INTERNET OF THINGS LAB

(CASE STUDY)

"SMART WATERING OF PLANTS"

BACHELOR OF TECHNOLOGY IN INFORMATION TECHNOLOGY

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ACKNOWLEDGEMENT

With great pleasure we want to take this opportunity to express our heartfelt gratitude to all the people who helped in learning this course**.**

On successful completion of our **Internet of Things (IOT) LAB**, we are bound to convey our sincere thanks to **"Mrs. A. Surekha"** for giving support and guidance with valuable during learning days

Submitted To

Mrs.A. Surekha

Date: 15/04/2024 (InformationTechnology)

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CERTIFICATE

This is to certify that the project report entitles "**SMART WATERING OF PLANTS"** submitted by in partial fulfillment of the requirements for the award of the degree of bachelor of Technology in Information Technology of Anil Neerukonda Institute of technology and sciences, Visakhapatnam is a record of bonafide work carried out under my guidance and supervision.

Project Guide	**Head of the department**
Mrs. A.Surekha	**Dr. M. Rekha Sundari**
Assistant Professor	Professor
Department of IT	Department of IT
ANITS	ANITS

DECLARATION

We hereby declare that the project work entitled "**SMART WATERING OF PLANTS"** submitted to Anil Neerukonda Institute of Technology and Sciences is a record of an original work done by **M.Sanjay (A21126511106) ,M. Sai Varshitha(A21126511107) , P. Ruthvika (A21126511114), P. Gyana Sreeja(A21126511115), N. Brahmanandreddy(A21126511210)** under the esteemed guidance of **Mrs. A. Surekha** Assistant Professor of Information Technology , Anil Neerukonda Institute of Technology and Sciences and this project work is submitted in partial fulfillment of the requirements for the award of degree bachelor of technology in information technology . This entire project is done to the best of our knowledge and not submitted for the award of other degree in any other universities.

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SMART WATERING OF PLANTS

ABSTRACT

This is an innovative Internet of Things (IoT) project focused on Smart watering of plants involves utilizing technology to optimize the watering process, ensuring that plants receive the right amount of water at the right time.

Smart watering of plants refers to the use of technology and data-driven methods to optimize the watering process for plants, ensuring they receive the right amount of water at the right time. This approach typically involves the integration of sensors, automated systems, and data analysis to monitor environmental conditions and plant health, adjust watering schedules accordingly, and minimize water waste.

Smart watering systems utilize various sensors to collect data about environmental factors that affect plant hydration. Many smart watering systems offer remote monitoring and control capabilities, allowing users to access and adjust watering schedules from anywhere using smartphones or computers. This feature provides convenience and flexibility, especially for users with busy schedules or those who travel frequently.

By delivering water only when necessary and in the right amounts, smart watering systems help conserve water resources. This is particularly important in regions facing water scarcity or drought conditions.

Overall, smart watering of plants combines technology and ecological principles to promote efficient water use, healthy plant growth, and environmental sustainability. It is increasingly being adopted in various settings, including home gardens, commercial farms, and urban landscapes, to optimize plant care and minimize water wastage.

1. INTRODUCTION

In an era where technology permeates nearly every aspect of our lives, even the age-old practice of watering plants has undergone a transformation. Traditional methods of watering, often reliant on human observation and manual labor, are giving way to a more sophisticated approach: smart watering of plants. This emerging trend harnesses the power of technology to optimize plant hydration, conserve water resources, and promote healthier plant growth.

Smart watering systems represent a fusion of innovation and ecology, utilizing a combination of sensors, data analysis, and automation to tailor watering schedules to the precise needs of individual plants. By leveraging real-time environmental data, these systems ensure that plants receive the optimal amount of water at the right time, mitigating the risk of overwatering or underwatering that can lead to stunted growth or even plant mortality.

Moreover, the convenience and accessibility offered by smart watering technology are revolutionizing the way we interact with our gardens and landscapes. Remote monitoring and control capabilities enable users to manage watering schedules from anywhere, whether it's through a smartphone app or voice commands to a smart home assistant. This flexibility empowers gardeners with greater control over their plants' well-being, regardless of their location or schedule constraints.

1.1 OBJECTIVE:

The objective of this project is to design and implement a smart watering of plants that aims to minimize water wastage by delivering water precisely when and where it is needed. By leveraging sensors and data analysis, the system ensures that plants receive adequate hydration without overwatering, thereby conserving water resources and mitigating the risk of drought.

1.2 IOT Definition:

IoT stands for the Internet of Things. It refers to a network of physical devices, vehicles, appliances, and other objects embedded with sensors, software, and connectivity capabilities that enable them to connect and exchange data over the internet. In simple terms, IoT is the concept of connecting everyday objects and enabling them to communicate and interact with each other, as well as with users, through the internet.

The fundamental idea behind IoT is to bridge the gap between the physical and digital worlds, allowing objects to collect and share data, perform tasks autonomously, and provide enhanced functionality and convenience to users. These objects, often referred to as "smart" devices, can range from small sensors and wearable devices to larger systems like smart homes, industrial machinery, and even entire cities

2. SYSTEM SPECIFICATIONS

2.1 Functional Requirements:

Functional requirements for a smart watering of plants IoT project aimed at minimize water wastage by delivering water precisely when and where it is needed can include the following:

1. **Soil Moisture Detection:**

- The smart watering of plants should incorporate soil moisture sensors to detect moisture level in the soil.
- The system should provide real-time moisture level, so the if soil is dry watering starts other wise watering stops.

2.Water Pumping:

- The water pump should be activated when the soil moisture level falls below a certain threshold, indicating that the soil is dry and needs watering.
- If the soil moisture level is below the threshold (moistureLevel < moistureThreshold), the system considers the soil to be dry and prints a message indicating that it's watering the plants.

3.Relay Module:

- In a smart watering system for plants, the relay module serves as a crucial component for controlling the water pump based on signals from the Arduino and sensor data. Here's how the relay module contributes to the functionality of the system:

- The relay module plays a crucial role in the smart watering system by providing the necessary interface between the Arduino and the water pump, ensuring safe and reliable operation of the system while automating the watering process based on plant needs.

2.2 Non Functional Requirements:

Non-functional requirements for a smart shoes IoT project aimed at assisting blind and deaf individuals can include the following:

1. **Accessibility:**

- The smart watering of plants should be designed with consideration for accessibility standards, ensuring that they are usable by farmers for cultivation.
- The user interface and controls should be intuitive, easy to understand, and operate without requiring complex gestures or interactions.

2. **Reliability and Safety:**

- The smart watering of plants should be reliable, operating consistently and accurately in various environments and conditions.
- The system should have built-in fail-safe mechanisms to handle potential failures or errors, ensuring user safety at all times.

3. **User Experience:**

- The smart watering of plants should provide a positive user experience, ensuring that the system is intuitive, responsive, and easy to use.
- The companion mobile application or user interface should be user friendly and accessible, catering to the needs and preferences of farmers.

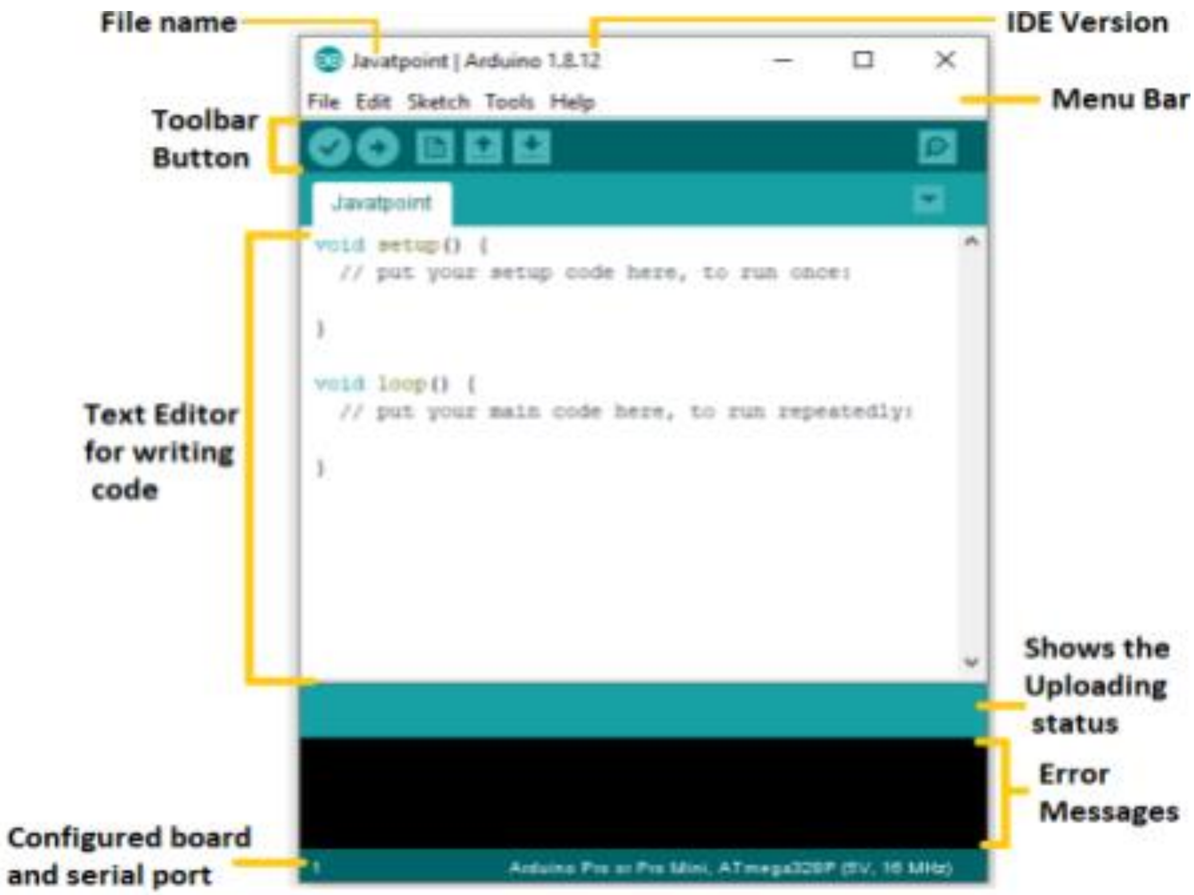
4. **Maintenance and Support:**

- The smart watering of plants should have a well-defined maintenance plan, including software updates, bug fixes, and user support channels.
- Adequate documentation and resources should be provided to assist users in troubleshooting issues and getting the most out of the smart watering of plants.

3. SYSTEM SOFTWARE

3.1 Arduino IDE:

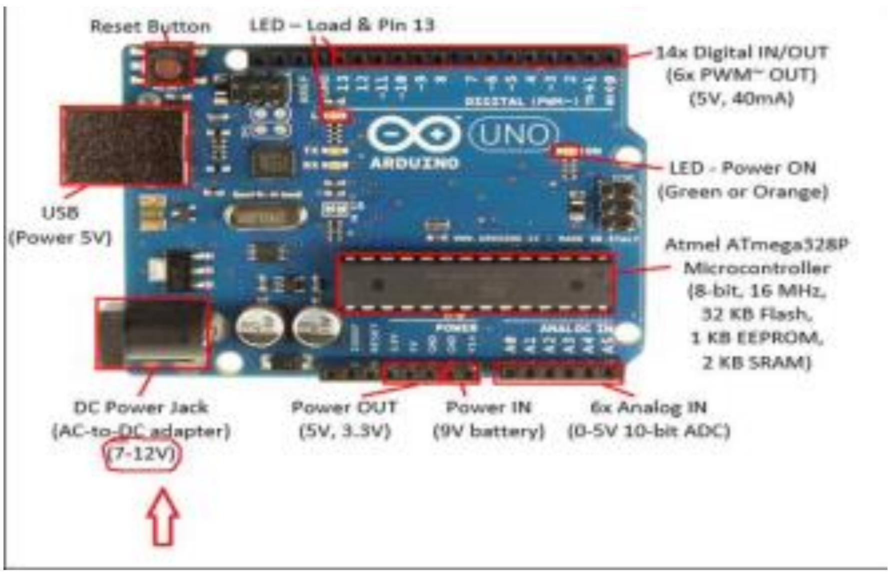
The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.



4. SYSTEM HARDWARE

4.1 Arduino Board:

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board



4.2 Relay Module :

The relay module plays a crucial role in the smart watering system by providing the necessary interface between the Arduino and the water pump, ensuring safe and reliable operation of the system while automating the watering process based on plant needs.

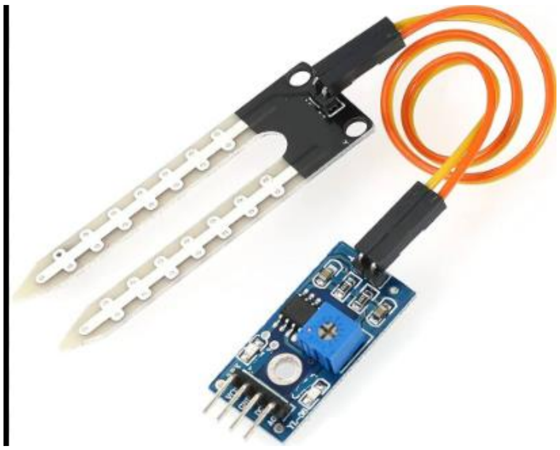
4.3 Jumper Cables:

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed

4.4 Water Pump

The purpose of a water pump in a smart watering system for plants is to deliver water to the plants when needed, based on the soil moisture level detected by sensors.

4.5 Soil Moisture sensor



soil moisture sensors play a vital role in smart watering systems by providing essential data for optimizing watering schedules, conserving water, promoting plant health, and automating the watering process, thereby ensuring efficient and effective irrigation practices for plants.

4.6 Water Tube:

Water tubes, also known as irrigation or watering tubes, are used to transport water from a water source to the plants in a garden or landscape. They serve as conduits through which water flows to reach the root zones of plants.

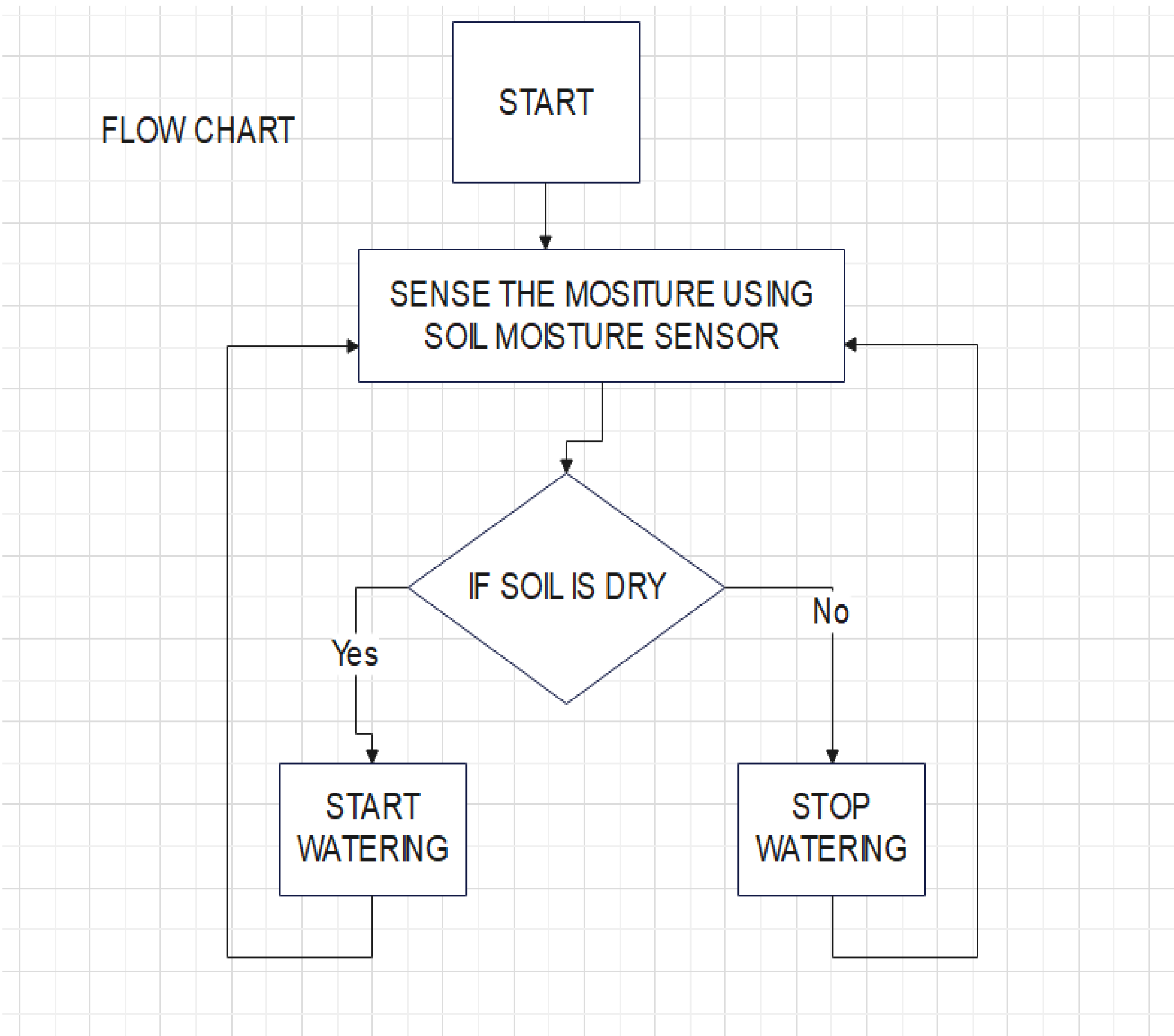
4.7 9v Battery:

A 9V battery provides a portable power source for the smart watering system, allowing it to be used in locations where mains power is unavailable or impractical. This is especially useful for outdoor applications such as garden beds, lawns, or remote areas where access to power outlets may be limited.

In case of power outages or interruptions, a 9V battery can serve as a backup power source to ensure continuous operation of the smart watering system. This helps prevent disruptions to the watering schedule and ensures that the plants receive water when needed, even during unexpected events.

Using a battery eliminates the need for a complex wiring setup or reliance on external power sources. It simplifies the installation process and makes the smart watering system more user-friendly, allowing for quick and hassle-free setup.

5. FLOWCHART


FLOW CHART
START
SENSE THE MOSITURE USING SOIL MOISTURE SENSOR
IF SOIL IS DRY
Yes
No
START WATERING
STOP WATERING

6. METHODOLOGY

6.1 Description of the Methodology:

The methodology of a smart watering system involves several key steps to efficiently water plants based on their specific needs while conserving water resources. Here's a generalized methodology for implementing a smart watering system:

Identify the optimal placement for soil moisture sensors within the garden or plant beds. Sensors should be positioned to accurately measure soil moisture levels in representative areas.

Calibrate the soil moisture sensors to establish baseline readings corresponding to different moisture levels in the soil. This calibration helps determine when watering is needed based on the sensor readings.

Continuously monitor soil moisture levels using the soil moisture sensors. Collect sensor data at regular intervals (e.g., every hour) to track changes in soil moisture over time. Analyze the sensor data to determine trends and patterns in soil moisture levels. Identify thresholds indicating when soil moisture falls below or rises above optimal levels for plant growth.

Consider factors such as plant type, soil type, environmental conditions (e.g., temperature, humidity), and historical watering patterns when designing the control logic. Implement the watering strategy based on the decision-making algorithms. Use microcontrollers (e.g., Arduino) to automate the watering process and control water delivery to plants.

Activate water pumps or irrigation systems to deliver water to plants when soil moisture levels fall below the predefined threshold. Ensure precise control over the amount and duration of watering to avoid overwatering or underwatering.

6.2 Overall flow of project:

Step-1: Gather Components:

Collect the necessary components for the project, including:

Arduino board (e.g., Arduino Uno)

Soil moisture sensor

Relay module

Water pump

Water tubing (optional)

Power source (e.g., 9V battery or DC power adapter)

Jumper wires

Breadboard (optional)

Step-2: Setup Arduino Environment,Write Arduino Code,Connect Components.

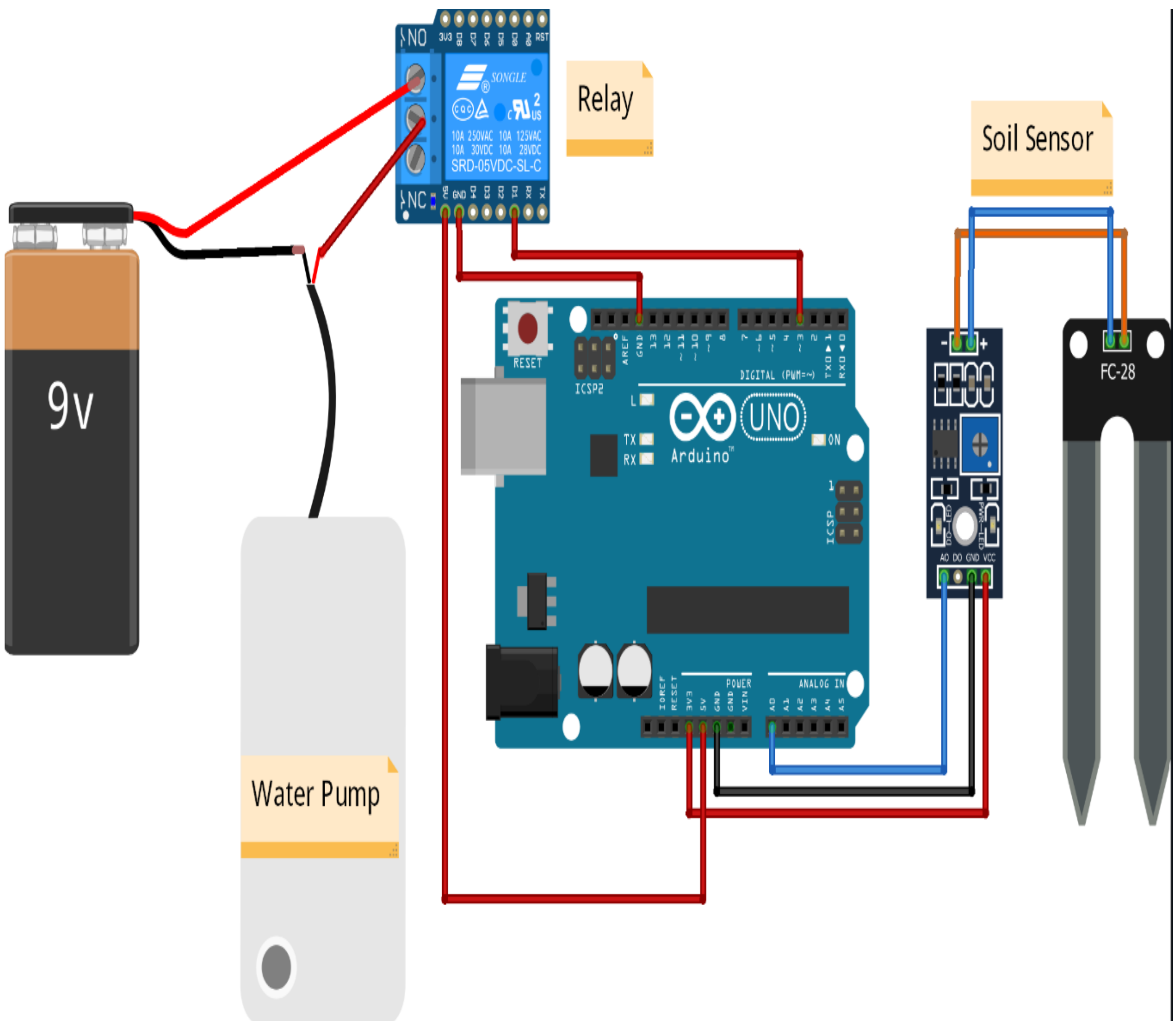
Step-3: Power on the Arduino and observe the system's behavior.

Check that the soil moisture sensor readings are accurate and respond to changes in soil moisture levels.

Test the relay module's functionality by activating and deactivating the water pump as intended.

Ensure that the watering thresholds and durations are appropriate for the plants' needs.

6.3 Environmental Setup



7. IMPLEMENTATION

7.1 Code:

```
int relayPin = 4;

int sensor_pin = A0;

 int output_value;


void setup()


{ Serial.begin(9600);

 pinMode(relayPin, OUTPUT);

  pinMode(sensor_pin, INPUT);

  Serial.println ("Reading From the Sensor...");

  delay(2000);

  }


void loop()


{ output_value = analogRead(sensor_pin);

 output_value =map (output_value, 550, 10, 0, 100);

  Serial.print ("Moisture: ");

   Serial.print (output_value);
```

```
  Serial.println("%");
   if (output_value <20 )
   { digitalWrite (relayPin, LOW);

}

else
 { digitalWrite (relayPin, HIGH) ;}

delay (1000);
}
```

7.2 Compilation Step

9. CONCLUSION

In conclusion, the experiment to create a smart watering system using Arduino demonstrates the potential for technology to enhance traditional gardening practices by automating the watering process based on real-time soil moisture data. By integrating components such as soil moisture sensors, relay modules, and water pumps, we have developed a system capable of monitoring soil moisture levels and delivering water to plants when needed.

Through the implementation of Arduino code and circuit connections, we have successfully automated the watering process, allowing for precise control over watering schedules and promoting efficient water usage. By leveraging the capabilities of Arduino and sensor technology, we have created a system that optimizes plant health and growth while conserving water resources.

Moving forward, further optimizations and enhancements can be made to the system, such as integrating additional sensors for environmental monitoring, implementing wireless communication for remote control and monitoring, or incorporating data logging for long-term analysis. Additionally, ongoing monitoring and maintenance will be essential to ensure the continued effectiveness and reliability of the smart watering system in real-world applications.

Overall, the experiment demonstrates the potential of smart technologies to revolutionize traditional gardening practices, offering a scalable and adaptable solution for automating plant care and promoting sustainable gardening practices.

10. FUTURE SCOPE

The future scope of smart watering systems using Arduino and similar technologies is promising and opens up several possibilities for further development and innovation. Here are some potential future directions for advancement:

Integration with IoT Platforms: Integration with Internet of Things (IoT) platforms could enable remote monitoring and control of smart watering systems via smartphones, tablets, or computers. Users could receive real-time alerts, access historical data, and adjust watering schedules from anywhere with an internet connection.

Machine Learning and Predictive Analytics: Incorporating machine learning algorithms and predictive analytics could enhance the intelligence of smart watering systems. By analyzing historical data on soil moisture, weather patterns, and plant growth, the system could learn and adapt its watering strategies over time to optimize plant health and water usage.

Sensing and Feedback Mechanisms: Integrating additional sensors, such as temperature sensors, humidity sensors, or light sensors, could provide more comprehensive environmental data for plant care. Feedback mechanisms, such as cameras or image recognition, could also be implemented to visually assess plant health and growth.

11.REFERENCES

1) https://youtu.be/wpia3aZ0-Co?si=9KuupEX0fDxlkwdN