Design and Development of Automated Indoor Plant Monitoring System

Mrs.V.Kirusanthy[a], Mrs.V.Thushyanthini[b]
[a] *kirusanthys@esn.ac.lk*
[a]*Eastern University, Sri Lanka, Nilaveli, Trincomalee, 31010, Sri Lanka.*
[b]thushyanthinv@esn.ac.lk, [b]*Eastern University, Sri Lanka, Nilaveli, Trincomalee, 31010, Sri Lanka.*

Abstract

The automated indoor plant monitoring system integrates sensor technology to provide real time effective and practical solution for monitoring key parameters such as soil moisture, temperature and humidity. The primary aim of this project is design and develop an indoor plant water monitoring system focusing on checking the moisture of soil without human workforce, highlighting the significance of such technology in enhancing plant care and addressing challenges by indoor gardeners. This system utilizes two soil moisture sensors embedded in the plant pots, which continuously measure the moisture content of the soil. These sensors are connected to the MCU programmed to collect and process the sensor data. Initial testing of the prototype has shown promising results, with the system effectively monitoring soil moisture levels and providing timely feedback through LCD. This test is conducted to examine the values represented by the dry soil and wet soil in the microcontroller. The user interface provides a user-friendly experience. According to soil moisture the system will starting or ending water supply.

Keywords: Indoor plant, Water monitoring system, Soil moisture sensors, Microcontroller unit (MCU), Liquid crystal display (LCD).

1. Introduction

In today's fast-paced world, maintaining indoor plants is facing major problems in watering [1]. Ensuring plants receive an adequate supply of water is crucial for their healthy growth [2]. The task of watering plants falls upon the shoulders of farmers and plant enthusiasts alike, as it is integral to their care regimen. Understanding the optimal timing and quantity of water to administer directly influences the watering process. Insufficient water can lead to dryness, while an excess of moisture can result in rotting [3].

With the advancement of technology, there arises an opportunity to mitigate risks and minimize human labour through the utilization of electronic equipment. In pursuit of enhancing the comfort and efficiency of gardeners, an automatic plant monitoring system has been devised [4]. The primary objective of this endeavour is to conserve water, eliminate the need for manual intervention, and optimize time management. Consider the scenario where the owner or gardener is absent from home; what becomes of the garden or the plants? This initiative ensures a consistent and automated supply of water to the plants, contingent upon the moisture levels detected within the soil [5].

Gardening's accessibility is stressed, showing that anybody may participate by addressing plants' basic needs, such as giving water, soil, air, sunlight, and adequate nutrients. This study introduces the concept of an automatic irrigation system as a method of efficiently meeting the needs of plants. This system's principal duty is to monitor plant status and provide water as needed [6]. Automation is advised to lessen the manual labour necessary for plant upkeep. The focus then changes to a specific research project called “Indoor Gardening with Automatic Irrigation System Using Arduino Microcontroller” [7]. The project attempts to create an autonomous irrigation system for indoor gardens that uses a moisture sensor to detect soil humidity and an Arduino microcontroller to manage water flow [8]. The study's aims include determining system requirements, designing the project with appropriate features, addressing implementation obstacles, conducting tests, and assessing the proposed system's accuracy. The Systems Development Life Cycle (SDLC) approach is provided as the project's guiding structure, with four stages: planning, analysis, design, and execution [9].

2. Required components

2.1. Software requirements

Software	**Specifications**
Programming Language	C/C++
Controller Support	AT mega 328
Installation Media	Arduino Software (IDE)

2.2. Hardware requirements

Microcontroller	• Brand Name: Arduino UNO • Operating Voltage:5V • Digital I/O pins:14(of which 6 provide PWM output) • Analogue Input Pins:6

LCD	• Brand Name: Unbranded • Model: 16x2 Character LCD Module Display • Display Size:2.5
Mini Water Motor	• Power: 4.8W • Voltage:12V DC • Max Current: 400mA
Moisture Sensor	• Input Voltage: 3.3-5V • Input Current: 35mA • Output Signal: both analogue and digital Pin-out
Solenoid valve	• Material: Metal Plastic • Input Voltage: 12V • Power: 8W
Relay module	• Operating voltage: 5V • Control DC/AC Signal • VCC=5V
DHT 11	• Input Voltage: 5V • Operating Current: 0.3mA • Temperature Range: 0°C to 50°

3. Results

Developing indoor plant monitoring system including temperature, humidity, and soil moisture in real-time. It features an automated watering mechanism based on collected data. Versatile and adaptable, it functions

seamlessly in homes, offices, and various indoor settings, simplifying plant care while ensuring optimal growth conditions

The main focus of our project is soil moisture measurement. Depending on the soil moisture, the system starts the water supply or shuts off the water supply.

When the soil moisture sensor reading exceeds 600, the system automatically starts the water supply. If it drops to 600 or below, the system shuts off the water supply.

The summary of the results at different times are as follows;

Test Number	Sensor Reading	Sensor Reading
1	764	567
2	881	535
3	756	350
4	981	435
5	1002	543

4. Conclusion

Humidity levels within the monitored area ranged, indicating adequate moisture content for plant growth. Maintaining optimal humidity levels is crucial to prevent dehydration or over hydration of plants, and the system's ability to monitor these fluctuations enables timely adjustments to environmental conditions.

In the future, we plan to implement Wi-Fi connectivity to enhance the precision and efficiency of our water monitoring system.

Acknowledgements

We would like to express our gratitude to the Staff of Trincomalee Campus, Eastern University, Sri Lanka for their support and guidance in this research project.

References

[1] Abhishek Gupta, ‘’Automatic Plant Watering System’’, Imperial Journal of Interdisciplinary Research {IJIR}, Vol-2, Issue-4, 2016.
[2] Y. C. Manurung, A. S. Hanafiah and P. Marbun, 2015, Pengaruh Berbagai Kadar Air Tanah Pada Efektivitas Mikoriza Arbuskular

Terhadap Pertumbuhan dan Serapan Hara Bibit Karet (Hevea brassiliesis Muell.Arg.) di Rumah Kasa, Jurnal Online Argoekoteknologi, Vol. 3, No. 2, hal 465-467. [Online]. Available: https://bit.ly/2B2xo1z.
[3] Jacquline M.S. Waworundeng. "Automatic watering System for Plants with IoT Monitoring and Notification'', Cogito Smart Journal, VOL. 4, NO. 2, 2018.
[4] Aniruddha Gujar1, "Indoor Plant Monitoring System using NodeMCU and Deep Learning", International Research Journal of Engineering and Technology (IRJET), Volume: 07 Issue: 11 | Nov 2020.
[5] P. Siva Kumar, ''Design and Development of Indore Plant monitoring System'', International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE), Volume 4, Issue 10, October 2015.
[6] Brechner, M.; Both, A.J. Hydroponic Lettuce Handbook. Cornell Controlled Environment Agriculture; Cornell University. Available online: http://www.cornellcea.com/attachments/Cornell CEA Lettuce Handbook.pdf.
[7] Lamsen, F. C., Favi, J. C., & Castillo, B. H. F. (2022). Indoor Gardening with Automatic Irrigation System using Arduino Microcontroller. *ASEAN Multidisciplinary Research Journal*, *10*(1), 131-148.
[8] T. Pranata, B. Irawan and Ilhamsyah, 2015, Penerapan Logika Fuzzy Pada Sistem Penyiraman Tanaman Otomatis Berbasis Mikrokontroler, Jurnal Coding Sistem Komputer Untan, Vol. III, No. 2, hal 11-22. [Online]. Available: https://bit.ly/2Qjc5mW.
[9] E. J. C. F. H. F. Engr. Febrey C. Lamsen, "Indoor Gardening with Automatic Irrigation System using Arduino", *ASEAN Multidisciplinary Research Journal,* vol. 10, p. 18, 2022.