Dry Soil

Figure 27: Soil Moisture Sensor Detecting Moisture When the Sensor is inside the Wet Soil

4.2.2. Test 2: To test that the DHT11 Sensor works properly

Objective	To test that the DHT11 Sensor works properly.
Action	DHT11 sensor was tested.
Expected Result	DHT11 sensor should detect the temperature and humidity level from the environment.
Actual Result	DHT11 sensor detected the level of temperature and humidity from the environment.
Conclusion	Test was successful.

Table 10: Table for Test 2

Figure 28: DHT11 Sensor detecting Temperature and Humidity Correctly

4.2.3. Test 3: To test that the LCD displays the information correctly

Objective	To test that the LCD displays the information correctly.
Action	LCD was tested whether it displays the information correctly or not.
Expected Result	LCD should show the information correctly.
Actual Result	LCD showed the information correctly.
Conclusion	Test was successful.

Table 11: Table for Test 3

Figure 29: LCD Displaying Temperature and Humidity Correctly

Figure 30: LCD Displaying Moisture Level Correctly

4.2.4. Test 4: To verify and upload the code to Arduino board

Objective	To verify and upload the code to Arduino board.
Action	Code was verified and uploaded.
Expected Result	Code should be verified and get uploaded without error to the Arduino board.
Actual Result	Code was correct and uploaded to the Arduino board without error.
Conclusion	Test was successful.

Table 12: Table for Test 4

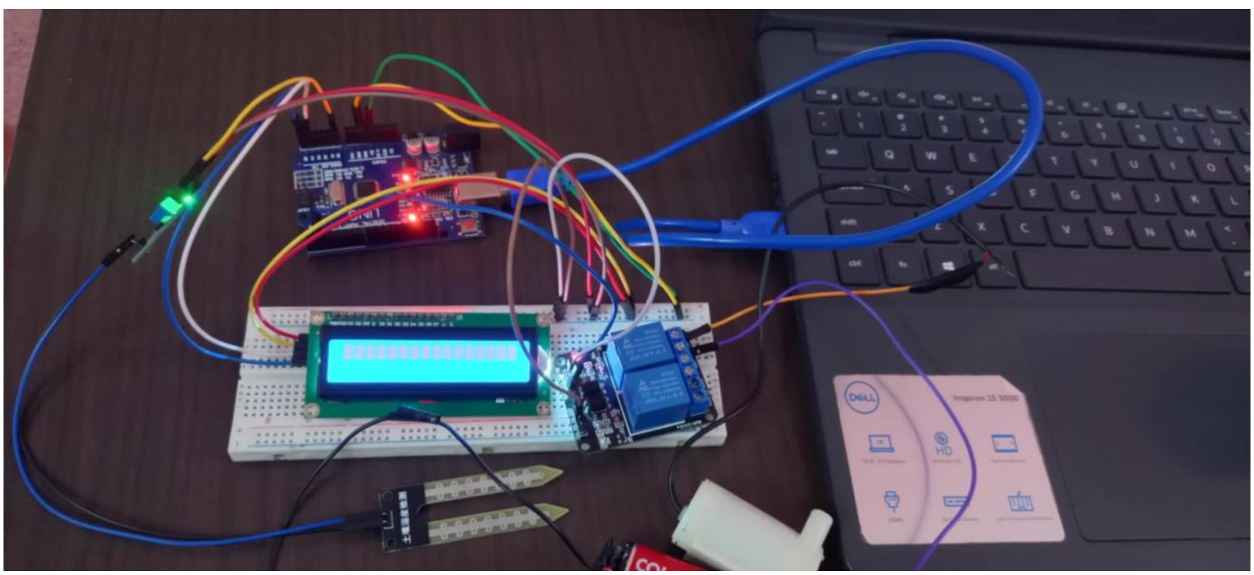

Figure 31: Connecting Arduino to Laptop for Uploading Code

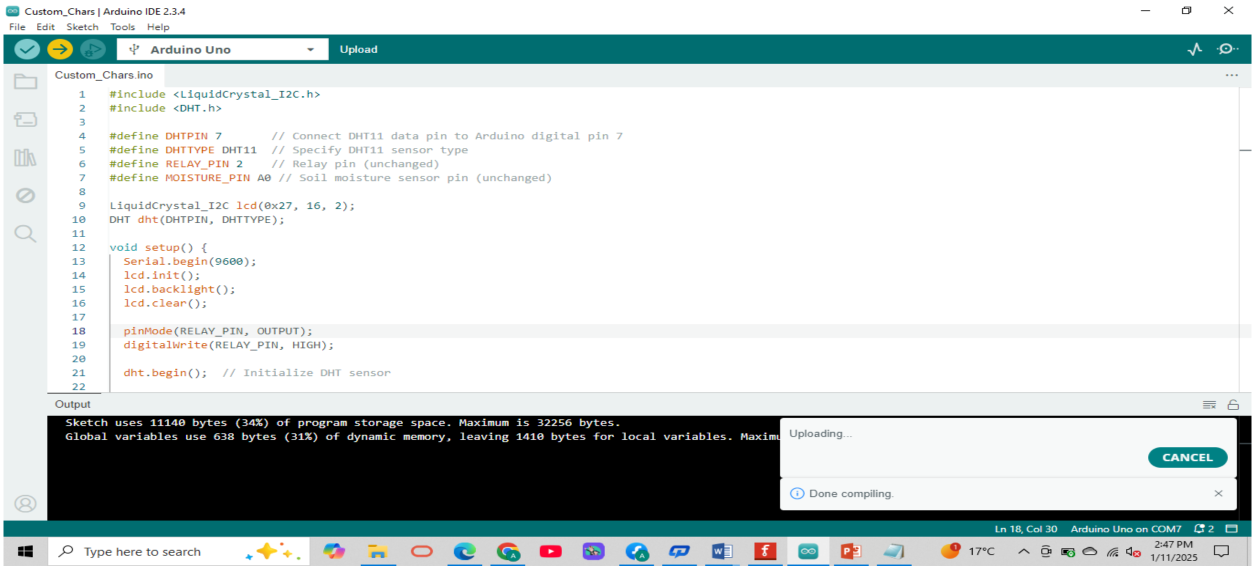

Figure 32: Verifying Code

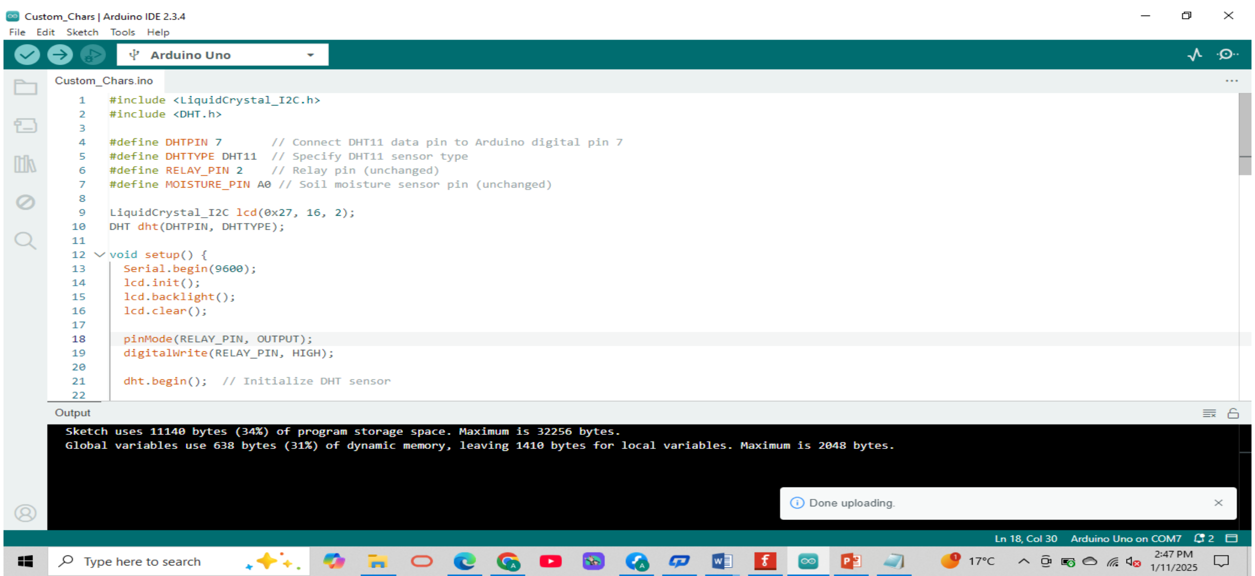

Figure 33: Uploading Code

4.2.5. Test 5: To test that the whole system works correctly

Objective	To test that the whole system works correctly.
Action	System was tested with all components.
Expected Result	Sensors should detect the data correctly, LCD should display the information correctly and water pump should run continuously when the moisture is low.
Actual Result	While individual sensors functioned correctly, when running simultaneously, the LCD occasionally displayed corrupted characters when switching between temperature/humidity and moisture readings. The water pump doesn't run continuously. This indicated a timing issue in the code when handling multiple sensor inputs.
Conclusion	Test was unsuccessful.

Table 13: Table for Test 5

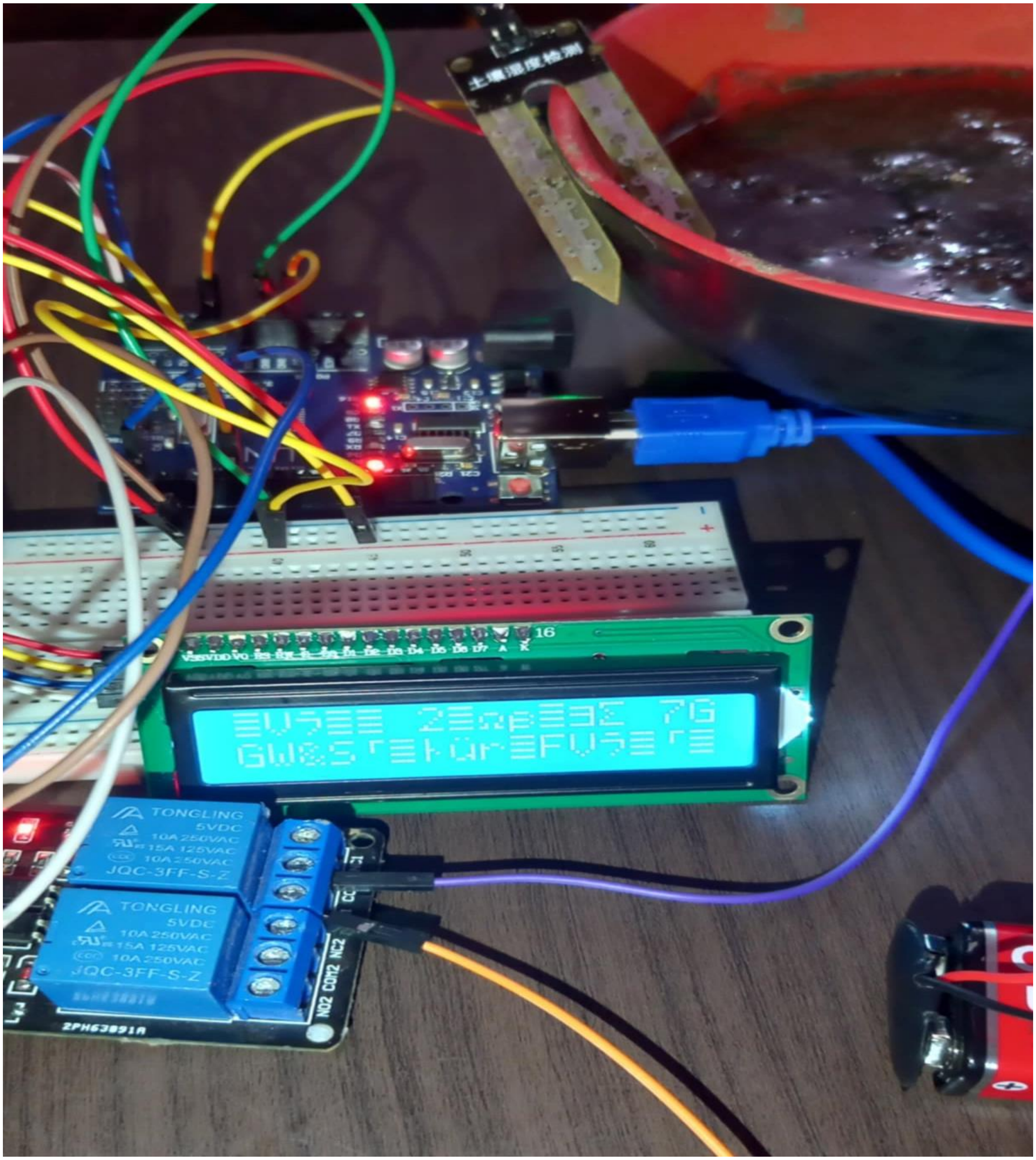

Figure 34: LCD Displaying Corrupted Information

5. Future Works

Nepal is a country blessed for agriculture, the irrigation system we made can significantly benefit the entire agriculture of our country, which is a key part of our economy. The system can be used in both small-scale farming and larger agricultural operations, especially in regions with limited water resources. We can use this in farms, green house or even our own plants we grow in a pot in our home. Since Nepal is a country blessed for agriculture, we can further enhance it by the irrigation system we made.

Addressing the water management challenges and improving productivity. It ensures efficient water usage by monitoring soil moisture and temperature and humidity sensors. The system's affordability makes it accessible for small-scale farmers as well. In rural and remote areas where electricity and resources are scarce, we can make the system solar-powered by adding a solar panel and batteries to make the irrigation system a sustainable and the perfect solution, which reduces dependency on unreliable power sources. We can add additional sensors such as pH sensors, EC (Electrical Conductivity) sensors, and light sensors for better and healthy soil and environmental monitoring.

6. Conclusion

In conclusion, we had successfully designed, developed and implemented the automatic irrigation system for our IoT project. The system that we had developed is specially used in agriculture. As the name of the project is automatic irrigation system, this system helps to automatically irrigate the plants that are in need of water by detecting the moisture level present in the soil which will significantly help in water management by reducing the wastage of water.

While doing this project we faced difficulties in various stages but, in the end we as a team manage to tackle all the hindrances. This IoT project not only enhanced our knowledge about IoT technology but, also developed the communication, critical thinking and teamwork skills. In overall, we have learned numerous things from this project and are grateful for the chance to be involved in such an important project.

7. References

Anon., 2019. *Flyrobo.* [Online] Available at: https://www.flyrobo.in/blog/what-is-arduino-uno?srsltid=AfmBOoorNWJNkw6nTTNDn8Ax8EMvDor_dnbNfuCUWq4vmKX9ErZNOS26

Anon., 2019. *TechTarget.* [Online] Available at: https://www.techtarget.com/whatis/definition/LCD-liquid-crystal-display#:~:text=LCD%20(Liquid%20Crystal%20Display)%20is,computer%20monitors%20and%20instrument%20panels.

Anon., n.d. *Javatpoint.* [Online] Available at: https://www.javatpoint.com/breadboard

Hemmings, M., 2018. *Sparkfuneducation.* [Online] Available at: https://blog.sparkfuneducation.com/what-is-jumper-wire

Kapoor, R., 2023. *KUNKUNE.* [Online] Available at: https://kunkune.co.uk/blog/understanding-the-basics-what-is-a-relay-module/
[Accessed 12 January 2025].

Pradhan, M., 2023. *Nepal Economic Forum.* [Online] Available at: https://nepaleconomicforum.org/nepals-agricultural-landscape-accessing-the-governments-stance/
[Accessed 1 December 2024].

Sparkfun, 2025. *https://learn.sparkfun.com/tutorials/how-to-use-a-breadboard/all.* s.l.:s.n.

Store, 2025. *Arduino Uno Rev3.* [Online] Available at: https://store.arduino.cc/products/arduino-uno-rev3
[Accessed 12 January 2025].

TechTarget, 2025. *TechTarget.* [Online] Available at: https://www.techtarget.com/whatis/definition/LCD-liquid-crystal-display
[Accessed 12 January 2025].

Vovyopump, 2024. *Vovyopump.* [Online] Available at: https://www.vovyopump.com/battery-powered-water-pump/
[Accessed 12 January 2025].

8. Appendix

8.1. Appendix A: Individual Contribution Plan

Student Name	Role	Contribution
Aakriti Chaudhary	**Proposal:** Introduction, Individual Contribution Plan **System Development Report:** Introduction, Background (System Overview, Design Diagrams), Development (System Development), Results and Findings (Findings) **Application Implementation:** Devices Connection **Presentation:** System Demonstration	25%
Akshat Raj Dali	**Proposal:** Expected Outcomes and Deliverables **System Development Report:** Background (Design Diagrams, Requirement Analysis), Development(Planning and Design), Future Works **Application Implementation:** Tested Connection of Devices **Presentation:** Aim and Objectives of the project	25%

Nischal Man Shrestha	**Proposal:** Aim and Objectives, Conclusion **System Development Report:** Aim and Objectives, Results and Findings (Results), Conclusion **Application Implementation:** Write Code **Presentation:** Introduction to the System	25%
Nobel Kumar Aryal	**Proposal:** Requirement Analysis **System Development Report:** Background (Requirement Analysis), Development (Resource Collection) **Application Implementation:** Tested code **Presentation:** Work Breakdown Structure, Conclusion	25%

Table 14: Individual Contribution Plan Table

8.2. Appendix B: Requirement Analysis

- **Arduino UNO**

The Arduino Uno is a user-friendly, open-source microcontroller board built around the ATmega328P processor. It’s designed to make working with electronics accessible and fun for beginners and professionals alike. The board features 14 digital input/output pins (6 of which can also function as PWM outputs), 6 analog input pins for reading sensor data, a USB port for programming and power, and a convenient power jack for external power supplies.

Go Back To Arduino UNO

- **Liquid Crystal Display (LCD)**

An LCD (Liquid Crystal Display) is a flat-panel display technology that operates using liquid crystals as its core mechanism. These displays have a wide range of applications for both consumers and businesses, frequently appearing in devices such as smartphones, televisions, computer screens, and instrument panels.

Go Back To LCD

- **Breadboard**

A breadboard is a handy tool for electronics projects. It’s a white, rectangular board with tiny holes that let you easily plug in and connect electronic components without soldering. Think of it as a reusable platform for building and testing circuits, perfect for prototyping and experimenting with new ideas.

Go Back To Breadboard

- **Resistor**

  A resistor is an electronic component designed to restrict or control the flow of electrical current within a circuit. It can also be used to supply a specific voltage to an active device, like a transistor.

  Go Back To Resistor

- **Jumper Wires**

  Jumper wires are simple, flexible wires with connector pins on each end, making it easy to link two points in a circuit without the hassle of soldering. They’re a go-to tool for working with breadboards and other prototyping setups, allowing you to quickly tweak and adjust your circuits as you experiment and build.

  Go Back To Jumper Wires

8.3. Appendix C: Source Code

```
#include <LiquidCrystal_I2C.h>

#include <DHT.h>


#define DHTPIN 7       // Connect DHT11 data pin to Arduino digital pin 7

#define DHTTYPE DHT11  // Specify DHT11 sensor type

#define RELAY_PIN 2    // Relay pin (unchanged)

#define MOISTURE_PIN A0 // Soil moisture sensor pin (unchanged)


LiquidCrystal_I2C lcd(0x27, 16, 2);

DHT dht(DHTPIN, DHTTYPE);


void setup() {

  Serial.begin(9600);

  lcd.init();

  lcd.backlight();

  lcd.clear();


  pinMode(RELAY_PIN, OUTPUT);

  digitalWrite(RELAY_PIN, HIGH);


  dht.begin();  // Initialize DHT sensor
```

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

void loop() {
  // Read sensors
  int soilMoisture = analogRead(MOISTURE_PIN);
  float humidity = dht.readHumidity();
  float temperature = dht.readTemperature();

  // Print sensor values to Serial Monitor
  Serial.println("Soil Moisture: " + String(soilMoisture));
  Serial.println("Temperature: " + String(temperature) + "°C");
  Serial.println("Humidity: " + String(humidity) + "%");

  // Control water pump based on soil moisture
  if (soilMoisture > 950) {
    digitalWrite(RELAY_PIN, LOW);
```

```
  lcd.setCursor(0, 0);
  lcd.print("Water Pump is ON ");
} else {
  digitalWrite(RELAY_PIN, HIGH);
  lcd.setCursor(0, 0);
  lcd.print("Water Pump is OFF");
}

// Display moisture level
if (soilMoisture < 300) {
  lcd.setCursor(0, 1);
  lcd.print("Moisture: HIGH");
} else if (soilMoisture > 300 && soilMoisture < 950) {
  lcd.setCursor(0, 1);
  lcd.print("Moisture: MID ");
} else if (soilMoisture > 950) {
  lcd.setCursor(0, 1);
  lcd.print("Moisture: LOW ");
}

// Display temperature and humidity every 5 seconds
delay(5000);
lcd.clear();
```

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

  lcd.setCursor(0, 1);
  lcd.print("Humidity: ");
  lcd.print(humidity, 0);
  lcd.print("%");

  delay(3000);
  lcd.clear();
}
```