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SMART AGRICULTURE MONITORING SYSTEM

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ABSTRACT

The Smart Irrigation System using ESP32 is an innovative solution designed to optimize water usage in agriculture while ensuring the safety of crops. It operates by monitoring soil moisture levels and activating a water pump through a relay to irrigate the land when the soil is dry, turning off automatically when the soil is adequately moist. A PIR sensor detects any human or animal intrusion within the crop area, immediately alerting the owner via Email Server or Blynk App. Additionally, the system tracks ambient temperature and humidity levels using a DHT22 sensor, with real-time data displayed on an LCD and uploaded to platforms like ThingSpeak or Blynk App. This system effectively combines soil and climate monitoring with real-time alerts, providing farmers with precise, automated control over their irrigation schedules and crop protection.

Keywords: Smart Irrigation, ESP32, Soil Moisture Sensor, Blynk App

I.INTRODUCTION:

Water scarcity and efficient resource management are critical issues in modern agriculture, especially in regions where water availability is limited. The Smart Irrigation System addresses these concerns by automating irrigation based on real-time soil moisture conditions. With advancements in IoT and sensor technology, it is now possible to create systems that provide precise control over irrigation, significantly reducing water waste. This system utilizes ESP32, a versatile microcontroller, in conjunction with soil moisture and DHT22 sensors to monitor soil and weather conditions, respectively. A relay-controlled pump ensures irrigation is activated only when necessary, while a PIR

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sensor adds a layer of security by detecting intrusions and alerting the owner. By integrating data upload to platforms like ThingSpeak and Blynk, this system enables remote monitoring and real-time notifications, making it a robust solution for sustainable agricultural practices.

II. LITERATURE REVIEW

Smart drip irrigation systems and smart irrigation systems more generally have been the subject of prior study [10,11]. General descriptions of smart irrigation systems may be found in references [12, 13]. Among the topics covered are various types of monitoring in this field, wireless communications, irrigation methods, and sensors that may be integrated into smart irrigation systems. Irrigation management, scheduling, and monitoring are thoroughly explained in references [14] and [15], respectively, while references [14] and [15] explore the use cases, issues, and worries of the Internet of Things (IoT) in agriculture.

Part of the smart irrigation system detailed in reference [16] included an Arduino UNO single board computer (SBC), a water flow meter, a temperature sensor, and a resistive soil moisture sensor. Soil moisture is monitored and watering is initiated when soil dries out or when temperatures rise beyond 30 °C. Reference [17] describes an IoT-based smart system for monitoring and controlling agricultural output. This device monitors the data and sends it to the farmer so he may control the system remotely as needed, which helps with part of his effort.

In reference [18], an intelligent watering system was proposed that makes use of an Arduino UNO SBC, together with temperature, air humidity, and resistive soil moisture sensors. Humidity and temperature readings are shown on the screen using the technology. The engine is started to water the ground when it becomes too dry. Using solar energy, the authors of reference [19] proposed a new smart drip irrigation system. Using a node microcontroller unit (MCU) that tracks temperature and humidity with a DHT11 sensor, it determines when the pump turns on based on the soil moisture value. Using LoRaWAN, the authors of reference [20] propose a smart farm.

III. EXISTING SYSTEM:

In traditional irrigation methods, farmers manually check soil conditions and activate water pumps based on estimated needs, often leading to water wastage. Existing automated systems may rely solely on soil moisture sensors for irrigation control but often lack comprehensive environmental monitoring and security alerts. The proposed Smart Irrigation System advances current technologies by combining multiple sensors and connectivity options for a more versatile solution. By integrating ESP32, soil moisture, and DHT22 sensors, along with a PIR sensor for intrusion detection, the proposed system addresses not only irrigation automation but also crop protection and environmental monitoring. This allows for a multi-functional system that conserves water, monitors weather, and secures crops against potential threats.

IV. PROPOSED SYSTEM:

By integrating ESP32, soil moisture, and DHT22 sensors, along with a PIR sensor for intrusion detection, the proposed system addresses not only irrigation automation but also crop protection and environmental monitoring. This allows for a multi-functional system that conserves water, monitors weather, and secures crops against potential threats.

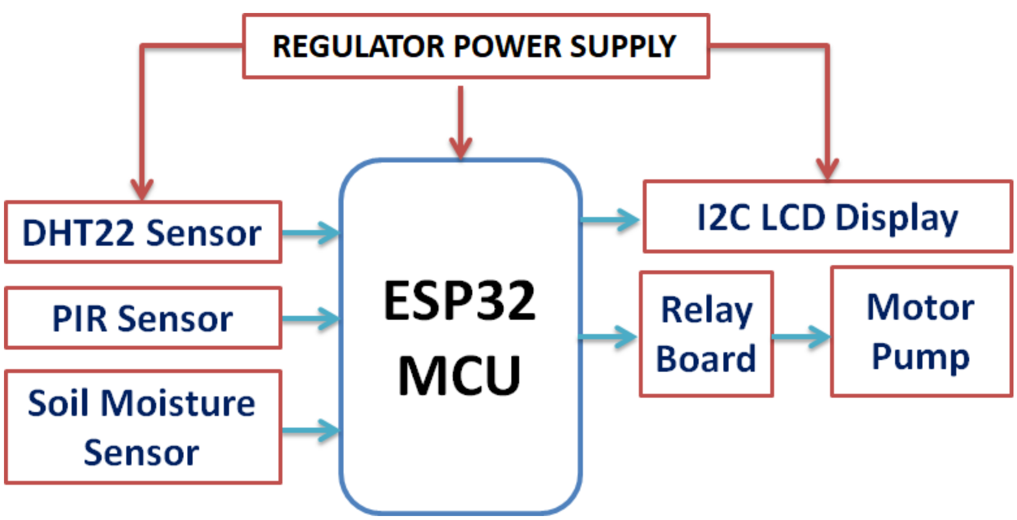

Fig.1: Block Diagaram

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V. WORKING METHODOLOGY

The Smart Irrigation System is based on the ESP32 microcontroller, which manages sensor data collection, processing, and communication with cloud platforms and alert systems. Soil moisture is constantly monitored using a soil moisture sensor connected to the ESP32. When the sensor detects dry conditions, the ESP32 activates a relay to turn on the water pump, irrigating the soil. Once the sensor detects sufficient moisture, the relay turns off, deactivating the pump, thereby preventing over-watering and conserving water resources.

The system also incorporates a PIR sensor to detect movement within the crop field. When a human or animal is detected, the ESP32 triggers an alert, sending a notification to the owner via an Email Server or the Blynk App. This feature ensures crop security and helps prevent damage from potential intruders.

The DHT22 sensor monitors temperature and humidity, with data processed by the ESP32 and displayed on an LCD for on-site reference. The same data, along with soil moisture readings, are uploaded continuously to platforms like ThingSpeak or Blynk App, enabling remote monitoring and providing a comprehensive view of the crop's environmental conditions. The LCD display also shows the operational status of the irrigation system, giving users immediate feedback on its current state. This combination of real-time monitoring, irrigation automation, and security alerts provides a holistic solution to modern farming challenges, contributing to more efficient and secure agricultural practices.

VI. HARDWARE DESCRIPTION

REGULATOR POWER SUPPLY: Embedded circuits like a regulated power supply may transform fluctuations in alternating current (AC) into a steady DC voltage. An AC supply is transformed into DC with the aid of a rectifier. Its job is to ensure that a circuit or device that is sensitive to fluctuations in power supply may get a

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consistent voltage (or, less often, current). The controlled power source's output is usually direct current (DC), however it might be alternating or unidirectional.

LIQUID CRYSTAL DISPLAY:

Liquid crystal display is the abbreviation for this technology. A wide variety of circuits and gadgets, including mobile phones, calculators, computers, televisions, and more, make use of this particular kind of electronic display module. Most multi-segment light-emitting diodes and seven-segment displays use them. There are no restrictions on displaying bespoke characters, special effects, animations, etc., and the module is cheap, easily customizable, and has animations. A liquid crystal display (LCD) screen is a kind of electrical display module that may create a visible picture. A fundamental module often used in do-it-yourself projects and circuits is the 16×2 LCD display. The display will have 16 characters per line over two lines when the dimensions are 16×2.

SOIL MOISTURE SENSOR:

The 6.5th item on the list is soil moisture sensors, which measure the amount of water in the soil. A soil moisture probe is like a jigsaw puzzle of separate sensors. To provide a more accurate reading of the soil's moisture content, sensors measure electrical resistance, dielectric constant, or interaction with neutrons, rather than drying a sample of soil to determine its free moisture content. The connection between the measured property and soil moisture might be calibrated differently depending on the kind of soil. The use of reflected microwave radiation, which is affected by soil moisture, is one way of using remote sensing in hydrology and agriculture. Mobile probes are useful for farmers and gardeners.

VII. SOFTWARE DESCRIPTION

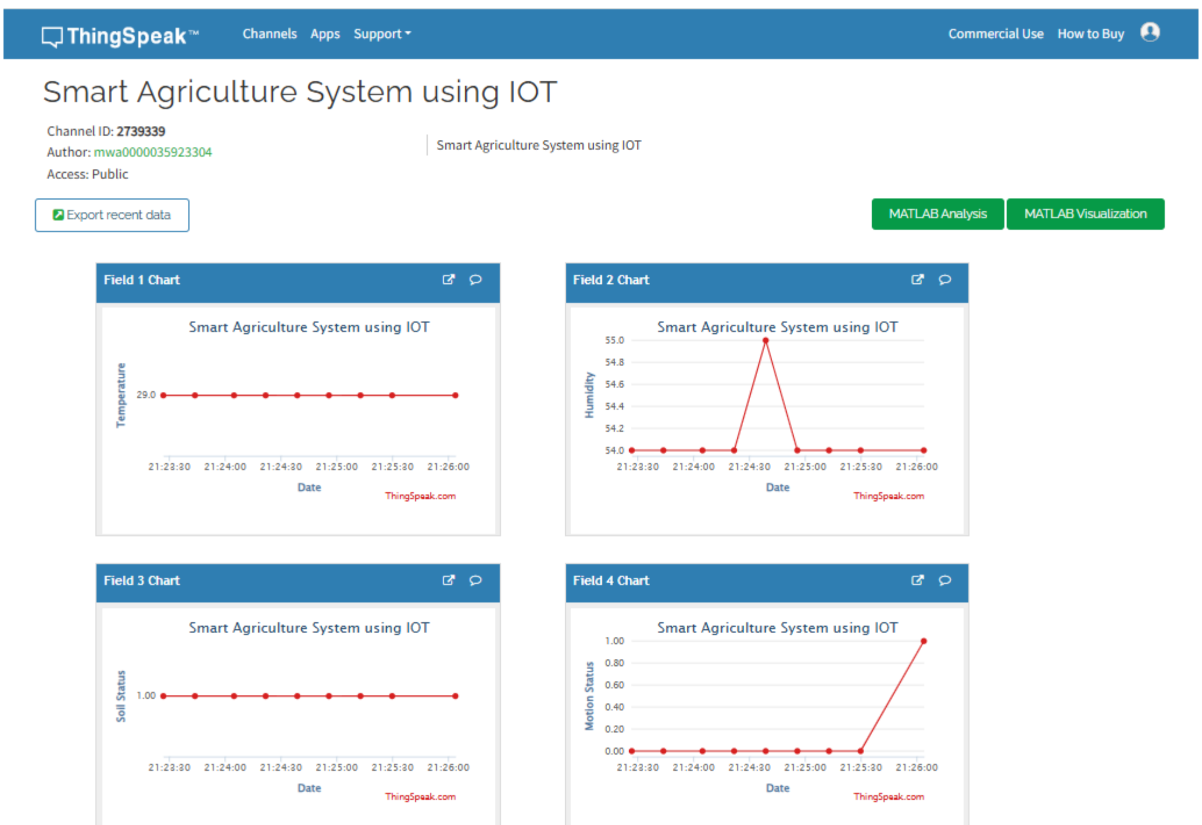
The Arduino IDE is a Java-based, cross-platform tool that takes its cues from the IDE for the Processing and Wiring languages and projects. A built-in code editor allows for one-click program compilation and uploading to the board. An Arduino "sketch" is a piece of code or software.

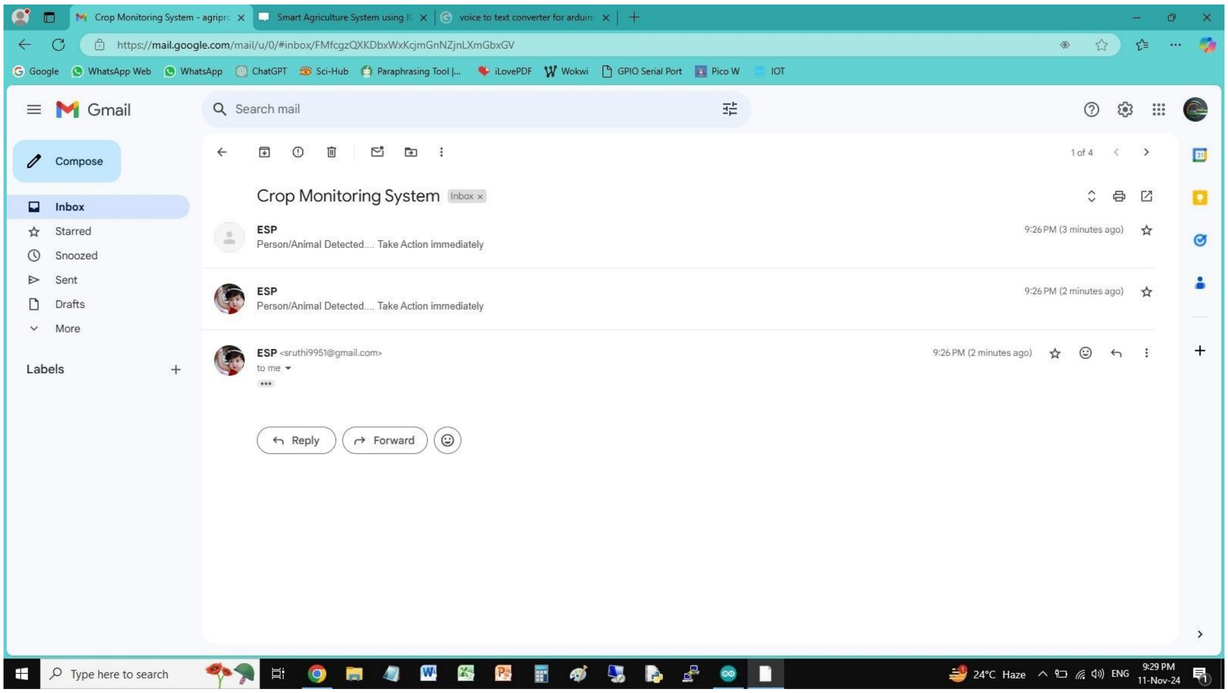
TESTING THE INSTALLATION

A computer must be connected to the ESP32 board. While the Arduino IDE is open, do these steps:

First, go to the Tools menu and choose Board. In my case, it's the DOIT ESP32 DEVKIT V1.

VIII. PROJECT RESULT





IX. CONCLUSION

The proposed Smart Irrigation System leverages ESP32, soil moisture, and DHT22 sensors to offer a holistic approach to sustainable farming. By automating irrigation based on soil moisture levels, the system conserves water while ensuring crops receive the necessary hydration. The inclusion of a PIR sensor for intrusion detection enhances crop protection, providing real-time alerts to farmers. Additionally, weather monitoring through the DHT22 sensor and data uploads to ThingSpeak or Blynk allow remote supervision and data analysis. This integration of environmental monitoring, irrigation automation and security notifications presents a viable solution to the challenges of traditional farming practices. Overall, this system offers an efficient and scalable solution that supports sustainable and secure agriculture, making it suitable for both small-scale and larger farming operations.

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