RAJALAKSHMI
ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

25 years OF ACADEMIC EXCELLENCE

Department of Computer Science and Engineering

IT23A31-IOT

SMART GARDENING SYSTEM

SIVA BHARATHI K – 230701317
SOWBARNIGAA SRIDHARAN - 230701327

Abstract

This project applies Internet of Things to the garden irrigation system, by remotely controlling water pump and monitoring soil moisture in the garden.

Using the application of the Internet of Things, the garden owners can measure and detect soil moisture in their plantations. The water supply inside the garden is connected to water pump that will be activated when the soil moisture sensor detects low moisture level, and will be automatically adjust the moisture parameter on its optimum number. In addition, the owner of the garden can monitor the condition of soil moisture through web dashboard.

This helps in providing the appropriate amount of water for plants so reduces situations like mud cracks, water logging, etc. This helps in irrigating the garden even during night time, so it does not require the gardener to water the plants unlike the conventional methods.

Introduction

Modern advancements in agricultural and gardening technologies have led to the creation of smart watering systems that adapt irrigation strategies based on different soil types. Each soil-whether sandy, clayey, loamy, or silty-has unique water retention and drainage characteristics, which significantly affect how plants absorb moisture. Smart irrigation systems equipped with soil sensors can identify the specific properties of the soil and adjust watering schedules accordingly .For instances, sandy soils drain quickly and may require more frequent watering, while clay soils retain water longer and benefit from less frequent irrigation. By analyzing real-time moisture data and soil composition, these systems ensure that plants receive the optimal amount of water based on the soil type, reducing waste, preventing overwatering or underwatering, and enhancing overall plant health. This intelligent approach supports sustainable gardening and farming practices, especially in diverse environmental conditions.

Problem Statement

Traditional watering methods rely on fixed schedules or manual judgment, often ignoring the specific needs of different soil types. Soils such as sandy, clayey, loamy, and silty have unique water retention and drainage properties, making uniform irrigation inefficient. Overwatering in clay soil can lead to waterlogging and root rot, while sandy soil drains quickly and may result in underwatering and plant dehydration. Gardeners also struggle to monitor key soil conditions like moisture levels and nutrient retention, which vary greatly between soil types. Without proper monitoring, it's difficult to deliver the right amount of water, leading to poor plant health. Maintaining ideal irrigation for each soil type requires continuous attention and knowledge, which can be challenging for busy individuals or those with limited gardening experience.

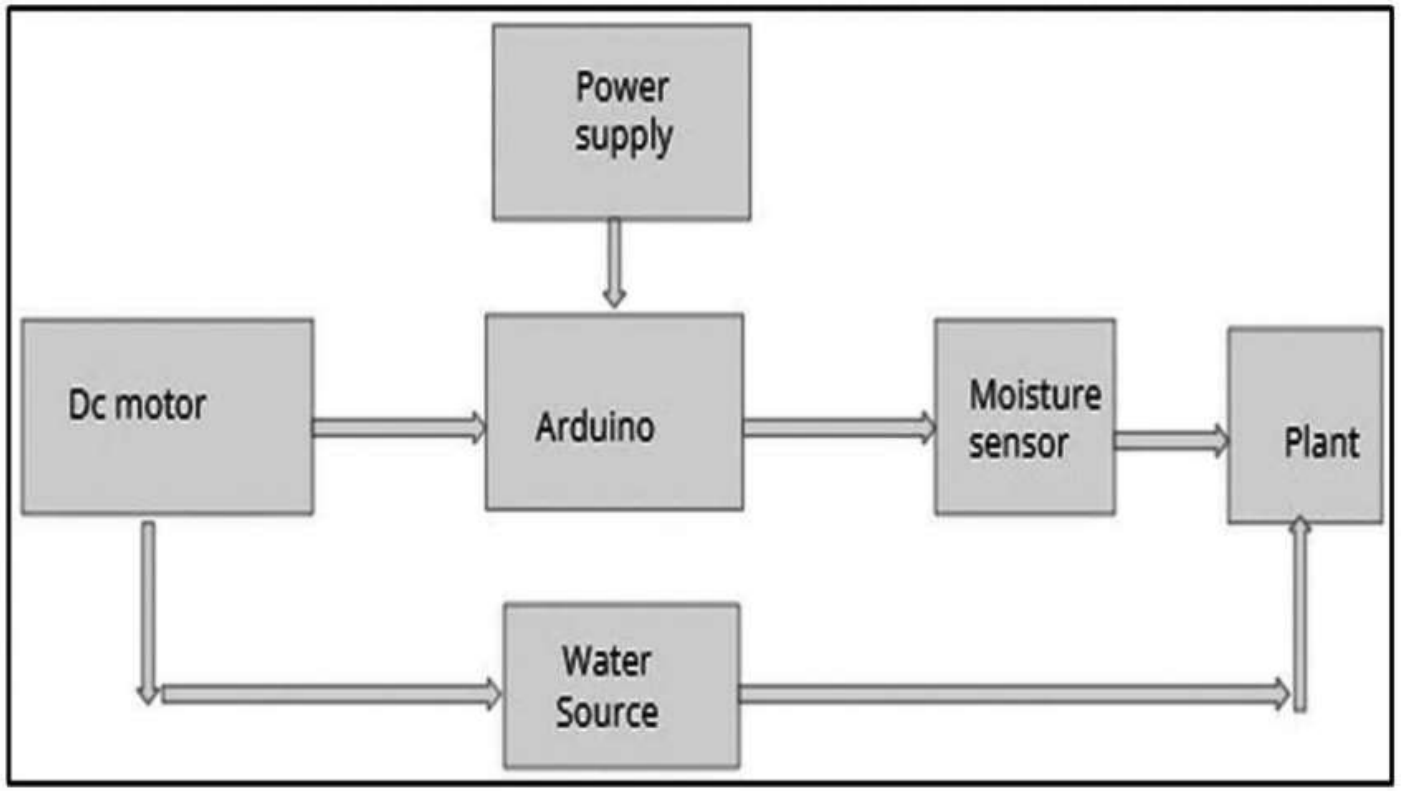
Proposed Work

Efficient garden maintenance requires precise monitoring of soil conditions and timely irrigation—tasks that become even more complex when dealing with different soil types such as sandy, clayey, loamy, or silty. Each type has unique water retention and drainage characteristics, and using a one-size-fits-all watering schedule often leads to overwatering or underwatering. Our proposed Smart Gardening System addresses this challenge by integrating soil moisture sensors that adapt to the specific properties of the soil. The system continuously monitors real-time moisture levels and automatically adjusts irrigation based on the soil type's behavior, ensuring optimal watering for each condition. This approach improves plant health, conserves water, and reduces the need for manual intervention, providing an intelligent, efficient solution for diverse gardening environments.

Hardware Setup

The Smart Gardening System is built using essential IoT components including an Arduino UNO, a soil moisture sensor, a relay module, a battery, a water pump motor, jumper wires, and a leveling pipe. The soil moisture sensor is placed into the soil to constantly monitor the moisture level. The Arduino acts as the brain of the system, reading the sensor values and controlling the water pump through the relay module. Jumper wires are used to establish electrical connections between all components, and a battery provides power to both the Arduino and the motor system. The leveling pipe ensures a steady and even flow of water to the plants.

Architecture



Hardware and Software requirements

HARDWARE REQUIREMENTS:

- Arduino UNO software
- Soil moisture sensor
- Relay
- Water pump motor
- Battery(5V)
- Jumper wires
- Water pipe

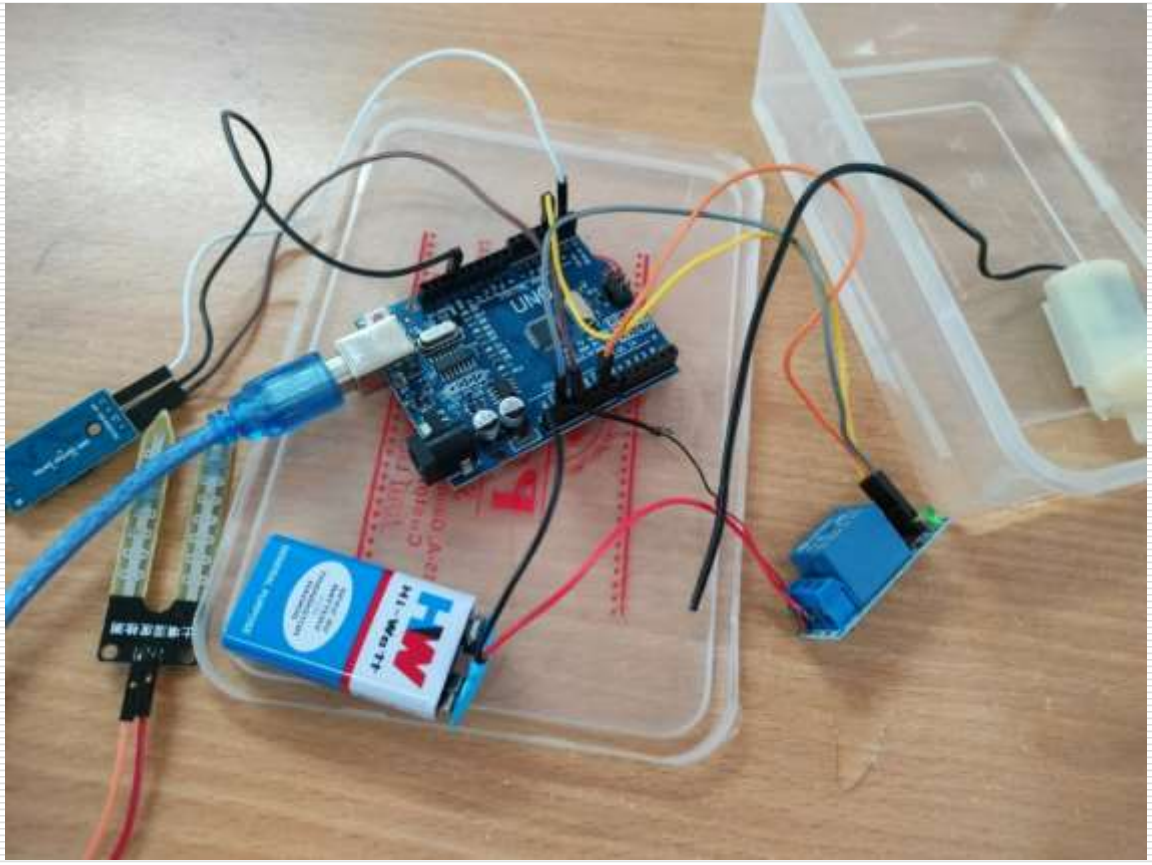
SOFTWARE REQUIREMENTS:

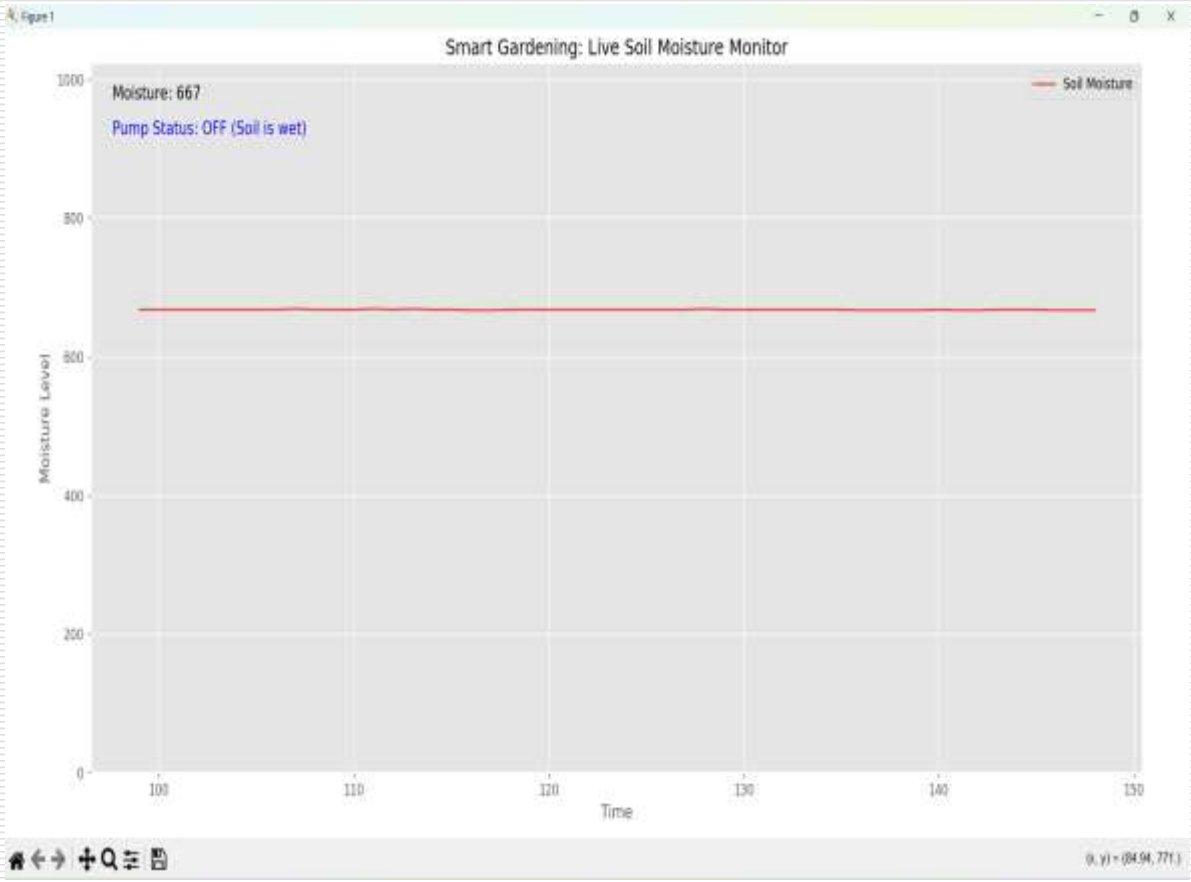
- Python(Flask)
- HTML

Advantages of the proposed system

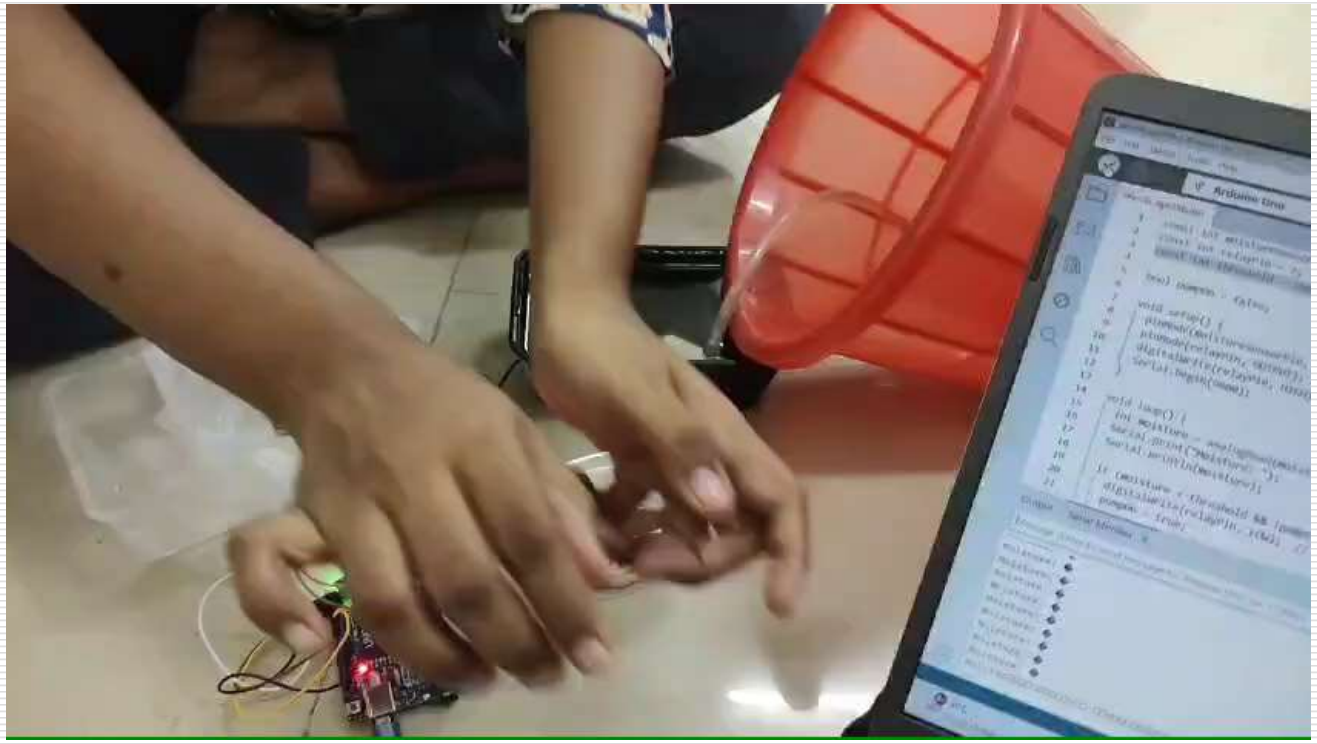
- ✓ Efficient water usage and reduced wastage
- ✓ Automatic detection and adjustment for different soil types
- ✓ Low-cost and easy to implement
- ✓ Minimal human intervention required
- ✓ Scalable for larger gardens or multiple plants
- ✓ Promotes consistent plant health and growth
- ✓ Supports sustainable and eco-friendly gardening
- ✓ Great educational tool for learning automation and IoT concepts

Smart Gardening System





Smart Gardening System



Circuit Design and Flow

In the circuit design, the soil moisture sensor is connected to the analog input pin (A0) of the Arduino. The relay module is connected to a digital output pin (such as D7), controlling the motor. The motor itself is connected externally to a battery through the relay switch, providing sufficient power for water pumping. The system's logical flow is simple: the sensor reads the soil condition, type of the soil ,Arduino processes the data, and based on the result, the relay controls the water pump accordingly. This real-time monitoring and response mechanism makes the system efficient, reliable, and highly practical for smart gardening applications.

Working Principle

The Smart Gardening System monitors soil moisture in real time using multiple sensors, each placed in zones with different soil types (e.g., sandy, clay, loamy). These sensors send analog signals to the Arduino, which compares the values to predefined moisture thresholds specific to each soil type. If moisture in a zone drops below its threshold, the Arduino activates a relay to turn on a water pump or valve, irrigating that zone. Once adequate moisture is restored, the relay turns off, stopping the water flow.This automated process ensures each soil type receives the right amount of water, preventing both overwatering and underwatering, and promoting healthy plant growth efficiently and reliably.

Conclusion

The Smart Gardening System provides an efficient, automated solution for watering plants based on the specific needs of different soil types such as sandy, clay, and loamy soils. By using multiple soil moisture sensors and a programmable Arduino, the system ensures that each zone receives the right amount of water based on its unique properties. This targeted irrigation approach conserves water, reduces manual effort, and promotes healthier plant growth. The system's ability to adapt to varying soil conditions makes it a practical and scalable solution for modern gardening and small-scale agriculture.

References

- **“IoT based Smart Irrigation System"** – *S. Rajalakshmi and Dr. S. Devi*
- **"Automated Irrigation System Using a Wireless Sensor Network and GPRS Module"** – *V. G. Aditya and K. M. Krishna*
- **"Design and Implementation of an Automatic Irrigation System based on Wireless Sensor Networks and Fuzzy Logic"** – *R. Gutiérrez, J. F. Villa-Medina, A. Nieto-Garibay, and M. Á. Porta-Gándara*
- **"Smart Agriculture System Using IoT Technology"** – *S. Shinde and S. Mane*

Thank You