NUTAN MAHARASHTRA VIDYA PRASARAK MANDAL'S,

NUTAN COLLEGE OF ENGINEERING & RESEARCH

DTE CODE- 6419

(UNDER ADMINISTRATIVE SUPPORT OF PIMPRI CHINCHWAD EDUCATION TRUST)

A

Project Report

On

Smart Irrigation System

Submitted By

Sayali Nikam	54
Jayesh Jadhav	63
Prathamesh Warade	47
Bhagyshree Bagde	71

Under the Guidance of
Prof. Shaweta Narula

Department of
Electronics and Communication Engineering

(Academic year 2023-24)

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PRACTICAL MANUAL

OF

Subject: **Mini Project – 1 (BTETM507)**

(Academic year 2023-24)

Subject coordinator

Prof. Shaweta Narula

Head of Dept

(Department ECE Engg.)

Academic Coordinator

(Third Year Engg. Dept.)

Principal

(N.C.E.R.)

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We are grateful to our project guide Prof. Sujata Gaikwad for the immense support and keeninterest shown in the project.

We would like to express our gratitude towards our parents as without them, the support system that we needed would never have been possible. We would also extend our thanks to our batch mates and faculties of Electronics communication engineering for their kind cooperation and encouragement which motivated us and helped us in thinking of this project.

Sayali Nikam(54)
Jayesh Jadhav(63)
Prathamesh Warade(47)
Bhagyashree Bagde (71)

Abstract

This report presents the design, construction, and performance analysis of a smart irrigation system. water is an important resource and not all communities around the world can afford to be liberal with their water needs; it has become important to use available water as efficiently as possible, especially in agriculture. For the purpose of reducing the overwatering of crops, an unattended ground moisture sensor can be implemented to measure the current moisture level in the soil surrounding the plants. This will allow a farmer to know when to water/stop watering his crop. For convenience, the moisture data information should be transmitted wirelessly to the user. The design of an unattended ground moisture sensor and wireless communication/user interface system is discussed. The sensor design consists of a Wheatstone bridge for determining the resistance of the soil, followed by a differential amplifier for converting the measured resistance into a voltage. This is done because there exists a correlation between moisture and resistance. This voltage is interpreted by a microcontroller as moisture data and sent wirelessly to a Lora communication receiving node by a Lora communication transmitting node. The receiving node then relays that information to a PC host for access by the user. The system has a power circuit that consists of a battery and a linear regulation.

Contents

Chapter 1 - Introduction

In the face of growing global population, climate uncertainties, and the imperative to sustainably manage vital natural resources, agriculture stands at a critical juncture. One of the pivotal challenges confronting modern farming practices is the efficient utilization of water. Traditional irrigation methods often fall short in optimizing water usage, leading to issues of overwatering, under-watering, and environmental repercussions. The solution to these challenges lies in the innovation and integration of Smart Irrigation Systems.The as agriculture evolves to meet the demands of an expanding population, it is imperative to adopt practices that not only increase productivity but also promote sustainability. Smart Irrigation Systems represent a technological leap forward, offering a solution that marries precision agriculture with advanced automation to revolutionize the way we irrigate our crops.

Smart Irrigation Systems go beyond conventional methods by infusing intelligence into the watering process. These systems utilize an intricate network of sensors, actuators, and sophisticated algorithms to gather real-time data about the environment and plant conditions. The goal is to make informed decisions on irrigation, ensuring that crops receive the right amount of water at the right time.

Objectives

- Efficiently manage water resources in agriculture to minimize wastage, addressing the increasing challenges of water scarcity and promoting responsible water use
- Implement a sophisticated irrigation scheduling system that leverages real-time data and environmental conditions to precisely regulate the timing, frequency, and quantity of water delivery to crops.
- Integrate intelligent control mechanisms for pumps and valves to optimize energy consumption, reducing operational costs and mitigating the environmental impact associated with excessive energy use.
- Enable farmers to remotely monitor and control the irrigation system, providing them with real-time insights and the ability to make timely adjustments in response to changing conditions.
- Utilize data collected from sensors to make informed decisions about irrigation management, ensuring that practices are dynamically adjusted based on the most current environmental and crop-specific parameters.

Chapter 2-Literature

- **Smart Irrigation Technology and Implementation::**

"Smart Irrigation Technologies and Systems: A Review" by A. Elanchezhian, S. Kirthika, and K. Shankar in the International Journal of Agricultural and Biological Engineering (2017).

"Smart Agriculture: An Approach towards Green Revolution" by A. S. Deshmukh, S. A. Jondhale, and P. D. Kale in the International Journal of Computer Applications (2013).

"Wireless Sensor Networks for Precision Agriculture: A Review" by S. B. Akshay, N. R. Sunitha, and G. P. Shivaprasad in the Procedia Computer Science (2016).

"Remote Sensing and GIS-based Smart Irrigation Management System for Sustainable Agriculture" by M. S. A. Viloria, R. H. B. Exconde, and L. L. Sison in the Journal of Geographic Information System (2012).

Chapter 3- Methodology

This block diagram represents the flow from soil moisture sensing to the Arduino board, which processes the data using the decision algorithm. The actuator control based on this data regulates the water valve for effective irrigation implementation.

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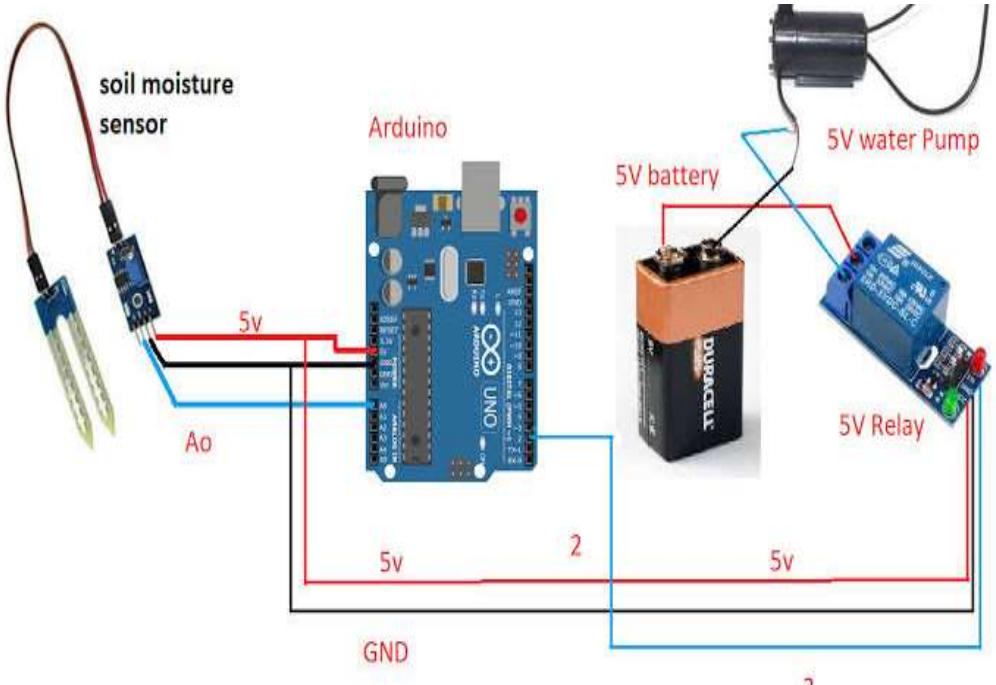
Block Diagram:

Circuit Diagram:



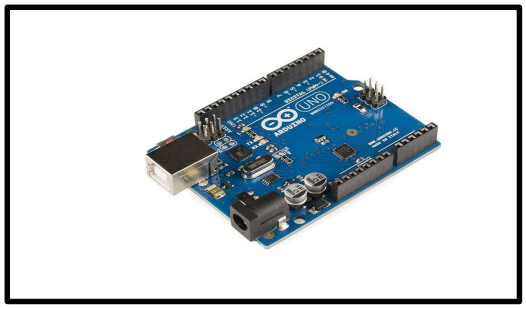
Major Components of a Mini Audio Amplifier:

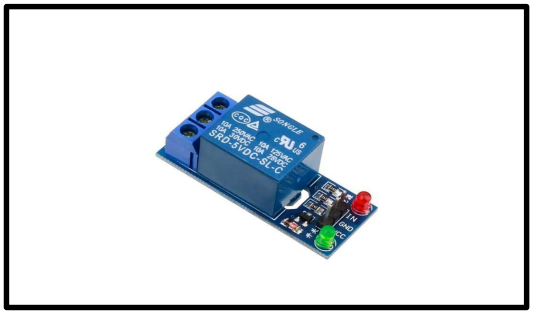
- **Relay:**

  A relay is an electromechanical device used to control high-power electrical devices with a low-power signal, such as the one generated by a microcontroller like Arduino. In the context of a smart irrigation system, relays are often used to control the flow of water by activating or deactivating pumps or solenoid valves.

  Arduino:

  Arduino is an open-source electronics platform based on easy-to-use hardware and software. It is designed for hobbyists, students, and professionals interested in creating interactive projects. Arduino boards can be used to sense and control the physical world by receiving input from a variety of sensors and controlling outputs such as motors, lights, and other actuators.





- **9W Battery:**

  Hi-Waote 9V Battery is the most commonly used and portable 9V battery. It is non rechargeable and is a high capacity and low-cost solution for many electronic devices. It is based on Zinc Carbon Chemistry and can be used easily replaced if discharged just like anytandard AA and AAA batteries.

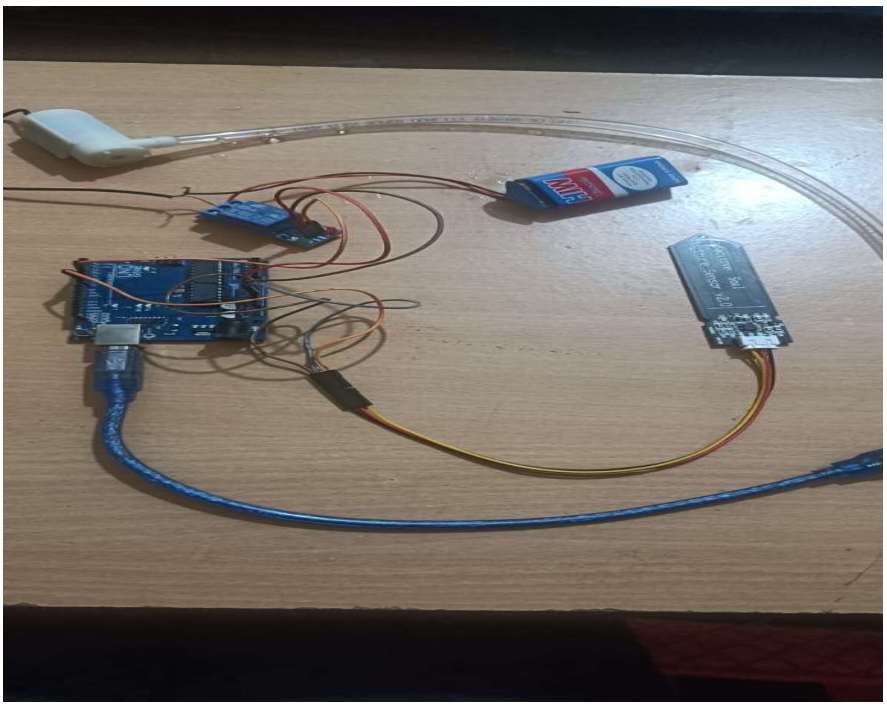
9W Battery

- **Soil Moisture Sensor:**

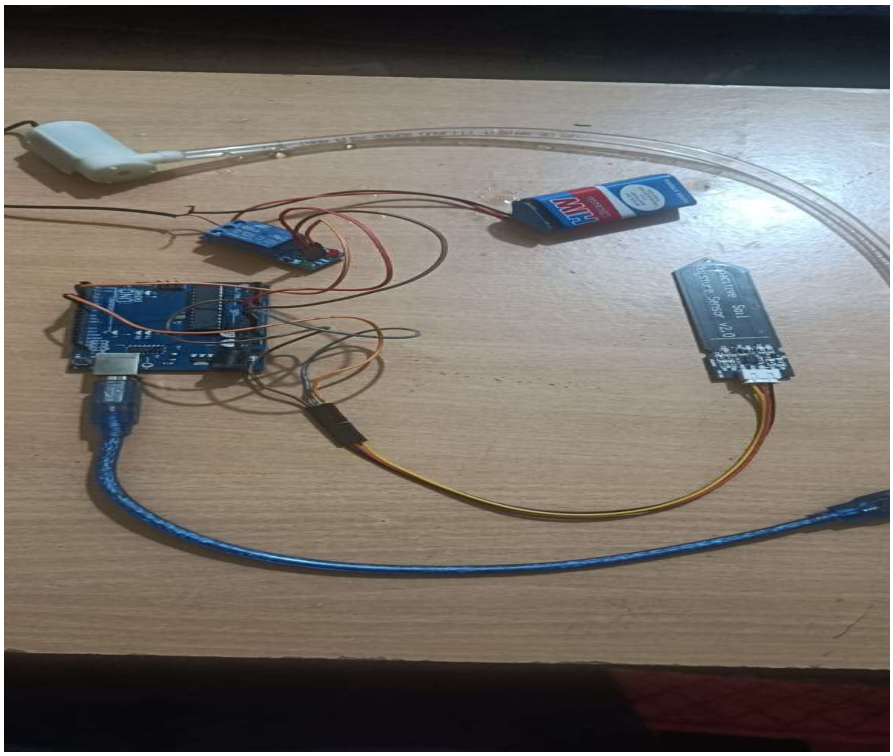
The Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the sensor averages the water content over the entire length of the sensor. There is a 2 cm zone of influence with respect to the flat surface of the sensor, but it has little or no sensitivity at the extreme edges. The figure above shows the electromagnetic field lines along a cross-section of the sensor, illustrating the 2 cm zone of influence.

Soil Moisture Sensor

- **Result:**



Smart Irrigation system



Chapter 4 –
Advantages & Disadvantages

Advantages:

1. Smart irrigation systems use real-time data from sensors to determine precise water requirements, reducing water wastage and promoting efficient water use..

2. By optimizing water usage, smart irrigation systems can lead to reduced water bills over time, making them cost-effective in the long run.

3. The automation feature allows for precise scheduling of irrigation cycles based on actual environmental conditions, reducing the need for manual intervention.

4. By providing the right amount of water at the right time, smart irrigation systems contribute to improved plant health and growth.

5. Many smart irrigation systems offer remote monitoring and control through mobile apps or web interfaces, providing convenience and flexibility for users to manage their irrigation systems from anywhere.

6. Integration with weather data allows smart irrigation systems to adjust watering schedules based on current and forecasted weather conditions, preventing overwatering during rain events.

7. Smart irrigation systems collect and analyze data over time, providing insights into water usage patterns and helping users make informed decisions about irrigation strategies.

Disadvantages:

1. The initial cost of purchasing and installing smart irrigation components, including sensors and controllers, can be higher compared to traditional irrigation systems.

2. Smart irrigation systems may require technical expertise for installation, programming, and troubleshooting. Users who are not familiar with technology may find the setup challenging.

Chapter 5 - Conclusion and Future scope

Conclusion:

a smart irrigation system presents a transformative solution to traditional agricultural practices, offering efficiency, sustainability, and precision in water management. By integrating advanced technologies such as IoT sensors, weather forecasting, and data analytics, smart irrigation systems empower farmers to optimize water usage, reduce wastage, and enhance crop yield.

The benefits of a smart irrigation system extend beyond resource conservation. These systems contribute to environmental sustainability by minimizing the environmental impact of excessive water usage and chemical runoff. Additionally, the real-time monitoring and control capabilities enable farmers to respond swiftly to changing weather conditions, ensuring that crops receive the right amount of water at the right time..

Moreover, the automation and remote accessibility inherent in smart irrigation systems streamline operational processes, saving time and labor for farmers. This not only improves overall farm management but also enables farmers to focus on other critical aspects of cultivation, fostering increased productivity and profitability.

Chapter 6 – References

[1] Department of Electronics & Communication Engineering GOVERNMENT POLYTECHNIC JALGOAN.

[2] https://en.m.wikipedia.org/wiki/Irrigation_controller

[3] http://www.electronicshub.org/