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SECURE SMART AGRICULTURE MONITORING SYSTEM USING MQTT

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Abstract- **This paper presents a smart agriculture monitoring system designed to improve farming efficiency using IoT technology. Traditional farming methods face challenges such as lack of real-time monitoring and inefficient resource utilization. To address these issues, the proposed system uses sensors to collect data like soil moisture, temperature, and motion detection.**
The ESP8266 microcontroller processes the data and transmits it to the cloud using the MQTT protocol, enabling remote monitoring. The system is powered by solar energy, making it suitable for rural and low-power environments.
The developed system provides real-time updates, reduces manual effort, and helps in better decision-making for farmers. It is a cost-effective and eco-friendly solution for modern agriculture.

Keywords:- **MQTT, IOT, ESP8266, Wi-Fi, Sensors, Solar panel, Smart Agriculture, Real-time Monitoring.**

I. INTRODUCTION

Agriculture plays a vital role in the Indian economy, but traditional farming methods face several challenges such as inefficient water usage, lack of real-time monitoring, and high dependency on manual labor. These issues often result in reduced productivity and increased operational costs.
With the advancement of technology, smart agriculture systems have emerged as an effective solution to overcome these challenges. The integration of Internet of Things (IoT) in agriculture enables real-time monitoring of environmental conditions such as soil moisture, temperature, and humidity. This helps farmers in making timely and informed decisions.
In this context, the MQTT (Message Queuing Telemetry Transport) protocol plays an important role by providing efficient and reliable communication between devices. It ensures fast data transmission with minimal power consumption, making it suitable for remote agricultural applications.
This paper presents a smart agriculture monitoring system using MQTT protocol, which collects real-time data from sensors and transmits it to the cloud for remote monitoring. The system is powered by solar energy, making it cost-effective, energy-efficient, and suitable for rural areas. The proposed system aims to improve agricultural productivity and reduce manual effort through automation.

II. METHODOLOGY

This system is developed to monitor agricultural conditions using IoT technology. It gathers data from different sensors and transmits it to the user through wireless communication .The system provide efficient secure transfer of data.

Figure 1. Internal Circuit Setup of the Proposed System

In this system, sensors are installed in the agriculture field to continuously monitor parameters such as soil moisture, temperature, and humidity. These sensors collect real-time data, which is then sent to the ESP8266 microcontroller for processing .The processed data is transmitted using the MQTT protocol through a WI-FI network, allowing the user to access the information remotely .Farmers can easily check the field conditions on their mobile devices and take necessary actions like irrigation at the right time . The system is powered by a solar panel , which makes it cost-effective and suitable for use in rural and remote areas.

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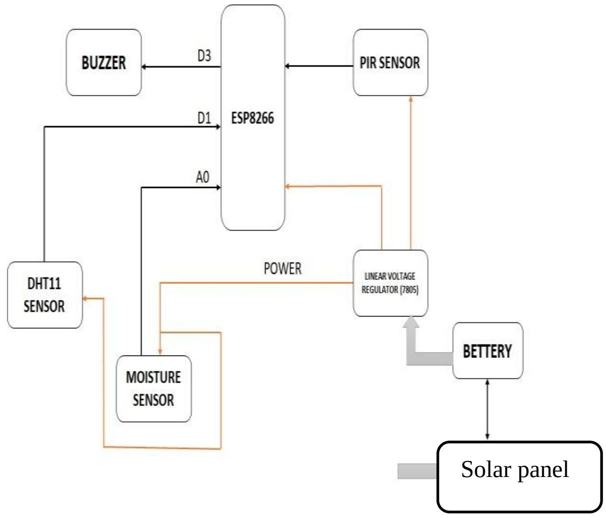

Figure 2: Block Diagram of Smart Agriculture System

The above block diagram represents the overall working flow of the proposed system. It shows how data moves from sensors to the processing unit and then to the cloud.
Initially, sensors such as soil moisture, temperature, and PIR detect environmental conditions. The collected data is sent to the ESP8266 microcontroller for processing. After processing, the data is transmitted to the cloud using the MQTT protocol via Wi-Fi.
This flow enables real-time monitoring of agricultural parameters and helps users to take timely actions. The diagram clearly explains the step-by-step operation of the system.

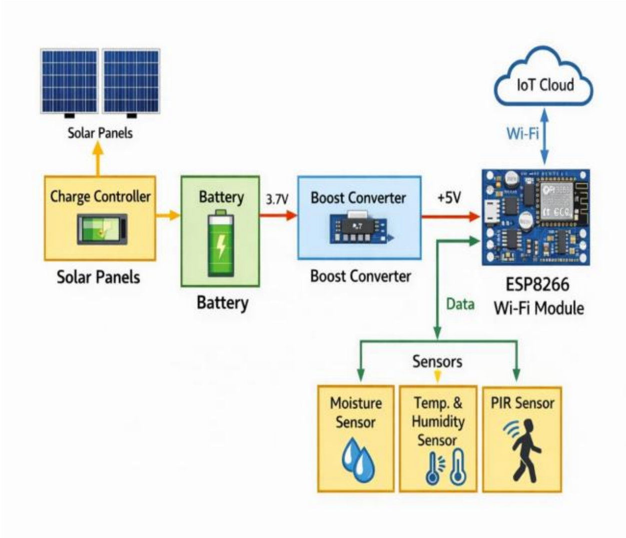

Figure3: System Architecture of Proposed System

The system architecture of the proposed model represents the overall structure and organization of the system components. It shows how different hardware and software elements are interconnected to perform the required operations.

The system consists of a solar panel, charge controller, battery, ESP8266 microcontroller, and various sensors such as soil moisture sensor, temperature and humidity sensor, and PIR sensor. The solar panel generates electrical energy, which is stored in the battery through the charge controller. This ensures continuous power supply to the system.
The ESP8266 acts as the central unit that connects all components. It receives input data from the sensors and processes it accordingly. The processed data is then transmitted to the IoT cloud using Wi-Fi and MQTT protocol, enabling remote monitoring of agricultural conditions.
This architecture ensures efficient communication between components and supports real-time data transmission. It also makes the system energy-efficient and suitable for use in remote and rural areas.

III. CIRCUIT DIAGRAM

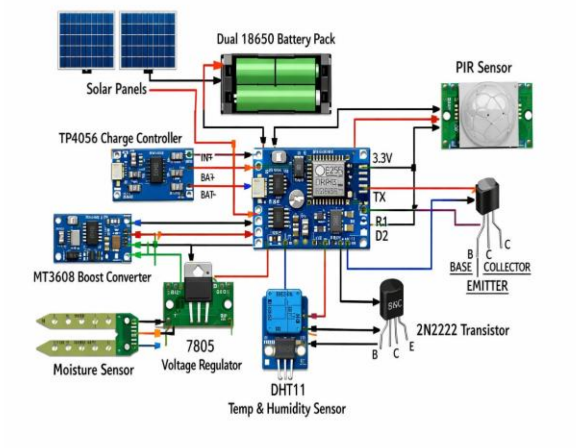

Fig 4: Circuit Diagram of Proposed System

The circuit diagram represents the practical implementation of the proposed smart agriculture system. It shows how all hardware components are connected to perform the desired operations.
The solar panel is used as the primary power source, which charges the battery through a charge controller (TP4056). The stored energy in the battery is supplied to the system through a boost converter and voltage regulator to maintain a stable output voltage.
The ESP8266 microcontroller acts as the main control unit and is connected to various sensors such as the soil moisture sensor, temperature and humidity sensor, and PIR sensor. These sensors continuously monitor environmental conditions and send the data to the microcontroller for processing.
A transistor is used as a switching device to control the output components such as buzzer or motor. The entire circuit is designed to operate efficiently with low power consumption, making it suitable for long-term use in agricultural fields.

IV. RESULT AND DISCUSSION

The developed system was tested under different environment conditions to observe its performance and accuracy. The sensors successfully collected real-time data such as soil moisture, temperature, and humidity from the agriculture field. The ESP8266 microcontroller processed the data efficiency and transmitted it using the MQTT protocol over a WI-FI network. The data receive on the user interface was found to be stable and timely, allowing continuous monitoring of field conditions. The system responded properly to change in environment parameters, which make it useful for decision-making in irrigation and crop management. The use of a solar panel as a power source ensured uninterrupted operation of the system, especially in areas where electricity supply is limited.This makes the system reliable and cost-effective for rural applications. However, slight variations in sensor readings were observed due to environment factors, which can be improved due to environmental factors, which can be improved by using high- precision sensors in the future. Overall, the system demonstrated good performance and proved to be an effective solution for smart agriculture monitoring.

The system showed consistent performance during testing and was able to provide real-time updates without significant delay. The integration of IoT technology makes the system suitable for modern smart farming applications.

The results indicate that the proposed system can reduce manual effort and improve efficiency in agricultural monitoring.

The performance of the system was analyzed by observing its behavior under continuous operation. It was found that the system maintained stability without significant fluctuations in data transmission. The sensors responded accurately to environmental changes, and the communication between devices remained consistent.

The system also showed good adaptability in different conditions, which makes it suitable for real-world agricultural applications. The integration of IoT and wireless communication enhances its usability and efficiency in monitoring large agricultural areas.

Figure 5. prototype of secure smart agriculture monitoring system

V. FUTURE SCOPE

The proposed system can be further enhanced by integrating advanced technologies such as artificial intelligence and machine learning for predictive analysis. This will help in making more accurate and data-driven decisions.

A mobile application can be developed to provide a user-friendly interface for farmers to monitor and control the system remotely. The addition of cameras can improve field security and enable visual monitoring.

In the future, more sensors can be added to monitor parameters such as humidity, soil nutrients, and weather conditions. This will make the system more efficient and suitable for large-scale agricultural applications.

VI. CONCLUSION

The developed smart agriculture monitoring system offers a useful solution for monitoring environmental conditions in real time. By using IoT technology, sensors, and the MQTT protocol, the system ensure efficient data collection and communication. The integration of a solar panel makes the system energy efficient and suitable for remote areas. This system helps farmers in making better decisions related to irrigation and crop management, which can improve productivity and reduce resource wastage. Overall, the proposed system provides a practical, reliable, and cost-effective solution for modern smart agriculture.

VII. REFERENCES

[1]. Singh R., (2020), IoT Based Smart Irrigation System, IEEE International Conference, (pp. 45–49).

[2]. Kumar V., (2021), Smart Agriculture Monitoring Using IoT, International Journal of Engineering Research, (pp. 12–18).

[3]. MQTT.org, (2019), MQTT Version 3.1.1 Protocol Specification.

[4]. Patel R., (2022), Soil Moisture Monitoring using ESP8266, International Journal of Scientific Research, (pp. 88–92).

[5]. Sharma A., (2021), Smart Farming using Wireless Sensor Networks, Springer Journal, (pp. 101–110).

[6]. Verma N., (2020), Temperature and Humidity Monitoring in Agriculture, IJERT, (pp. 67–72).

[7]. Espressif Systems, (2023), ESP8266 Technical Reference Manual.

[8]. Arduino, (2023), Arduino Official Documentation for Sensor Interfacing.

[9]. Random Nerd Tutorials, (2023), ESP8266 Wi-Fi Module with DHT11 and Soil Moisture Sensor.

[10]. HiveMQ, (2022), MQTT Essentials for IoT Communication.

[11]. IEEE Xplore, (2021), IoT Based Crop Monitoring System, (pp. 210–215).

[12]. Blynk Inc., (2023), Blynk IoT Platform Documentation.

[13]. ThingsBoard, (2022), IoT Dashboard for Smart Agriculture Monitoring.

[14]. Adafruit, (2021), DHT11 Sensor Guide and Documentation.

[15]. ResearchGate, (2020), Automated Agriculture Monitoring using IoT.

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