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SMART COCONUT FARMING USING IOT AND BLYNK: A REAL-TIME MONITORING AND IRRIGATION SOLUTION

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Abstract
In recent years, precision agriculture has gained significant attention as a means to increase productivity and sustainability in farming. This paper presents a smart coconut farming system that leverages the Internet of Things (IoT) and the Blynk IoT platform to monitor and automate key aspects of irrigation and environmental conditions. The system employs sensors to measure soil moisture, temperature, and humidity in real-time. The collected data is transmitted to a cloud-based Blynk dashboard via Wi-Fi, allowing farmers to monitor conditions remotely using smartphones. Based on preset thresholds or manual control, the system can automatically activate a water pump to irrigate the coconut crop efficiently. This reduces water wastage, ensures timely watering, and minimizes human intervention. The integration of IoT with mobile-based interfaces like Blynk makes this solution scalable, cost-effective, and highly adaptable for modern agricultural practices.
Keywords: IoT, Blynk, Soil Moisture Sensor, Real-Time Monitoring, Automated Irrigation, Precision Agriculture, Smart Agriculture, Wireless Sensor Network

1. INTRODUCTION
Agriculture is a cornerstone of human civilization, providing essential resources such as food, raw materials, and employment. Coconut farming, in particular, plays a crucial role in tropical regions by contributing to the local economy and food security. However, traditional coconut farming methods often face challenges related to inefficient water usage, lack of continuous environmental monitoring, and dependence on manual labor. These limitations can negatively impact crop yield, quality, and sustainability.
Precision agriculture, driven by advances in technology, offers promising solutions to these challenges. By utilizing sensors, communication networks, and automated control systems, precision agriculture enables farmers to optimize resource use, improve crop health, and increase productivity. The Internet of Things (IoT) is a key enabler in this context, providing real-time data collection and remote management capabilities.
This paper introduces a smart coconut farming system that integrates IoT technology with the Blynk IoT platform to monitor soil moisture, temperature, and humidity continuously. Using sensor data, the system can make intelligent irrigation decisions either automatically or through manual control via a smartphone application. This approach ensures that coconut trees receive water precisely when needed, reducing water wastage and labor requirements.
The real-time monitoring capability allows farmers to make data-driven decisions, improving crop health and yield. Furthermore, the use of the Blynk platform facilitates easy scalability and remote accessibility, making the system suitable for diverse farm sizes and conditions. This paper demonstrates how modern IoT solutions can transform traditional agriculture into a more efficient, sustainable, and technology-driven practice.

2. LITERATURE SURVEY
Blynk-Based Remote Farming Solutions for Small-Scale Farmers (Nguyen & Patel, 2025): Nguyen and Patel developed a cost-effective IoT system for remote monitoring and control of irrigation using the Blynk platform. Their focus was on enabling small-scale farmers to adopt smart farming practices without requiring extensive technical skills. The system included real-time alerts, manual override features, and easy scalability. Results demonstrated improved water management and farmer satisfaction.
IoT-Based Smart Irrigation System (Rani et al., 2020): Rani and colleagues developed an IoT-based irrigation system that used soil moisture sensors to automate watering. Their work demonstrated wa-

ter conservation by triggering irrigation only when moisture levels dropped below set thresholds. However, the system lacked a mobile interface for remote monitoring, limiting usability in large farms.

Wireless Sensor Networks for Agricultural Monitoring (Sharma & Singh, 2019): Sharma and Singh proposed a wireless sensor network for real-time monitoring of soil and climatic conditions including temperature and humidity. Their system enabled timely irrigation and fertilizer management but required complex infrastructure that could be cost-prohibitive for small-scale farmers.

Mobile Application Integration in Smart Farming (Patel et al., 2021): Patel et al. showcased the use of the Blynk IoT platform for creating customizable dashboards accessible via smartphones. Their solution allowed farmers to monitor environmental data and control irrigation devices remotely, improving convenience and response times in crop management.

Automated Moisture-Based Irrigation for Coconut Plantations (Kumar et al., 2022): Kumar and team designed a moisture-sensing automated irrigation system specific to coconut farming. Their approach significantly reduced water wastage and improved crop yields. Nonetheless, the system lacked integration with cloud-based monitoring platforms, restricting remote accessibility.

Environmental Monitoring for Crop Health (Lee & Park, 2018): Lee and Park studied the impact of temperature and humidity on crop stress and irrigation needs. They concluded that continuous monitoring of these parameters can provide early warnings and optimize irrigation schedules, leading to healthier crops and better water management.

Most existing smart irrigation systems lack user-friendly mobile interfaces and remote monitoring features. Many solutions require costly, complex infrastructure unsuitable for small-scale farmers. Current systems often focus on specific trees without scalable, adaptable designs. Integration with cloud platforms for real-time data access remains limited. Environmental factors like temperature and humidity are underutilized in irrigation control. There is a need for affordable, easy-to-use IoT solutions tailored to smallholders. Systems must combine multi-parameter monitoring with remote control capabilities. Many lack real-time alerts and manual override features for flexible management. Scalability and technical simplicity are essential for broader adoption. Overall, an integrated, cost-effective smart farming system for small farmers is needed. To bridge these gaps, it is essential to develop an IoT-based irrigation solution that offers comprehensive remote monitoring and control through an intuitive mobile application. This system should be cost-effective, scalable, and designed specifically for small-scale farmers' needs, incorporating multiple environmental sensors and cloud integration for real-time data access and alerts.

3. METHODOLOGY AND MODELING

3.1 Blynk-Based Smart Irrigation Application for Coconut Farms

Leveraging the Blynk platform, a new smart irrigation system tailored for coconut plantations can be developed by integrating soil moisture, temperature, and humidity sensors with a customizable mobile dashboard. This system would enable real-time monitoring and automated irrigation based on the specific water needs of coconut palms, while also allowing farmers to manually override irrigation schedules via the app. Cloud connectivity would facilitate instant alerts and historical data logging, enhancing water use efficiency and crop health management in coconut farms. Emphasizing simplicity, affordability, and scalability, this solution aims to empower small-scale coconut farmers with minimal technical expertise to adopt smart farming practices and optimize their irrigation management.

4. PROPOSED SYSTEM

The suggested system consists of soil moisture, temperature, and humidity sensors connected to a microcontroller unit (such as ESP32) that collects and processes environmental data. This data is transmitted via Wi-Fi to the Blynk cloud platform, enabling real-time visualization on a mobile dashboard accessible to farmers. The system automates irrigation by activating water pumps or valves when sensor readings fall below preset thresholds specific to coconut crop needs. Farmers retain the ability to manually override automated controls using the mobile app for flexible management. Cloud integration allows for historical data logging and instant notifications, facilitating efficient water use and proactive crop care. The design prioritizes affordability, simplicity, and scalability to ensure adoption by small-scale coconut farmers with minimal technical expertise.

5. SYSTEM REQUIREMENTS

Hardware Requirements

1. Soil Moisture Sensor: Measures soil moisture levels to determine irrigation needs. One kind of inexpensive electronic sensor used to measure soil moisture is called a "Soil Moisture Sensor." This sensor can determine the exact amount of water present in ground. The Sensing Probs & Sensor Module are two primary components of this sensor. By allowing an electric current to flow throughout soil, probes can measure the soil's resistance and so determine its moisture content. The sensor probes' readings are processed and converted into digital/analog form by Sensor Module. Soil moisture sensors may provide you either a digital or an analog reading of the soil's moisture levels.

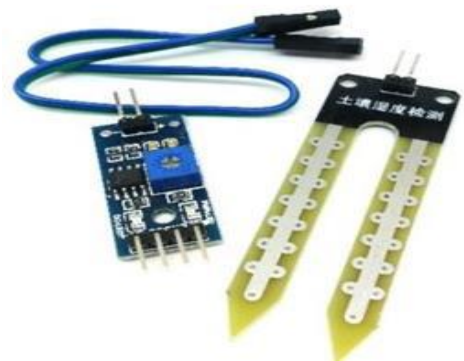

Figure 1. Soil Moisture Sensor

2. Temperature Humidity DHT11 Sensor: Temperature sensor monitors ambient temperature affecting coconut crop health. Humidity sensor tracks environmental humidity to optimize irrigation scheduling. Digital humidity and temperature sensor DHT11 is inexpensive. This sensor can take immediate readings of humidity and temperature when interfaced with a microcontroller like the Arduino, Raspberry Pi, etc. The DHT11 is a sensor and a module that measures humidity and temperature. This sensor is distinct from a module in that it has a pull-up resistor with a status LED. DHT11 measures relative humidity. This sensor employs a thermistor with a capacitive humidity sensor to analyze the ambient air.

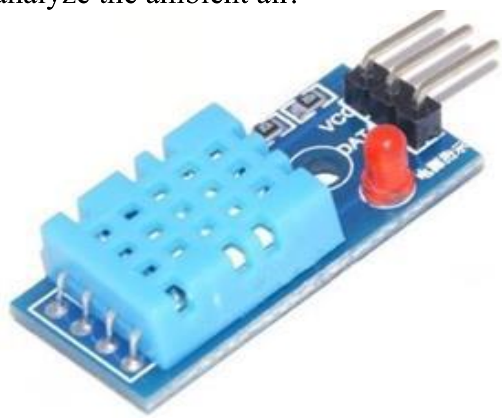

Figure 2. DTH11 Sensor

3. Microcontroller (ESP32): Processes sensor data, controls irrigation devices, and communicates with the Blynk cloud via Wi-Fi.

4.Water Pump or Solenoid Valve: Controls water flow for irrigation based on system commands.

5.Power Supply: Battery or solar panel to provide energy for remote, off-grid operation.

6.Wi-Fi Module: Integrated with ESP32 for internet connectivity.

Software Requirements

1.Blynk IoT Platform: For cloud data storage, visualization, and remote control via a mobile app.

2.Firmware on ESP32: Custom code to read sensor data, implements irrigation logic, and handle communication with Blynk.
3.Mobile Application: User interface on smartphones/tablets for real-time monitoring, threshold configuration, and manual overrides.
4.Cloud Connectivity: Enables data logging, notifications, and access to historical sensor data for decision support.

6. PROPOSED ARCHITURE

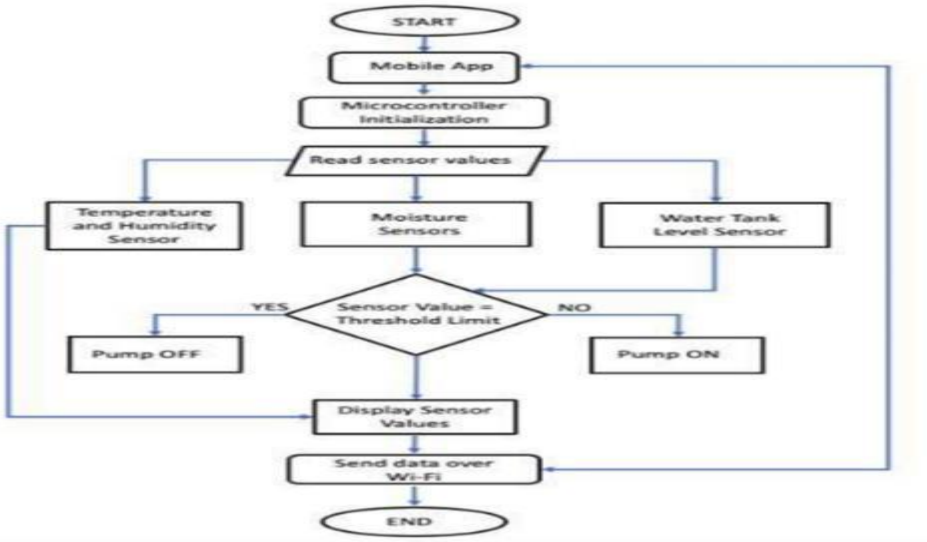

Figure 3. Flow of Proposed model

The IoT-based coconut farming system begins with a mobile app that enables farmers to control and monitor field conditions remotely. A microcontroller initializes and reads data from multiple sensors, including temperature, humidity, soil moisture, and water tank level sensors. The temperature and humidity sensor assesses the climate of the coconut grove, while the soil moisture sensor determines irrigation needs. The water tank level sensor checks water availability. Based on the soil moisture readings, the system either activates or deactivates the water pump—turning it off when moisture is sufficient and on when it's low. All sensor data is displayed and transmitted via Wi-Fi for real-time monitoring and data logging. This smart irrigation system ensures efficient water usage, boosts coconut yield, and minimizes the need for manual intervention.

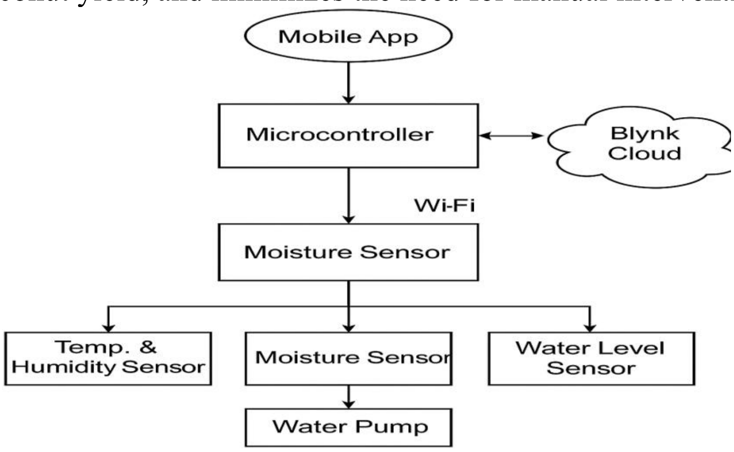

Figure 4. System Architecture

Figure 4 depicts illustrates a smart coconut farming setup that integrates Internet of Things (IoT) technology with the Blynk platform for efficient, automated irrigation management. The process begins with a mobile app, which serves as the user interface for farmers. Through the Blynk Cloud, this app communicates wirelessly with a microcontroller (such as NodeMCU or ESP8266) over Wi-Fi. The microcontroller acts as the central control unit, gathering and processing data from multiple sensors deployed in the field.

The system incorporates key sensors, including a soil moisture sensor, which determines if the soil needs irrigation; a temperature and humidity sensor, which helps monitor atmospheric conditions relevant to coconut tree health; and a water level sensor, which checks the available water in the storage tank. If the soil moisture level is found to be below a pre-set threshold, the microcontroller triggers the water pump to irrigate the field.
All data is transmitted in real-time to the Blynk Cloud and displayed on the mobile app, allowing farmers to monitor and manually control the irrigation process remotely. This intelligent system reduces water wastage, ensures timely watering, minimizes manual labor, and enhances the sustainability and productivity of coconut farming practices.

7. WORKING OF THE PROPOSED SYSTEM
Smart coconut farming system operates by integrating sensor data acquisition, automated control, and remote monitoring through the Blynk IoT platform. The entire process begins with the initialization of a Wi-Fi-enabled microcontroller (such as NodeMCU or ESP8266), which acts as the central processing unit. Various sensors are connected to this microcontroller to continuously gather real-time data from the field.

- A soil moisture sensor monitors the moisture content in the soil to determine the irrigation needs of the coconut crop.
- A temperature and humidity sensor helps assess the climatic conditions within the plantation.
- A water level sensor ensures there is sufficient water in the storage tank before activating irrigation.

All collected data is transmitted via Wi-Fi to the Blynk Cloud, where it is displayed on the mobile dashboard of the farmer through the Blynk mobile app. The app enables both automated control (based on threshold values set in the code) and manual operation of the water pump.
When the soil moisture falls below the predefined threshold, the system automatically activates the water pump to irrigate the field. Once adequate moisture is detected, the pump is turned off. This process helps conserve water, improves irrigation timing, and significantly reduces the need for manual intervention, making it ideal for large-scale coconut farms.

8. SYSTEM IMPLEMENTATION
The proposed smart coconut farming system is implemented using a combination of IoT hardware components and cloud-based software integration through the Blynk platform. At the core of the system is a Wi-Fi-enabled microcontroller, such as the NodeMCU (ESP8266), which acts as the central controller to interface with various sensors and control devices.
The soil moisture sensor is embedded in the coconut field to continuously measure soil moisture levels. When the sensor detects that the moisture level is below the pre-defined threshold, the microcontroller automatically triggers the relay module to power the water pump, thereby initiating irrigation. Once adequate moisture is restored, the pump is turned off, ensuring efficient water usage.
To further support environmental monitoring, a DHT11 or DHT22 sensor is used to measure ambient temperature and humidity, while a water level sensor ensures there is sufficient water in the storage tank before irrigation begins.
All collected data is processed by the microcontroller and sent to the Blynk Cloud via Wi-Fi. The Blynk mobile application then displays the real-time data through user-friendly dashboards, enabling remote monitoring and control. The app also allows manual override of the pump, offering flexibility for the farmer.
This implementation not only reduces labor but also conserves water, improves irrigation timing, and ensures consistent crop health making it a reliable and modern solution for coconut farming.

9. RESULT AND DISCUSSION
The Blynk IoT platform was successfully configured to monitor and control key parameters in the smart coconut farming system. The results were visualized through a user-friendly mobile application interface, allowing real-time updates and manual control of the irrigation system. The interface

includes widgets to monitor soil moisture, temperature, humidity, and buttons for mode selection and pump control.

Moisture Monitoring (V1 - Gauge Widget)

The gauge widget shows real-time soil moisture percentage. In this result, the moisture value is displayed as **20%**, which is below the threshold, indicating the need for irrigation.

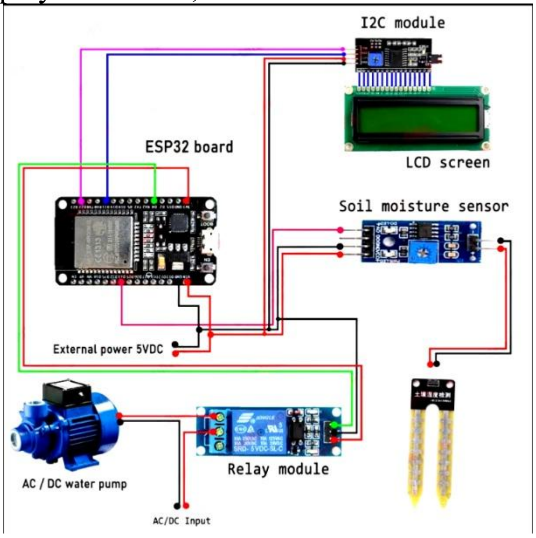

Figure 5. System Module

Temperature and Humidity (V2 & V3 - Labeled Widgets)

These widgets display environmental readings. For example, **21°C** temperature and **45%** humidity were recorded, which help in assessing the crop's atmospheric conditions.

Mode Selection (V4 - Button Widget)

A **manual/auto toggle** is provided to switch between automated and manual control of the pump. In manual mode, the farmer can decide when to water the crop.

Water Pump Control (V5 - Button Widget)

The pump status (ON/OFF) is displayed and controlled via the app. In this case, it shows **PUMP OFF**, meaning irrigation is not currently active.

System Feedback (Screenshot 6)

The final screen shows real-time status for all key parameters: Moisture (V1), Temperature (V2), Humidity (V3), Mode (V4), and Pump (V5). This confirms effective integration and communication between hardware and cloud interface.

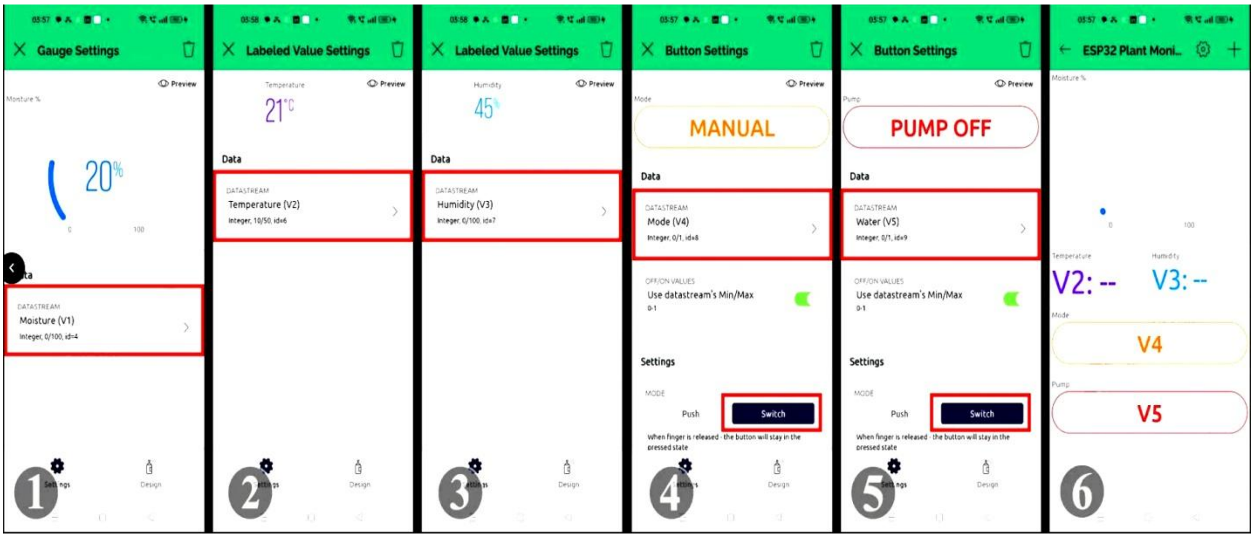

Figure 6. Predicted result on Application

The Blynk app results confirm the successful real-time data acquisition, threshold-based automation, and remote control capability of the system. When the soil moisture drops below the set limit (e.g., <30%), the microcontroller sends a signal (V5 = 1) to activate the pump. The mode switch (V4) allows flexibility—automated operation for hands-free farming or manual mode for user-defined control.These features:

- Enable optimized water usage
- Provide remote farm monitoring
- Support user customization
- Enhance scalability and practical use in real-world farming environments.

This system ultimately supports sustainable and efficient coconut farming by reducing water wastage, labor costs, and over-irrigation.

10. CONCLUSION

With the information provided by these IoT-based smart irrigation solution tailored for coconut farms using the Blynk platform. By integrating multiple environmental sensors and providing a user-friendly mobile interface, the system addressed key challenges faced by small-scale farmers, such as inefficient water use and lack of timely irrigation control. The solution's cloud connectivity and automation features improved water conservation and crop productivity, making smart irrigation accessible to farmers with minimal technical expertise. Future work can focus on expanding sensor types, enhancing AI-driven predictive irrigation, and further optimizing energy efficiency with renewable power sources.

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