Crop Water Management by Using Ai Technology

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ABSTRACT - The Automatic irrigation system we innovated is used for the purpose of irrigation to reduce the excess water supplied to the field, reduce the electricity and manpower. The components used in this project are ESP8266 microcontroller, soil moisture sensor, relay, DC pump. The ESP8266 microcontroller is controlled by using the IDE software. The soil moisture sensor is used for the continuous monitoring of the water content present in the soil. The series of valves are connected to gather with DC pump. The water content in the soil is controlled by the soil moisture sensor fixed in the soil for each plant that signals the soil moisture sensor and sends to the ESP8266. The programmed ESP8266 connected to the relay will checks the water content signal and turns the DC pump on when the water content is below the programmed level and turns off the DC pump when the water content exceeds the programmed level. The user can monitor in the online website as well as from mobile application (Blynk IoT). The system can control automatically as well as manually by using the Blynk IoT application. By this we can reach the maximum yield of the crop with minimized manpower, water and electricity consumed for the irrigation system.

Keywords - Irrigation water management, Automatic moisture monitor, Micro controller, ESP8266, IDE, Blyk IoT, etc.

I. Introduction

The introduction of a Smart Irrigation System using ESP8266 heralds a new era in efficient and intelligent water management for agricultural and garden applications. This innovative system integrates the capabilities of the ESP8266 microcontroller with advanced sensors, including a soil moisture sensor, a relay, a DC pump, and an LCD display. In this method, soil moisture sensors are positioned in the plant's root zone and close to the module, and the gateway unit manages the sensor data [1]. The design of automatic plant irrigation system using wireless sensor networks produces irrigation configurations that can be controlled automatically [2]. This convergence of technology aims to address the challenges associated with traditional irrigation methods by offering an automated, data-driven, and remotely accessible solution. Improvement of agricultural industry are significant, as this industry meet one of the primary needs of society and the economy of the country [3]. By using IoT and AI software the crop health can be tracked, monitored, crop watering and also any doubts or issues faced by farmers regrading agricultural land can be solved [4].

II. Equipment

ESP8266 Microcontroller: Understand the role of the ESP8266 microcontroller as the brain of the system and explore its capabilities in terms of wireless communication, data processing and interfacing with other components.

Fig. 1. ESP8266

Soil Moisture Sensor: Explore the importance of the soil moisture sensor in providing real-time data about soil conditions. Learn how this sensor aids in making informed decisions about irrigation scheduling. It consists of a pair of electrodes to measure the resistance of the soil [5].

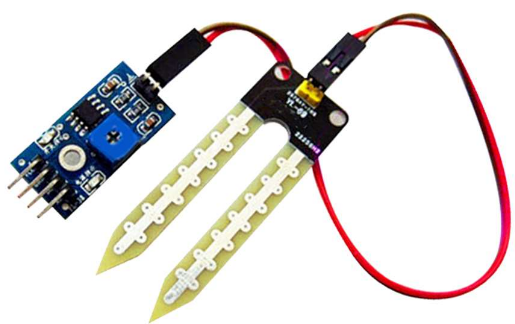

Fig. 2. SOIL MOISTURE SENSOR

Relay: Acting as a switch, the relay is employed to control the DC pump. The ESP8266 utilizes the relay to activate or deactivate the pump based on the soil moisture readings, ensuring precise and efficient water delivery.

Fig. 3. RELAY

DC Pump: The DC pump is responsible for drawing water from a water source and distributing it to the irrigation system. The system's automation ensures that the pump operates only when necessary, conserving water resources and promoting sustainable irrigation practices.

Fig. 4. DC PUMP

LCD Display: Discover the role of the LCD display as an interface for users. Explore the information it provides, such as soil moisture levels, pump status, and alerts, enhancing user interaction and system transparency.

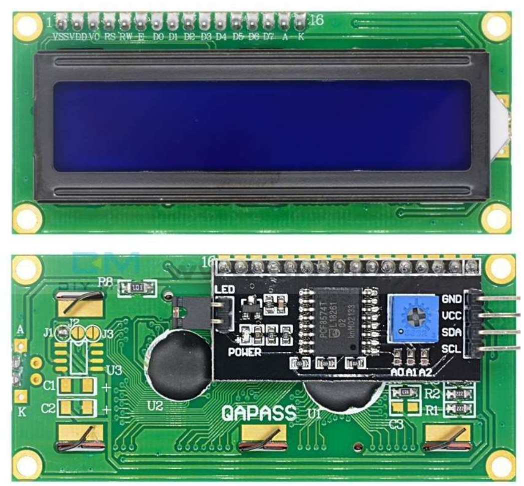

Fig. 5. LCD

III. Working Principle

The working principle of the automatic irrigation system revolves around the synergy of the ESP8266 microcontroller, soil moisture sensor, relay, DC pump, and LCD. This intelligent system operates seamlessly, ensuring optimal soil moisture levels and efficient water usage in agricultural or garden settings. The ESP8266 is a low-cost, Wi-Fi-enabled microcontroller that has gained popularity for its versatility and ease of use in embedded systems and Internet of Things (IoT) applications. Developed by Express if Systems, the ESP8266 integrates a microcontroller unit (MCU) with built-in Wi-Fi capabilities, making it suitable for a wide range of projects that require wireless communication.

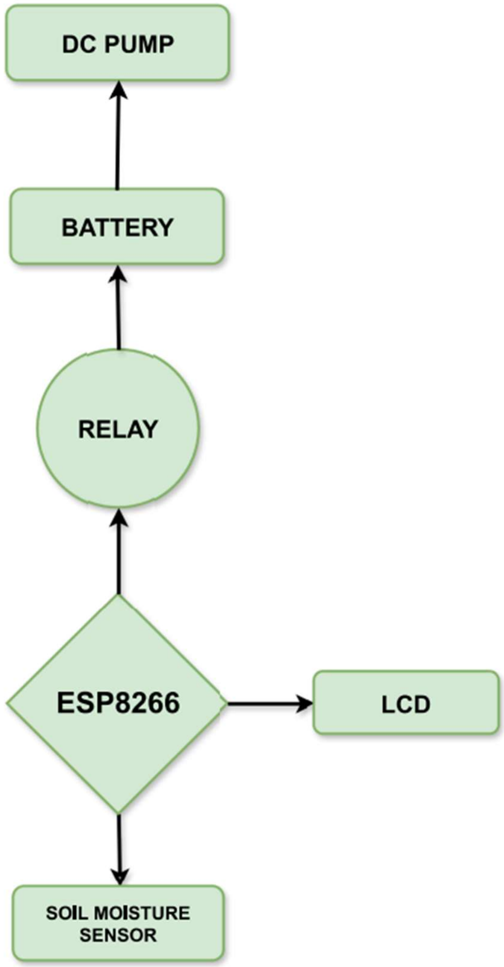

Fig. 6. Flow chart

Soil Moisture Sensing:

The core functionality begins with the soil moisture sensor, which is strategically placed in the root zone of the plants. This sensor continually measures the moisture content in the soil, providing crucial data for the irrigation system. The soil moisture sensor typically consists of two probes that penetrate the soil. The electrical conductivity between these probes' changes with the soil's moisture content, and this change is translated into a measurable signal.

ESP8266 Processing and Decision-Making:

The ESP8266, acting as the brain of the system, receives the real-time data from the soil moisture sensor. The microcontroller processes this information using a predefined control logic. The control logic incorporates various factors such as current soil moisture levels, historical data, time of day, and potentially other environmental parameters. This data-driven approach ensures that irrigation decisions are not solely based on a single factor, but rather on a holistic assessment of the plant's needs and external conditions.

Decision Criteria:

The decision criteria for initiating irrigation are flexible and can be adjusted based on specific plant requirements or user preferences. For example, the system may trigger irrigation when the soil moisture falls below a certain threshold, but it may also consider factors like the time of day to avoid watering during peak sunlight hours. This intelligent decision-making process enhances water conservation and promotes efficient resource utilization.

Wireless Communication:

The ESP8266, equipped with Wi-Fi capabilities, establishes a wireless connection for communication. This enables users to interact with the irrigation system remotely through a dedicated mobile application or a web-based interface. Users can monitor real-time data, adjust settings, and receive notifications or alerts, providing a high level of control and convenience.

Relay Operation:

Once the ESP8266 determines that irrigation is necessary based on the control logic and decision criteria, it sends signals to the relay. The relay acts as a switch, controlling the power supply to the DC pump. In its default state, the relay is in the off position, ensuring that the pump remains inactive when not needed. When the ESP8266 signals the relay to activate, it completes the circuit, allowing electrical power to flow to the DC pump.

DC Pump Activation:

Upon receiving the signal from the relay, the DC pump is activated. The pump draws water from a designated water source, such as a reservoir or well, and initiates the irrigation process. The water is then distributed through the irrigation system to the plant roots, ensuring a targeted and efficient delivery.

Soil Moisture Reassessment:

Throughout the irrigation process, the soil moisture sensor continues to monitor the soil's moisture levels. The ESP8266 periodically reassesses the data to determine when the optimal moisture level is achieved. Once the desired soil moisture level is reached, the microcontroller sends a signal to the relay to deactivate the DC pump, concluding the irrigation cycle.

LCD Display:

Simultaneously, the LCD provides real-time feedback to users. It displays relevant information such as current soil moisture levels, pump activation status, and any alerts or notifications. This visual interface enhances user awareness and engagement, allowing users to monitor the system's performance and make informed decisions.

User Interaction and Customization:

Users have the flexibility to interact with the system through the mobile app or web interface. They can customize irrigation schedules, set moisture threshold levels, and receive notifications or alerts for critical events such as low water levels or system malfunctions. This user-centric approach empowers individuals to tailor the system to specific plant needs and environmental conditions.

System Optimization:

Over time, the system accumulates data and refines its decision-making process. Machine learning algorithms can be implemented to optimize irrigation schedules based on historical data and evolving environmental conditions. This adaptive capability ensures continuous improvement and efficiency in water management.

IV. Circuit diagram

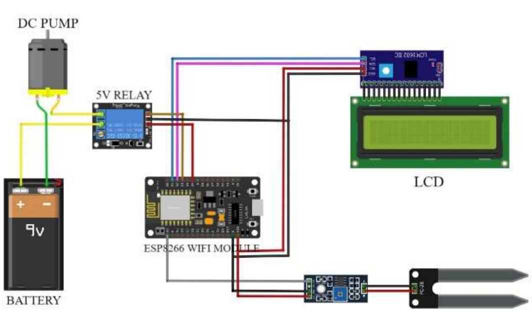

Fig. 7. Circuit diagram

V. Applications and Case Studies

Agricultural Applications: Explore real-world applications of the smart irrigation system in agriculture. Understand how the system can be adapted to various crops and farming practices, optimizing water usage and enhancing productivity.

Garden and Landscape Implementation: Delve into the application of the system in gardens and landscaping. Explore how the smart irrigation system contributes to the health and aesthetics of plants in residential and commercial settings.

VI. Conclusion

The working principle of the Automatic Irrigation System using ESP8266, Soil Moisture Sensor, Relay, DC Pump, and LCD is a dynamic interplay of data sensing, intelligent decision-making, wireless communication, and user interaction. This integrated approach promotes water conservation, efficient irrigation, and user-friendly control in agricultural or garden settings, making it a sustainable and technologically advanced solution of modern agriculture.

References

[1] Mohit Jambu, Kulwinder Singh, harsh Kumar Shrivastava Singh “smart irrigation system for farmers using ESP8266 detection moisture, temperature and water level in fields” Volume 10, Issue 2, April 2023.

[2] Eko Noerhayati, Margianto, Bambang Dwisulo, Anita rahawati “sprinkler irrigation test with microcontroller NODEMCU ESP8266” volume 10, issue 10, October 2019.

[3] Amirul amin Abd Halim, Rosalina Mohamed, Farah Yasmin Abdul Rahman,harlisya Haruna” IoT based smart irrigation, control, and monitoring system for chilli plants using NODEMCU ESP8266” volume 12, issue 5, October 2023.

[4] P.k.sheela shanthakumari, k. Mahalakshmi, Dr. j. Senthil Murugan, Dr. w. t. chembian, tharun R, Vishal Krishnan R, yamen ali J “A study on IoT based smart irrigation system & weather forecasting using ESP8266” volume 72, issue 1, 2023.

[5] Prof. DR. Sangeeta kurundhar, Kapil muchandani, Shubham bannore, pranita mor, Akshay Aserkar. “PLAWATOS – An automatic plant watering IoT based system using ESP8266” volume 3, issue 7, July 2017.