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Agriculture Monitoring System

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Abstract: *Smartphones, sensors, and cameras have transformed how farmers monitor and manage their crops, livestock, and equipment. These technologies enable better decision-making and improved efficiency in agriculture. Sensors and cameras can track plant growth, health, nutrient levels, and soil moisture, allowing farmers to make informed choices about irrigation, fertilization, and pest control by integrating this data into a smartphone app. Additionally, sensors installed on agricultural machinery such as harvesters, tractors, and combines help monitor performance and detect potential issues before they become serious, ensuring timely maintenance and reducing downtime. By leveraging these advancements, farmers can optimize productivity, reduce costs, and enhance overall farm management.*

Keywords: *temperature sensor, moisture sensors, camera, smartphone app*

I. INTRODUCTION

Agriculture monitoring tools are revolutionizing how farmers care for their land and grow crops. These systems provide real-time data on a variety of agricultural production components using cutting-edge technology and data processing. To help farmers make better decisions regarding planting, irrigation, and fertilization, agriculture monitoring systems measure crop health, soil moisture, weather, and other important factors. One of the main components of an agriculture monitoring system is sensors placed across the property. Data is gathered and analyzed by a central system that can be connected to these sensors. To track the amount of moisture and nutrients in the soil, sensors can be placed inside the soil. Additionally, they can be used to track environmental factors like humidity, temperature, and others that could impact crop development.

II. LITERATURE REVIEW

The study [1] (European Journal) The project involves creating a weather monitoring system driven by the Internet of Things (IoT) that gathers and stores meteorological data for convenient access and recording. It is also capable of leveraging prior recordings to predict future weather data. Tracking the weather is one method of One of the most heavily populated regions of contemporary society. This information is gathered from many sources by weather monitoring systems. There are also satellite systems that do comparable tasks and cover a larger area. Creating a low-cost weather monitoring system that can gather this data over time in a specific location is the aim of the project. The system consists of hardware based on an ESP8266 (NodeMCU) and a webpage. Data is transferred between physical devices and servers via the industry-standard HTTP connection protocol. Sensors such as temperature, humidity, rain, and pressure are necessary for the system to function properly. System Sensors provide data to a server over Wi-Fi, which is then saved and accessible via a webpage. The data is then analyzed and used to forecast future data.

The paper [2] (International Journal on) Since the world is moving toward new technology and practices, it is imperative that agriculture follow suit. Numerous studies have been conducted in the realm of agriculture. A wireless sensor network is used in the majority of projects to gather data from several sensors placed at separate nodes and transmit it over a wireless protocol. Information about the different environmental elements is provided by the data that has been gathered. Crop output can be increased in part by monitoring environmental conditions, but not entirely. More elements contribute to a greater degree of productivity loss. Therefore, to address these issues, automation in agriculture must be used. Therefore, to address all of these issues, it must be necessary to create a comprehensive system that addresses every aspect influencing productivity at every level. However, several problems prevent agriculture from becoming fully automated. Despite being used at the research level, farmers do not receive it as a product to use the resources. Therefore, this article discusses how to use IoT to construct smart agriculture that is accessible to farmers.

The article [3] (Asian Journal of Applied Science and Technology) In India, the primary source of income is without doubt agriculture. Growing agricultural production is required to keep up with the population growth. A larger amount of fresh water is needed for irrigation to sustain increased agricultural productivity. In India now, 83% of all water use is attributed to agriculture. When water is used without planning, it unintentionally wastes water.

Consequently, an Arduino-based Automatic Plant Irrigation System is being created, which automatically irrigates plants and sends updates via SMS. A water pump is turned on by an Arduino to supply water to the plant when the soil moisture level is low, which is detected by the soil moisture sensor in this plant watering system. When the device detects sufficient moisture in the soil, the water pump automatically shuts off. The user receives a message via the IOT module updating the soil moisture and water pump status whenever the system turns the pump on or off. The crane concept is used to add the water pump and the spray motor. Farms make extensive use of this method. Homes, gardens, etc. Human involvement is not required because this system is fully automated. To create graphs for analysis, the sensor readings are also sent to a Thing talk channel.

III. OBJECTIVE

This section highlights the transformative impact of agricultural monitoring systems on farming practices. It focuses on how modern technologies—particularly sensors and data processing—are used in agricultural operations such as irrigation, fertilization, and crop health management to improve automation, decision-making, and real-time monitoring. Additionally, it suggests that these systems have the potential for significant advancements in the future. The section aims to showcase the role of the Internet of Things (IoT), sensors, cameras, and smartphone applications in optimizing crop and livestock management. It explains how these technologies collect and analyze real-time data, enabling farmers to make informed decisions regarding irrigation, fertilization, pest control, and equipment maintenance. Furthermore, it outlines the overarching objective of these systems in enhancing agricultural efficiency and productivity.

IV. METHODOLOGY

When it comes to crop management and resource allocation, farmers and agricultural specialists may make well-informed decisions with the aid of an agriculture monitoring system. Through the use of a variety of sensors, data-gathering instruments, and analytics software, this system can offer important insights regarding temperature, moisture content, soil health, and other critical factors that impact crop yield and growth. Real-time problem detection and response is one of the main advantages of an agriculture monitoring system. For instance, the data gathered by the monitoring system might be used by a farmer to discover possible problems like pest infestations, nutrient deficits, or irrigation concerns if they observe that a specific crop is not developing as well as they had anticipated. The Internet of Things (IoT) has revolutionized every aspect of the average person's life by making everything intelligent and smart. The Internet of Things (IoT) is a network of objects that can adjust itself. The emergence of IoT-based Intelligent Smart Farming equipment is revolutionizing agricultural output by improving it, cutting waste, and making it more economical. The goal of this research is to suggest an Internet of Things (IoT)-based smart farming system that would help farmers obtain real-time data (temperature, soil moisture) for effective environmental monitoring, allowing them to boost their overall output and product quality. The two primary functions of the current system, which was developed in earlier research, are the detection of sleepiness and the post-action, such as an alert. In addition to alerting the ag, this system can use the Telegram API to alert anybody else.

V. HARDWARE REQUIREMENT

Choosing the right hardware is essential to guaranteeing the existence, functionality, and performance of any software system. Size, processor power, memory capacity, storage needs, and compliance with the software's operational requirements are all important considerations when selecting hardware. During initial deployment and as the system expands over time, these factors assist in guaranteeing that the hardware can support the software's functionality, scalability, and efficiency. To attain the best possible balance between sustainability and performance, it's also critical to assess energy efficiency, costs, and maintenance needs.

A. Camera: ESP32CAM

Based on the ESP32, the ESP32-CAM is a tiny, low-power camera module. Along with an integrated TF card slot, it has an OV2640 camera. Numerous clever Internet of Things applications, including wireless video monitoring, WiFi picture upload, QR identification, and more, can make use of the ESP32-CAM.

B. Arduino

The open-source electronics platform Arduino is built on user-friendly hardware and software. [4] (Asian Journal of Applied Science and Technology (AJAST)) Arduino boards can read inputs, such as a finger on a sensor a light on a button, or a tweet - and convert it into an output, turning on a motor, publishing something online on an LED.

You can instruct your board by giving the board's microprocessor a series of instructions. To accomplish this, you utilize the Wiring-based Arduino programming language and the Arduino software Processor-based (IDE).

C. Temp & Humidity Sensor

An electrical gadget that is inexpensive and sensitive to temperature and humidity detects, measures, and reports air temperature as well as wetness. The percentage from the maximum quantity of moisture at a particular air temperature to the amount of moisture visible everywhere the temperature.

D. Light Sensor

Light sensors are a subset of photodetectors, sometimes known as photosensors, that are capable of detecting light. Various kinds of light sensors are useful for measuring illumination, reacting to variations in the quantity of light received or the conversion of light into electricity.

E. Moisture Sensor

A sensor that is attached to an irrigation system is called a soil moisture sensor (SMS). [5] (International Journal on Recent and Innovation) controller that determines how much moisture is in the soil in the active root zone before each scheduled watering event, and if the soil moisture level is higher than a user's established set point

F. Water Level Sensor

To determine the amount of material that can flow, level sensors are employed. Liquids, slurries, powders, and granular materials are examples of substances. Level of Measurements can be taken within containers or at a lake or river level.

G. Relay

Relays are switches that are powered by electricity. There are a number of input terminals for an operational set of contact terminals and one or more control signals. What's Contacts on a switch can be in any number of different forms, including making either break contacts, contacts, or a combination of both.

VI. RESULT

Farming methods have been drastically changed by the use of mobile apps, sensors, and cameras, which have produced impressive gains in productivity, sustainability, and profitability. These days, sensors and cameras allow for accurate tracking of soil moisture, nutrient levels, plant health, and growth.

Mobile apps analyze this data to help farmers implement the best possible irrigation, fertilization, and pest management plans. Comparably, the introduction of animal-mounted sensors that monitor health, location, and behavior has improved livestock management by facilitating the early detection of disease or stress and improving worker welfare. Predictive maintenance helps save repair costs and minimize downtime by using sensors to monitor the functioning of agricultural equipment. Additionally, precise planting, harvesting, and resource allocation are made possible by the creation of accurate field maps by drones and satellites fitted with cameras and sensors.

VII. CONCLUSION

A monitoring system for agriculture is a useful tool for helping farmers and agricultural experts make educated decisions about crop management and resource allocation. By using a range of sensors, data collection tools, and analytics software, this system can provide valuable insights about temperature, moisture content, soil health, and other crucial elements that affect crop development and production.

One of the key benefits of an agriculture monitoring system is its capacity to recognize and promptly remedy issues. For instance, if a farmer notices that a certain crop is not growing as well as they had planned, they may use the data collected by the monitoring system to identify potential concerns like pest infestations, nutrient deficiencies, or water problems.

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