As per UGC guidelines an electronic bar code is provided to secure your paper

International Journal for Modern Trends in Science and Technology
Volume 10, Issue 05, pages 48-53.
ISSN: 2455-3778 online
Available online at: http://www.ijmtst.com/vol10issue05.html
DOI: https://doi.org/10.46501/IJMTST1005008

IoT Based Automatic Plant Watering System

Dr.K Phani Srinivas[1] | N.Surekha Bhagyasri[2] | K.Akhila[2] | M.Jyothi[3]

[1]Head, Department of Electronics and Communication Engineering, Lingayas Institute of Management and Technology, Vijayawada, Andhra Pradesh, India.
[2]Department of Electronics and Communication Engineering, Lingayas Institute of Management and Technology, Vijayawada, Andhra Pradesh, India.
[3]Corresponding Author, Professor, Lingayas Institute of Management and Technology, Vijayawada, Andhra Pradesh, India.

To Cite this Article
Dr.K Phani Srinivas, N.Surekha Bhagyasri, K.Akhila and M.Jyothi, IoT Based Automatic Plant Watering System, International Journal for Modern Trends in Science and Technology, 2024, 10(05), pages. 48-53. https://doi.org/10.46501/IJMTST1005008

Article Info
Received: 17 April 2024; Accepted: 11 May 2024; Published: 12 May 2024.

ABSTRACT

The Smart Garden Watering System represents a pioneering approach to modern gardening practices by integrating wireless networking and IoT technologies to automate watering processes and provide real-time monitoring and control capabilities. This project utilizes Arduino microcontrollers, DHT11 temperature and humidity sensors, moisture sensors, water pumps, an ESP01 RF receiver, Node MCU development boards, and cloud-based services to create a robust and efficient gardening solution. The core functionality of the system revolves around the automated control of water pumps based on environmental conditions and user-defined settings. The DHT11 sensor measures temperature and humidity levels in the garden, while the moisture sensor detects soil moisture content. The collected sensor data is displayed in real-time on an LCD screen, providing users with insights into the garden's environmental conditions. Upon sensing low soil moisture levels, the system triggers the water pump to irrigate the garden automatically, ensuring optimal hydration for plants. This automation not only simplifies gardening tasks but also helps conserve water by delivering moisture precisely when needed. Furthermore, the system incorporates wireless networking capabilities for remote monitoring and control. Sensor data, including temperature, humidity, and soil moisture levels, is transmitted wirelessly to an ESP01 RF receiver. From there, the data is forwarded to a Node MCU development board, which uploads it to a cloud-based platform for storage and analysis. Users can access the sensor data and control the watering system remotely through a dedicated mobile application. The application provides a user-friendly interface for viewing real-time sensor readings, adjusting watering schedules, and receiving alerts or notifications regarding the garden's status.

KEYWORDS: Node MCU, ESP01 ,LCD Screen, IoT Technologies

1.INTRODUCTION

The traditional approach to gardening often involves manual watering methods, which can be inefficient, time-consuming, and prone to human error. Gardening enthusiasts face challenges in maintaining optimal hydration levels for their plants, particularly when environmental conditions fluctuate or when they are away from home for extended periods. Additionally, inadequate watering practices can lead to plant stress, wilting, and even death, impacting the overall health and vitality of the garden.

Moreover, the lack of real-time monitoring and control capabilities makes it challenging for gardeners to accurately assess the moisture levels in the soil and adjust watering schedules accordingly. This reliance on guesswork and manual observation may result in overwatering or underwatering, both of which can have detrimental effects on plant growth and development. Furthermore, the absence of automation in watering processes limits the efficiency and sustainability of gardening practices, as water resources may be wasted unnecessarily.

In summary, the problem statement revolves around the need for a more efficient, reliable, and sustainable approach to garden watering. There is a clear need for a solution that integrates automation, real-time monitoring, and remote control capabilities to optimize watering processes, conserve water resources, and ensure the health and vitality of garden plants. The Smart Garden Watering System aims to address these challenges by leveraging wireless networking and IoT technologies to automate watering tasks, provide real-time monitoring and control, and empower gardeners with actionable insights for better garden management.

2.LITERATURE SURVEY

Existing methods for garden watering typically involve manual techniques such as hose watering, sprinklers, or drip irrigation systems. While these methods have been effective to some extent, they come with several drawbacks:

Inefficiency: Manual watering methods often result in overwatering or under watering, as they rely on human judgment and may not take into account the specific moisture needs of different plant species or changes in environmental conditions.

Time-Consuming: Traditional watering methods can be time-consuming, requiring gardeners to spend significant time and effort watering their plants, especially in larger gardens or during hot and dry weather conditions.

Inconsistent Watering: Manual watering may lead to inconsistent watering patterns, with some areas of the garden receiving too much water while others remain dry, resulting in uneven plant growth and health.

Water Waste: Inefficient watering practices can lead to water wastage, particularly in regions facing water scarcity or drought conditions. This not only impacts water bills but also contributes to environmental concerns related to water conservation.

Limited Monitoring and Control: Traditional watering methods lack real-time monitoring and control capabilities, making it challenging for gardeners to accurately assess soil moisture levels or adjust watering schedules based on changing environmental conditions.

Dependency on Weather: Gardeners often rely on weather forecasts to determine when and how much to water their plants, which may not always be accurate or reliable, leading to suboptimal watering practices.

Risk of Plant Stress and Disease: Inconsistent watering and overwatering can stress plants and make them more susceptible to diseases such as root rot, fungal infections, and pest infestations, compromising their overall health and vitality.

In summary, existing methods for garden watering have limitations in terms of efficiency, consistency, water conservation, and plant health. There is a clear need for a smarter, more automated approach to garden watering that leverages technology to address these challenges and optimize plant care while conserving water resources. The Smart Garden Watering System aims to fill this gap by offering automated watering processes, real-time monitoring, and remote-control capabilities to enhance efficiency, sustainability, and plant health in the garden.

3. PROPOSED SYSTEM FOR IMPLEMETATION

The proposed Smart Garden Watering System represents a pioneering solution to address the limitations of existing garden watering methods by integrating wireless networking and IoT technologies. This system aims to automate watering processes, provide real-time monitoring and control capabilities, and optimize plant care for gardeners of all levels

Key components of the proposed system include:

Sensors: The system incorporates sensors such as DHT11 temperature and humidity sensors and moisture sensors to continuously monitor environmental parameters in the garden, including temperature, humidity, and soil moisture levels.

Water Pumps: Water pumps are used to deliver water to the garden based on sensor readings and user-defined preferences. The system can adjust watering schedules and duration to ensure plants receive the optimal amount of moisture for healthy growth.

Arduino Microcontrollers:Arduino microcontrollers are utilized to interface with sensors, control water pumps, and manage data processing and communication tasks. These microcontrollers serve as the brain of the system, orchestrating various components to automate watering processes and optimize plant care.

Wireless Networking: The system incorporates wireless networking capabilities, allowing sensor data to be transmitted wirelessly to a central hub for processing and analysis. This enables real-time monitoring of garden conditions and remote access and control via a dedicated mobile application.

Mobile Application: A dedicated mobile application provides users with a user-friendly interface to monitor garden conditions, adjust watering schedules, and receive alerts or notifications regarding the garden's status. Users can access the application from anywhere with an internet connection, enabling remote monitoring and control of the watering system.

Cloud-Based Services: Sensor data is uploaded to cloud-based platforms for storage and analysis, enabling users to access historical data, track trends, and receive insights into garden health and hydration levels over time. Cloud-based services also facilitate scalability and flexibility, allowing the system to accommodate future expansions or enhancements.

Overall, the proposed Smart Garden Watering System offers a comprehensive solution to optimize garden watering processes, conserve water resources, and enhance plant health and vitality. By integrating automation, real-time monitoring, and remote control capabilities, this system empowers gardeners to achieve optimal plant care with greater efficiency and convenience, ultimately leading to healthier and more vibrant gardens.

Overall, the Smart Garden Watering System offers a convenient, efficient, and environmentally friendly solution for garden maintenance. By leveraging wireless networking and IoT technologies, it empowers users to cultivate healthy and thriving gardens while minimizing water waste and labor-intensive tasks.

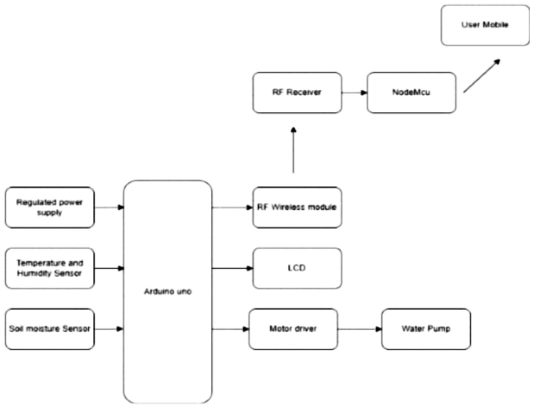

Fig 1 : Shows Block Diagram of the Proposed system

The implementation of the Smart Garden Watering System involves several key steps to integrate the various components and ensure the system's functionality and effectiveness. Here's a detailed outline of the implementation process:

Hardware Setup:

Configure Arduino microcontrollers to interface with sensors (DHT11 temperature and humidity sensors, moisture sensors) and water pumps.

Connect sensors to Arduino boards and ensure proper calibration for accurate data collection.

Set up water pumps and ensure they are properly connected to the Arduino boards for automated control.

Software Development:

Develop firmware for Arduino microcontrollers to read sensor data, control water pumps, and manage communication tasks.

Write code to process sensor data, adjust watering schedules based on user-defined preferences, and trigger water pumps as needed

Implement wireless networking protocols (e.g., Wi-Fi or Bluetooth) for communication between Arduino boards and the central hub.

Central Hub Setup:

Set up a central hub, such as a Raspberry Pi or a dedicated server, to receive sensor data from Arduino boards.Develop software to process incoming sensor data, store it in a database, and provide real-time monitoring and control capabilities.Implement cloud connectivity to upload sensor data to cloud-based platforms for storage and analysis.

Mobile Application Development:

Develop a mobile application for iOS or Android platforms to provide users with remote access and control of the watering system.

Design a user-friendly interface for viewing real-time sensor data, adjusting watering schedules, and receiving alerts or notifications.

Implement secure authentication and encryption protocols to ensure data privacy and security

Integration:

Integrate Arduino boards, sensors, water pumps, and the central hub into a cohesive system.

Establish communication between Arduino boards and the central hub to transmit sensor data and control commands.

Test the system's functionality and connectivity to ensure seamless operation and data transmission.

APPLICATIONS

The Smart Garden Watering System offers several advantages in the field of gardening and plant care:

Efficiency: By automating watering processes based on real-time sensor data, the system ensures that plants receive the optimal amount of moisture, leading to healthier growth and reduced water waste.

Convenience: Gardeners can remotely monitor and control the watering system via a mobile application, allowing them to adjust watering schedules and receive alerts or notifications from anywhere with an internet connection

Water Conservation: The system helps conserve water resources by delivering moisture precisely when needed, minimizing overwatering and runoff, and promoting sustainable gardening practices.

Improved Plant Health: Consistent and accurate watering provided by the system helps prevent under-watering or overwatering, reducing plant stress and susceptibility to diseases and pests , resulting in healthier and more vibrant plants.

Time Savings: Automated watering processes save gardeners time and effort spent on manual watering tasks, allowing them to focus on other aspects of garden maintenance or enjoy leisure time.

4.RESULTS AND CONCLUSION

This soil moisture sensor measures soil moisture levels by capacitive sensing rather than resistive sensing like other sensors on the market. It is made of corrosion-resistant material which gives it excellent service life. Insert it into the soil around your plants and monitor the real-time soil moisture data.

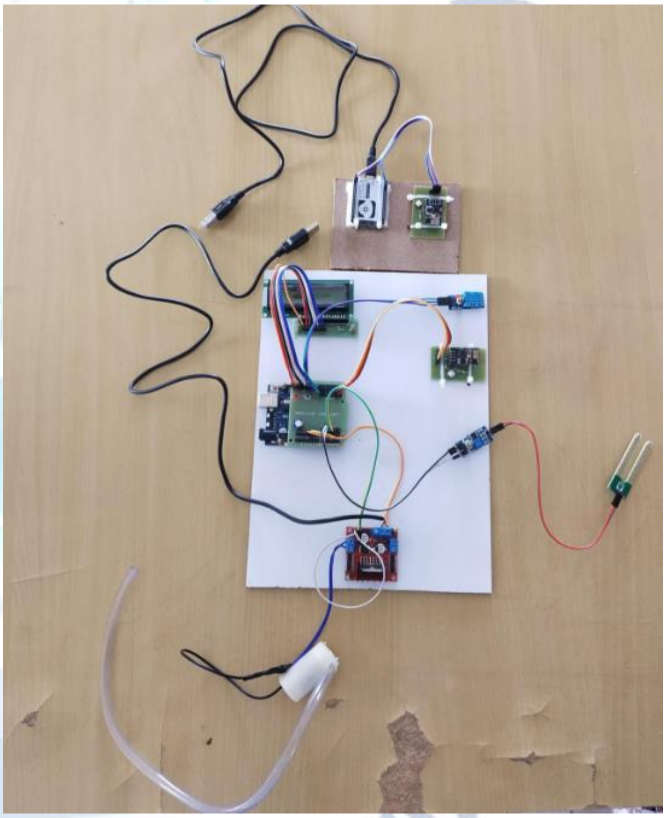

Fig 2:Shows the Physical view of the Proposed system

This module includes an onboard voltage regulator which gives it an operating voltage range of 3.3 ~ 5.5V. It is perfect for low-voltage microcontroller with both 3.3V and 5V power supply.

For the Code :

https://drive.google.com/drive/folders/10jDap2dsMyFxaS0oZD1x_qdGrgofXD_I?usp=sharing

In conclusion, the Smart Garden Watering System represents a significant advancement in gardening practices, offering an efficient, convenient, and sustainable solution for automating watering processes and optimizing plant care. By leveraging wireless networking and IoT technologies, this system empowers gardeners to maintain healthy and vibrant gardens with minimal effort while conserving water resources and promoting sustainability

The advantages of the Smart Garden Watering System, including efficiency, convenience, water conservation, improved plant health, and customization options, make it a valuable tool for home gardeners, commercial agriculture, community gardens, educational institutions, and botanical gardens alike. Whether used in backyard gardens, urban farms, school gardens, or greenhouse settings, the system enhances plant care and gardening success while promoting environmental stewardship and conservation.

As the demand for smart gardening solutions continues to grow, the Smart Garden Watering System stands out as a versatile and innovative solution that revolutionizes traditional watering methods. Its integration of automation, real-time monitoring, and remote control capabilities offers a glimpse into the future of sustainable gardening practices, where technology plays a central role in optimizing plant care and promoting environmental sustainability.

In summary, the Smart Garden Watering System represents a smart, efficient, and eco-friendly approach to gardening that empowers gardeners to achieve optimal plant health and gardening success while contributing to water conservation and environmental stewardship. With its numerous advantages and applications, this system has the potential to revolutionize gardening practices and promote a greener, healthier planet for generations to come.

FUTURE SCOPE:

A. Integration with Smart Home Systems: Integration with existing smart home platforms to enable seamless control and monitoring alongside other home automation devices.

B. Advanced Sensor Technologies: Adoption of more advanced sensors for improved data accuracy and additional parameters such as nutrient levels and air quality.

C. Machine Learning Integration: Utilizing machine learning algorithms to analyze data patterns and optimize watering schedules based on historical data and predictive analytics.

D. Solar-Powered Solutions: Development of solar-powered devices to reduce reliance on external power sources and increase sustainability.

C. Expansion to Commercial Agriculture: Scaling up the technology for use in large-scale agriculture, where precise water management can have significant economic and environmental benefits.

E. Mobile Applications: Enhancing user experience with dedicated mobile applications for easier access to data, customization options, and notifications/alerts

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Sandeep CH, Kumar SN, Kumar PP (2018) Security challenges and issues of the IoT system. Indian J Public Health Res Dev (IJPHRD) 9(11):748–753

[2] Ahmed SM, Sai Chandu T, Rohit U, Naveen G, Naveen S (2019) IoT based garbage disposer for educating rural India. In: International conference on data sciences, machine learning and applications (DSMLA 2019), 29–30 Mar 2019, Springer Conference

[3] Patil MSS, Malvijay AV (2014) Review for arm based agriculture field monitoring system. Int J Sci Res Publ 4(2)

[4] Tani FH, Barrington S (2005) Zinc and copper uptake by plants under two transpiration rates. Part I. Wheat (Triticum aestivum L.). Environ Pollut 138:538–547

[5] Gutierrez J, Villa-Medina JF, Nieto-Garibay A, Porta-GándaraMA (2013) Automated irrigation system using a wireless sensor network and GPRS module. IEEE

[6] Patil SS, Malvijay AV (2016) Review for ARM based agriculture field monitoring system. Int J Sci Res Publ 4(2). Nagothu SK (2016) Weather based smart watering system using soil sensor and GSM. In: 2016 World conference on futuristic trends in research and innovation for social welfare (startup conclave). IEEE Xplore: 06 Oct 2016

[7] ury WA, Vaux HJ (2007) The emerging global water crisis: managing scarcity and conflict between water users. Adv Agron 95:1–76

[8] Arun C, LakshmiSudha K (2012) Agricultural management using wireless sensor networks—a survey. In: 2nd International

conference on environment science and biotechnology (IPCBEE), vol 48. IACSIT Press, Singapore

[9] Nagothu SK, Anitha G, Annapantula S (2014) Navigation aid for people (Joggers and runners) in unfamiliar urban environment using Inertial Navigation. In: 2014 Sixth international conference on advanced computing (ICoAC), pp 216–219

[10] Yuan G, Luo Y, Sun X, Tang D (2004) Evaluation of a crop water stress index for detecting water stress in winter wheat in the North China Plain. Agric Water Manage 64(1):29–40

[11] Nagothu SK (2016) Weather based smart watering system using soil sensor and GSM. In: 2016 World conference on futuristic trends in research and innovation for social welfare (startup conclave). IEEE Xplore: 06 Oct 2016