

Smart Agriculture Using Iot and Cloud Computing

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ABSTRACT:Internet of things is the most advanced concept in the modern internet era. It provides support to probably all the domains on the Globe. Agriculture is one of such domains, which makes use of the IoT for making the agriculture smart. Several applications of IoT are evident in the field of Agriculture for the unimaginable benefits of farmers which in turn for the successful development of the nation. This paper reveals an analyzes of potential applications of IoT in the field of Agriculture for the essential improvement of the farmers to better crop cultivation.

Key Words: Internet of Things, Smart Agriculture.

I.INTRODUCTION

Farming is the backbone for the advancement of the nation. India is called as an Agricultural country for its remarkable agricultural lands and its other resources. In recent days, the temperature and soil moisture factors affect the growth of agriculture such as productivity, diseases, and yield production. Agriculture based issues has been the barrier for the development for the nation. There is a need for Modernization of the current standard techniques for Agriculture. New trends in Agriculture are required in managing crops in a controlled environment. Eg. Green houses. The Internet of Things is the recent advancement in the Internet field. The ideas facilitate to interconnect physical objects equipped with sensing, actuating, computing power by lending them the potential to collaborate on a task, by remaining connected to the internet, termed as the "Internet of things" IoT. With the assistance of detector, actuators and embedded microcontrollers the purpose of creating good object is accomplished. These good objects collect knowledge from the surroundings of development, process them, and initiate appropriate actions. Thus, the Internet of Things can bring wonderful support and helps humans in leading a wise and smart Agriculture. The importance and therefore the application of those technologies in the field of Agriculture has been studied and analyzed in this paper. With IoT, farmers will simply get a timely cultivating guideline relating to the parameters such as pesticide usage, seasonal plant diseases and additionally regarding natural disasters and recovery methods. Main advantage of synergizing agriculture with IoT, is elimination of human-to-human interaction and human-to-computer interaction.

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Connecting Agriculture to the internet is one of the important activities of the proper operation of IoT device. It presumes the connection to be wireless, which are classified based on energy consumption, uplink data rate & downlink data rate, packet size, device per access point, topology, frequency band range and channel width.

The proposed paper explains about the issues faced in Agriculture and provides the survey of various authors in the field of Agriculture. It also shows the ways of implementing IoT in agriculture.

II.LITERATURE REVIEW

The technologies used in smart agriculture enables the farmers to gain access to the GPS, soil scanning, and can better monitor the cultivating crops.

Miguel A.Zamora- Izquierdo introduced a concept termed as Percision Agriculture. He proposed an IoT platform for the use of soilless culture by making use of saline water. he proposed three different planes for communicating with the crops, processing the collected information and processing the data for necessary action. Miguel A.Zamora-Izquierdo used IoT protocols for communication and concluded that by this method the farmers are always are connected to the farming environment. Mahammad Shareef Mekala, P.Viswanathan has proposed a Cloud enabled Clay-Mist Measurement index. They took the two important parameters such as temperature and humidity of the soil that is directly connected to the plant growth. The results have proven to be 94% accurate with less execution speed.

Sutanni Bhowmick have detailed about Vertical farming concept in his paper. Vertical farming is a modern tool for measuring the ambient factors of the soil that improve the crop cultivation. He developed sensor arrays for collecting data and sent those data to the cloud system module and analysed the ambient factors. He also made use the app, to intimate the farmers about the threshold falls. K.S.Patil, has proposed a model in a combined approach with internet and wireless communications. He named the system as Remote Monitoring System (RMS). The system collects real time data from the production environment and inform the farmer through SMS, and also provide some general advices on weather patterns, crops to be cultivated on the soil etc., Thus this method succeeded in making the easy access of agricultural facilities to the farmers. Almw Ayele Aniley introduced Thin Film Dual Probe Heat Pulse (DPHP) Micro Heater Network for Soil Moisture Content Estimation in Smart Agriculture. He proposed the network model by connecting sensors and actuators over the farming environment. the proposed system monitored the soil nutrients, and Ph of the soil for improving the soil humidity.

Sowmya B. J. proposed an automated prediction system that analyze the massive information units of existing records in the field of agriculture. Large information analytics is the procedure of inspecting massive amount of facts comes from variety of resources like sensors, weather forecasting, and social media information. the system takes better decisions based on the existing information on a related scenario.

IoT ENABLING TECHNOLOGIES

Internet of Things has the following technologies:

Wireless Sensor Networks (WSN)

WSN consists of number of sensors or nodes, that are connected together to track the various sort of data.

Cloud Computing (CC)

It is termed as on-demand computing that shares the system resources and data among the requested users. It can be represented in various forms such as IaaS, PaaS, SaaS.

Big Data Analytics

It is the concept of processing large data sets that have various forms of data types.

Communication Protocol

Communication protocols are the backbone of IoT systems. They enable connectivity of various applications and also data exchange over the network.

Embedded Systems (ES)

It is a combination of hardware and software, that are intended to do a specific task. It supports the connection of various sensors over IoT.

APPLICATIONS OF IoT IN SMART AGRICULTURE

Although the use of smart agriculture is not popular in India, still it shows dynamic capabilities for supporting agriculture. It supports the plant growth and development in many ways. Some of such applications are listed below to enhance plant growth:

Monitoring of Climate Conditions

Climate and weather conditions are the primary factors to be noted during agriculture. Smart agriculture using IoT makes use of several sensors for monitoring the climate conditions of the surroundings. the task of the sensor is to collect the data across the field send it to the cloud. the cloud is loaded with some basic measurements which will then be compared with the sensed data. Based on the comparison, we will be able to map the climatic conditions and choose the required crop for cultivation. Some examples of such agriculture IoT devices are all METEO, Smart Elements, and Pycno.

Agriculture Drones

One of the best applications of IoT in agriculture are Drones. Drones provide pictorial and aerial maps about the plants, thus making the farmer understand that which crop is in need of immediate attention. Drones also evaluate the health state, irrigation, monitoring of progress, spraying, and planting of each crop. Drones are helpful in saving time and effort.

the drones are comprised of two types: ground-based and aerial based drones. Both are used for crop health assessment, irrigation, planting, and soil & field analysis. Farmers have to choose the height or ground resolution of the field for which the Drones have to be used. Then the Drones take the pictures of the crops and helps the farmer to give immediate assistance for the required crops.

Livestock Monitoring

Livestock Monitoring is the way of tracking the state of the herds. the health of the animals is tracked using the IoT device and monitored for the signs of disease. The sensors connected to the animals will collect data about the location and well-being of the animals. The sensors can even track the state of pregnancies of cattle and intimate the state of the cattle which is about to deliver.

Smart Greenhouses

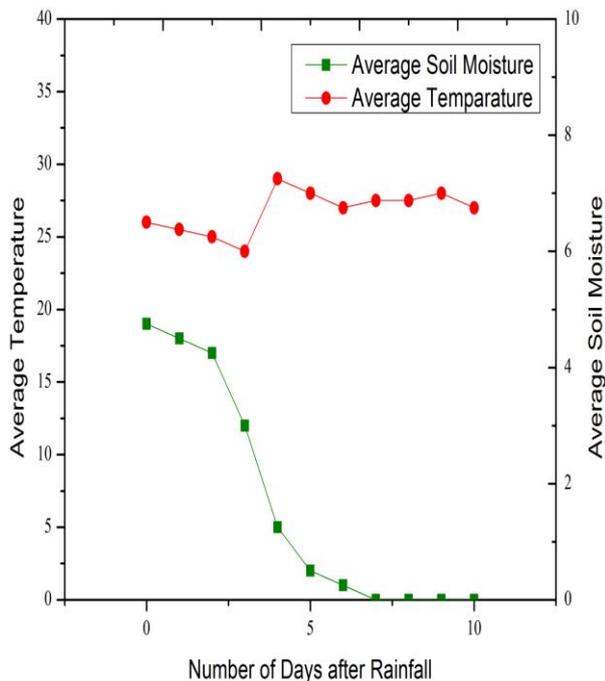
Greenhouse farming is a technique that boosts the yield of crops, vegetables, fruits etc., Environmental parameters are controlled by Greenhouses in two ways; either through manual intervention or a proportional control mechanism. However, since manual intervention has disadvantages such as production loss, energy loss, and labor cost, these methods are less effective. A smart greenhouse through IoT embedded systems not only monitors intelligently but also controls the climate. Thereby eliminating any need for human intervention. Different sensors that measure the environmental parameters according to the plant requirement are used for controlling the environment in a smart greenhouse. Then, a cloud server creates for remotely accessing the system when it connects using IoT.

Crop Water Management

Water is the essential resource for performing agriculture. All the agricultural activities are based on the adequate supply of water. Hence it is necessary for the farmer to ensure adequate supply of water to the crops. This technique uses the Web Map Service (WMS) and Sensor Observation Service (SOS) for ensuring proper water supply for the irrigation of the crops. Thus this IoT reduces water wastage.

RESULTS

The following graph shows the variation of temperature and soil moisture with the increase in the number of days of rainfall. Arduino mega 2560 is used in the research. DS18B20 sensor is used to measure the temperature of the soil. Also, a soil moisture sensor is used for measuring the soil moisture. From the analysis made, it is seen that as the temperature increases the soil moisture decreases.



SENSORS USED IN IOT FOR SMART AGRICULTURE:

- Location sensors use the GPS satellite signals to find latitude, longitude and altitude within the feet. It requires three location sensors to be fixed, since for triangulating the position.
- Optical sensors are used to measure the clay, organic matter and moisture content of the soil. these sensors are generally fixed to the drones.
- Electrochemical sensors provide the essential information about the pH and soil nutrient level.
- Mechanical sensors are used to find out the mechanical resistances of the soil.
- Dielectric soil moisture sensor measures the moisture level of the soil, by using the dielectric constant.
- Parrot sensors are used to monitor the plant's temperature, moisture, soil salinity. The information is sent to the farmers' mobile phone.
- Spruce is a sensor device, which is used for

irrigation control. The data is saved in the cloud server and the user can access it at anytime and anywhere.

- Koubachi is used for sprinkling water to the plants in the garden. It acts a node that collects data from multiple sensors like air temperature, soil moisture, sun light etc.

BENEFITS OF IOT IN SMART AGRICULTURE

- IoT enables the large amount of data to be collected over the sensors and thus providing better control over the internal processes and, as a result, lower production risks.
- With IoT efficient monitoring of the farming environment is ensured.
- IoT helps the farmers to monitor the fields at multiple locations by enabling remote monitoring. Decisions can be made in real-time and from anywhere. IoT guarantees increased crop production by keen tracking of planting, watering, pesticide application and harvesting.

III.CONCLUSION

The proposed paper has discussed about role of IoT in the field of agriculture. Various technologies supported by IoT, applications of IoT in smart agriculture are reviewed in this paper. This paper reveals about the benefits of IoT in agriculture. IoT is the emerging concept in the Globe, and a clear understanding of its concepts is more essential. This paper gives a brief assistance for the farmers in increasing agriculture yield and take efficient care in agriculture. All the above discussed applications show 98% accuracy. This can help the farmer to enhance the crop yield and thus improving the wellbeing of the nation.

S.No	Applications of IoT	Sensors used	Measures	Uses
1	Monitoring of Climate Conditions	Temperature sensor, Light Dependant Resistor, sound and CO sensor	Rainfall, Wind speed and direction, Temperature, relative humidity, light intensity and CO level	Reduces labor costs, Effective decision making, Ease of time, Utilization of resources
2	Agriculture Drones	NDVI Sensor, Phantom 4 Pro V2.0 Drone, Matrice 210 Drone, Zenmuse XT2 Thermal Camera, AGRAS MG-1S Drone	Irrigation problems, soil variation, and pest and fungal infestations	Increase crop production and crop growth
3	Crop Water Management	Ultrasonic sensors for water level, Temperature and relative humidity sensor, Soil Moisture sensor,	Focus on climatic circumstances	Understand the soil properties, Demand of water supply for various plants, Control the water wastage,
4	Smart Greenhouses	Temperature Sensor, Arduino compatible Mini Luminance Sensor, light sensor and actuators	Temperature, humidity, Water content, Light level, CO2 level, Soil water potential	Efficient plant growth, Controlled temperature
5	Livestock Monitoring	Connected sensors	Measures the heart rate, blood pressure, respiratory rate, temperature, digestion, and other vitals of the livestock	Saves time, prevent health issues of cattle at earlier stage, Track the location of livestock

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