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Smart Irrigation with Tank Level Monitoring System

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Abstract: *Smart irrigation systems offer a sustainable solution for optimizing water usage in agriculture. This paper presents a novel approach integrating a tank level monitoring system with smart irrigation technology. The proposed system utilizes sensors to monitor the water level in tanks and employs an intelligent algorithm to regulate irrigation schedules based on real-time data and crop requirements. By incorporating IoT technology, the system enables remote monitoring and control, enhancing efficiency and conserving water resources. Experimental results demonstrate the effectiveness of the system in improving water management and maximizing crop yield while minimizing water wastage. Effective water management in agriculture is crucial for sustainable food production, particularly in the face of climate change-induced water scarcity. This paper introduces a sophisticated smart irrigation system augmented with tank level monitoring capabilities to enhance water usage efficiency in agricultural practices. The system integrates state-of-the-art sensor technologies to provide real-time monitoring of soil moisture levels, weather conditions, and tank water levels, enabling precise and adaptive irrigation scheduling.*

The core components of the proposed system include soil moisture sensors strategically placed in the field to continuously measure the moisture content of the soil. These sensors provide valuable data to determine the actual water needs of the crops, thus preventing both over- and under-watering. Additionally, weather sensors are deployed to gather meteorological data such as temperature, humidity, and precipitation forecasts. This information is crucial for adjusting irrigation schedules based on prevailing weather conditions, ensuring optimal water utilization while minimizing water wastage.

Moreover, the system incorporates tank level monitoring sensors installed in water storage tanks to track the availability of water resources. By continuously monitoring the water levels in the tanks, farmers can effectively manage water supply and plan for refilling or alternative water sources when necessary. Furthermore, the system is equipped with wireless connectivity and a user-friendly interface, allowing farmers to remotely access and control the irrigation system using mobile devices or computers

Keywords: Smart irrigation, Tank level monitoring, IoT, Water management, Crop yield optimization

I. INTRODUCTION

Efficient water management in agriculture is essential for sustainable food production and environmental conservation, especially in the face of increasing water scarcity and climate variability. Traditional irrigation methods often lead to inefficient water usage, resulting in water wastage, reduced crop yields, and environmental degradation. To address these challenges, smart irrigation systems have emerged as promising solutions by leveraging advanced technologies to optimize water usage and enhance agricultural productivity.

This paper presents a novel smart irrigation system integrated with tank level monitoring capabilities, aimed at maximizing water efficiency in agricultural settings. By incorporating state-of-the-art sensor technologies, real-time monitoring, and data-driven decision-making, the proposed system offers a comprehensive approach to irrigation management. Through continuous monitoring of soil moisture levels, weather conditions, and tank water levels, farmers can precisely tailor irrigation schedules to meet the specific water requirements of crops while minimizing water wastage..

The integration of tank level monitoring sensors enables farmers to monitor the availability of water resources in storage tanks, facilitating proactive management of water supply and conservation efforts. Furthermore, wireless connectivity and remote monitoring capabilities empower farmers to access and control the irrigation system from anywhere, improving operational efficiency and responsiveness to changing conditions.

This introduction sets the stage for discussing the importance of smart irrigation systems in addressing water management challenges in agriculture and introduces the key components and features of the proposed system. Subsequent sections will delve into the technical details, implementation strategies, and benefits of the smart irrigation system with tank level monitoring, supported by relevant literature and case studies. Overall, the integration of advanced technologies holds great promise for enhancing water efficiency, crop productivity, and environmental sustainability in agricultural practices.

II. LITERATURE SURVEY

1. Smart Irrigation Systems for Sustainable Agriculture

This review provides an overview of smart irrigation systems and their role in sustainable agriculture. It discusses various sensor technologies used for monitoring soil moisture, weather conditions, and water levels, highlighting the importance of real-time data for efficient water management.

2. Integration of IoT and Sensor Technologies in Agricultural Water Management

This paper explores the integration of Internet of Things (IoT) and sensor technologies in agricultural water management. It discusses the implementation of IoT-based smart irrigation systems and their potential to improve water efficiency and crop productivity.

3. Wireless Sensor Networks for Precision Agriculture: A Review

This review article examines the use of wireless sensor networks (WSNs) in precision agriculture, including applications in soil moisture monitoring and irrigation management. It discusses the benefits and challenges of WSNs in optimizing water usage and enhancing agricultural productivity.

4. Tank Level Monitoring Systems for Water Resource Management

This conference paper focuses on tank level monitoring systems for water resource management. It discusses the importance of real-time monitoring of water levels in tanks for efficient water distribution and usage in agricultural settings.

5. Sustainable Agriculture Practices for Climate Change Adaptation

This research article examines sustainable agriculture practices for climate change adaptation, including the use of smart irrigation systems. It highlights the role of advanced technologies in mitigating the impact of climate change on agricultural productivity and water resources.

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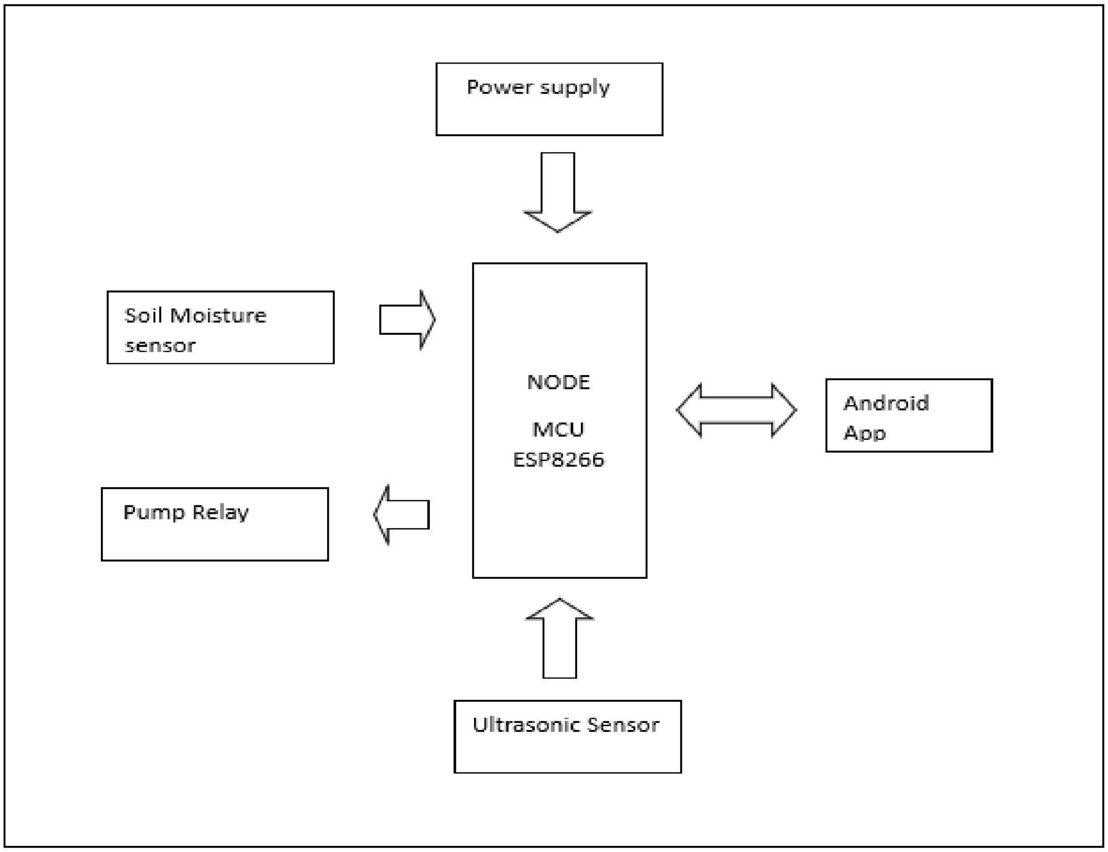
III. PROPOSEDSYSTEM



Block diagram:

1. ESP8266: The ESP8266 is a microcontroller unit commonly used for IoT (Internet of Things) projects due to its built-in Wi-Fi capabilities. In this setup, the ESP8266 serves as the central control unit responsible for gathering data from sensors, controlling the pump relay, and communicating with the Android app over Wi-Fi.

2. Power Supply: The power supply provides electrical power to the entire system, including the ESP8266 and connected sensors. It ensures the continuous operation of the system by supplying the necessary voltage and current.

3. Soil Moisture Sensor: The soil moisture sensor is used to measure the moisture content of the soil. It typically consists of two probes that are inserted into the soil, and the resistance between the probes varies depending on the soil moisture level. The ESP8266 reads the sensor data to determine if irrigation is needed based on preset thresholds.

4. Pump Relay: The pump relay is an electromechanical switch controlled by the ESP8266. When the soil moisture sensor detects that the soil moisture level is below a certain threshold, indicating that irrigation is required, the ESP8266 activates the pump relay to turn on the water pump and irrigate the soil.

5. Ultrasonic Sensor: The ultrasonic sensor is used to measure the level of water in a tank or reservoir. It emits ultrasonic waves and measures the time taken for the waves to reflect back after hitting the surface of the water. By calculating the distance traveled by the waves, the ESP8266 can determine the water level in the tank and decide whether to initiate irrigation or not.

6. Android App: The Android app serves as the user interface for monitoring and controlling the irrigation system. It communicates with the ESP8266 over Wi-Fi to receive real-time sensor data and send commands to activate or deactivate the pump relay. Users can view the soil moisture level, water tank level, and manually control the irrigation process through the app.

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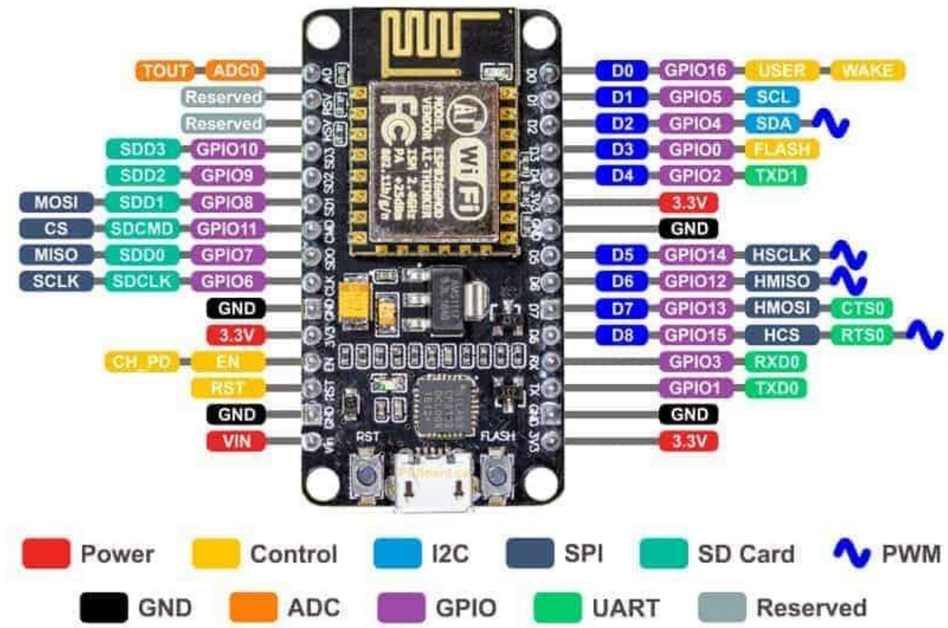
1. Node MCU



The Node MCU (Node Micro Controller Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

2. Ultrasonic Ranging Module HC - SR04

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:
Using IO trigger for at least 10us high level signal,
The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.
Test distance = (high level time×velocity of sound (340M/S) / 2,

3. Soil Moisture

The working of the soil moisture sensor is pretty straightforward.

The fork-shaped probe with two exposed conductors, acts as a variable resistor (just like a potentiometer) whose resistance varies according to the water content in the soil.

This resistance is inversely proportional to the soil moisture:

The more water in the soil means better conductivity and will result in a lower resistance.

The less water in the soil means poor conductivity and will result in a higher resistance.

The sensor produces an output voltage according to the resistance, which by measuring we can determine the moisture level.

IV.CONCLUSION

System to monitor moisture levels in the soil was designed and the project provided an opportunity to study the existing systems, along with their features and drawbacks. The proposed system can be used to switch on/off the water sprinkler according to soil moisture levels thereby automating the process of irrigation which is one of the most time consuming activities in farming. Agriculture is one of the most water-consuming activities. The system uses information from soil moisture sensors to irrigate soil which helps to prevent over irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through a website. Through this project it can be concluded that there can be considerable development in farming with the use of IOT and automation. Thus, the system is a potential solution to the problems faced in the existing manual and cumbersome process of irrigation by enabling efficient utilization of water resources

V. ACKNOWLEDGMENT

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