JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

IMPLEMENTATION OF SMART IRRIGATION SYSTEM USING IOT

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ABSTRACT

Implementation of Smart irrigation systems are a new technology that uses sensors and weather data to optimize watering schedule for plant. Many sensors are used by smart irrigation systems to keep an eye on weather patterns and soil moisture. Here work "Smart Irrigation System Using IoT" describes a system that utilizes IoT technologies to efficiently manage irrigation. The system incorporates a soil moisture sensor and a DHT sensor to monitor soil moisture levels and ambient temperature and humidity, respectively. These sensors are interfacing with Node MCU (ESP8266). The Blynk cloud is used for user interaction. When power is ON this system, the Node MCU board connects to the Blynk cloud. where it receives the data on soil moisture and transmits the watering threshold and status of the automatic mode to the system. When the soil moisture levels drop below a certain threshold, indicating a need for watering, the system activates a pump to irrigate the soil. This automated approach to irrigation ensures that plant receive the appropriate amount of water, optimizing water usage.

Keywords: *node MCU, blynk cloud, smart irrigation etc.,*

1. *Introduction*

The Smart Irrigation System, which uses the Internet of Things to enhance plant management and water efficiency, offers a comprehensive approach to agriculture. Using real-time data from sensors tracking soil moisture and weather factors, this creative method in modern agriculture optimizes irrigation techniques by automatically modifying watering schedules and volumes. By using this advanced technology, farmers are able to tackle the difficulties they experience in managing overall raised crops positions, including unequal water distribution and financial losses from low-quality crops. The Smart Irrigation System offers a comprehensive solution for automating the entire irrigation process. In this project, we are utilizing an ESP8266 NodeMCU Module and a DHT11 Sensor to create an IoT-based Irrigation System. This system not only automatically waters the crops based on the moisture level in the soil but also sends data to Blynk Cloud to keep track of the land conditions. The system includes a water pump that is responsible for sprinkling water on the land, taking into account the environmental conditions such as moisture, temperature, and humidity. It is important to note that different crops have varying requirements for soil moisture, temperature, and humidity. For this tutorial, we have chosen a crop that requires a soil moisture level of approximately 5055%. When the soil moisture drops below 50%, the motor pump will automatically turn on to sprinkle water on the land. It will continue to do so until the moisture level reaches 55%, after which the pump will be turned off. The sensor data will be periodically sent to Blynk Cloud, allowing for remote monitoring from anywhere in the world.

2. *Literature Survey*

An Internet of Things (IoT) is a network of physical items connected by software, sensors, and other means. This wraps up the project based on the fields of agriculture that automate irrigation and that address the issue of water consumption in certain places within the agriculture sector. A variety of sensors were used in the development of the system, including the (1) Soil Moisture Sensor, which gauges the amount of moisture in the soil, and the (2) Humidity and Temperature Sensor (DHT11), which tracks temperature variations. The Node MCU ESP8266 microcontroller, a Wi-Fi module, is linked to all of these sensors. The information is uploaded to the cloud and shown as readings that the Blynk Application has identified. The readings from this sensor are used to control the pump in an emergency, such as when stopping the irrigation pump. Thus, by examining soil moisture and meteorological circumstances, this project may automate the irrigation process, addressing crucial factors like reduced labour, power usage, dependability, and cost. The main role of this project is to develop a Microcontroller system to irrigate the plant automatically and the information is been sent to the farmers.[1] Water is the main resources for Agriculture and most of the farmers are using traditional methods of irrigation for farming and a large amount of water is getting wasted due to these methods. These outdated techniques have to be replaced with the automated techniques. In this paper we proposed a new irrigation system, which works based on the latest IOT technology to reduce wastage of water and it reduces manual labour to irrigate the crops. The main objective of the proposed irrigation system is to supply the required amount of water to be crop based on the type and stage of the crop. The purpose injection system pumps the water to the crop based on the type, area, and date of the plantation of the crop, and these parameters are registered by the farmer through the IOT based Android app. The design irritation system uses ESP8266 Controller, moisture, and water level sensor for irrigating the crops. The problem with the moisture sensor-based irrigation system is to supplying water to the crop only based on the sensor reading, but different crops require different amount of water at different stages. Hence, in this paper, we divide the total crop into five different stages. Based on the type and stage, the crop gets irrigated automatically using the motor incorporated in the circuit and the motor action can be controlled by using the algorithm design for ESP8266. Another problem with moisture sensor is it shows maximum reading even when the water level is low and hence, the irrigation system is superior to the existing moisture sensor based irrigation system. The key factor involved in this proposed methodology is fixing the water level of the crop instead of quality of water[2].Along with various IoT application areas agriculture includes cultivation and water management. A wide range of sensors can be used for agricultural applications, viz. leaf wetness, soil moisture, temperature, humidity, ultraviolet and solar radiations, wind vanes, pluvio meter, etc. IOT comprises of deployment of sensors at the respective application fields and storage of their data cloud for processing. The same concept can be used for irrigation system for monitoring and controlling. There are various communication technologies for IoT. “Various WSN solutions have been proposed based on IEEE 802.15.4 standards, e.g. ZigBee, 6LoWPAN, etc[3]. Proper monitoring and control of irrigation and fertilization system is crucial in agriculture field to ensure sufficient nutrients and moisture supplied to the plant is maintained all the time. There are two type of parameters being monitored which are soil moisture and its pH level. A systematic approach in monitoring and control of these parameters is thus necessary to uphold sustain smart farming solutions. Main objective of this project is to design smart irrigation and fertilization system for chili plant using Fuzzy Logic. In thiswork, the implementation of Internet of Things (IoT) also included where Wi-Fi node is used for the means of connection medium. Fuzzy Logic was implemented as a controller in this system to administer the flowrate of water, alkali and acid solutions into the soil in order to maintain its moisture and pH level. This system was tested on a chili plant where the growth of a plant under controlled environment have better performance compared to the traditional method[4]. The smart irrigation system is the combination of software, hardware, and firmware with the help of various computational techniques such as IoT, artificial intelligence, and Machine learning. It is important and needed to society because of the effective production of yields and effective usage of resources. Effective techniques are needed to optimize the water, monitor the moisture, and increase the yields. This article presents different recent techniques related to the smart irrigation systems in agriculture using IoT and artificial intelligence system. The various components, Modern irrigation system, various comparison parameters, and its requirements are presented in this article. Finally, presented various issues, challenges, and future direction of the research in the smart irrigation system[5].

3. Methodology

3.1: Project Planning

Objective: The primary aim of the smart irrigation system needs to be determined, whether it is to reduce water usage, optimize plant growth, or automate irrigation processes.

Scope: The project's scope should be defined, encompassing the size of the area to be irrigated, the types of plants involved, and the environmental factors to be considered.

Budget: It is essential to allocate a budget for the necessary hardware, software, and other resources required for the project.

Timeline: A timeline should be developed, outlining key milestones for the design, development, testing, and deployment phases of the project.

Resource Identification: The identification of required human resources, such as developers, engineers, and domain experts, is crucial for the successful execution of the project.

3.2: Requirements Gathering

User Requirements: Gather the requirements from end-users or stakeholders, which may include farmers, gardeners, or agricultural experts. Understand their needs and expectations regarding the smart irrigation system.

Functional Requirements: Clearly define the required functionality for the system, such as monitoring soil moisture, controlling irrigation pumps, and receiving alerts.

Non-functional Requirements: Specify the non-functional requirements, which encompass aspects like reliability, scalability, security, and ease of use.

3.3: Hardware Selection:

NodeMCU (ESP8266): Opt for NodeMCU as the primary microcontroller board for connecting with sensors and actuators. NodeMCU has the ability to link to Wi-Fi networks and can be programmed using the Arduino IDE.

Sensors: Pick suitable sensors for monitoring soil moisture, temperature, and humidity. Common options include capacitive soil moisture sensors and DHT11/DHT22 temperature and humidity sensors.

Actuators: Select actuators like solenoid valves or pumps for managing the irrigation system.

3.4: Software Development:

NodeMCU Programming: Develop code to interact with sensors, collect data, and operate actuators. Utilize the Arduino IDE and libraries that are compatible with NodeMCU and the chosen sensors.

Blynk Integration: Merge Blynk into the NodeMCU firmware to allow remote monitoring and control of the irrigation system through the Blynk app.

User Interface: Create the user interface within the Blynk app to showcase sensor readings, manage irrigation schedules, and receive notifications/alerts.

3.5: Testing and Validation:

Unit Testing: Conduct thorough testing of the NodeMCU code and sensor connections to ensure their proper functionality.

Integration Testing: Verify the seamless integration of NodeMCU with the Blynk app by testing the remote monitoring and control functionalities.

Field Testing: Deploy the smart irrigation system in the designated environment and perform field tests to validate its performance under real-world conditions.

3.6: Deployment and Maintenance:

Installation: Properly install the smart irrigation system at the desired location, ensuring accurate placement of sensors and actuators.

User Training: Provide comprehensive training to end-users on how to effectively utilize the Blynk app for monitoring and controlling the irrigation system.

Monitoring and Maintenance: Implement efficient monitoring tools to track the system's performance and schedule regular maintenance activities, including sensor calibration and battery replacement.

Updates and Upgrades: Strategize for future updates and upgrades to enhance the system's functionality, incorporating user feedback and evolving requirements.

4. Architecture

The ESP8266 collects data from both the DHT11 sensor and the soil moisture sensor. Uponanalyzing the sensor data, it triggers the water pump through the relay module to irrigate theplants. The Blynk app enables remote monitoring and control of the irrigation system.

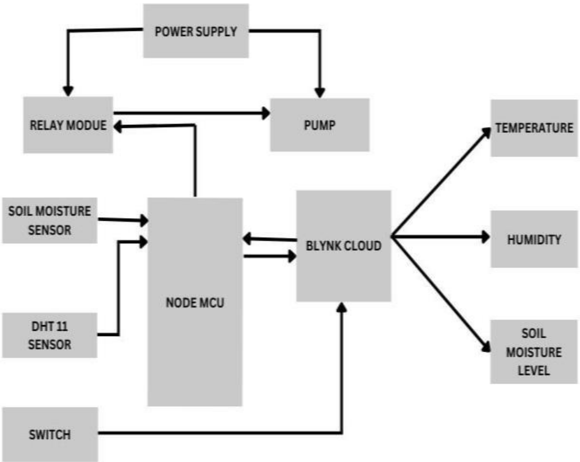

Fig 1: Architecture of Smart irrigation system using IOT

5. Results & Discussion

IoT technology in irrigation offers numerous advantages, with smart irrigation systems utilizing IoT sensor units to precisely calculate irrigation requirements, thus avoiding plant stress by monitoring both product temperature and soil moisture levels. This ultimately results in optimized product yields while conserving water and promoting sustainable growth.

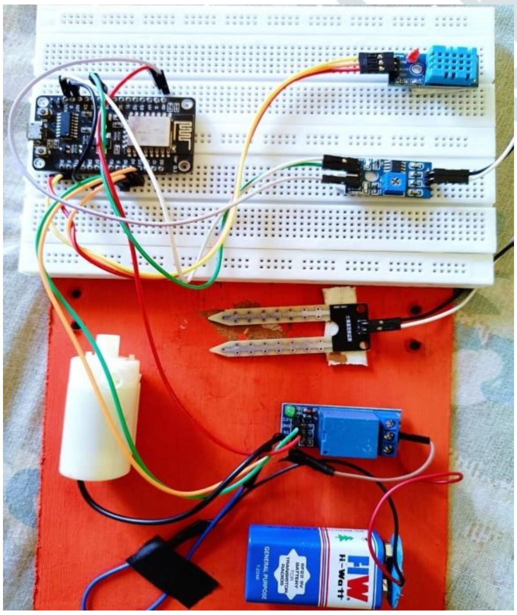

Fig.2: Smart Irrigation System Using IOT Connections

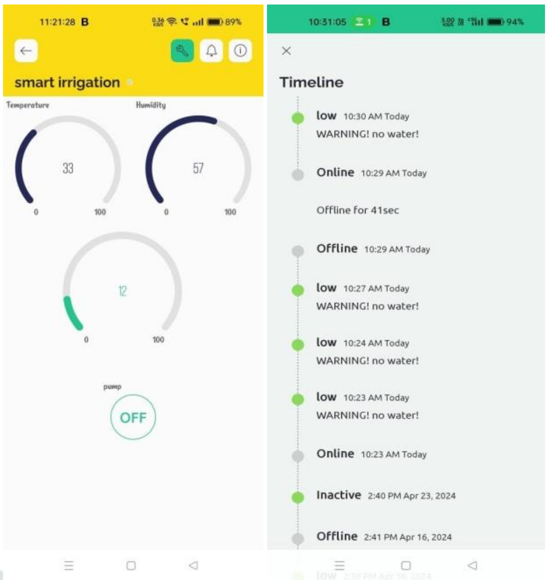

Fig.3: Blynk App Notifications

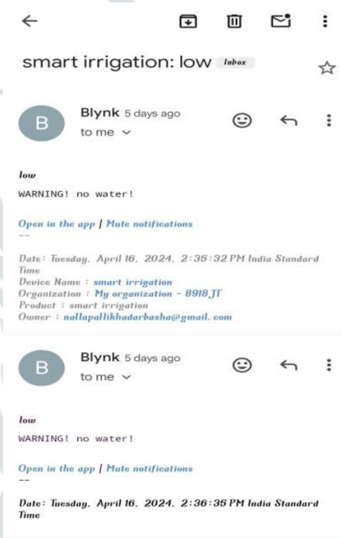

Fig.4: Mail notification from Blynk App

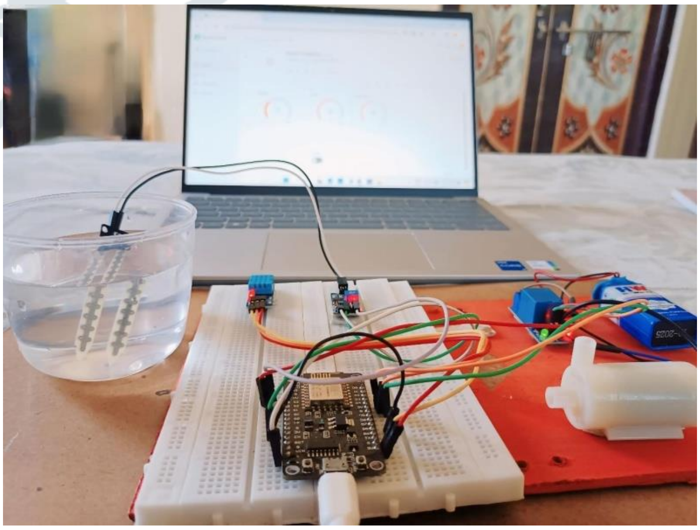

Fig.5 :Smart Irrigation System Using IOT

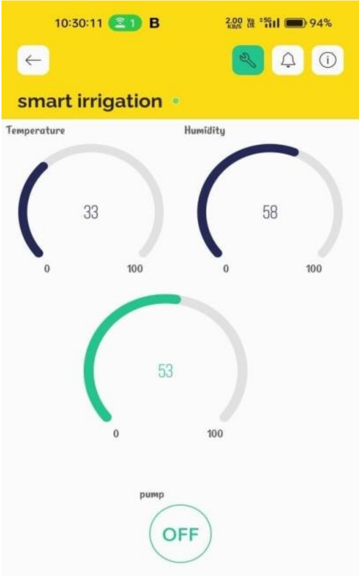

Fig.6: Final Result From Blynk App

5. *CONCLUSION*

The IoT-powered Smart Irrigation System has successfully combined a number of sensors, microcontrollers, and cloud platforms to produce an effective and adaptable irrigation management system. The technology makes sure that water is used as efficiently as possible, cutting down on waste and protecting this essential resource by utilizing real-time data from environmental sensors and soil moisture sensors. The Blynk platform's user-friendly interface has made it simple to monitor and operate the system, and the ESP8266 microcontroller has proven to be a dependable and affordable method of control. In addition to encouraging healthy plant growth and possibly raising agricultural yields, the wok methodology has shown to be successful in keeping soil moisture levels appropriate. In conclusion, this work displays environmentally friendly farming by explaining how water limiting factor and the growing demand for food production may be solved with IoT technology. It gives farmers new opportunities and enables them to more effectively and efficiently manage their resources.

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