



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 7, July 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

 ijirset@gmail.com

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Monitoring and Control of Solar Powered Irrigation System using IOT

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ABSTRACT: Today's peoples are making smart and everything's we access remotely. So now a day's farmer also became smart. That's why they need to smart irrigation system in that remotely controlling and monitoring water pump. This thesis overcome this issue and design solar powered energy for controlling and monitoring various components and sensors to used water irrigation system in farming. The implementation of a reduced Internet - of - things smart irrigation system with solar energy is the aim of this thesis. The affordable, trustworthy device is made to provide information and to irrigate areas only if there is a need for water. Farmers can view the field's status by visiting the BLYNK app stream link after receiving the information acquired by the device via a cloud webpage BLYNK app. For measuring soil moisture, temperature, and humidity, this project makes use of the Node-MICROCONTROLLER ESP32, a soil moisture sensor, and a DHT11 sensor. Wi-Fi module embedded inside the microcontroller uploads all the data to the cloud database of the BLYNK app. The proposed intelligent irrigation system uses less water than the conventional method.

KEYWORDS: Solar Panel, Node MCU, DHT11, Soil sensor, temperature sensor, BLYNK App etc.

I.INTRODUCTION

India is an agricultural country. Lot of are emerging in the field of agriculture increase its productivity. But, till in agriculture scheme some disorder. Few of them are listed below .Agriculture is the strength of Indian Economy. Agriculture water consumption is more than rainfall every year. Farm improving yield is essential for the rapidly growing demand of food to population growth across the world. Developing IOT technologies can help to collect large amount of ecological and crop recital data major source of income is from agriculture sector and 70% of farmers and general people depend on the agriculture. Now uses manual irrigation system but Irrigation requirement depends on soil properties like temperature, moisture and the type of crop which is grown in the soil. For efficient use of water for irrigation new technologies have been developed. Environment issue two main reasons for wastage of water and electricity in the field, When farmer forgets to switch off irrigation pump (field may get excess amount of water). When field is having rain and still pump is giving water to the field. Farmer's life going through difficult tracts during night-time leads farmer's life towards wild risks. The objective of this this is to provide more efficient and cost hurdles. To provide crop wise irrigation system that help farmer to monitor and controlling irrigation in farms.

In order to reduce water waste in irrigation fields, a low cost IoT based smart irrigation system is built in this study. The affordable, trustworthy device is made to provide data and to hydrate areas only if there is a need for water. By visiting the BLYNK app stream link after receiving the information acquired by the device via a cloud website named BLYNK app farmer can view status. For measuring soil moisture, temperature, and humidity, this project makes use of the Node-MICROCONTROLLER ESP8266, a soil moisture sensor, and a DHT11 sensor.

II. ARCHITECTURE

Below is a simplified architecture diagram for monitoring and controlling a solar-powered irrigation system using IoT:

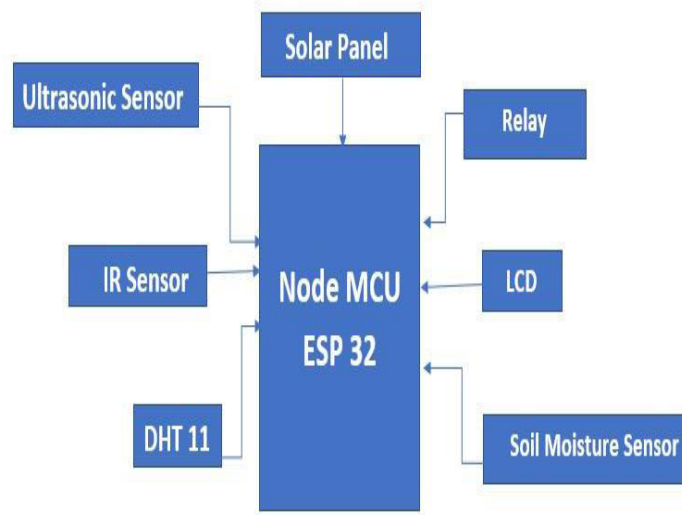


Fig.1 Architecture of solar powered irrigation system

A. Hardware Components:

- **Solar Panels:** These panels convert sunlight into electricity to power the irrigation system. The size and number of panels depend on the power requirements of the system.
- **IoT Gateway:** This device connects the sensors, controllers, and actuators in the irrigation system to the internet. It collects data from sensors and sends commands to actuators.
- **Sensors:** Various sensors are deployed to gather data about environmental conditions, soil moisture levels, water flow rates, etc.
- **Actuators:** These components control the operation of the irrigation system, such as turning pumps on/off, opening/closing valves, and adjusting the direction of sprinklers.
- **Microcontroller/Embedded System:** This controls the overall operation of the system, interfacing with sensors, actuators, and the IoT gateway.

B. Software Components:

- **IoT Platform:** A cloud-based platform where data from sensors is collected, stored, and analyzed. It also provides tools for remote monitoring and control.
- **Data Analytics:** Algorithms are used to analyze the data collected by sensors. This helps in optimizing irrigation schedules, detecting anomalies, and predicting maintenance needs.
- **User Interface:** A web or mobile application allows users to monitor the system in real-time, view historical data, and control various parameters remotely.

C. Workflow

- **Data Collection:** Sensors measure various parameters such as soil moisture, weather conditions, and water flow rates.
- **Data Transmission:** Collected data is sent to the IoT gateway through wired or wireless connections.
- **Data Processing:** The microcontroller processes the incoming data and makes decisions based on predefined algorithms or user-defined rules.

- Data Transmission to IoT Platform: Processed data is transmitted to the IoT platform for storage, analysis, and visualization.
 - User Interaction: Users access the IoT platform through the user interface to monitor system performance, adjust settings, and receive alerts.
 - Control Commands: Users can send control commands through the user interface to adjust irrigation schedules, activate/deactivate actuators, or change system parameters.
 - Feedback Loop: The system continuously monitors environmental conditions and system performance, adjusting irrigation schedules and settings as needed to optimize water usage and crop growth.
- By following this architecture, farmers can efficiently monitor and control their solar-powered irrigation systems, leading to improved crop yields, water conservation, and overall farm productivity.

III. IMPLEMENTATION AND TESTING

A. Flowchart

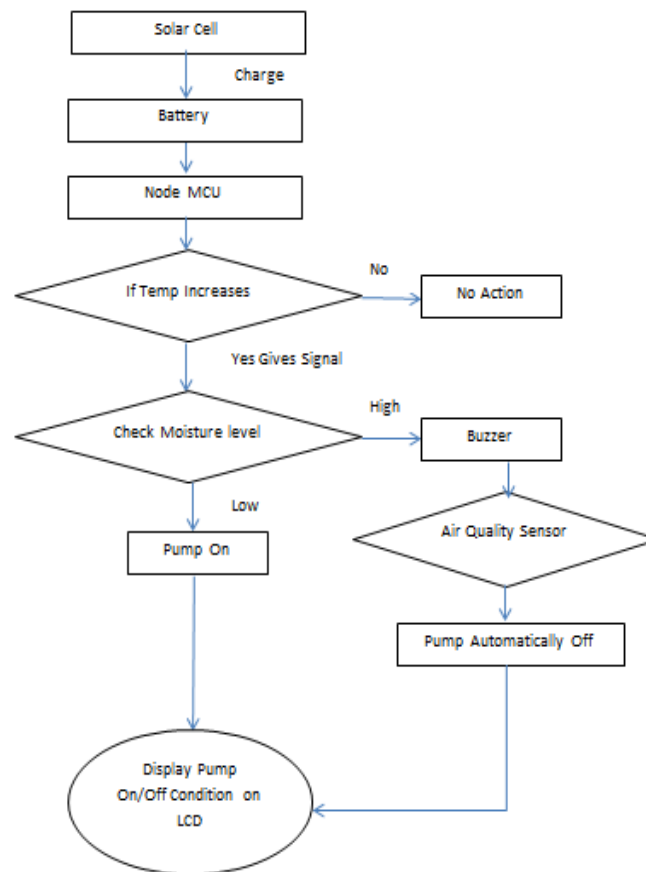


Fig2: Flowchart

B. BLYNK APPLICATION

Blynk is a popular platform for building Internet of Things (IoT) applications without needing to delve deeply into programming and hardware configuration. Here's an overview of Blynk and its applications:

- Overview: Blynk provides a drag-and-drop interface for building IoT applications. It consists of a smartphone app (available on iOS and Android) and a cloud service. Users can create custom dashboards to control and monitor various IoT devices and sensors
- Features: Drag-and-drop interface: Users can easily design their IoT applications by dragging widgets (buttons, sliders, graphs, etc.) onto a canvas in the Blynk app.

- Support for various hardware platforms: Blynk supports a wide range of hardware platforms, including Arduino, Raspberry Pi, ESP8266, ESP32, Particle, and others.
- Cloud connectivity: Blynk provides cloud connectivity, allowing users to remotely control and monitor their IoT devices from anywhere with an internet connection.
- Widgets: Blynk offers a variety of widgets that can be used to interact with IoT devices, such as buttons, sliders, gauges, graphs, and displays.
- Notification and alerts: Users can set up notifications and alerts to receive real-time updates from their IoT devices.
- Data logging: Blynk allows users to log data from their IoT devices and display it in graphs for analysis.

IV. EXPERIMENT RESULTS AND DISCUSSIONS

A. Experimental Setup and Result

First, the processor detects the presence of solar energy, which is connected to the motor and then to the driver. Sensors control the maximum and minimum soil moisture levels. When soil moisture is low, the pump motor will pump water into the field. The thermometer will measure the temperature around the farm, the rain gauge will detect heavy rain and close the panels to protect the crops, and all the above information will be sent to the user via IoT technology. There lay is connected to the water pump and when the humidity sensor detects that the soil is dry, the pump starts pumping water the humidity sensor is used to detect the humidity of the farmland and feed it with water. In fig 3 we shows component structured on board and 4 is actual project figure.

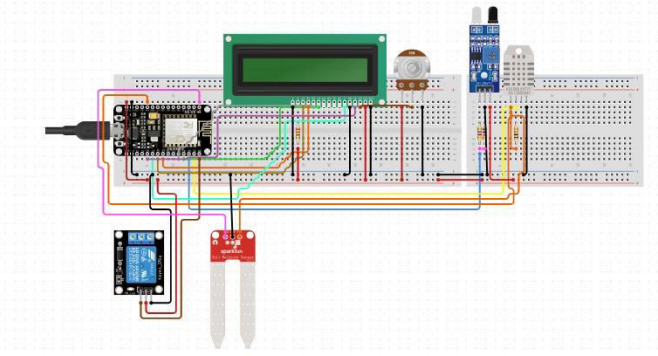


Fig 3: Experimental Component Setup



Fig 4: Experimental Component Setup

B. System Snapshots



Fig5: Screen shot 1

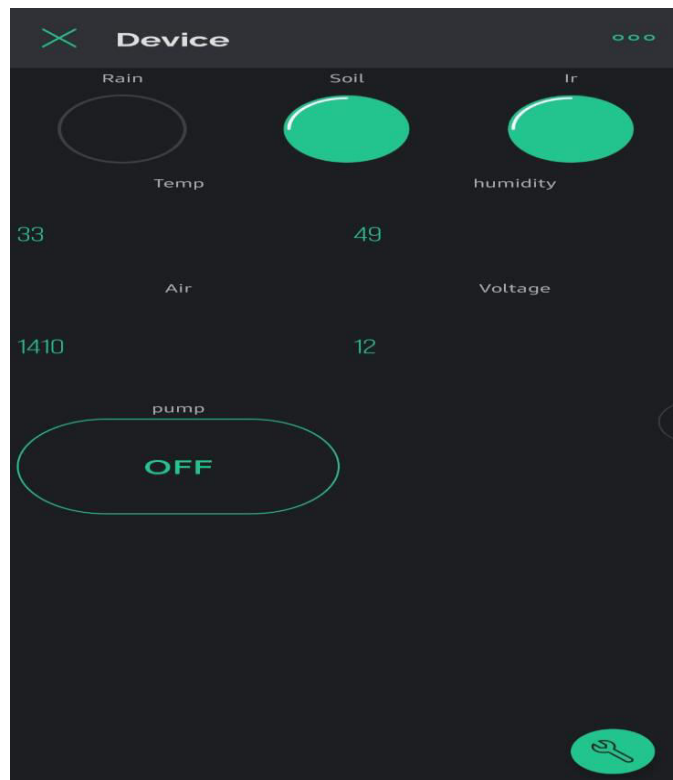


Fig6: Screen shot 2

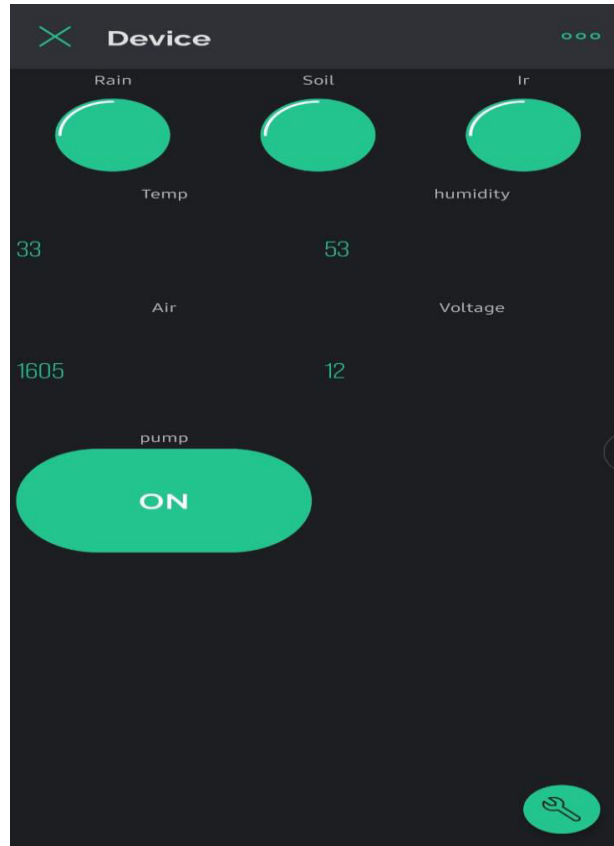


Fig7: Screenshot 3

V. CONCLUSION

In this project by using IoT technology we successfully developed the affordable, trustworthy device is made to provide information and to irrigate areas only if there is a need for water. Farmers can view the field's status by visiting the BLYNK app stream link after receiving the information acquired by the device via a cloud webpage BLYNK app. For measuring soil moisture, temperature, and humidity, this project makes use of the Node-MICROCONTROLLER ESP32, a soil moisture sensor, and a DHT11 sensor. Wi-Fi module embedded inside the microcontroller uploads all the data to the cloud database of the BLYNK app. The proposed intelligent irrigation system uses less water than the conventional method.

VI. FUTURE SCOPE

A smart irrigation system using IoT (Internet of Things) technology has a promising future scope for several reasons:

A. Water Conservation:

With increasing concerns about water scarcity and environmental sustainability, there's a growing need for efficient water usage in agriculture. Smart irrigation systems can optimize water usage by monitoring soil moisture levels, weather forecasts, and plant water requirements in real-time, thereby reducing water wastage.

B. Cost Savings:

Traditional irrigation methods can be inefficient and costly due to overwatering or under-watering. By automating irrigation processes based on real-time data, smart systems can help farmers save on water bills, energy costs, and labour expenses.

C. Remote Monitoring and Control:

IoT-enabled irrigation systems allow farmers to monitor and control their irrigation systems remotely using smartphones or computers. This capability is especially valuable for farmers with large or multiple fields, as they can make adjustments to irrigation schedules or settings without physically being present on-site.

D. Data Analytics and Insights:

Smart irrigation systems generate vast amounts of data about soil moisture, weather conditions, crop health, and water usage patterns. By analyzing this data, farmers can gain valuable insights into crop performance, make informed decisions about irrigation strategies, and optimize crop yields.

E. Integration with Precision Agriculture:

Smart irrigation systems can be integrated with other precision agriculture technologies, such as drones, satellite imagery, and sensors, to create a comprehensive farm management system. This integration enables farmers to monitor and manage all aspects of their farm operations more effectively, leading to improved productivity and sustainability.

F. Scalability and Adaptability:

IoT-based irrigation systems are highly scalable and adaptable to different types of crops, soil conditions, and climate zones. They can be customized to meet the specific needs of individual farms or even micro-manage irrigation at the level of individual plants, ensuring optimal growth conditions.

G. Environmental Benefits:

By reducing water usage, minimizing runoff and leaching of fertilizers and pesticides, and promoting healthier soil and plant growth, smart irrigation systems contribute to environmental conservation and sustainability.

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