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Smart Agriculture Irrigation System and Weather Analysis by Using IOT

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A B S T R A C T

An agricultural nation like India depends heavily on agriculture for its development. Approximately 70% of people in India are farmers. Farming is done. by hand for ages. It is imperative that agriculture embrace the new technologies and applications that the world is embracing. A result of people moving from rural to urban areas is agriculture facing challenges. Modern technology updates daily, so keeping up with these advancements is equally essential. agriculture as well. Smart agriculture can benefit greatly from the use of IoT.

Thus, the paper's goal is to use automation and Internet of Things technology to make agriculture smarter. An Internet of Things (IoT)-based agriculture monitoring system uses wireless sensor networks to gather data from several sensors placed at different nodes and transmit it via wireless protocols. It has sensors for temperature, moisture content in the soil, water level, and humidity. One of this project's features is an Android application that displays real-time information.

about the water level, soil moisture, humidity, and temperature. Second, it incorporates intelligent decision-making based on smart control and smart irrigation. reliable field data in real time. Thirdly, an automated climate control system that regulates the field's temperature and humidity (e.g. green house, Poultry Farming, Goat Farming).

Keywords: Internet-of-Things (IoT), Smart Agriculture, Smart Irrigation, Weather Analysis, Automation, Smart Poultry Farming

1. Introduction

The agricultural domain is another crucial area within the internet of things. IOT is in charge of modernizing agriculture by applying effective techniques and tools to manage crops, soil, and animals. Consequently, there has been a decrease in the production of garbage and a

extraordinary rise in output. This is IOT-powered smart agriculture.The idea of smart agriculture is very new. The majority of farmers and experts in agriculture are fresh to this idea. The application of intelligent technology, including automated devices to manage and run agricultural areas, such as drones, security cameras, actuators, and sensors and fauna. The goal is to simultaneously raise the quantity and quality of agricultural products. considering the price and energy use.

The automated equipment and robots in the smart farms run everything, eliminating the farmer's need to set foot in the field. As a result of clever farming, physical labor costs are reduced. IoT links and integrates the whole farm to increase crop quality and yield. other goods.

1.1 Problem Statement

- To analyze the situation, field parameter monitoring is crucial.
- An automated irrigation system is required to maximize water usage due to high water demand.
- Conventional methods may result in either excessive or insufficient irrigation.
- Unsafe working circumstances have the potential to cause mishaps and waste resources including manpower, money, and time.

1.2 Objectives

- This paper's primary goal is to create an Internet of Things (IoT)-based agricultural monitoring system that can easily access field data. It is simple to keep an eye on this IOT server from anywhere.

- The main objective of this paper is to develop an easily accessible field data-accessible agricultural monitoring system based on the Internet of Things (IoT). Monitoring this IOT server from any location is easy.
- To create a system that automatically controls the water levels in the fields.
- To offer a smart weather control system to manage humidity and temperature.
- to conserve money, time, manpower, etc.

2. Literature Survey

Various researches have been carried out on how soil irrigation can be made more efficient. .The researchers have used different ideas depending on the condition of the soil and quantity of water Different technologies used and the design of the system was discussed by the researchers.

An IOT Based Crop-field monitoring an irrigation automation system describes how to monitor a crop field. A system is developed by using sensors and according to the decision from a server based on sensed data, the irrigation system is automated. Through wireless transmission the sensed data is forwarded to web server database. If the irrigation is automated then the moisture and temperature fields are decreased below the potential range. The user can monitor and control the system remotely with the help of application which provides a web interface to user [1]

Prof. K..A..Patil and Prof. N..R..Kale propose a wise agricultural model in irrigation with ICT (Information Communication Technology).The complete real-time and historical environment is expected to help to achieve efficient management and utilization of resources. [2]

The system focuses on developing devices and tool to manage, display and alert the users using the advantages of a wireless sensor network system. It aims at making agriculture smart using automation and IoT technologies [3].

IOT Based Smart Agriculture Monitoring System develops various features like GPS based remote controlled monitoring, moisture and temperature sensing, intruders scaring, security, leaf wetness and proper irrigation facilities.[4]

Mahammad shareefMekala, Dr..P..Viswanathan demonstrated some typical application of Agriculture IOT Sensor Monitoring Network Technologies using Cloud computing as the backbone. [5]

By smart Agriculture monitoring system and one of the oldest ways in agriculture is the manual method of checking the parameters. In this method farmers by themselves verify all the parameter and calculate the reading [6]

The cloud computing devices are used at the end of the system that can create a whole computing system from sensors to tools that observe data from agriculture field. It proposes a novel methodology for smart farming by including a smart sensing system and smart irrigator system through wireless communication technology [7].

This system is cheap at cost for installation. Here one can access and also control the agriculture system in laptop, cell phone or a computer [8].

This paper shows idea of wireless sensors can be used in agriculture. This paper simplifies plant monitoring process and reduced human effort drastically. User can create customized environment for the plants, thus providing them with optimal growth conditions. Also shares idea about the interfacing with android software [9]

The sensors and microcontrollers of all three Nodes are successfully interfaced with raspberry pi and wireless communication is achieved between various Nodes.[10]

This paper provides basic guidelines for deploying Wireless Sensor Networks (WSNs) in Agriculture, and more specifically in applications requiring crop monitoring. Firstly, it reviews the main components that existing WSN applications use, namely node platforms, operating systems (OSs), power supply, etc. Based on these data, a generic guide is proposed discussing basic considerations for deploying WSNs in applications relevant to agriculture. [11]

In this paper, authors have proposed a novel methodology for smart farming by linking a smart sensing system and smart irrigator system through wireless communication technology. System focuses on the measurement of physical parameters such as soil moisture content, nutrient content, and pH of the soil that plays a vital role in farming activities.[12]

The implemented framework comprises of different sensors and de-vices and they are interconnected by means of remote correspondence modules. The sensor data is been sent and received from client end utilizing Internet connectivity which was enabled in the Node MCU module- an open source IOT platform.[13]

This project uses IOT technology in agriculture, gathering crops growth environmental parameters in a fixed place to help farmers find problems in time. [14]

This project shows IoT works in different domains of farming to improve time efficiency, water management, crop monitoring, soil management and control of insecticides and pesticides. [15]

This paper considered all aspects and highlighted the role of various technologies, especially IoT, in order to make the agriculture smarter and more efficient to meet future expectations. For this purpose, wireless sensors, UAVs, Cloud-computing, communication technologies are discussed thoroughly. [16]

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3. Proposed System

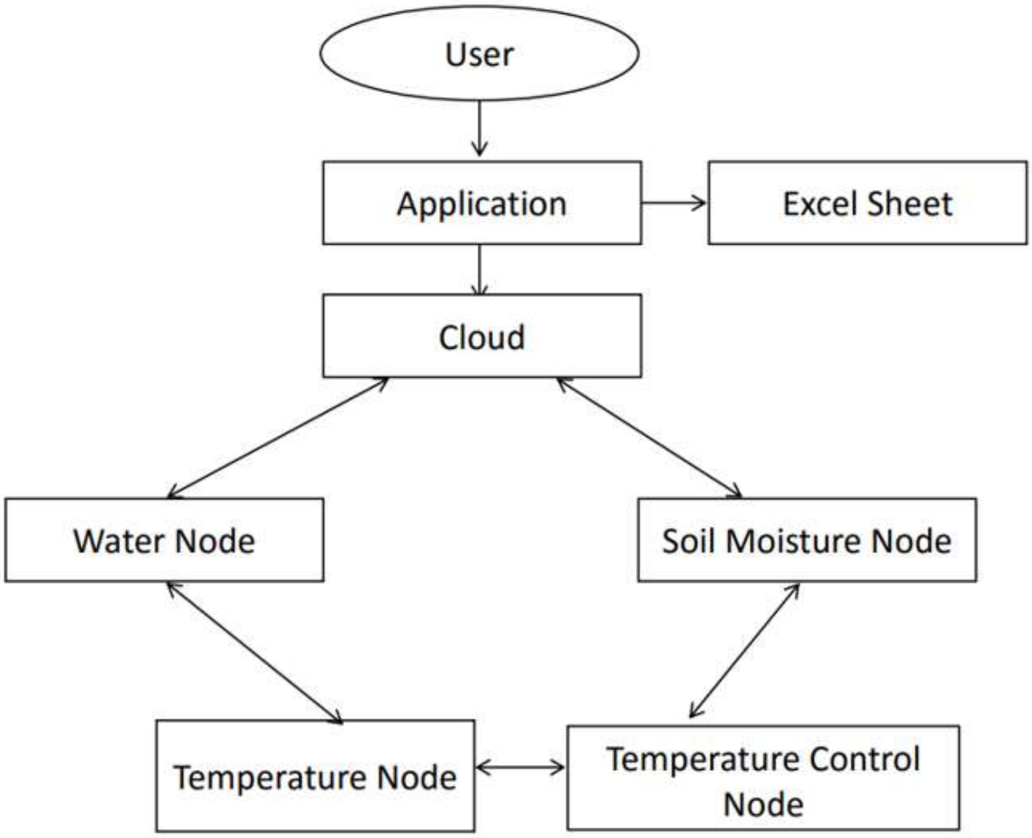

Fig.1 – Block Diagram of The Proposed Work

This system consists of both software and hardware parts. The software portion consists of an Android-based application linked to the bridge ESP (32) board and additional hardware components via the Internet of Things (IOT), while the hardware portion is made up of various sensors such as temperature and humidity sensors, soil moisture sensors, and water level sensors. The Android application is made up of a database and signals in which sensor readings—temperature, humidity, soil moisture, and water level—are shown. The use of wireless technology to improve irrigation systems network is a way to improve the irrigation process while also preserving water. Using an automated regulatory system and a water level sensor It is possible to reach the water level in the field. Weather regulation is possible with the use of temperature and humidity data.

The block diagram for each of the materials listed above is displayed in the figure. The primary mechanism of operation for this system is to link the soil moisture sensor—which was originally integrated into the plant—to the soil moisture node (ESP8266), which is in turn connected to the other electrical parts mentioned above, as seen in Figure 1. The sensor measures the moisture content of the soil, transmits the data, and parameters pertaining to the soil moisture to the water node (8266), which regulates the pump, and the bridge (ESP32). Should the soil moisture content fall below a Upon reaching a specific value, the relay module receives a signal from the water node (ESP8266), which activates a pump to supply a specific volume of water to the grow. When there is sufficient water delivered, the pump shuts off. The water level sensors are used to keep the water tank at the proper level. The sensor will give data to the ESP8266 water node if the water level drops below a certain level. The water node uses the data it receives from the sensor to send signals to the motor driver, which will cause the motor to start in the appropriate manner. Once the desired water level is reached, the water node will To halt the motor, send data to the motor driver.

In order to maintain temperature and humidity levels within threshold levels, a fan will turn on if they exceed the reference value, which is determined based on the crop. The heater bulb will begin to maintain the threshold levels if the temperature value is lower than the reference value.

A local network is formed by connecting the three nodes (ESP8266)—the temperature, soil moisture, and water nodes—to the bridge (ESP32). The bridge will be equipped with Wi-Fi connectivity to facilitate data sharing via the internet. Every piece of sensor data will be kept in a Google Cloud account as a spreadsheet. To track the field data in real time, an Android application is needed.

4. Hardware Requirement

4.1 IOT (WI-FI module ESP32) Hardware Requirements

Figure: ESP32 Module

A single 2.4 GHz Wi-Fi and Bluetooth System on a Chip is called the ESP32. The Internet of Things (IoT) and wearable electronics are the target markets for the ESP32. With up to 150 Mbps of Wi-Fi connectivity, it supports 802.11 b/g/n as well as Classic Bluetooth v4.2 and BLE protocols. It works with 34 GIPOs. Up to 16MB of external flash memory may be installed, and it contains 512kB of SRAM. Additionally, up to 8 MB of additional SRAM memory is supported. Built on top of the Wi-Fi protocol is a networking protocol called ESP-MESH. With ESP-MESH, several devices, or nodes, dispersed over a vast physical region to be connected by a single WLAN (Wireless Local-Area Network), including both indoor and outdoor spaces.

4.2 IoT (WI-FI module ESP8266

Figure: ESP8266 Module

The microcontroller, NodeMCU (ESP8266), shown has an integrated Wi-Fi module. This device has thirty total pins, of which seventeen are GPIO (General Purpose Input/Output) pins. These pins are linked to a variety of sensors in order to receive data from the sensors and provide output data to other devices that are attached. Programs and data may be stored in the 4MB flash memory and 128KB RAM of the NodeMCU. The program is thrown into the NodeMCU via USB and is kept there. Every time the NodeMCU gets input data from the sensors, it verifies and saves the information. the data obtained. The Wi-Fi module appears in the 46 (indoors) to 92 (outdoors) meter range on the NodeMCU.

4.3 Soil moisture sensor

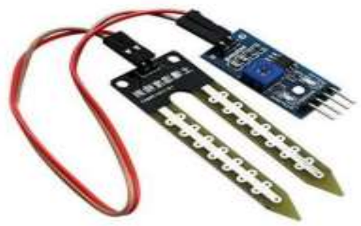

Figure: Soil Moisture Sensor

A soil moisture sensor is a device that measures the amount of moisture in the soil; it is seen in Figure. The module output is at a high level when the sensor detects a water scarcity in the field; otherwise, the output is at a low level. This sensor keeps track of the soil's moisture content and alerts the user when their plants need to be watered. It is extensively utilized in botany gardening, agricultural, and land irrigation.

4.4 Temperature Sensor (DHT11)

Figure: Humidity & Temperature Sensor

The temperature and humidity of the atmosphere are measured using a Temperature Sensor (DHT-11). The figure depicts the DHT-11. It's a straightforward, incredibly affordable digital temperature and humidity sensor. It separates out a digital signal on the data pin by measuring the ambient air using a thermistor and a capacitive humidity sensor. The electrical resistance between two electrodes is measured by the DHT-11 to determine relative humidity.

4.5 Water level Sensor

Figure: Water Level Sensor

The water level in the stored water tank is ascertained using the water level sensor. Similar to a potentiometer, the power and sensing traces combine to produce a variable resistor, whose resistance changes in response to the amount of water they come into contact with. The resistance of the sensor is directly proportional to its depth of immersion in water. Specifically, the greater the depth of immersion, the lower the resistance and the better the conductivity of the sensor. The sensor detects less water he greater the resistance and the lower the conductivity when submerged. An output voltage proportionate to the resistance is produced by the sensor; by It is possible to detect the water level by monitoring this voltage.

4.6 Water pump

Figure: Water Pump

A tiny, inexpensive submersible pump motor is the DC 3-6V Mini Micro Submersible Water Pump, which is seen in Figure 5. It requires a power supply ranging from 2.5 to 6 V to run. With a relatively low current consumption of 220mA, it can pump up to 120 liters per hour. Simply attach the tube pipe to the motor outlet, power it, and submerge it under water.

4.7 Relay

Figure: Relay

As an electrically operated switch, a relay is utilized, as seen in Figure. It has a set of working contact terminals and a set of input terminals for one or more control signals. Numerous contacts in various contact types that can establish or break connections may be present in the switch. Relays are used to activate the water pump, which keeps the crop's moisture content constant.

4.8 Power Supply

An electrical device known as a power supply provides electricity to an electrical load. A power supply's primary job is to transform electrical current from a source into the proper voltage, current, and frequency so that the load may be powered up. Power supplies are thus also known as electric power converters. While some power supplies are integrated into the load appliances they power, others are independent, standalone pieces of equipment.

5. Benefits of the Proposed System

These are some of the advantages of smart farming with IoT technology:

- Water usage optimization
- Energy resources optimization
- Better crop yield & plant quality
- Time & energy saving
- Workload reduction

Conclusion

This paper proposes the use of IoT-based farming enabled by smart farming for real-time temperature, soil moisture, water level, motor status, fan, and heater light monitoring. Farmers may get information about the condition of their crop from anywhere at any time. Conversely, wireless sensor networks allow you to automate some tasks and regulate the atmosphere on the farm. This essay illustrates the. the creation and use of automated water level control, smart weather, and smart irrigation systems in the field of agriculture command.

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