Smart Agriculture Based on IoT & Cloud Computing

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Abstract- *Smart Health Care Systems, Smart Cities, Smart Mobility, Smart Grid, Smart Home, and Smart Metering are examples of Internet of Things (IoT) and Cloud adoption. Agriculture is one such field of study that has experienced this acceptance, resulting in Smart Agriculture. Agriculture is a vital source of income and livelihood for any of the world's most populous countries, such as India and China.. IoT is crucial in the agriculture business, which is expected to feed 9.6 billion people by 2050. Smart agriculture reduces waste, improves fertiliser efficiency, and hence increases crop output. In this paper, a system is designed to monitor crop fields and manage irrigation utilising sensors (soil moisture, temperature, and humidity). Wireless transmission is used to send data from sensors to a web server database. The data in the server database is encoded in JSON format.If the field's moisture and temperature fall below the threshold, irrigation is automatically turned on. Incorporating IoT and Cloud Computing into the agricultural industry would result in improved crop production by controlling costs, monitoring performance, and maintaining equipment, all of which would benefit farmers and the nation as a whole. Farmers' cell phones receive notifications on a regular basis. This study focuses on the introduction of a DRUM SYSTEM for crop management, where real-time data combined with IoT and Cloud Computing technologies aid in the development of a sustainable Smart Agriculture. This technique will be more beneficial in locations where water is scarce. This technology is 92% more efficient than the traditional method.*

Keywords- Internet of Things (IoT), smart agriculture, Soil moisture, temperature, humidity, light intensity, automation of irrigation system.

I. INTRODUCTION

Agriculture is important to the country's economy. Agriculture provides a living for more than 70% of the Indian people. As agriculture's contribution to GDP is decreasing, we are under pressure to boost agricultural yield through efficient and effective water use. Irrigation is critical in agriculture since monsoon rainfall is variable and unreliable. Agriculture has been a major issue in the face of water constraint. There is a huge demand for massive technical expertise to improve the efficiency of irrigation systems. Traditional irrigation systems have been used in the past in many different ways. Water resources such as tanks and reservoirs are positioned at significant heights for quick influx irrigation. When the channel is linked to the tank or reservoir, the water begins to flow down it automatically. This method of irrigation is commonly seen in flat places. Lift irrigation is used when the fields are higher than the available water. Water is pumped from wells, tanks, canals, and rivers to irrigate the land. Today, ground water is pumped to irrigate the land as well. Other traditional irrigation systems that have been used in the past include well, water, tank water, inundation irrigation, furrow irrigation, and basin base irrigation. Many solutions have been created employing new technology to improve traditional approaches, such as reducing agricultural wastes, preventing excessive and sparse irrigation of crops, and thereby increasing crop production. So far, numerous contemporary irrigation methods have been designed. Drip irrigation is one such way that saves both water and fertilizer. Drip irrigation has been employed since the dawn of time. Water and fertilizer are dripped straight to the root of the plants in the form of water droplets in this procedure. Water application design differs depending on the crop variety. It utilizes 30 to 50 percent less water than the usual approach.The alternative option is pot irrigation, which is better suited to locations where rainfall is scarce. Up to the neck, the pitchers are anchored to the ground. Pitchers are drilled with holes to allow water to trickle over the soil and keep it wet for the plants. This approach works well in locations where flow irrigation is not possible. The sprinkler system, which is similar to natural rainfall, is the second option. The water is transported through a network of pipes before being sprinkled into the air, breaking up into minute water droplets that fall to the earth. The pump supply should be constructed in such a manner that water is applied uniformly throughout the soil surface.

A. Concept of IOT

The Internet of Things (IoT), a common phrase these days, describes a system in which the whole world is connected to the Internet via various types of sensors. It enables things to be sensed or controlled remotely through existing network infrastructure, allowing for more direct integration of the physical world with computer-based systems, resulting in better efficiency, accuracy, and economic gain, as well as less human interaction. All household appliances, furniture, clothing, automobiles, roadways, and smart materials, among other things, are readable, recon sided, locatable, addressable, and/or controlled over the Internet. It is a sensory and intellectual combination of ubiquitous communications, ambient intelligence, and pervasive objects achieved by merging technology advances in item

B. Concept of EMBEDDED SYSYTEM

A special-purpose computer system that is totally enclosed by the device it operates is known as an embedded system. Unlike a general-purpose personal computer, an embedded system has specialized requirements and performs pre-defined functions. An embedded system is a piece of hardware that has been coded. The 'raw material' is a programmable hardware chip that has been programmed with specific purposes. This should be viewed in the context of older systems with fully working hardware or systems with general purpose hardware and externally installed software. Embedded systems are a mix of hardware and software that allows for mass production and a wide range of applications. A computer hardware and software combination, maybe with extra mechanical or other pieces, designed to accomplish a certain purpose.

C. Concept of Cloud Computing

Today's Information Technology (IT) depicts a computer paradigm that provides on-demand access to a vast pool of systems that are connected to each other privately/publicly/hybrid. It represents a new method of adding, utilising, and sharing IT services based on the internet, which includes delivering dynamic, extensible, and virtualized resources. The essential principle in inventing the concept of Cloud Computing is the reusability of IT skills, which is a crucial element for cost effectiveness. It broadens views beyond corporate boundaries by offering a realistic solution to seeing immediate cost savings in compute, application hosting, content distribution, and storage. The term "cloud" can refer to a combination of networks, hardware, storage, and interfaces used to provide a service Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) are cloud-based services that may be delivered on public, private, or hybrid clouds.

II. LITERATURE REVIEW

We did a Smart Agriculture literature study including academic papers, journals, and publications. If given crop and site parameters, one study discussed the Fuzzy Control System for irrigation and water saving in agricultural fields. It offers a technique for implementing a fully automated irrigation system in the field. Another article presented a greenhouse Monitoring System based on agricultural IoT with a cloud, in which sensors are deployed in the farm to gather information from the agriculture field area on a regular basis and store it online. Other articles proposed an agricultural use of wireless sensor networks for crop field monitoring, with the systems outfitted with two types of sensor nodes, one to detect different factors such as humidity, temperature, and so on, and the other to monitor crop yield. The majority of the articles are primarily concerned with irrigation on agricultural area. One such document talked about the reference crop's Neural Computing modelling evapotranspiration to better manage limited water resources in dry locations and the significance of correct calculating the water requirements of the plant Another piece of writing suggested Intelligent Irrigation Decision Support. A system for managing irrigation in agricultural. The system calculates a plant's weekly watering requirements planting based on soil and climate measurements variables collected by a network of autonomous nodes in the field Few additional papers proposed intelligent irrigation systems using Internet of Things sensors. Data is sent across a network to a smart gateway and then to a website service. We proposed a system for monitoring humidity and application of fertilizer is distributed using a drum technology.

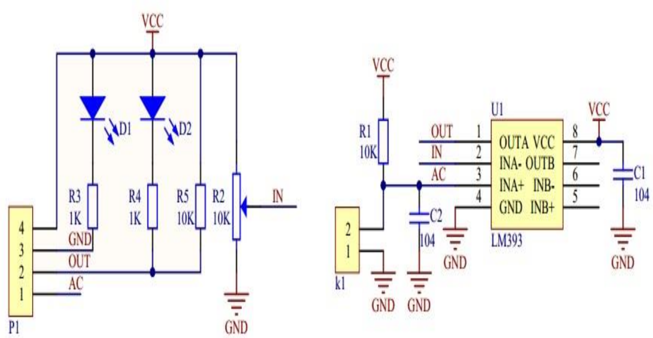
III. PROJECT NARRATIVE

The direct monitoring of soil chemistry using tests such as pH, moisture, nutrient content, humidity, and temperature is an important use of sensors in agriculture. Soil testing findings are critical in order to get a high yield with good quality. Plant ion uptake has also been monitored using ISE and ISEFT sensors. The rate of nutrient absorption is governed by the plant's demand, which is dictated by the plant's growth rate and the state of its nutrient content. To detect various ions, ion-selective sensors have been created. To monitor nitrogen ions in soil and crops, ISE sensors have been created. High-tech solutions are in high demand to assist in the cultivation of high-performance crops. Researchers are using sensors tomatch the crops to different soils and weather conditions. Farming operations on a daily basis are centred on how to grow plants, eradicate weeds and pests, diagnose and correct plant illnesses, apply fertilisers, and predict crop growth/yield. They entail a number of field operations, including as sowing, weeding, fertilising, and watering, which are repetitive, boring, and labour-intensive.

A.Sensing technology-

1. Soil sensor

Soil Moisture Sensor is the project's major component (apart from the Arduino UNO). It is divided into two sections: the primary Sensor and the Control Board. The sensor portion of the Soil Moisture Sensor is made up of two conductive probes that may be used to measure the volumetric content of water in soil. The control board is made up of the LM393 IC, which is a voltage comparator. The board also includes all of the components required to assess soil moisture, such as connections, LEDs, and resistors. There is also the ability to modify the sensitivity of the module using a Potentiometer.



The Soil Moisture Sensor operates in a fairly straightforward manner. It operates on the voltage comparison concept. The circuit below will help you understand how a common soil moisture sensor works. As you can see, one of the comparator's inputs is linked to a 10K Potentiometer, while the other is coupled to a voltage divider network made by a 10K Resistor and the Soil Moisture Probe. The conductivity of the probe changes with the quantity of water in the soil. If the water content is lower, the conductivity through the probe is lower as well, and the input to the comparator is higher. This signifies that the comparator's output is HIGH, and as a result, the LED is turned off. Similarly, when there is enough water, the conductivity of the probe increases and the comparator output becomes LOW. The LED then begins to light.

• Estimate the crop yield, i.e., provides the plant counting.
• Provide data on soil fertility by detecting nutrient deficiencies based on graph and humidity sensing
• Measure irrigation and control crop by identifying areas where water stress is suspected.

2.Rain sensor-

There are several approaches that automakers have tried to abolish or replace the wiper system. A rain sensor is a relatively new addition to a car's windshield. Rain sensors have been present since the 1950s, but they did not become common in automobiles until the late 1990s. They are now very prevalent in both local and international passenger cars and trucks. A rain sensor detects the presence of water on the windshield glass. When rain is detected, the sensor instructs the vehicle to switch on the wipers automatically. The rain sensor is situated beside the rear-view mirror, such that it makes contact with the windshield. To conceal the rain sensor, a tiny section of the windshield has been darkened. However, there is a tiny view port that is not darkened and through which the sensor can detect rain. The rain sensor operates on the idea of total internal reflection. This method takes use of infrared light. The sensor within the automobile emits an infrared light at a 45-degree angle on a clean region of the windscreen. When it rains, the light scatters due to the wet glass, and less light is reflected back to the sensor. When the amount of light reflected back falls below a threshold determined by the software within the sensor, the car's wiping mechanism activates to begin the drying process. The programme also controls the wiper speed based on the quantity of moisture accumulated. This speed varies depending to the sensor's detection of moisture.

B. Communication:

The communication and networking block is in charge of information flow and needs to be robust against environmental uncertainties and quickly adapt to changes in network topology isotropic radiation intensity patterns and has 4G/LTE modem with embedded IoT wireless technologies like Wi-Fi, ZigBee that are tested for aerial networks and help in the wireless communication to remotely control the drone and receive the data acquired IoT devices can be any smart device, such as a smartphone, laptop, or iPad, that acts as a gateway and provides internet connectivity when needed and accessible. These communication devices allow you to connect to the drone from any device, at any time. The data acquired from the drone is controlled by a smart device at a remote place that is equipped with WIFI; the data obtained may be transferred to the cloud in real time and seen throughout the internet. The acquired data is saved in the application cloud and utilised for data analysis, assessment, and providing best practises and strategies to farmers in specific situations.

C. Coordination:

The coordination block is concerned with adjusting to the requirements of the application of interest. It is made up of three major components: Mission Control, Mission Planning, and Sensor Data Analysis. To deal with both static and dynamic situations, we would devise distributed and centralised coordinating mechanisms. The mission control unit receives user input and sends it to the appropriate components; mission planning breaks down high-level activities into flight routes to be visited and specific actions for each waypoint. Finally, the graph is mosaiced using sensor data analysis.

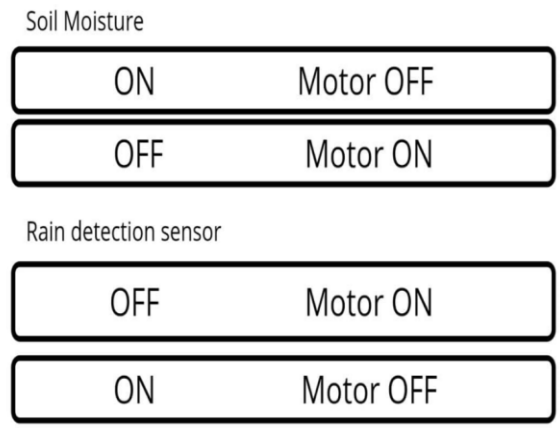
D. Drum

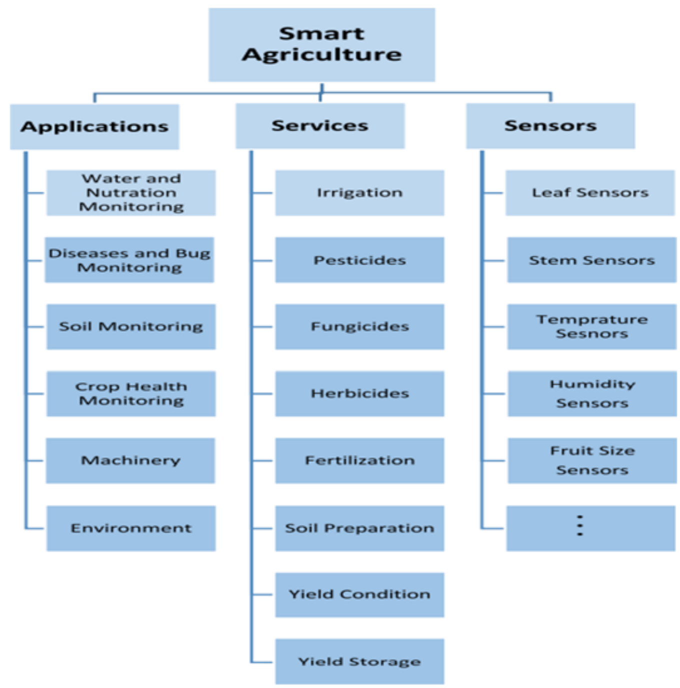
The drum is utilised to save time, energy, money, and other physical and capital resources. It aids in the scattering of fertilisers over time, and its sole human application is to put fertiliser into the inlet route. This type of equipment allows farmers to forget about watering and fertilising their plants on a regular basis. This can be quite beneficial in both water shortage and surplus areas of land. There are three pieces to this drum. The water will be pumped from a water source such as a well, lake, or other water reservoir, and will be fed into the second layer.The second layer is made up of three motors with propellers that help mix the solid ingredient (fertiliser or pesticide) before feeding it to the third layer. The third layer contains a filter system for removing solid particles; if the percentage is greater than 95 percent, no solid particles will get lodged in the filter. If so, it can be readily opened and cleaned when the procedure is completed, and the solid particles will not interfere with or hinder the filtration process because they are kept separate. The filtered water is then fed to the plants, saving time and money by ensuring that fertiliser is distributed evenly to all of the plants.

COLOUR	REPRESENTATION
BROWN	FERTILIZER
BLUE	WATER
GREEN	MIXTURE OF WATER AND FERTILIZER

III. RESULT AND DISCUSSION

The project's main goal is to reduce the capital investment in these types of technologies and make them more effective and user friendly to everyone. Drought can be reduced where water is scarce, and ground water irrigation can be reduced. Spend a lot of money on drilling. It also helps to reduce manpower and other external factors.





IV. CONCLUSION

IoT-based SMART FARMING SYSTEM for Live Monitoring of Temperature and Soil Moisture has been proposed using embedded bords and sensors. The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IoT-based smart farming System being proposed via this report will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide a helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results.

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