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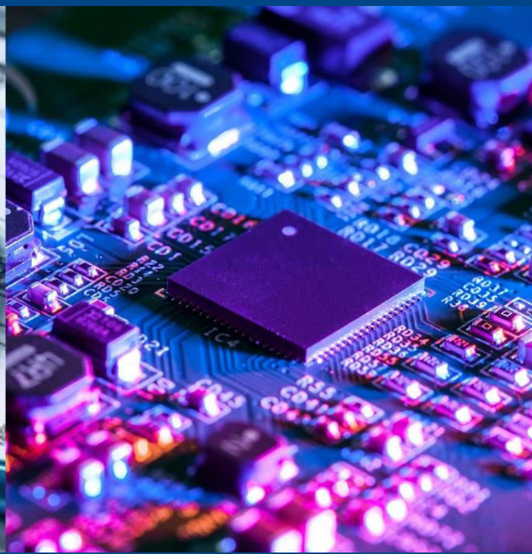

International Journal of Multidisciplinary Research in Science, Engineering and Technology

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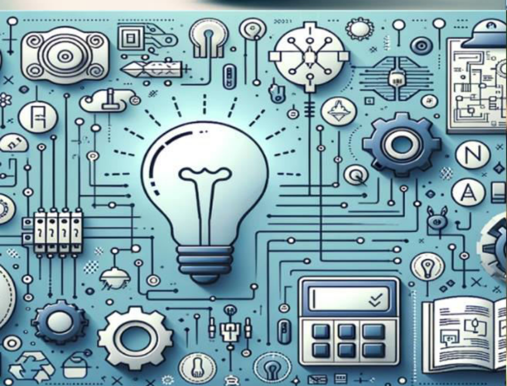

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IoT Based Smart Farming System

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ABSTRACT: This paper presents an IoT-Based Modern Agriculture System designed to automate irrigation by monitoring environmental parameters such as temperature, humidity, soil moisture, and atmospheric pressure. The system utilizes an ESP8266 microcontroller with sensors (DHT22, BMP280, soil moisture sensor) to collect real-time data, which is transmitted via BLYNK to a cloud server and Android app. Based on the data, a relay-operated water pump is activated to optimize irrigation. This approach enhances crop productivity, conserves water, and supports precision farming.

KEYWORDS: IoT, Smart Farming, Precision Agriculture, ESP8266, Automated Irrigation, BLYNK, Soil Moisture Monitoring, Sustainable Agriculture.

I. INTRODUCTION

Agriculture has always been a vital component of economic development and food security. However, traditional farming methods often suffer from inefficiencies, including excessive use of water, fertilizers, and labor. With the growing demand for food and limited natural resources, there is a pressing need to modernize agricultural practices using technology-driven solutions. The emergence of the Internet of Things (IoT) has revolutionized various industries, including agriculture. IoT enables the integration of smart sensors, microcontrollers, and wireless communication technologies to monitor and manage agricultural activities remotely and in real-time. This innovation leads to Smart Farming or Precision Agriculture, which ensures optimal resource utilization and increased productivity. This paper proposes an IoT-Based Modern Agriculture System that automates irrigation based on real-time environmental data. The system uses an ESP8266 microcontroller to read values from a DHT22 temperature and humidity sensor, a BMP280 atmospheric pressure sensor, and a soil moisture sensor. The collected data is analyzed, and decisions are made to control a water pump through a relay, ensuring that irrigation is performed only when necessary.

The data is also transmitted to a cloud platform using the BLYNK protocol, and can be accessed via an Android application. This allows farmers to monitor field conditions and make informed decisions without being physically present on the farm. By implementing such a system, farmers can reduce water waste, minimize manual labor, and improve crop yields, making agriculture more sustainable and efficient.

II. PROBLEM STATEMENT

Traditional irrigation practices in agriculture often lead to overwatering, resource wastage, and increased labor costs due to the lack of real-time environmental monitoring. Farmers face challenges in manually tracking soil and weather conditions, which affects crop yield and resource efficiency. There is a need for an automated, low-cost, and smart solution that can monitor field conditions and control irrigation accordingly.

III. OBJECTIVES

The main objectives of the IoT-Based Modern Agriculture System are:

- To design and implement an automated irrigation system using IoT technology.
- To monitor environmental parameters such as temperature, humidity, soil moisture, and atmospheric pressure in real-time.
- To control a water pump automatically based on sensor data to ensure optimal soil conditions.
- To transmit sensor data to the cloud using BLYNK protocol for remote monitoring.
- To provide farmers with a mobile-based interface for real-time updates and decision-making.
- To reduce water wastage, save manual labor, and support sustainable farming practices.

IV. SCOPE

The project focuses on developing a low-cost, scalable, and efficient IoT-based system for automating irrigation in small to medium-sized agricultural fields. It includes real-time monitoring of environmental conditions and automated control of a water pump. The system supports remote access via a mobile app and cloud connectivity, making it suitable for farms, gardens, and plantations where manual monitoring is difficult.

V. LITERATURE SURVEY

Recent advancements in **IoT and sensor technologies** have significantly contributed to the evolution of **Smart Agriculture**, addressing issues such as inefficient irrigation, excessive water usage, and lack of real-time monitoring. Several studies have proposed innovative solutions integrating microcontrollers, wireless communication, and cloud computing.

Patil and Kale (2016) developed an IoT-based system for smart irrigation using Arduino and moisture sensors. The system controlled water flow based on soil conditions, showing significant water savings but lacked real-time cloud integration and mobile access.

Kulkarni and Sathe (2014) proposed a GSM-based automated irrigation system. Although it enabled remote control of irrigation, it relied on SMS communication, which limited scalability and real-time performance compared to BLYNK or Wi-Fi-based systems.

Nagaraj and Rekha (2017) presented a model where Arduino Uno and sensors monitor environmental parameters, and data is displayed on an LCD. However, their system lacked mobile connectivity and advanced analytics for precision farming.

Mehmood et al. (2019) introduced a cloud-based agricultural monitoring system using NodeMCU (ESP8266) and Blynk for real-time data visualization. Their system demonstrated the potential of cloud-IoT integration in agriculture, aligning closely with the goals of this paper.

Rani and Reddy (2020) proposed a smart irrigation system that used a combination of temperature, humidity, and soil sensors. While their design improved irrigation accuracy, it did not fully leverage the benefits of BLYNK for lightweight communication in real-time environments.

From the above studies, it is evident that while many systems focus on automation and monitoring, few offer a comprehensive, real-time, mobile-connected solution using BLYNK and ESP8266, as proposed in this paper. This project aims to fill that gap by offering a cost-effective and scalable solution with enhanced communication and user accessibility features.

VI. METHODOLOGY

6.1 Hardware Design

- **Microcontroller:** ESP8266 is used for processing sensor data and controlling the system.
- **Sensors:**
  - **DHT22** for measuring temperature and humidity.
  - **BMP280** for atmospheric pressure measurement.
  - **Soil Moisture Sensor** to detect soil water content.
- **Relay Module:** Controls the water pump based on commands from the ESP8266.
- **Water Pump:** Provides irrigation when activated by the relay.
- **Power Supply:** Provides stable power to microcontroller, sensors, and pump.
- **Connectivity:** ESP8266 connects to Wi-Fi for data transmission via BLYNK protocol.

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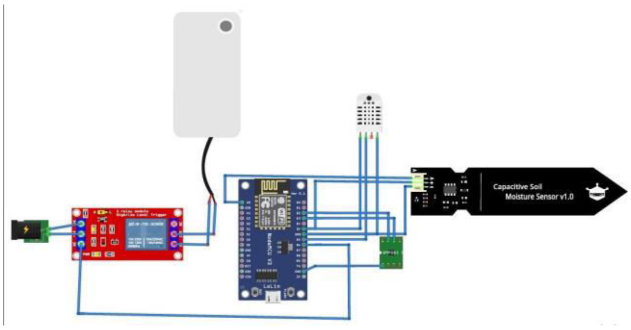
6.2 Software Design

- **Sensor Data Acquisition:** The ESP8266 reads data from connected sensors at regular intervals.
- **Data Processing:** Sensor readings are compared against predefined thresholds to decide whether irrigation is required.
- **Control Logic:** Based on soil moisture levels, the ESP8266 sends signals to the relay to switch the water pump ON or OFF.
- **Mobile Application Interface:** Displays real-time sensor data and irrigation status, allowing farmers to monitor and control the system remotely.
- **Serial Monitor:** Used during development for debugging and verification of sensor data and pump control.

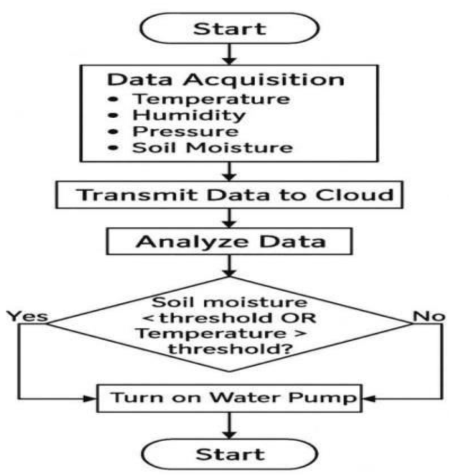
6.3 Block Diagram



VII. HARDWARE COMPONENTS

- ESP8266 Microcontroller
- DHT22 Temperature and Humidity Sensor
- BMP280 Atmospheric Pressure Sensor
- Soil Moisture Sensor
- Relay Module
- Water Pump
- Power Supply (e.g., 5V adapter or battery)
- Jumper Wires
- Breadboard or PCB Board

Flowchart



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VIII. SOFTWARE REQUIREMENTS

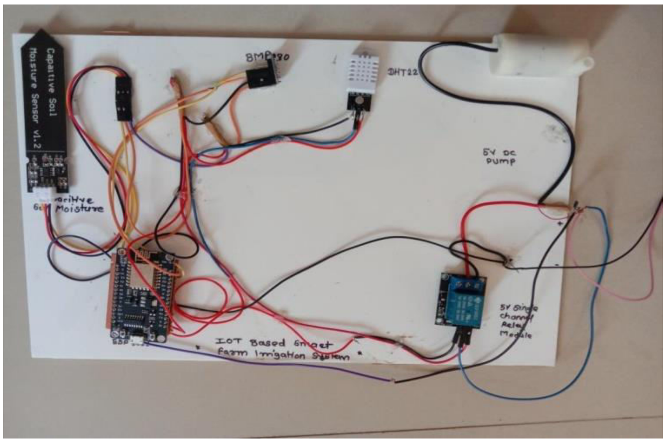
- **Arduino IDE** for ESP8266 programming
- Required sensor and communication libraries (ESP8266WiFi, PubSubClient, DHT, BMP280)

IX. TESTING & RESULTS

The IoT-Based Modern Agriculture System was tested under controlled conditions to evaluate its performance in real-time environmental monitoring and automated irrigation.

- **Sensor Accuracy:** The DHT22, BMP280, and soil moisture sensors were calibrated and tested to ensure reliable data readings. Sensor values were cross-checked with standard measuring instruments, showing an accuracy within acceptable error margins.
- **System Response:** The relay module successfully activated the water pump when soil moisture fell below the threshold, demonstrating effective automation of irrigation.
- **Water Conservation:** Automated irrigation reduced unnecessary watering compared to manual schedules, conserving water and optimizing resource use.

Overall, the system showed reliable performance, accuracy, and responsiveness, validating its feasibility for precision agriculture applications.



X. ADVANTAGES & DISADVANTAGES

Advantages:
1. Automates irrigation, saving water and labor.
2. Enables real-time remote monitoring via mobile app.
3. Cost-effective and easy to deploy on small to medium farms.

Disadvantages:
1. Requires stable Wi-Fi connectivity for cloud communication.
2. Sensor accuracy can be affected by environmental factors.
3. Initial setup and calibration may need technical knowledge.

XI. CONCLUSION

The IoT-Based Modern Agriculture System successfully automates irrigation by monitoring key environmental parameters and controlling water supply efficiently. It helps conserve water, reduces manual labor, and supports precision farming through real-time data access and remote control. This low-cost, scalable solution can significantly improve agricultural productivity and sustainability.

XII. FUTURE SCOPE

Future improvements could include integrating additional sensors (e.g., nutrient, pH), enhancing data analytics with AI for better decision-making, expanding mobile app features for alerts and control, and implementing solar power for energy efficiency. The system can also be adapted for large-scale farms and other crops.

REFERENCES

[1] S. Patil and M. Kale, “IoT Based Smart Irrigation System Using Arduino,” International Journal of Engineering Research & Technology, vol. 5, no. 7, pp. 117-121, 2016.
[2] A. Kulkarni and S. Sathe, “GSM Based Automatic Irrigation System,” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 3, no. 4, pp. 12764-12769, 2014.
[3] M. Nagaraj and P. Rekha, “Automated Irrigation System Using Arduino,” International Journal of Innovative Research in Science, Engineering and Technology, vol. 6, no. 2, pp. 3431-3435, 2017.
[4] F. Mehmood, M. A. Khan, and J. Lee, “Cloud-Based IoT Framework for Smart Agriculture,” IEEE Access, vol. 7, pp. 156237-156247, 2019.
[5] M. Rani and A. Reddy, “Smart Irrigation System Using IoT,” International Journal of Computer Applications, vol. 175, no. 30, pp. 15-19, 2020.

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