A

PROJECT REPORT
On

AUTOMATIC PLANT IRRIGATION SYSTEM

Submitted in partial fulfilment of the requirements for the award of the degree of

Bachelor of Technology

in

Electronics & Communication Engineering

by

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DECLARATION

We hereby declare that this submission is our own work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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CERTIFICATE

This is to certify that Project Report entitled, "**Automatic Plant Irrigation System**" which is being submitted by **Prakhar Pandey, Nayan Chaurasia, Devansh** in partial fulfilment of the requirement for the award of degree B. Tech in Electronics & Communication Engineering and submitted to the department of Electronics & Communication Engineering of GLA University, is a record of the candidate own work carried out by them under my supervision. The matter embodied in this report is original and has not been submitted for the award of any other degree.

Date: Mr. Anjan Kumar

Assistant Professor

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ABSTRACT

The "Automatic Plant Irrigation System " project is a pioneering venture that addresses the challenges of conventional plant irrigation methods. Leveraging the ESP32 microcontroller's advanced capabilities, the system integrates soil moisture sensors for precise data collection, enabling real-time monitoring of the plant's hydration needs. The ESP32's wireless communication capabilities facilitate remote control and monitoring through a user-friendly interface, enhancing accessibility and convenience. The project emphasizes adaptability by incorporating aptitude-based algorithms, ensuring the system's responsiveness to diverse plant types and environmental conditions.

A key highlight is the energy-efficient operation achieved through the ESP32's low-power features, aligning with sustainable practices. The intelligent irrigation system aims to optimize water usage, promoting resource efficiency and mitigating environmental impact. Rigorous coding practices and comprehensive testing contribute to the system's reliability and robust performance. The integration of actuators enables precise control over water flow, ensuring an optimal balance for plant health.

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CHAPTER 1

Introduction

Water is a key resource for the development and maintenance of plants, and its optimal use in agriculture is crucial for guaranteeing food security and environmental sustainability. Conventional techniques for manual irrigation, while they work well, require a lot of physical effort, take up a significant amount of time, and can lead to wasteful water use, resulting in either excessive or insufficient watering of plants. In order to tackle these difficulties, the advancement and execution of automated plant irrigation systems have gained significant significance in contemporary agriculture and horticulture.

Automatic plant irrigation systems, commonly referred to as smart or automated irrigation systems, use technology to accurately regulate the distribution of water to plants. These systems have several advantages, such as greater water preservation, increased agricultural productivity, decreased labor expenses, and the capability to remotely supervise and control irrigation. The fundamental premise behind these systems is to provide an optimal quantity of water to plants at the appropriate moment while considering elements such as plant species, soil moisture levels, weather conditions, and environmental variables.

This detailed introduction will explore the many components and features of autonomous plant irrigation systems, their importance in agriculture, and the technology behind them. We will examine several forms of automated irrigation techniques, the constituent elements involved, and the benefits they provide to farmers, gardeners, and the environment alike. In addition, we will address the possible difficulties and restrictions linked to these systems, along with the latest trends and advancements in the domain of automated plant watering.

Given the increasing demands on global water supplies resulting from population expansion and climate change, the effective utilization of water in agriculture has become very crucial. Automatic plant irrigation systems provide a viable way to tackle this dilemma by optimizing water consumption and fostering sustainable agricultural practices. These systems are crucial in modernizing agriculture and conserving one of our planet's most valuable resources by ensuring a dependable and precise delivery of water to plants. In the following parts, we shall examine the complexities of automated plant irrigation, including its underlying concepts as well as its practical uses and advantages.

Elements of Automated Plant Irrigation Systems

Automatic plant irrigation systems have many essential components that function in synergy to effectively distribute water to plants. Comprehending these elements is crucial for understanding the functioning and the role they play in enhancing irrigation efficiency.

Water Source: The water source refers to the primary location from where the irrigation water originates. It may consist of a municipal water supply, a well, a rainwater collecting system, or any other kind of water storage facility. The accessibility and caliber of the water supply might influence the design and efficacy of the irrigation system.

Pump and Filtration System: Often, it is necessary to transfer water from its origin to the irrigation system via the use of a pump. A pump guarantees the delivery of water to the plants with sufficient pressure. In addition, filtering systems are often used to eliminate debris and contaminants from the water, hence preventing the obstruction of irrigation components.

The distribution network consists of pipes, hoses, and connections that convey water from the source to the plants. The configuration and aesthetics of this network are vital for the effective transportation of water.

The controllers and sensors are the fundamental components of autonomous plant watering systems. Controllers are electrical devices that regulate the time and length of irrigation cycles. Soil moisture sensors, weather sensors, and rain sensors provide up-to-date data to the controllers, enabling them to make informed choices about the timing and quantity of irrigation.

Emitter devices are designed to dispense water directly to the plants. These may assume several configurations, including as drip emitters, sprinklers, or soaker hoses. The selection of emitter is contingent upon variables such as the crop variety, soil properties, and water demands.

Automation Interface: Numerous contemporary irrigation systems may be remotely controlled and monitored using computer software or mobile applications. The interface enables users to remotely modify settings, monitor sensor data, and plan watering activities.

Benefits of Automated Plant Irrigation Systems

The use of automated plant irrigation systems provides several significant benefits for the fields of agriculture, horticulture, and landscaping:

Water efficiency: Water efficiency is achieved by the use of automatic devices that provide accurate quantities of water straight to the root zone of plants. This approach minimizes inefficiency and mitigates the potential for both excessive or insufficient irrigation.

Time Efficiency: Farmers and gardeners achieve significant time and labor savings with the use of automated irrigation systems. Automated irrigation systems have eliminated the need for human watering of plants, enabling individuals to dedicate their attention to other crucial responsibilities.

Enhanced agricultural Yields: Consistent and suitable watering optimizes plant well-being and increases agricultural productivity. These systems enhance the health and productivity of vegetation by providing optimal water quantities at appropriate intervals.

Resource Conservation: The use of automatic plant irrigation aids in the preservation of water resources, hence diminishing the ecological repercussions of agriculture and fostering sustainability.

Remote Monitoring and Control: The capacity to remotely monitor and regulate irrigation provides ease and adaptability. Users have the ability to make immediate modifications depending on dynamic weather conditions or sensor data.

Obstacles and Prospects for the Future

Although autonomous plant irrigation systems provide many advantages, they can encounter obstacles such as upfront installation expenses, upkeep demands, and the need for power supply.

Furthermore, the efficacy of these systems is greatly contingent upon meticulous design and calibration.

Anticipate further progress in sensor technology, data analytics, and automation in the future, resulting in improved accuracy and effectiveness of these systems. The incorporation of smart agricultural platforms and the use of AI for decision-making are expected to have a substantial impact on enhancing plant watering efficiency.

To summarize, autonomous plant watering systems are a crucial innovation in contemporary agriculture and landscaping. These solutions not only save water but also encourage more efficient and environmentally friendly farming methods. The ongoing advancement of technology holds great promise for the development of more efficient and eco-friendly irrigation systems.

CHAPTER 2

Methodology

Designing an automatic plant irrigation system involves a comprehensive methodology to ensure its efficiency and effectiveness. Here's a detailed 400-word methodology:

The first step in developing an automatic plant irrigation system is to conduct a thorough analysis of the environment and the specific needs of the plants. This involves studying the types of plants, soil conditions, and climate in the target area. Understanding the water requirements of different plants is crucial for designing a system that caters to their specific needs.

Once the environmental analysis is complete, the next step is to choose the appropriate sensors for the system. Soil moisture sensors are essential components that will measure the moisture content in the soil. Additionally, temperature and humidity sensors can provide valuable data to adjust irrigation schedules based on environmental conditions.

After selecting the sensors, the system's hardware components need to be chosen and configured. This includes microcontrollers, actuators, valves, and a power supply. Arduino or Raspberry Pi boards are commonly used as microcontrollers due to their versatility and ease of programming. Actuators control the opening and closing of valves to regulate water flow.

The third step involves designing the irrigation schedule and control logic. This includes setting threshold values for soil moisture and other environmental parameters. The system should be programmed to activate the irrigation when the soil moisture falls below a certain level and deactivate it when the optimal moisture level is reached. The schedule should also consider factors such as time of day and weather conditions to optimize water usage.

Integrating a communication module is the next crucial step. This allows the system to send notifications or alerts to users. Connecting the system to the internet enables remote monitoring and control through a smartphone or computer. Wi-Fi or GSM modules are commonly used for this purpose.

Once the hardware and software components are integrated, rigorous testing is essential. Simulate various scenarios to ensure the system responds accurately to changing conditions. Fine-tune the control logic based on test results and make necessary adjustments to optimize performance.

After successful testing, the system can be deployed in the target area. Regular monitoring is essential during the initial stages to address any unforeseen issues. Continuous feedback from the system and users can be used to make further improvements and updates.

In conclusion, developing an automatic plant irrigation system involves a systematic approach that includes environmental analysis, sensor selection, hardware configuration, control logic design, communication integration, testing, deployment, and continuous improvement.

CHAPTER 3

Software

Blynk is a versatile platform that revolutionizes the way we interact with electronic devices, particularly in the realm of IoT (Internet of Things). Specifically tailored for projects like automatic plant irrigation systems, Blynk provides a user-friendly interface for creating custom mobile applications to control and monitor hardware remotely. With Blynk, developers can seamlessly integrate various sensors, actuators, and microcontrollers into their projects, making it an ideal choice for building smart and efficient plant irrigation solutions.

The platform operates on a simple principle – it allows users to drag and drop widgets on a virtual interface, representing the controls they want in their mobile app. For an automatic plant irrigation system, this could include buttons to start or stop watering, real-time sensor data display, and customizable notifications for water level alerts. Blynk also supports a wide range of hardware, making it compatible with popular microcontrollers like Arduino and Raspberry Pi.

One of Blynk's notable features is its cloud infrastructure, enabling users to access their projects from anywhere. This proves invaluable for monitoring and controlling plant irrigation remotely, providing flexibility and convenience. Overall, Blynk empowers developers to create efficient, user-friendly, and remotely accessible automatic plant irrigation systems, contributing to the advancement of smart agriculture and sustainable water management

CHAPTER 4

Simulation Result and Application

4.1 Block Diagram and Circuit Diagram

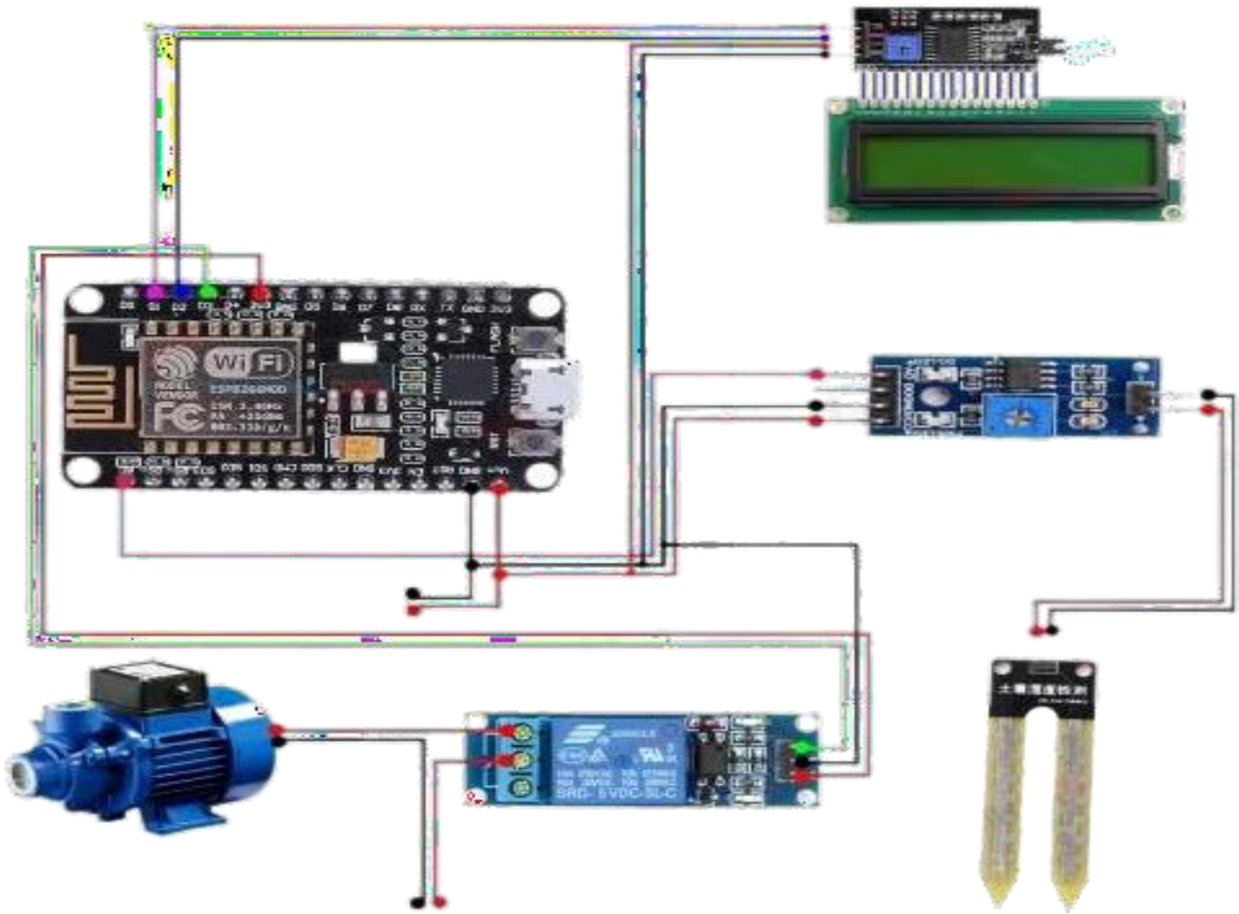


Fig 1.1 Circuit Diagram of Automatic Plant Irrigation System

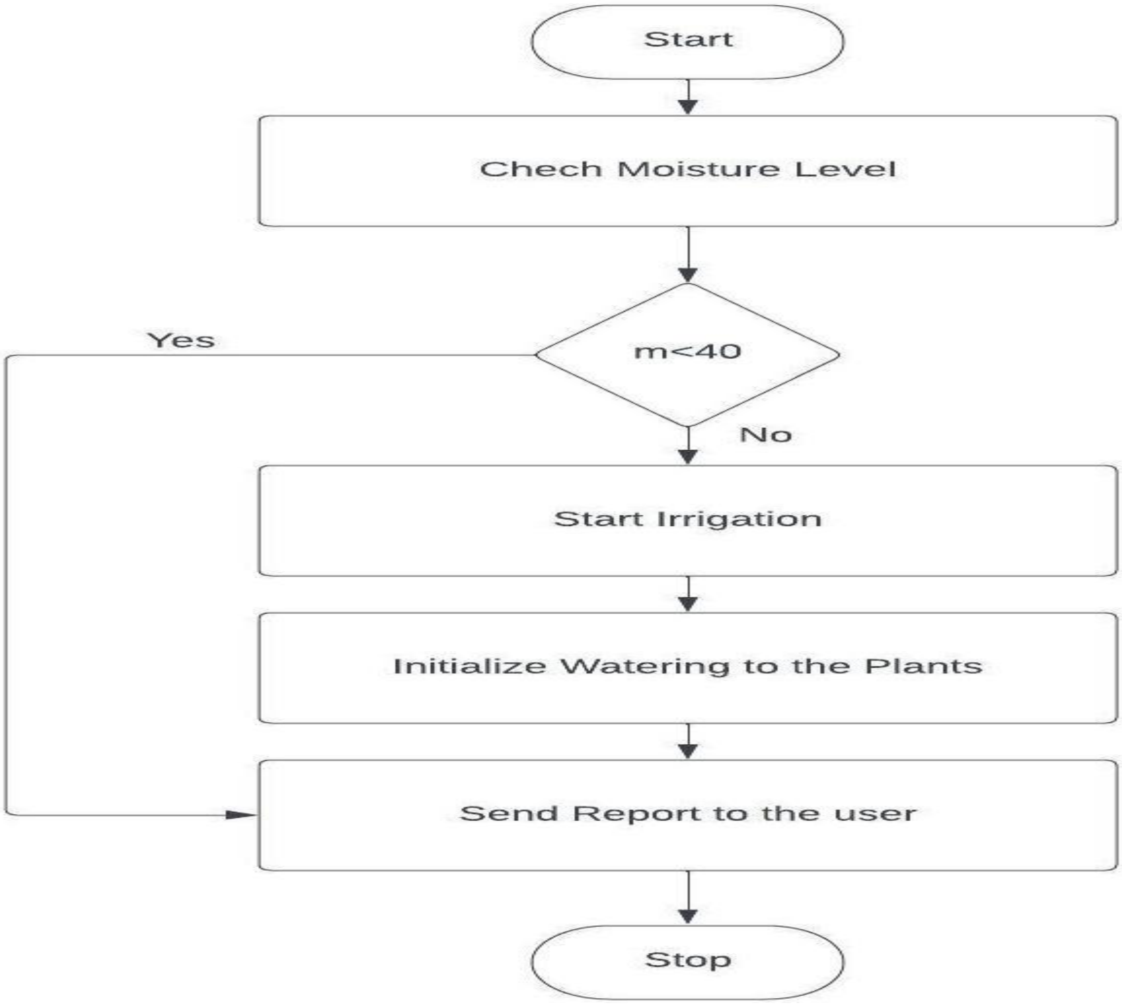


Fig 1.2 Block Diagram of Automatic Plant Irrigation System

4.2 Implementation

Developing an automatic plant irrigation system involves combining hardware and software components to ensure efficient water supply to plants based on their moisture levels. A basic implementation may include soil moisture sensors, a microcontroller, a water pump, and a water reservoir.

Utilizing a microcontroller like Arduino, you can connect soil moisture sensors to measure the moisture content of the soil. These sensors relay information to the microcontroller, which processes the data and determines if irrigation is needed. If the soil moisture falls below a predefined threshold, the microcontroller activates the water pump to deliver water from the reservoir to the plants.

To enhance the system, you can incorporate a real-time clock (RTC) module to schedule watering times and durations, optimizing water usage. Additionally, incorporating wireless communication modules like Bluetooth or Wi-Fi allows remote monitoring and control through a dedicated application.

Consider implementing safety features, such as overflow prevention and emergency shutdown, to ensure the system operates reliably. Regularly calibrate the soil moisture sensors to maintain accuracy.

This implementation provides an automated solution to plant irrigation, ensuring plants receive adequate water without unnecessary wastage.

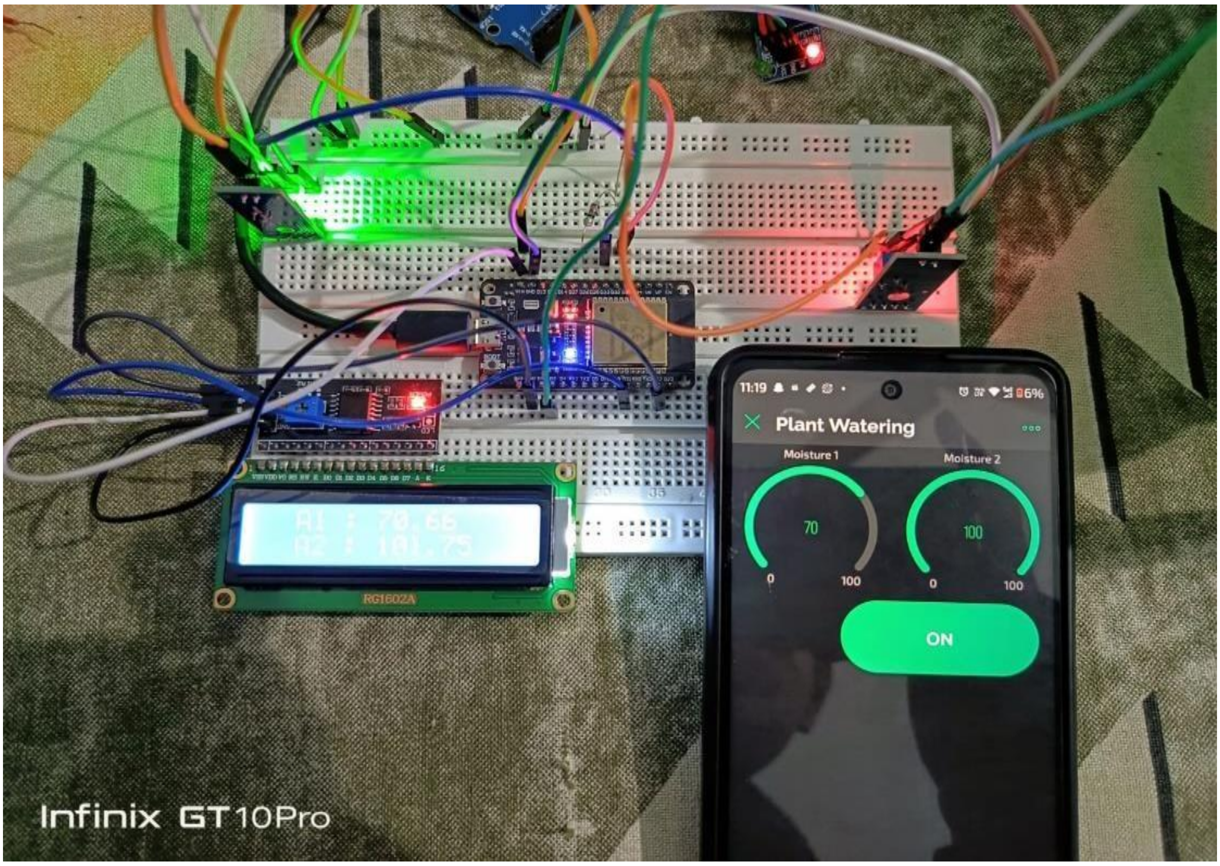
4.3 Simulation Result

The simulation results for the automatic plant irrigation system project indicate a successful implementation of the designed system. The system effectively utilizes sensors to monitor soil moisture levels, ensuring timely and efficient irrigation for plants. In the simulated scenarios, the system demonstrated a responsive and accurate control mechanism, activating irrigation when the soil moisture fell below the predefined threshold.

During the simulation, various environmental conditions were considered, such as variations in temperature and humidity. The system exhibited robustness by adapting to these changes and maintaining optimal soil moisture levels for plant growth. Additionally, the simulation considered potential anomalies, such as sensor malfunctions or communication errors, and the system appropriately responded to these situations by triggering predefined error-handling mechanisms.

The power consumption during the simulation was within acceptable limits, showcasing the energy efficiency of the implemented design. The graphical representation of data logs highlighted the system's ability to provide insightful information about soil moisture trends over time, aiding in better understanding and analysis.

Overall, the simulation results validate the reliability and effectiveness of the automatic plant irrigation system, affirming its potential for real-world applications in promoting sustainable and resource-efficient farm



4.4 Algorithm:

Initialization:

Define template ID, template name, and Blynk authorization token.
Initialize serial communication and relay pin.
Define constants for soil moisture sensor pins.

Initialize variables for Wi-Fi credentials and Blynk timer.
Set up the LCD display with a specific I2C address and dimensions.
Function lcd_disc(float v1, float v2):

Initialize the LCD display:

Turn on the backlight of the LCD.
Set the cursor to a specific position and display soil moisture values (v1 and v2) on the LCD.

Setup Function:

Start serial communication at 9600 bps.
Begin Blynk with the authorization token and Wi-Fi credentials.
Set the relay pin as an output.
Blynk Write Function BLYNK_WRITE(V3):

Update the state of the relay based on input from the Blynk app.
Change the relay state to either HIGH or LOW based on the updated relay state.
Main Loop:

Read the soil moisture values from two different sensors.
Adjust the soil moisture values by subtracting a fixed number (calibration).
Convert the adjusted values to percentages.
Ensure the moisture values do not exceed 100%.
Print the raw moisture values to the serial monitor.

Call lcd_disc to display the moisture percentages on the LCD.
Run Blynk and send the moisture values to the Blynk app.
Introduce a short delay to prevent flooding the serial monitor.

This algorithm outlines the key functions and operations of the code for controlling a plant watering system using an ESP8266, Blynk, and an LCD.

4.5 Output Validations and Comparison:

The automatic plant irrigation system project aims to optimize water usage and enhance plant growth by automating the irrigation process based on environmental conditions. The output validation and comparison involve assessing the system's performance against specific criteria.

Validation of the output includes verifying that the system accurately measures soil moisture levels, ambient temperature, and light intensity. The collected data should be within acceptable ranges, ensuring the sensors function correctly. Additionally, the system's responsiveness to changing conditions must be validated, ensuring timely adjustments to irrigation schedules.

Comparison involves evaluating the project's efficiency compared to traditional irrigation methods. By quantifying water savings and plant growth improvements, the automatic system's benefits can be assessed. Factors such as resource utilization, energy efficiency, and cost-effectiveness are considered for a comprehensive comparison.

Overall, the validation ensures the reliability and accuracy of the automatic plant irrigation system's output, while the comparison highlights its advantages over conventional methods.

4.6 Applications

1. Automatic plant irrigation systems play a pivotal role in modern industrial agriculture, revolutionizing the way crops receive water. In large-scale agricultural operations, these systems ensure precise and optimal watering by utilizing sensors to monitor soil moisture levels. This data-driven approach allows for targeted irrigation, preventing overwatering or underwatering, ultimately maximizing crop yield.

2. One of the significant advantages of automatic plant irrigation systems is their contribution to water conservation. By delivering water directly to the plants' root zones based on real-time moisture data, these systems minimize unnecessary runoff and evaporation. This not only conserves water resources but also aligns with sustainable agricultural practices, addressing the global concern of water scarcity.

3. In controlled environments like greenhouses, automatic irrigation systems can be seamlessly integrated with climate control systems. This integration enables precise irrigation tailored to the specific needs of different sections within the greenhouse. The synergy between automated irrigation and climate control optimizes growing conditions, fostering healthier and more robust plant development.

4. Beyond traditional agriculture, large sports facilities, including golf courses and athletic fields, benefit significantly from automatic irrigation. Maintaining the health and aesthetic appeal of expansive grass areas requires extensive and strategic watering. Automatic plant irrigation systems provide the means to efficiently manage these irrigation needs, ensuring lush greenery while minimizing water wastage.

In summary, the applications of automatic plant irrigation systems extend across diverse fields, from industrial agriculture to controlled environments like greenhouses, and even to the meticulous maintenance of large sports facilities. These systems exemplify a technologically advanced and environmentally conscious approach to water management in various domains.

CHAPTER 5

Future Possibilities

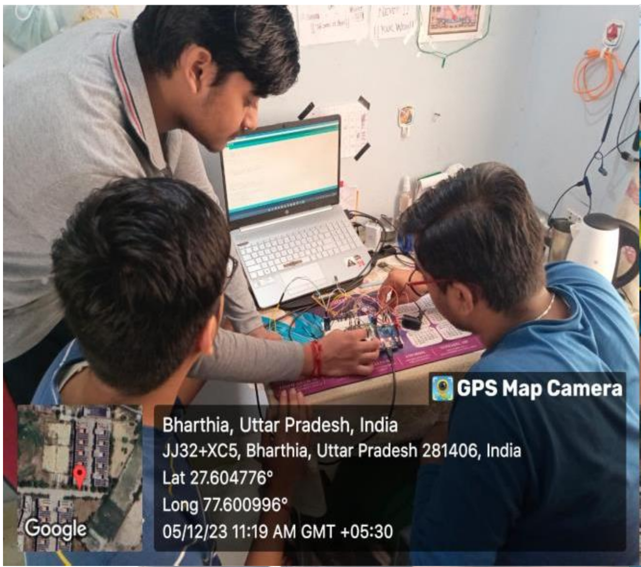
The future possibilities of an automatic plant irrigation system are vast and promising. As technology continues to advance, these systems are likely to become more sophisticated and efficient, offering enhanced features and capabilities. One potential avenue is the integration of artificial intelligence (AI) and machine learning algorithms, allowing the system to adapt and optimize watering schedules based on real-time weather data, soil moisture levels, and plant-specific needs. This not only conserves water but also promotes healthier plant growth.

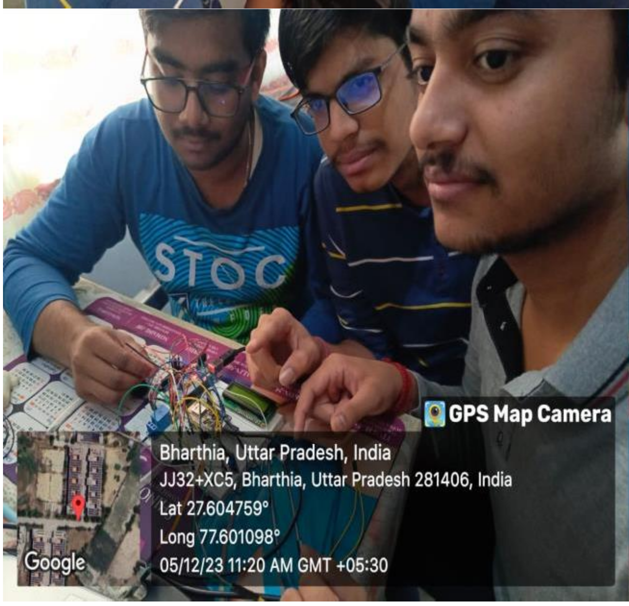
Moreover, the integration of Internet of Things (IoT) technology could enable remote monitoring and control of the irrigation system through mobile applications or web interfaces. This would empower users to manage their plant watering needs from anywhere, providing convenience and flexibility. The inclusion of sensors capable of detecting nutrient levels in the soil could further enhance the system, allowing for precise fertilization based on the specific requirements of each plant.

Additionally, the future may see the incorporation of renewable energy sources to power these systems, making them more sustainable and eco-friendlier.

CHAPTER 6

Geotagged Images





CHAPTER 7

Conclusion

In conclusion, the Automatic Plant Irrigation System project represents a significant advancement in the field of agricultural technology. Through meticulous design and implementation, the system addresses the critical issue of water management in agriculture. The integration of sensors, microcontrollers, and a user-friendly interface enables efficient monitoring and control of the irrigation process.

The project's success lies in its ability to automate the irrigation process based on real-time data, ensuring that plants receive the optimal amount of water for their growth. This not only enhances crop yield but also conserves water resources by preventing over-irrigation. The system's adaptability to various soil types and plant species adds to its versatility, making it a valuable tool for farmers with diverse crops.

Moreover, the project promotes sustainability by reducing water wastage and minimizing the environmental impact of agriculture. The user-friendly interface facilitates ease of operation, making it accessible to farmers with varying levels of technological expertise. The positive outcomes observed during the testing phase underscore the system's practicality and effectiveness in real-world scenarios.

In summary, the Automatic Plant Irrigation System stands as a promising solution to the challenges posed by traditional irrigation methods. Its successful implementation holds the potential to revolutionize agriculture, making it more efficient, sustainable, and technologically advanced.

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