International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 02 | February - 2024 SJIF Rating: 8.176 ISSN: 2582-3930

OPTIMIZING PLANT HEALTH THROUGH IoT

Ch. Narendra[1], D. Sai Kiran[2], K. Surya Vamsi[3], S. Anoosh Varma[4], S. Swaroop[5]

[1-4]B.Tech Student , [5] Assistant Professor, LIET

[1-5] Computer Science and Systems Engineering, Lendi Institute of Engineering and Technology

---***---

ABSTRACT

Design and implement a smart plant watering system that uses IoT technology to monitor and regulate moisture levels in flower pots. The system should be able to automatically adjust watering frequency and amount based on real-time moisture measurements to ensure plant health and minimize water loss. In addition to our commitment to holistic plant care, an additional feature, NPK fertilizer, has been seamlessly integrated into the system. Containing essential nutrients nitrogen, potassium and phosphorus, this feature optimizes plant growth and health. This system automatically applies fertilizer according to a pre-set schedule or on-the-fly adjustments, creating the perfect solution for efficient and sustainable plant growth. The main goal is to create convenient and sustainable solutions. Meets the needs of both experienced and novice plant enthusiasts.

Keywords: Internet of Things, NPK fertilizer, humidity sensor, WiFi module, buzzer, motor.

1. INTRODUCTION

In an age of advancing technology and increasing awareness of sustainability, the combination of Internet of Things (IoT) technologies and traditional horticultural practices has paved the way for innovative plant care solutions. One such innovative project is the development and implementation of a "smart" plant irrigation system that goes beyond traditional irrigation methods. The system uses IoT capabilities to monitor and regulate moisture levels in flower pots, as well as autonomously adjusting watering frequency and amount based on real-time measurements. The comprehensive approach to plant care is further illustrated by the seamless integration of the additional features of NPK fertilization. Containing the essential nutrients nitrogen, potassium and phosphorus, it ensures optimal plant growth and health [1]. One of the components of agricultural operations is the irrigation mechanism of plants. previously plant Irrigation mechanisms were an important and important factor in the planting process. There is a more advanced plant watering system called "Tampa". Otherwise, your plants will produce incomplete or poor harvests. Recently, irrigation systems have been built with microcontroller-based applications that enable water storage. During the dry season, plant watering devices are monitored so they can be more efficient for the plants. Moisture in the muscles can be provided by installing an irrigation system if water is lacking. Provide plants with sufficient water [2]. However, new irrigation systems are still using the autonomous operation concept. In the autonomous operation cycle of irrigation devices, the problem still remains that farmers are not provided with knowledge about each irrigation. Knowledge of irrigation is really necessary to understand whether the system is working correctly. Accordingly, with the development of Internet technology, the need for an automatic water supply device that can provide knowledge water supply remotely through the Internet using the Internet of Things (IoT) is emerging. skeleton. Based on the above context, this article will discuss the architecture of an automated factory. A device that can supply water remotely via the Internet using the Internet of Things (IoT) Framework [3].

2. LITERATURE REVIEW

IoT-Based Automatic Plant Irrigation System with Soil Moisture Sensing - Technology to Support Farmers' Farming in Rural India Syed Mustaq Ahmed, B. Kovela and Vineet Kumar Gunjan Abstract Agriculture and cultivation of rice, wheat and vegetables are mainly carried out in rural areas. It happens locally. Technology is not available to the extent that it can help farmers by automating the massive production of grains and vegetables. Farmers spend most of their time in the fields watering their crops, aside from other tasks. Therefore, to help farmers avoid staying in the field all day [4], we developed a project that detects soil moisture and, based on the data, this system automatically turns on the water pump in the field, and automatically turns on the water pump when the soil reaches sufficient moisture level. The water pump will then turn off automatically. This concept could therefore provide farmers with a long-term solution for maintenance-free farming, where farmers do not have to stay in the field breathing in toxic chemical sand that harms their health. IoT-based smart irrigation system for sustainable agriculture [5]. Agricultural development is important because India's population is increasing day by day and the country will experience a serious food shortage within 25 to 30 years. Today, agriculture suffers from rainfall and water shortages. The biggest problem facing modern society is water shortage, and labor-intensive agriculture consumes a lot of water, so a system that can use water efficiently is needed. The main goal of this work is to develop an intelligent and automated system for watering plants. Automated systems require fewer manual steps and are reliable, flexible and accurate. The Internet of Things has seen a major shift from data generated by devices to objects in physical space [6].

3. PROPOSED SYSTEM

The goal of our project is to develop a simple yet effective system involving automated irrigation to provide optimal watering to small pots or crops with minimal human intervention. Additional features include application of NPK fertilizer to improve overall plant health and growth. The goal of the system is to combine automation and digital communication to keep users informed of their plants' well-being, allowing them to grow plants efficiently. This project uses the ESP8266 microcontroller programmed to receive input signals from various indoor humidity conditions. soil through sensitive devices. Sensor data is stored in a database. The web application is designed in the following way:

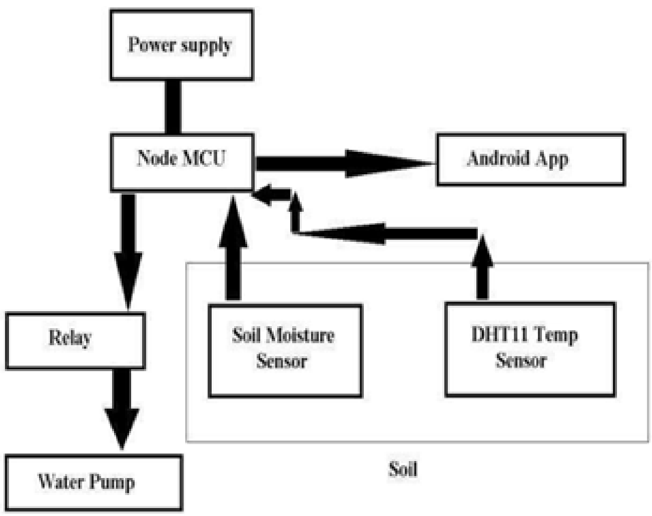

Fig 1 Block Diagram of Watering System

Analyze the data obtained and determine thresholds for humidity, humidity and temperature. For irrigation automation, decisions are made on the server. If soil moisture is lower than the standard value, The engine turns on and turns off when soil moisture exceeds the threshold. In agriculture, field sensors are used as soil moisture sensors, humidity sensors, and temperature sensors. Information The sensor sends to the NODEMCU ESP8266, and then NODEMCU sends a signal to the user to get the information about irrigation.

4. HARDWARE REQUIREMENT

4.1 ESP8266

The ESP8266 is a compact, low-cost Wi-Fi module with an integrated 32-bit microcontroller that provides seamless Wi-Fi connectivity for embedded projects. Its versatility is emphasized by GPIO pins for interfacing with other components, built-in flash memory for program storage, and support for multiple communication protocols. Recognized for its minimal power consumption, it is well-suited for IoT devices powered by batteries. The module can be programmed using popular IDEs such as Arduino, and its active community provides extensive documentation and support. Despite the advent of ESP32, ESP8266 is still widely used in various IoT applications.

4.2 SOIL MOISTURE SENSOR

Soil moisture sensors are small electronic devices designed to measure soil moisture. Commonly used in agriculture and horticulture, these sensors provide real-time data on soil moisture levels to help manage irrigation effectively. It generally consists of two electrodes and measures the resistance between them, which is affected by moisture. The sensor provides an analog or digital signal that indicates whether the soil is dry, wet, or saturated. This information helps users determine the optimal watering schedule, promotes water conservation, and provides plants with the moisture they need for healthy growth.

4.3 IR SENSOR

In smart plant watering systems, infrared (IR) sensors serve as an important component to detect soil moisture levels. The IR sensor emits infrared light into the soil, and the receiver measures the intensity of the reflected light. The moisture content of the soil affects reflection, allowing the sensor to determine whether the soil is dry or wet. This real-time data is used by the system to automatically adjust watering schedules and amounts, providing accurate and adaptive irrigation based on the specific needs of each plant. Integrating an IR sensor can improve system efficiency and save water by preventing plants from overwatering or flooding.

4.4 POWER SUPPLY

The power supply segment is responsible for providing a stable 5V voltage to power system components. LM7805 is used to maintain a constant output voltage of 5V. The input voltage, typically 220VAC, interacts with a transformer to reduce the AC voltage to the desired DC output level. The diode rectifier then produces a full-wave rectified voltage, which is initially filtered by a base capacitor filter to produce a DC voltage. The resulting DC voltage may have slight AC voltage ripple or fluctuation. The regulator circuit dampens ripple and maintains a constant DC current value, ensuring stability even when the DC input voltage fluctuates or the connected load changes. Voltage regulation is usually achieved using well-known voltage regulator ICs.

International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 02 | February - 2024 SJIF Rating: 8.176 ISSN: 2582-3930

4.5 TEMPERATURE SENSOR

The DHT11 stands as a prevalent sensor for measuring temperature and humidity. The sensor comes with a dedicated NTC for temperature measurement and an 8-bit microcontroller to output temperature and humidity values as serial data. Additionally, the sensor is factory calibrated, making it easy to interface with other microcontrollers. The sensor is capable of measuring temperatures in the range of 0°C to 50°C and humidity levels from 20% to 90%, boasting an accuracy of ±1°C and ±1%. Therefore, if your measurement requirements fall within this range, opting for this sensor could be the suitable choice.

4.6 WATER PUMP

Water pumps operating on mechanical and hydraulic principles have been an essential part of society since ancient times. Used in a variety of applications such as domestic water supply, agriculture, municipal water supply and industrial processes, these pumps play a key role in providing essential services. The historical significance of water pumps is notable in that they evolved over the centuries, adapting to the changing needs of society. It works by integrating mechanical components for actuation and hydraulic principles for fluid movement. Modern advancements, including smart pumping systems, have improved efficiency and monitoring capabilities. Different types of pumps are designed for specific applications, reflecting ongoing technological advances in this field.

4.7 BUZZER

Audible signals or audible signaling devices, such as buzzers, may be electromechanical, piezoelectric, or mechanical in nature. Its main purpose is to convert audio signals into audible sound. They are usually powered by DC voltage and find application in timers, alarm systems, printers, computers and many other devices. Depending on the design, it can produce various sounds such as alarm, music, bell, siren, etc.

5. SOFTWARE REQUIREMENT

5.1 ARDUINO IDE

The Arduino integrated development environment, also known as the Arduino software (IDE), includes a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and various menus. Establishes a connection with Arduino and Genuino hardware for program download and communication. Code written with the Arduino software (IDE) is called a sketch and is saved with the file extension ".in". The text editor includes the ability to cut, paste, search, and replace text. The message area provides feedback and also displays errors during saving and exporting. The console in the Arduino software (IDE) showcases textual output, encompassing complete error messages and supplementary details. Details regarding configured boards and serial ports are presented in the bottom-right section, while user-friendly toolbar buttons facilitate tasks such as inspecting, loading, sketching, opening, saving, and accessing the serial monitor.

6. SYSTEM DESCRIPTION

6.1 FLOW CHART

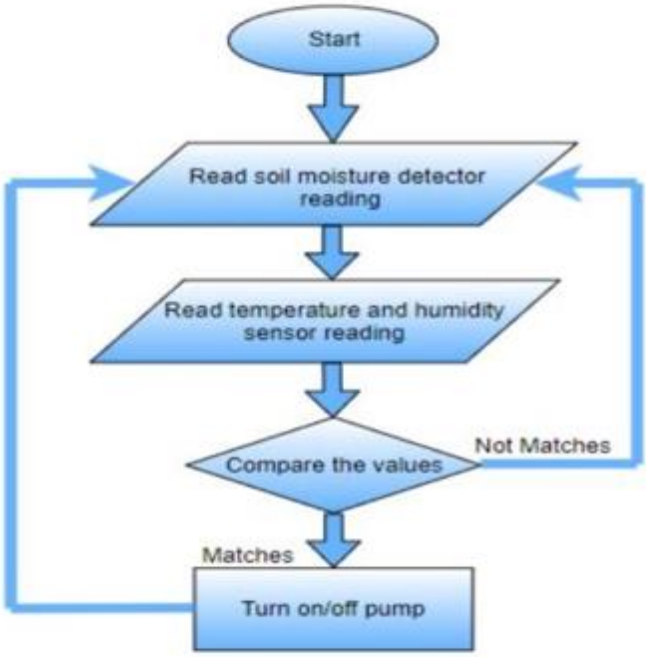

Fig 2 Flow Chart

6.2 BENEFITS OF PROPOSED SMART IRRIGATION SYSTEM

TIME EFFICIENCY: Our system takes care of all your watering tasks, saving you valuable time.
WATER SAVINGS: Using an automated system helps save water as it requires less water than manual watering.
CUT DOWN THE MONEY: Save money by reducing your water bills and extending the life of your plants.
STRESS REDUCTION: Enjoy a stress-free vacation with an automatic system for watering your plants.
SOIL REACTION: The system adjusts its operation to soil conditions to provide optimal plant care.
ENVIRONMENTALLY FRIENDLY: This control system prevents food contaminants from being released into the environment. MANPOWER DRSTRUCTION: Experience completely eliminating the need for physical labor when watering your plants.

7. RESULTS AND DISCUSSIONS

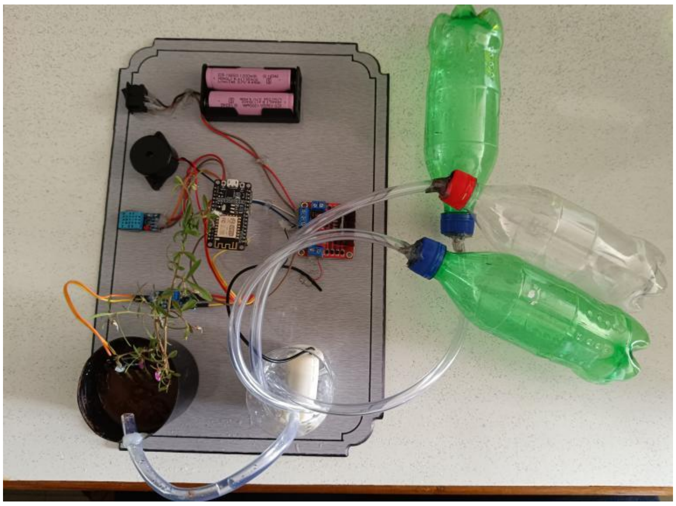

Fig 3 Snap Shot of Device Connections

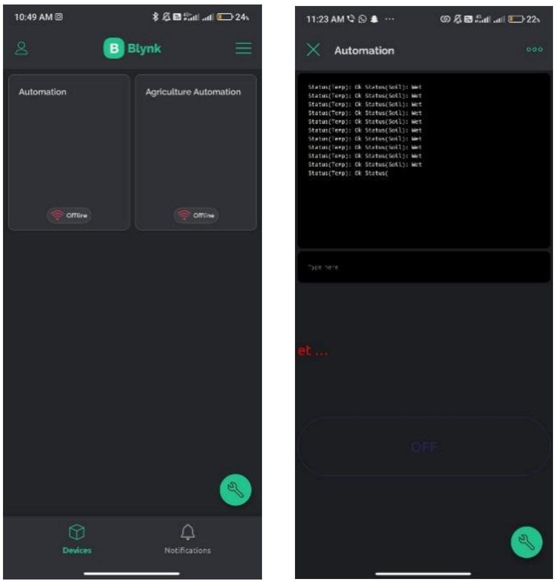

Fig 5: Android application

8. FUTURE WORK & CONCLUSION

For future advancements, the potential exists to expand and scale up this system for extensive agricultural landscapes. Integration with soil quality checks and crop growth monitoring on a per-soil basis could further enhance its capabilities. The successful interfacing of sensors and microcontrollers, along with the achievement of wireless communication between various nodes, sets the foundation for these improvements. Additionally, incorporating machine learning algorithms capable of comprehending crop requirements could transform the field into a fully automated system. The findings suggest that implementing this solution holds promise for minimizing water loss and decreasing the manpower needed for field management.

ACKNOWLEDGEMENT

We would like to thank Department of Computer Science and systems Engineering, Lendi Institute of Engineering and Technology, Vizianagaram for helping us carry out the work and supporting us all the time.

REFERENCES

1. T.Baldwin Immanue, P. Rathnavel, P. Adarsh, A. Duraipandi, N.Mohammed Yaseer, "PV Powered Standardised Irrigation System Using Soil Moisture Sensor", 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS), pp.1017-1020, 2020.
2. Kesevan Veloo, Hayate Kojima, Shogo Takata, Masashi Nakamura, Hironori Nakajo, "Interactive Cultivation System for the Future IoT-Based Agriculture", 2019 Seventh International Symposium on Computing and Networking Workshops (CANDARW), pp.298-304, 2019.
3. Mitul Sheth, Pinal Rupani, "Smart Gardening Automation using IoT With BLYNK App", 2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI), pp.266-270, 2019.
4. Muhammad Razif, M. R., Ravindran, P., Mohd Nordin, I. N. A., & Zulkifli, N. S. A. (2019). Automatic Irrigation System using Wireless Control. ELEKTRIKA- Journal of Electrical Engineering, *18*(3-2), 42–46.
5. D. Femi, K T Habeeb Rahman, "Automated Moisture Monitoring and Irrigation Vehicle for Smart Agriculture", 2023 2nd International Conference on Automation, Computing and Renewable Systems (ICACRS), pp.1921-1928, 2023.
6. Tanisha Patil, Jayashree D. Mallapur, D. G. Mallapur, "Self Monitored Indoor Plant Maintenance with Wastewater", 2023 International Conference on Network, Multimedia and Information Technology (NMITCON), pp.1-6, 2023.