VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JNANA SANGAMA”, BELAGAVI - 590 018 article graphicx

MINI PROJECT REPORT

on

“SMART IRRIGATION SYSTEM”

Submitted by

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In partial fulfillment of the requirements for the V semester

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE & ENGINEERING

Under the Guidance of

Mrs. Reshma M

Designation, Department of CSE

at

SAHYADRI

College of Engineering & Management

An Autonomous Institution

MANGALURU

2023 - 24

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This is to certify that the mini project work entitled **"Smart Irrigation System"** has been carried out by **Shalini L(4SF21CS144), Shravani H N(4SF21CS151), Tejashree N P(4SF21CS176) and Thanvi M C(4SF21CS177)**, the bonafide students of Sahyadri College of Engineering and Management in partial fulfillment of the requirements for the V semester of Bachelor of Engineering in Computer Science and Engineering of Visvesvaraya Technological University, Belagavi during the year 2023 - 24. It is certified that all suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the said degree.

Project Guide	**Project Coordinator**	**HOD**
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DECLARATION

We hereby declare that the entire work embodied in this Mini Proejct Report titled **"Smart Irrigation System"** has been carried out by us at Sahyadri College of Engineering and Management, Mangaluru under the supervision of **Mrs. Reshma M,** in partial fulfillment of the requirements for the V semester of **Bachelor of Engineering** in **Computer Science and Engineering**. This report has not been submitted to this or any other University for the award of any other degree.

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Abstract

In recent years, the integration of Internet of Things (IoT) technology in agriculture has revolutionized traditional farming practices, leading to the development of efficient and sustainable solutions. One such innovation is the Smart Irrigation System, which utilizes IoT components to optimize water usage, improve crop yields, and reduce environmental impact.

This paper presents an abstract overview of a Smart Irrigation System designed to address the challenges of water scarcity and inefficient irrigation practices. The system incorporates various IoT components such as soil moisture sensors, microcontrollers, internet connectivity, actuators, and an IoT platform for data management and analysis.Smart irrigation systems represent a pivotal advancement in agricultural and landscaping practices, integrating modern technology with traditional irrigation methods to optimize water usage and promote healthier plant growth. These systems rely on a network of sensors, controllers, actuators, and connectivity tools to collect real-time data on soil moisture levels, weather conditions, and plant health indicators.

The Smart Irrigation System using IoT presents a promising solution to address the challenges faced by modern agriculture.

Acknowledgement

It is with great satisfaction and euphoria that we are submitting the mini project report on **"Smart Irrigation System"**. We have completed it as a part of the curriculum of Visvesvaraya Technological University, Belagavi in partial fulfillment of the requirements for the V semester of Bachelor of Engineering in Computer Science and Engineering.

We are profoundly indebted to our guide, **Mrs. Reshma M**, Assistant Professor, Department of Computer Science and Engineering for innumerable acts of timely advice, encouragement and we sincerely express our gratitude.

We also thank **Dr. Suhas A Bhyratae**, **Dr. Adarsh Rag S** and **Mr. Raghavendra Sooda**, Project Coordinators, Department of Computer Science and Engineering for their constant encouragement and support extended throughout.

We express our sincere gratitude to **Dr. Mustafa Basthikodi**, Professor and Head, Department of Computer Science and Engineering for his invaluable support and guidance.

We sincerely thank **Dr. S. S. Injaganeri**, Principal, Sahyadri College of Engineering and Management and **Dr. D. L. Prabhakara**, Director, Sahyadri Educational Institutions,who have always been a great source of inspiration.

Finally, yet importantly, we express our heartfelt thanks to our family and friends for their wishes and encouragement throughout the work.

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Chapter 1

Introduction

Traditionally, irrigation has often been conducted based on fixed schedules or manual assessments, leading to inefficiencies, overwatering, and underutilization of resources. However, the emergence of smart irrigation systems marks a paradigm shift, offering precision and intelligence in the delivery of water to plants.At the core of smart irrigation systems lie a network of sensors that continuously monitor environmental parameters such as soil moisture levels, weather conditions, and plant health indicators. These sensors provide real-time data, enabling the system to make informed decisions about when, where, and how much water to dispense. Due to alarming changes in the climate, farmers cannot rely on natural rainwater.Irrigation is important to yield good quality crops in the seasonable or non-seasonable period.For modern agriculture, a smart irrigation system is one of the best techniques that give more production in minimum duration. To many extend, this smart irrigation system is designed and fully automated to minimize manual handling in agriculture and one of the good things is that it is very comfortable for users (or farmers) to understand the concept of IoT and sensors for smart irrigation. The motivation for developing a Smart Irrigation System stems from the urgent need to address the inefficiencies and challenges prevalent in traditional irrigation practices. Conventional methods often lead to overuse or underutilization of water resources, contributing to water scarcity and environmental degradation. Climate change further exacerbates these issues, making it crucial to adopt advanced technologies for sustainable agriculture.The Smart Irrigation System aims to mitigate these challenges by leveraging modern sensor technologies and automation. By monitoring soil moisture levels in real-time and considering dynamic weather patterns, the system optimizes irrigation schedules, ensuring crops receive precisely the amount of water they need. This not only enhances agricultural productivity but also conserves water resources, promoting responsible and efficient use. The motivation behind this system is rooted in the pursuit of resource conservation, increased crop yields, and the broader goal of creating. resilient. and sustainable agricultural practices that can adapt to a changing climate. Through innovation in irrigation, we strive to secure food production, minimize environmental impact, and contribute to the long-term viability of agriculture.

Chapter 2

Literature Survey

The literature survey ,it involves systematically reviewing and synthesizing the literature available on a specific subject to gain a comprehensive understanding of the current state of knowledge, identify gaps or inconsistencies in the existing research, and provide a context for the researcher's own study.

Paper 1: International Journal of Creative Research Thoughts

Methodology: Through the utilization of IoT (Internet of Things) technology, a smart irrigation system presents an exceptionally efficient and productive approach to watering plants and crops. By employing sensors, controllers, and connectivity devices, this advanced system is capable of gathering and analyzing real-time data pertaining to soil moisture, weather conditions, and other factors that significantly impact plant growth.

Conclusion: The implementation of an IoT enabled smart irrigation system brings numerous benefits to farmers, gardeners, and the environment alike. By leveraging real-time data and automation, these systems optimize water usage, mitigate the risks of over- and underwatering, and enhance crop yields and overall plant health.

Paper 2: 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE)

Methodology: The primary aim of the study is to develop a framework to stay track of remote soil wetness from an abroad area and to deal with the moisture of soil so it doesn't influence the products. The IOT basically based arranged framework given amid this examination are valuable to achieve such an undertaking. The prototype framework examination of this study enables monitoring any agricultural arrive and keeps up moisture of the dirt. This thought will unquestionably encourage any country move to sensible Agriculture. The framework is foreseen to figure and create records in period. The real execution of the framework would require changes in detecting component, innovations and supply code in spite of the fact that the approach and control remain steady. The proposed system was demonstrated with the help of Thing speak cloud. Thing Speak is an IOT analytics place to accommodate to sanctions to aggregate, depict and analyze real-time data streams in the cloud. Thing Speak gives instant envision of data posted by the contrivances with the competency to execute MATLAB code. Additionally, it is often utilized for prototyping and proof of concept IOT systems that require analytics.

Conclusion: The sand and the water level are the critical parameter for the development of smart irrigation system. Generally, the soil moisture is affected by a sundry parameter such as air temperature, soil temperature, air humidity, ultra violet rays, and much more. This paper proposed an IoT based smart irrigation system utilizing sensors to record the data and store it in the cloud storage. The future work can be prediction of soil moisture using the recorded data and it may provide cost effective. The auto mode makes it a smart system and it can be further customized for application categorical scenarios. The future plan is to conduct a water saving analysis based on proposed algorithm with multiple nodes along with minimizing the system cost.

Paper 3: International Research Journal of Modernization in Engineering Technology and Science

Methodology: Depending on the type of crop, three possibilities are sprinkling irrigation, channel irrigation, and drip irrigation. With the help of a channel system, large regions are watered. Smart irrigation systems outperformed the other methods. A smart irrigation system denotes an automated system as opposed to drip and sprinkle irrigation systems, which are frequently operated by a person. Whether the farmer is in the field or not, irrigation is done. The soil moisture sensor has a comparator in it. The value of the soil's varying resistance in the middle two probing areas depends on the moisture content of the soil. To gauge the amount of soil moisture, moisture sensors are placed in the ground, and irrigation is then carried out as necessary. Before being delivered to a microcontroller, the output sensor value of the comparator LM 393 is compared to a predetermined value. A model of agriculture industry irrigation system automation was included in the paper. The soil's moisture content has a big impact on plant development. The farmers have benefited greatly from the use of this technology, which was put into practice in a distant area. By reducing water waste and labour -intensive manual labour, the use of an automated irrigation system maximizes the usage of water. The longevity of the system is increased while electronic devices use less energy. According to the requirements of the crops, the water was used.

Conclusion: In order to monitor and control the environment in nurseries, this study describes research using a ZigBee based wireless sensor network (WSN). Instead of the usual two stations seen in earlier frameworks, the proposed framework features three stations: a Sensor Station, Coordinator Station, and Central Station (a detecting station and a control station). The sensor station reacts to six different environmental limits: temperature, relative wetness, soil temperature, dampness, light intensity, and carbon dioxide (CO2). The facilitator station has features akin to switches. From the nursery station, it is in charge of communicating information and directives to the focus station. Using nearby hardware, such as sprinklers, radiators, exhaust fans, and other devices, it is also in charge of controlling the nursery's atmosphere. The primary station serves as the framework's primary regulator. It completes various tasks, including information gathering, capacity building, handling, and changing the nursery environment. With three stations, the workload is evenly distributed across each station, finally focusing on the execution, imperturbable quality, and flexibility of the framework.

Paper 4: International Journal of Engineering and Technology

Methodology: Irrigation can be automated by using sensors, microcontroller, Bluetooth, android application. The low-cost soil moisture sensor and temperature and humidity sensor are used. They continuously monitor the field. The sensors are connected to Arduino board. The sensor data obtained are transmitted through wireless transmission and are reached to the user so that he can control irrigation.

Conclusion: The automated irrigation system implemented was found to be feasible and cost effective for optimizing water resources for Agri-culture production. This irrigation system allows cultivation in places with water scarcity thereby improving sustainability. The irrigation system helps the farmer by making his work smarter. As the demand for water increases, along with the need to protect aquatic habitats, water conservation practices for irrigation need to be effective and affordable. As multiple sensors are used water can be provided only to the required area of land. This system reduces the water consumption to greater extent. It needs minimal maintenance. The power consumption has been reduced very much. The crop productivity increases and the waste-age of crops are very much reduced. The extension work is to make user interface much simpler by just using SMS messages for notifications and to operate the switches.

Paper 5: Social Science Research Network.

Methodology: Irrigation can be automated by using sensors, microcontroller, WIFI module, android application. The low-cost soil moisture sensor continuously monitors the field. The sensors are connected to Arduino board. The sensor data obtained are transmitted through wireless transmission and are reached to the user so that he can control irrigation. The mobile application can be designed in such a way to analyze the data received and to check with the threshold values of moisture, humidity and temperature. The decision can be made either by the application automatically without user interruption or manually through application with user interruption. If soil moisture is less than the threshold value the motor is switched ON and if the soil moisture exceeds the threshold value the motor is switched OFF. The sensors are connected to the Arduino. This hardware communicates through WIFI module so that user can access the data through his mobile that has an android application which can get the sensor data from the Arduino via WIFI module.

Conclusion: The machine learning requires a mass data so our recorded metero-logical data helps a lot in improving the performance. The region or area wise prediction can be done for giving more accurate farming suggestions of which crop can be grown by analyzing the data based on the soil and weather conditions. This paper can further be industrialized with camera feeds for checking the discoloration of leaves or plants and accordingly send the results to control the disease from anywhere. The field area can be protected from the trespassers by the deployment of AI and surveillance.

Chapter 3

Problem Statement

Enhancing Water Management Through Smart Irrigation Systems. In the case of traditional irrigation system water saving is not considered. Since, the water is irrigated directly in the land, plants under go high stress from variation in soil moisture, therefore plant appearance is reduced. The absence of automatic controlling of the system result in improper water control system .At present there is emerging global water crisis where managing scarcity of water has become a serious job.

3.1 Objectives

- Water Conservation: One of the primary objectives of a smart irrigation system is to conserve water by minimizing wastage and optimizing the use of available resources. By precisely delivering water to plants based on real-time environmental conditions and plant needs, smart irrigation systems help reduce water consumption and mitigate the risk of water scarcity.
- Optimized Plant Growth: Smart irrigation systems aim to promote healthier plant growth and improve crop yields by ensuring that plants receive the right amount of water at the right time. By monitoring soil moisture levels, weather patterns, and plant health indicators, these systems can adjust watering schedules and volumes to provide optimal growing conditions for different types of plants.
- Support of multiple views of the data
- Sharing of data and multiuser transaction processing

Chapter 4

Requirements Specification

4.1 Hardware

- Arduino Uno :

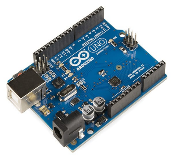

Figure 4.1: Figure 1 : Arduino UNO

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

- Soil Moisture sensor:

Figure 4.2: Figure 2 : Sensor module

The working of the soil moisture sensor is very easy to understand. It has 2 probes with exposed contacts that act like a variable resistor whose resistance varies according to the water content in the soil. This resistance is inversely proportional to the soil moisture which means that higher water in the soil means better conductivity and hence a lower resistance. While the lower water in the soil means poor conductivity and will result in higher resistance. The sensor produces an analog voltage output according to the resistance.

- Jumper wires:

Figure 4.3: Figure 3 : Jumper wire

Jumper wires are essential components in electronics and prototyping, commonly used to establish electrical connections between various components on a breadboard, circuit board, or other electronic devices. They are typically made of flexible, insulated wire with connectors at both ends, allowing for easy insertion into sockets, pins, or terminals.

- 6v Mini water pump :

Figure 4.4: Figure 4 : Water pump

We need a small pump to irrigate the plant, but in the case of a garden, we need to drive a larger pump that can provide a higher volume of water depending on the size of your garden which can't be directly powered by an Arduino. So in case you need to operate a larger pump, a driver is necessary to provide enough current for the pump, to show that I am using a 5v relay. You can also use an AC-powered pump and use a suitable relay. The working will remain the same as shown in this project, you just have to replace the DC power input connected to the relay with an AC power input and have to power your Arduino with a separate DC power source.

- 5v battery:

Figure 4.5: Figure 5: 5v battery

A 5V battery refers to a type of battery that provides a nominal output voltage of 5 volts. This voltage level is commonly used in various electronic devices, particularly those powered by USB (Universal Serial Bus) ports, which typically provide 5 volts of power.

- Relay module:

Figure 4.6: Figure 6 : Relay module

A 5v relay is an automatic switch that is commonly used in an automatic control circuit and to control a high-current using a low-current signal. The input voltage of the relay signal ranges from 0 to 5V.

- Plastic Battery Storage Case Holder:

Figure 4.7: Figure 7 : Battery case

A battery holder is one or more compartments or chambers for holding a battery.A battery holder is a plastic case with the shape of the housing molded as compartments that accept batteries. Coiled spring wire or flat tabs that press against the battery terminals are the two most common methods of making the electrical connection inside a holder.

- Vinyl tube:

Figure 4.8: Figure 8 : Vinyl tube

Vinyl (PVC) tubing is very popular because it is flexible, versatile, and economical. It offers outstanding clarity and is used in a wide range of applications and settings, from general laboratory use to food, beverage, medical device, and pharmaceutical manufacturing.

4.2 Software

- Arduino IDE for coding

Chapter 5

System Design

5.1 Use-Case Diagram

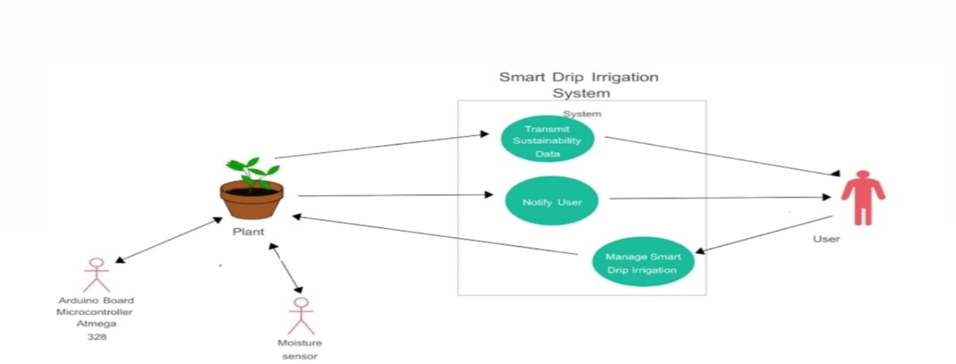

Figure 5.1: Figure 9: User-Case Diagram

5.2 Data Flow Diagram

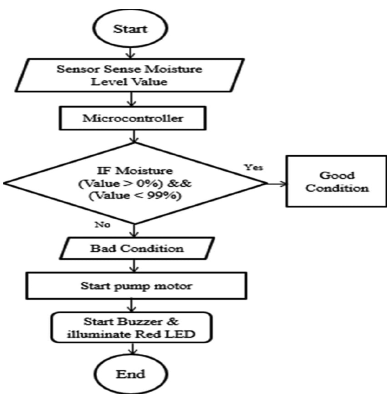

Figure 5.2: Figure 10 : Data Flow Diagram

5.3 Sequence Diagram

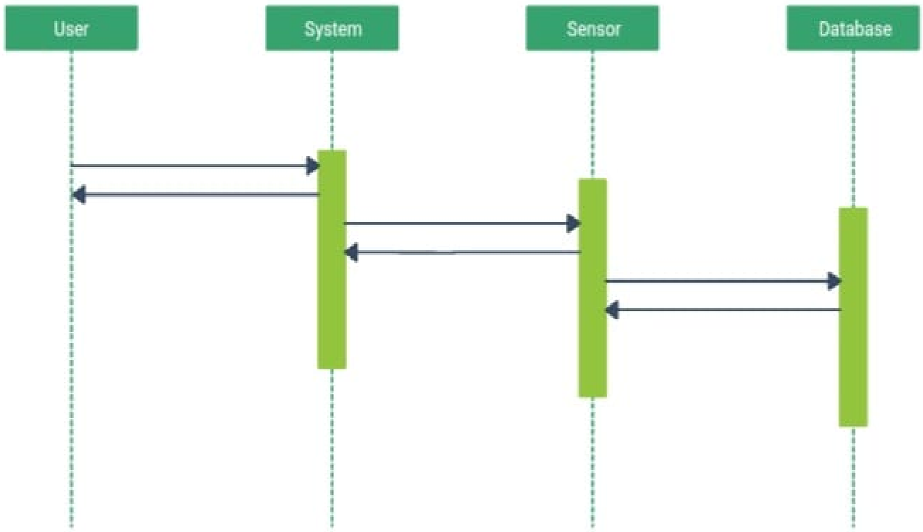

Figure 5.3: Figure 11 : Sequence Diagram

5.4 Circuit Diagram

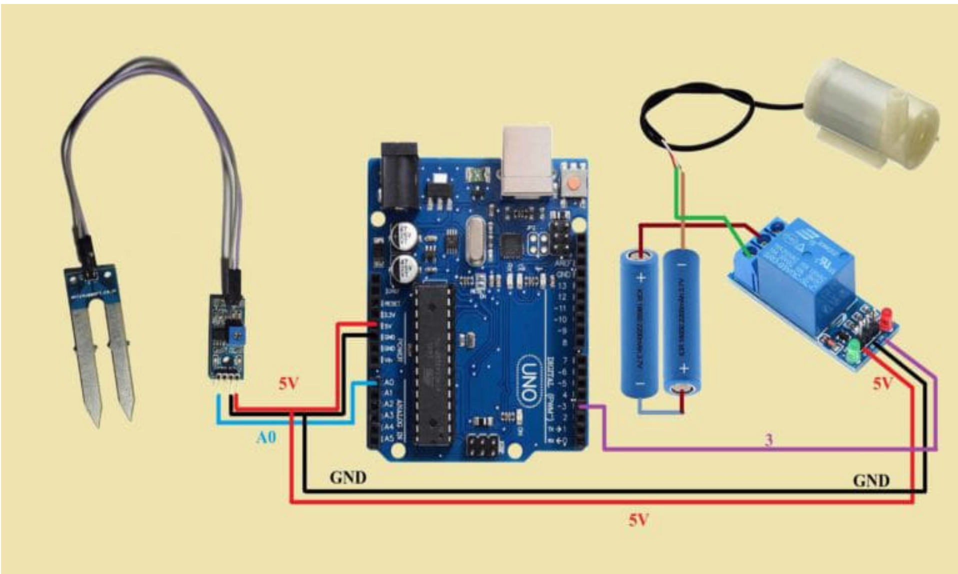

Figure 5.4: Figure 12 : Circuit Diagram

Chapter 6

Results and Discussion

The implementation of a smart irrigation system using IoT technology has yielded promising results in optimizing water usage, improving crop yields, and promoting sustainable agricultural practices. This section presents an analysis of the outcomes obtained from the deployment of the system and discusses the implications of these results. Water Conservation: The smart irrigation system effectively optimized water usage by monitoring soil moisture levels in real-time and delivering water to crops only when necessary. As a result, significant reductions in water consumption were observed compared to traditional irrigation methods. Improved Crop Yields: By ensuring that crops receive the right amount of water at the right time, the smart irrigation system contributed to improved crop yields and quality. This demonstrates the potential of IoT-enabled technologies to enhance agricultural productivity and food security. Cost Savings: The efficient use of water and reduction in labor-intensive irrigation practices resulted in cost savings for farmers. Environmental Benefits: In addition to water conservation, the smart irrigation system offers environmental benefits by minimizing the use of agrochemicals and reducing soil erosion and nutrient runoff. Scalability and Adaptability: The scalability and adaptability of the smart irrigation system allow for its implementation across various agricultural settings and crop types. Challenges and Limitations: Despite the positive outcomes, certain challenges and limitations were encountered during the deployment of the smart irrigation system. Overall, the results and discussion highlight the significant benefits of implementing a smart irrigation system using IoT technology in agriculture. By harnessing the power of data-driven decision-making and automation, the system offers a sustainable solution to the challenges of water scarcity, inefficient irrigation practices, and environmental degradation, paving the way for a more resilient and productive agricultural sector.

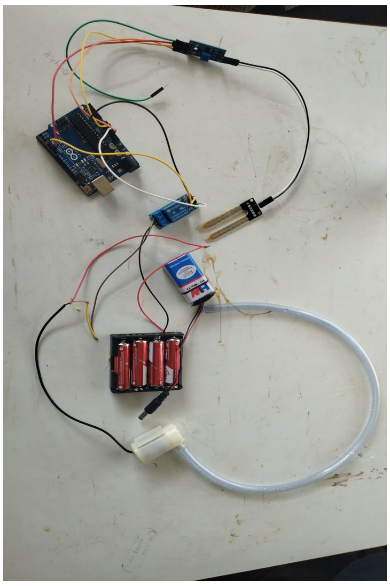

Figure 6.1: Figure 13 : Connection of circuit diagram

Figure 6.2: Figure 14 : Output

Chapter 7

Project Plan

Project Scope and Objectives: Define the scope of the project, including the features and functionalities of the Smart Irrigation System. Objectives: Develop an automated irrigation system that optimizes water usage based on soil moisture levels and environmental conditions, thereby conserving water and improving plant health.

Timeline: Phase 1: Planning and Research (2 weeks) Phase 2: Hardware Setup and Prototyping (4 weeks) Phase 3: Integration and Testing (4 weeks) Phase 4: Documentation and Deployment (2 weeks)

Tasks and Activities: Conduct research on existing Smart Irrigation Systems and Arduino-based projects. Design the hardware setup including sensors, actuators, and Arduino board.Test the system under various environmental conditions. Document the project including schematics, code, user manual, and troubleshooting guide.

Resource Allocation: Hardware: Arduino board (e.g., Arduino Uno or Arduino Mega), Soil moisture sensors, Water pump Relay module, Power supply. Software: Arduino IDE for coding, Libraries for sensor and actuator interfacing.

Communication Plan: Weekly status meetings to discuss progress, challenges, and next steps. Email updates to stakeholders. Documentation repository for sharing project documents and code.

Change Management: Any changes to project scope or requirements must be evaluated by the project manager and approved by stakeholders. Changes should be documented and communicated to the project team.

Documentation and Deployment: Prepare user manual and installation guide. Deploy the Smart Irrigation System in a test environment. This project plan provides a structured approach for developing a Smart Irrigation System using Arduino, ensuring that the project is completed efficiently and successfully.

Chapter 8

Conclusion

The implementation of a Smart Irrigation System using IoT represents a significant advancement in agricultural technology, offering a promising solution to address the challenges faced by modern farming practices. By leveraging the power of IoT components such as soil moisture sensors, microcontrollers and data analytics, this system enables precise and efficient irrigation management while promoting sustainability and environmental conservation.

Through continuous monitoring of soil moisture levels and real-time data analysis, the Smart Irrigation System optimizes water usage, minimizes water wastage, and ensures that crops receive the right amount of water at the right time. This not only improves crop yields and quality but also conserves precious water resources, mitigates the impact of water scarcity, and contributes to the long-term sustainability of agriculture.Furthermore, the integration of remote monitoring and control capabilities empowers farmers to manage irrigation activities efficiently and conveniently, regardless of their location.

By reducing labor dependency, enhancing operational efficiency, and minimizing environmental impact, the Smart Irrigation System offers tangible benefits to farmers, agricultural communities, and the broader ecosystem. Moreover, as water scarcity continues to be a pressing issue globally, the adoption of smart irrigation technologies becomes increasingly imperative for ensuring food security, economic resilience, and environmental sustainability in the face of evolving climate challenges.

In conclusion, the Smart Irrigation System using IoT represents a transformative approach to irrigation management, combining cutting-edge technology with sustainable agricultural practices. By harnessing the potential of IoT innovations, this system paves the way for a more resilient, productive, and environmentally conscious agricultural sector, ensuring a brighter future for generations to come.

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