Monitoring the Farming Conditions Using IoT

K. Riyazuddin, R. Anitha, A. Devika Chowdary, P. Durga Prasad, and C. Girish Varma

Abstract The Internet of Things will transform every sector and everyone's lives by giving everything a sentient existence. It is a group of various devices that function as a self-configuring network. The use of Internet of Things in smart farming is revolutionising conventional agriculture by enhancing its productivity, expanding its accessibility to farmers, and lowering crop loss. The objective is to develop a system that can communicate with farmers in a number of ways. With real-time information from the fields, the tool will support farmers in their efforts to engage in smart farming (temperature, humidity, soil moisture, UV index, and IR).

Keywords ESP32s · DHT11 temperature and humidity sensor · Internet of Things (IOT) · Smart farming

1 Introduction

One of the key industries in India is agriculture. The support of human life is dependent on agriculture. Agriculture production rises in lockstep with population growth. Agriculture output essentially depends on the seasonal conditions if there are not enough water sources. IoT-based smart agriculture systems are used to improve agricultural outcomes and solve difficulties.

The term "Internet of Things" refers to a collection of hardware, software, and networking-enabled devices that allow for data sharing and communication between items. Farmers are gaining a plethora of advantages by implementing the IOT programme. Farmers have benefited from cost savings and higher agricultural yields. The irrigation system's primary goal is to create and maintain the right temperature and soil moisture conditions for the best possible development of crops [1].

In order to provide current information about food production, global and regional agricultural monitoring systems are being developed. An Internet of Things-based

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smart farming system is developed to monitor the agricultural field using sensors for light, humidity, temperature, soil moisture, etc. The state of the fields is always accessible to the farmers. Internet of Things-based smart farming is far more efficient than conventional farming methods. A DHT11 Sensor and an ESP32S Node MCU Module are used in the proposed Internet of Things-based irrigation system.

2 Literature Review

A technology known as the "Internet of Things" enables connections and communication between things. This helps to improve the procedures and methods utilised in both business and agriculture. In order to enhance planting production, a system that explains smart farming is offered. A control system and a sensor system are the two main components of smart farming. Two Arduino boards are used to set up the sensor and control systems. The system's controls are programmed in Python. An LCD display and a serial monitor, respectively, show the values from the numerous sensors that were seen [2].

It is impossible for our world to exist without agriculture. It satisfies every requirement that a person has to live in this world. Automation is replacing outdated ways as technology advances with the rise of the Internet of Things, leading to substantial gains in a number of industries. In a wide range of sectors, including smart homes, waste management, automobiles, industries, farming, health, grids, and other areas, smarter technologies are constantly being enhanced at this time. Through the use of automation, the Internet of Things development has supported advancements in farming [3].

By making everything smart and intelligent, the Internet of Things (IoT) has revolutionised every industry and raised the standard of living for the average individual. An autonomous network of devices is referred to as "IoT." IoT-based technology is enabling the development of "intelligent smart farming," which improves agriculture production while lowering waste and increasing cost-effectiveness. This project aims to develop an innovative, clever IoT-based agriculture stick that will let farmers get real-time data (temperature, soil moisture) for effective environment monitoring. They will be able to practise smart farming as a result, increasing their total productivity and product quality [4].

This paper's major objective is to present cutting-edge innovation and talk about how it can advance agriculture. In the last century, agriculture has made some essential advancements, similar to how machinery has. Despite state-of-the-art innovation, growers and collectors perform better than their predecessors or have experienced only modest alterations. Agribusiness must use innovation effectively to increase productivity and employee employability. This exam's major objective is to decide how agricultural technology should be used. There are numerous methods to leverage innovations to boost productivity [5].

Physical things that are part of the Internet of Things can speak to one another when they are online. The agricultural industry, which by 2050 will be able to feed

9.6 billion people worldwide, depends on IoT agriculture techniques. In this work, a system is developed to monitor crop fields and manage irrigation using sensors (soil moisture, temperature, humidity, and light). Notifications are periodically sent to farmers' mobile devices. Farmers may monitor the condition of their fields from any location. This strategy will work better in areas with limited water supplies. The effectiveness of this strategy is 92% higher than the conventional approach [6].

3 Methodology

3.1 Existing Method

In the current system, agricultural land is controlled by a few sensors and micro-controllers. Below is a list of various sensors, including a soil moisture sensor and a UV sensor. In the current arrangement, the water motor will switch on based on the measurement of the moisture content of the soil by the soil moisture sensor. There is no automatic control on the water motor, though. The current system does not employ PIR sensors for either motion or animal detection. There is no such thing as cloud-based, motorised, remote pesticide spraying [7].

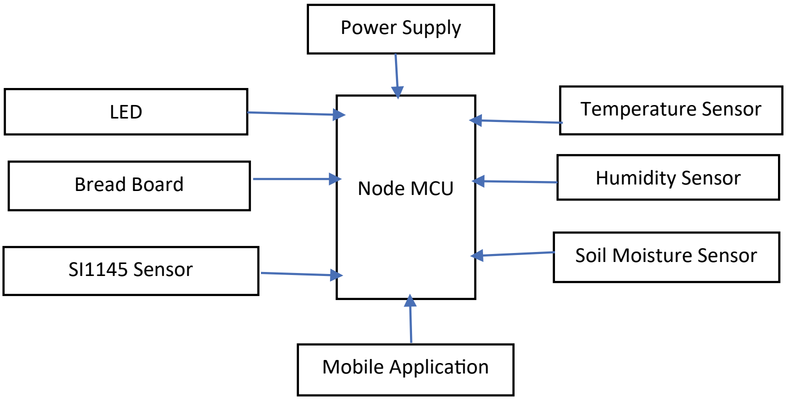
3.1.1 Limitations of Existing Method

This system is not secure. Motion detection is not present to protect agricultural crops. No automatic system exists.

3.2 Proposed Method

The soil moisture sensor measures the amount of soil moisture. Data from various sensors is transmitted and received by the node's MCU, which provides automatic controllability. We can continuously monitor a crop's growth using an ultrasonic sensor. The former can use this equipment to monitor and control the environmental conditions in their industry. Farmers need not physically visit their fields because they can remotely monitor and manage them using the cloud. The three techniques we employ to notify the farmers are the Blynk smartphone app, which also tracks live feeds, the various alert sounds produced by a little buzzer, and the LED visual alert. When using this product, farmers are urged to move swiftly. Nevertheless, there is still room for development, and the next task can be given more priority.

Block Diagram of Smart Farming:



A. ESP32s Node MCU

The Node MCU ESP32s is one of the development boards created by Node MCU to test the ESP-WROOM-32 module. The ESP32 microcontroller, a single chip that includes Wi-Fi, Bluetooth, Ethernet, and low-power support, serves as its central component. An Internet of Things (IoT) platform called Node MCU uses the Lua programming language (Fig. 1).

B. Bread board

A breadboard is essentially a board for designing or building circuits. Without soldering, circuits can be built by placing components and connections on the board. The holes in the breadboard handle your connections by firmly holding on to the wires or components where you insert them and electrically connecting them inside the board [8] (Fig. 2).

Fig. 1 ESP32s Node MCU

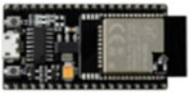


Fig. 2 Breadboard

C. DHT11 Temperature and Humidity Sensor

A calibrated digital output is produced by the DHT11 temperature and humidity sensor. A cheap temperature and humidity sensor with great long-term stability and dependability is the DHT11 (Fig. 3).

D. Soil Moisture Sensor

It establishes the soil's moisture content. Using the open-circuit theory, the sensor produces both analogue and digital data. To indicate whether the output is high or low, this system uses an LED (Fig. 4).

E. SI1145 sensor for UV/IR and visible light index

The SI1145, a brand-new sensor from SiLabs, calculates the UV index using a calibrated light-detecting algorithm. It simulates UV sensing by using the sun's visible and IR rays in place of a real UV sensor component (Fig. 5).

F. LEDs

The light-emitting diode is a typical kind of standard light source in electrical equipment (LED). It can be applied in a wide range of contexts, including mobile phones and enormous billboards for advertising. They are used most frequently in devices that show different types of data and the current time.

G. KY-006 passive buzzer

Based on the input signal's frequency, the KY-006 Passive Piezoelectric Buzzer Module can emit a variety of tones. The KY-012 Active Buzzer can be used to produce single-tone noises [9] (Fig. 6).

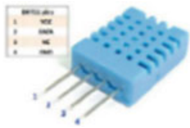


Fig. 3 Temperature and humidity sensor

Fig. 4 Soil moisture sensor

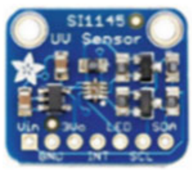


Fig. 5 SI1145 sensor

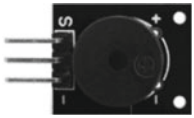


Fig. 6 Passive buzzer

H. Power Supply–Power Bank

The capacity of a power bank is measured in milliampere hours, or mAh. The more mAh a power bank has, the more charge it can store for you to draw from when you use it to charge your devices. Once the power bank's storage space has been depleted, it must be replenished.

Implementation:

Our aim was to develop a prototype model that is simple to use and can be quickly installed in the field because farmers may lack technical expertise. The system is automated thanks to the Internet of Things (Figs. 7 and 8).

(1) The wireless and Wi-Fi-enabled ESP32s node MCU was used.
(2) We connected the ESP, the DHT11 temperature and humidity sensor, the soil moisture sensor, the buzzer, the LEDs, and the SI1145 digital UV index, IR, and visible light sensor to the breadboard using jumper wires.
(3) Every 18 min, the ESP32 goes to sleep, wakes up, takes a reading, uploads it to the cloud of the Blynk app to offer real-time data, and then goes back to sleep.
(4) The farmer can check the LEDs and take the necessary action even if he did not hear the alert or get a phone notification because the LEDs save the status, where multiple signs are provided by changing red, blue, or violet. If one buzzer indicates something, two imply something else.
(5) The soil moisture sensor is located at the bottom of the lid, together with temperature and humidity sensors, a digital UV index sensor, and a buzzer.
(6) We provide electricity using a 6000 mAh battery bank, so the system starts up automatically after the code has been uploaded.

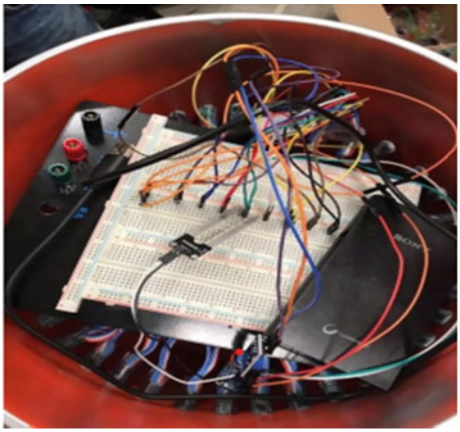


Fig. 7 Circuit of the prototype

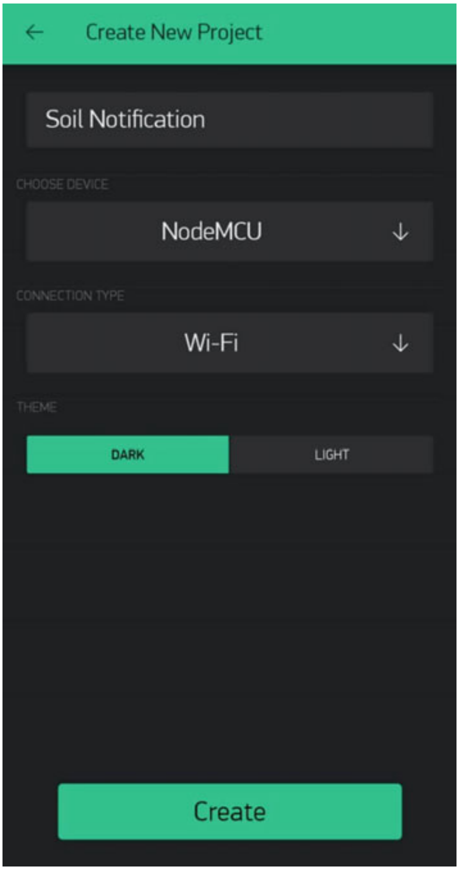


Fig. 8 Notification of Blynk mobile app

4 Result and Analysis

By giving farmers' real-time information on temperature, humidity, soil moisture, UV index, and infrared radiation using the Blynk mobile app, this article will help farmers. With the equipment and materials we used to build our prototype, we were able to provide farmers with a solution that was accurate, effective, and cost-effective. For farmers, this was also inexpensive and easy to implement. Thus, we can infer that this prototype will surely help farmers with little available land adequately to monitor their crops using the user-friendly software (Figs. 9, 10, and 11).

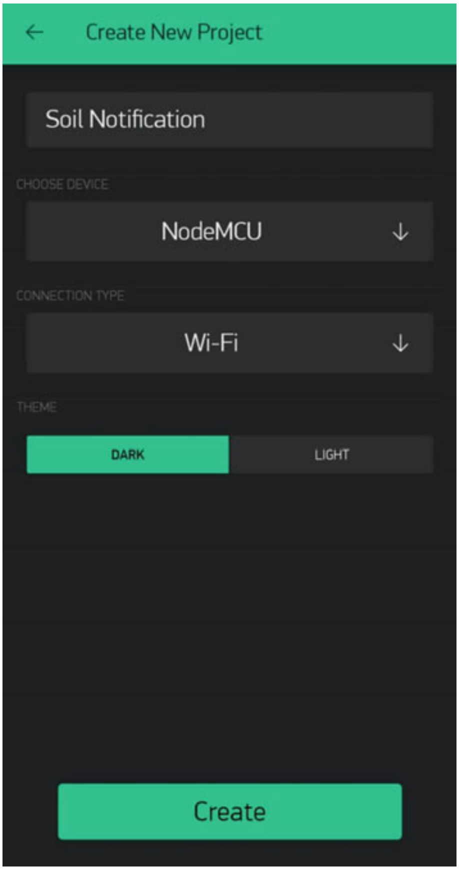


Fig. 9 Connecting to blink mobile app

Fig. 10 Output of farm field

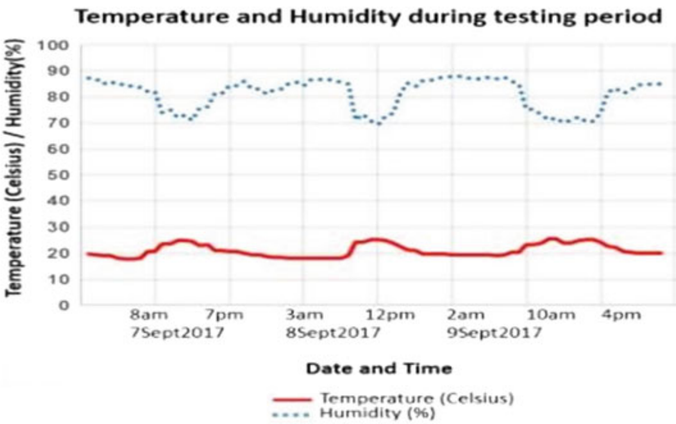


Fig. 11 Waveform of temperature and humidity

5 Conclusion

In IOT-based smart farming, a system is developed for remotely monitoring the agricultural field using sensors (light, humidity, temperature, soil moisture, and so on) and automating the irrigation system. Farmers can monitor the condition of their fields remotely. Smart farming powered by IoT is substantially more efficient than traditional farming.

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