IOT BASED SMART AGRICULTURE MONITORING SYSTEM

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Abstract:
In today's world, farming faces big challenges like feeding more people while using fewer resources. Our project introduces a smart system for farming called the IoT-based Smart Agriculture Monitoring System. It uses special electronic devices and sensors to keep track of important things like how wet the soil is, the temperature, and humidity. These devices are connected to the internet, so farmers can check the information on their smartphones anytime. This system is a game-changer because it helps farmers make better decisions about when to water their crops. By using this system, farmers can save water and reduce the use of chemicals, which is good for the environment. Another cool thing about this system is that it can work in different places around the world and is easy for farmers to use, even if they're not tech-savvy. It's like having a helpful assistant that makes farming easier and more efficient. As we look to the future of farming, this smart system offers hope for a better way of doing things. With technology on our side, we can create a more sustainable and productive farming industry for everyone.

Keywords: Farming challenges, Resource optimization, Electronic devices, Sensors, Soil moisture, Temperature, Humidity, Internet connectivity, Real-time data, Smartphone accessibility, Water conservation, Chemical reduction, Environmental sustainability, User-friendly, interface Farming efficiency, Technological innovation, Sustainable agriculture.

1. INTRODUCTION

Farming is all about growing food, but it can be tough work. One big challenge for farmers is knowing when to water their crops. Too much water can harm plants, and too little can make them die. It's really important to get this balance right so that crops can grow well and produce lots of food. Our project is here to help with this. We've created something called the IoT-based Smart Agriculture Monitoring System. It's a fancy name, but it's actually a clever system that makes farming easier.

This system uses special gadgets and sensors to gather information about the soil and the weather. For example, it can tell how wet the soil is and what the temperature is like. The cool thing about our system is that farmers can check all this information using their phones. They don't have to go out into the fields to check on their crops all the time. Instead, they can just look at their phones and see if everything is okay. This saves them time and makes farming less stressful.

Our goal is to help farmers do their jobs better. With our Smart Agriculture Monitoring System, they can make smarter decisions about when to water their crops and how to take care of them. This means they can grow more food and do it in a way that's better for the environment. It's like having a helpful assistant that makes farming easier and more successful.

2. PROBLEM STATEMENT

Farming is hard work, and one big challenge for farmers is knowing when and how much to water their crops. If they water too little, the plants might not grow well, but if they water too much, it can drown the plants. This is a big problem because it can affect how much food farmers can grow.

Farmers also need to understand other things like the temperature and humidity to take care of their crops properly. Right now, they often have to rely on guesswork or manual checks to figure these things out, which can be time-consuming and not always accurate.

Our project aims to solve these problems by creating a special system called the IoT-based Smart Agriculture Monitoring System. This system uses gadgets and sensors to help farmers know exactly what's happening in their fields, like how wet the soil is and what the weather is like. With this information, farmers can make better decisions about when to water their crops and how to take care of them, ultimately helping them grow more food efficiently.

3. LITERATURE REVIEW

[1] Farmers need to use water wisely because water sources are decreasing, and the weather is unpredictable. They can install special sensors in their fields to check the temperature and moisture levels of the soil. These sensors can be connected to a small computer that can control how much water is used. This system can run on solar power and can connect to the internet using a cell phone network.

[2] In the old way of farming, farmers had to check everything themselves, like the temperature and moisture of the soil.

[3] Some people are working on making farming easier using technology. They want to make tools that can work without people controlling them directly. For example, they're making a robot that can move around fields to do tasks like removing weeds, spraying pesticides, and checking for people.

[4] Scientists are thinking about using computers in the sky (cloud computing) to help with farming. They want to connect different tools and sensors in the field using wireless technology.

[5] People are finding ways to use small, cheap sensors to collect data from fields. This data can help decide when to water crops. They've also made systems that automatically water plants when needed, saving water.

4. METHODOLOGY

The methodology for implementing an IoT-based smart agriculture monitoring system using the ESP32 microcontroller involves integrating sensors, programming the microcontroller, connecting to the Blynk IoT platform, and configuring a mobile app for real-time data visualization.

Firstly, select appropriate sensors like soil moisture, temperature, and humidity sensors, and connect them to the ESP32 microcontroller. Write a program in the Arduino IDE to read data from these sensors. Utilize libraries DHT for temperature and humidity readings.

Next, program the ESP32 to connect to Wi-Fi for internet connectivity. This is crucial for real-time data transmission to the Blynk platform. The ESP32 code should continuously read sensor data and send it to the Blynk server.

Create a Blynk account, set up a new project, and add widgets in the Blynk app for temperature and humidity. Obtain the Blynk authentication token, and update the ESP32 code to include the Blynk library, connecting the ESP32 to the Blynk server.

In the Blynk app, configure virtual pins to receive data from the ESP32, allowing real-time monitoring of agricultural parameters. The mobile app provides a user-friendly interface for farmers to track temperature and humidity levels remotely.

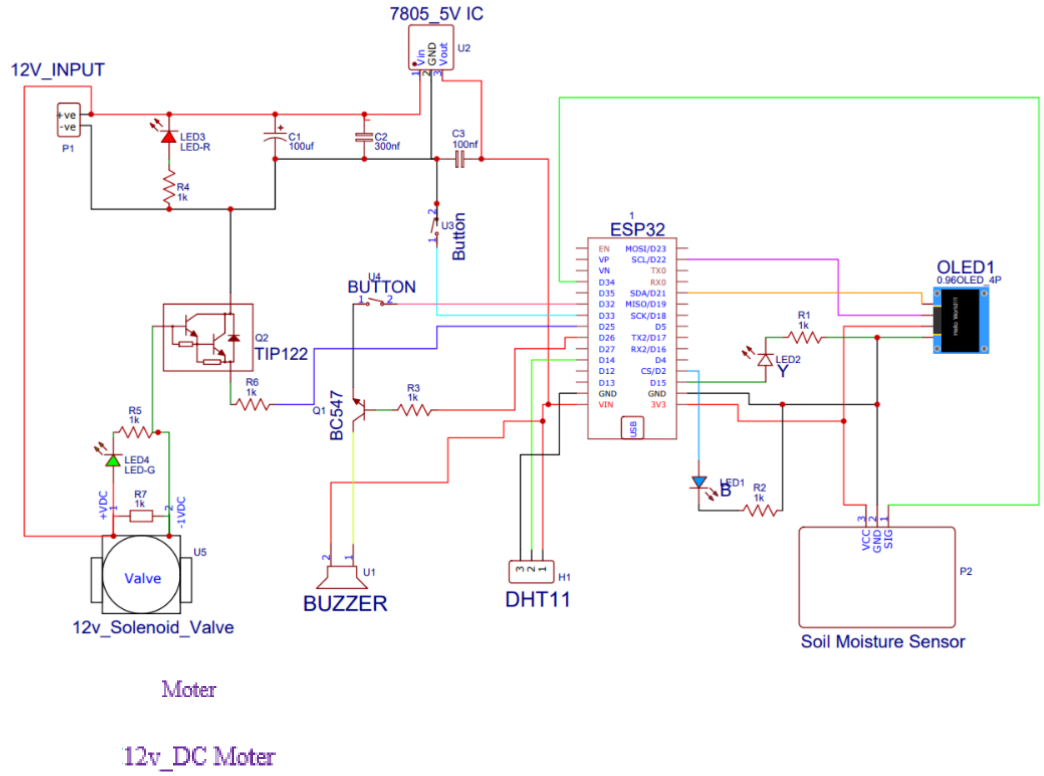
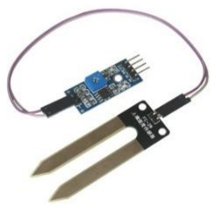


Fig. Circuit Diagram

5. COMPONENT SPECIFICATION

ESP-32 MICROCONTROLLER: The ESP32 microcontroller is a low-cost, high-performance microcontroller with built-in Wi-Fi and Bluetooth capabilities. It serves as the central processing unit and communication hub for the entire system.

SOIL MOISTURE SENSOR: The soil moisture sensor is an essential component for precision agriculture. It measures the moisture content of the soil, providing critical data to optimize irrigation and avoid overwatering or under watering crops.



DHT SENSOR: The DHT sensor measures temperature and humidity, providing valuable environmental data to help monitor and predict crop conditions.

BATTERY: The system is powered by a rechargeable battery, even in remote areas without a stable power supply, which provides mobility and ensures uninterrupted operation.

OLED DISPLAY: The OLED display can be used to show real-time data collected from various sensors. For example, it can display the current soil moisture level, temperature, humidity, or other relevant parameters. This allows farmers to quickly assess the conditions in their fields without needing to access a mobile app or computer interface.

BUZZER: A buzzer is a small electronic component that produces sound when an electric current is passed through it. It typically consists of a coil of wire wrapped around a magnetic core, a diaphragm or speaker cone, and a housing. When an electrical signal is applied to the buzzer, the coil generates a magnetic field that causes the diaphragm to vibrate, producing sound waves that we can hear.

7805 VOLTAGE REGULATOR: 7805 Voltage Regulator, a member of the 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.

12V_DC MOTER: A DC motor pump is a type of pump that is powered by a direct current (DC) motor. It is commonly used for pumping liquids such as water, chemicals, or fuels in various applications, including agriculture, automotive, industrial etc.

6. WORKING

Sensor Integration:
The project integrates various sensors including soil moisture sensor, temperature sensor, and humidity sensor along with a motor pump controlled by an ESP32 microcontroller. These sensors are placed strategically in the agricultural field to collect real-time data about soil moisture levels, temperature, and humidity.

ESP32 Configuration:
The ESP32 microcontroller acts as the central hub for data collection and control. It is programmed to read data from the sensors at regular intervals and transmit this data wirelessly to the Blynk IoT app using Wi-Fi connectivity.

Wireless Connectivity with Blynk App:
The ESP32 is configured to connect to the Blynk IoT app through Wi-Fi. Blynk provides a user-friendly interface where farmers can view the real-time data collected by the sensors on their smartphones. The Blynk app also allows users to remotely control the motor pump for water supply based on the sensor readings.

Data Transmission and Visualization:
As the sensors collect data, the ESP32 sends this data to the Blynk app via Wi-Fi. The Blynk app visualizes this data in the form of graphs, charts, or numerical values, providing farmers with easy-to-understand insights into the soil conditions and environmental parameters in their fields.

Decision-Making and Control:
Based on the data displayed on the Blynk app, the farmer can make informed decisions about when to water the crops. If the soil moisture levels are below a certain threshold indicating dry soil, the farmer can remotely activate the motor pump through the Blynk app to supply water to the crops.

Continuous Monitoring and Adjustment:
The ESP32 continuously monitors the sensor readings and transmits updates to the Blynk app in real-time. Farmers can adjust water supply schedules or irrigation settings as needed based on the changing environmental conditions reflected in the sensor data.

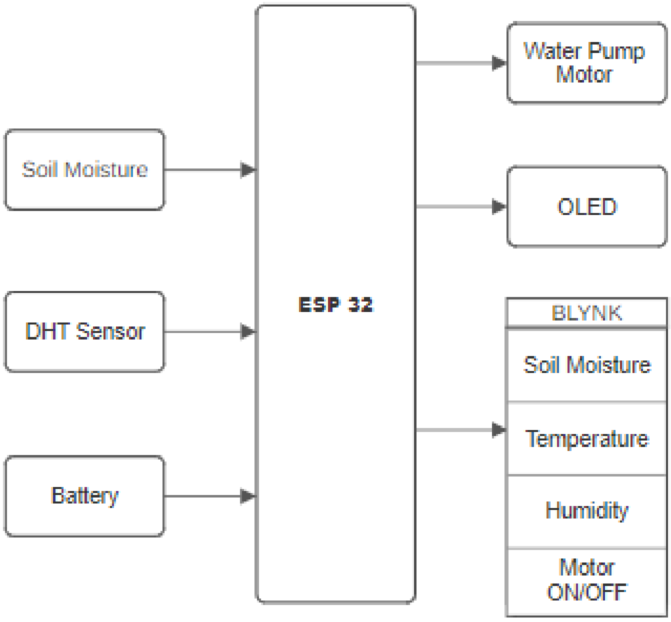


Fig. Block Diagram

7. ADVANTAGES

1. It is easy to maintain and cost is reasonable to purchase.
2. The components which are used are easily available.
3. It has advantage to observe the status on smartphone or laptop using internet.
4. The information is up-to-date even in absence of farmer.
5. The collected data is updated, and the farmer is conscious about the status of the crop.
6. To achieve more effective and accurate details of crop several additional sensors can also be included.
7. Reduced Operating Costs.
8. Remote monitoring.
9. Efficient use of water.
10. Timely irrigation.
11. Improve Crop Yield

8. RESULT AND ANALYSIS

The IOT-based smart agriculture monitoring system successfully collected real-time data from the field using various sensors, including soil moisture, temperature, humidity, and motion. The ESP32 microcontroller processed this data and made actual-time decisions based on predefined thresholds. Analysis of the collected data revealed insights into soil conditions, environmental factors, and crop health, enabling informed decision-making for irrigation and resource management.

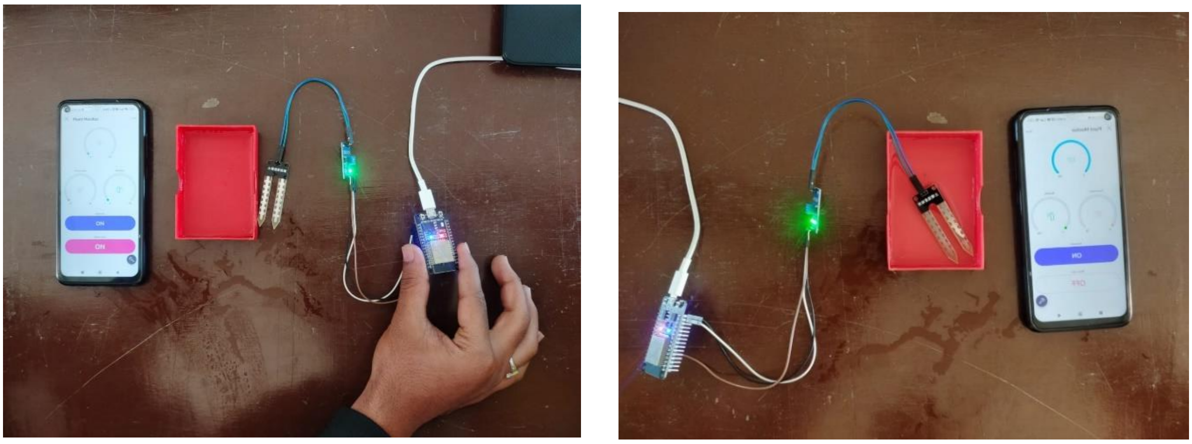
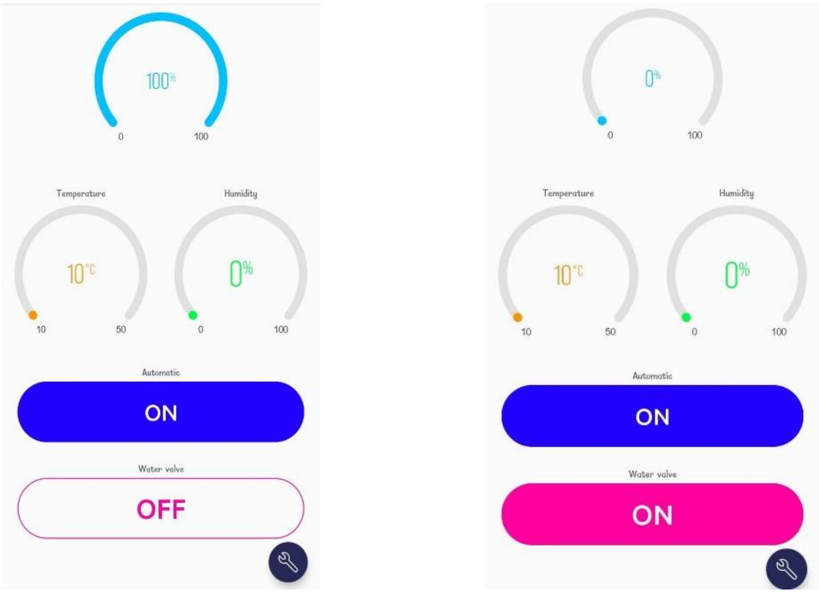


Fig. Results Output



9. CONCLUSION

- The smart farming system we've built is a big step forward in helping farmers grow crops better. By using technology like the ESP32 microcontroller, special sensors, and a tool called Blynk, we've made it possible for farmers to keep an eye on their fields from far away.

- With our system, farmers can see things like how wet the soil is, what the weather's like, and if there are any problems in the field. They can even tell the system to water their crops automatically if they need it. This helps the crops grow well and saves water at the same time.

- Our system is easy to use, and farmers can control it from their phones or computers. It helps them make smart decisions about how to take care of their crops and makes farming easier and more productive.

- In the end, our smart farming system shows how technology can make a big difference in farming. With more improvements and more people using systems like ours, we can make farming better for everyone and help produce more food while taking care of the environment.

- In summary, the smart farming system we've developed is a valuable tool for farmers. By utilizing sensors to monitor soil moisture, temperature, and humidity, and connecting them to an ESP32 microcontroller that controls a motor pump, we've simplified the process of monitoring field conditions.

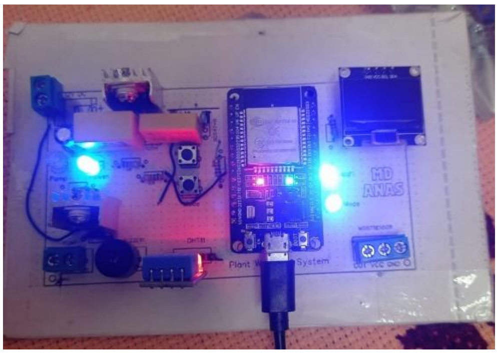


Fig. Working Device

10. FUTURE SCOPE

- The project holds immense potential for further development, focusing on enhancing user-friendliness and introducing additional features to the system, such as:

- **Webcam Integration**: By incorporating a webcam into the system, farmers can capture photos of their crops, enabling visual inspection and analysis. These images can be sent to a database for further reference and analysis, providing valuable insights into crop health and growth progress.

- **Speech-Based Interface**: Implementing a speech-based option within the system caters to farmers who may have lower literacy levels. This feature allows users to interact with the system using spoken commands, making it more accessible and user-friendly for a wider range of users.

- **GPS Integration**: Integrating GPS technology enables the system to provide the precise location of the farmer's fields or garden. This information facilitates more accurate weather reports tailored to the specific location, aiding in better decision-making regarding crop management and irrigation scheduling.

- **Regional Language Support**: Implementing support for regional languages accommodates farmers who are only familiar with their local languages. By offering the system interface in regional languages, it becomes easier for farmers to navigate and utilize the system effectively, enhancing their overall experience and uptake of the technology.

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