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INTERNET OF THINGS-BASED CROP HEALTH MANAGEMENT

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ABSTRACT: The system adopts machin learning techniques computer vision Deep learning is used to quantify the images captured and to keep track of the crop. In addition to this, it detects Fusarium wilt in radish plants. The whole radish crop is segmented into three divisions' i.e., radish, bare ground, mulching film, but we mainly emphasis on the crop and the bare ground. Inculcate various sorts of sensors collect the sensor data using ThingSpeak. The process includes setting up the sensors collecting the pictures and sensor data, analyzing the data and gets the result. Machine learning extends its services in every field especially in agriculture i.e., crop management starting from seedling to harvesting. The cycle starts with ground preparation, plantation of seeds, seeds breeding and requirement of water for the crop and even harvesting can be done automatically by robots depending upon ripeness of the crop by using the technology of computer vision. To achieve promising outcomes and broad potentials, this algorithm employs data analysis techniques and image processing. Profound learning gives high precision, beating existing ordinarily utilized picture handling methods. Since agriculture plays such a significant role in India's economy, it should be given top priority, with the most up-to-date technology like the web of Things (IoT). Through using the capabilities of the Platform applications based on the Internet of Things (IoT) can be built to manage and track crops with limited human intervention.

Key Words: IoT, Cloud Computing, Gateway, Hybrid Cloud, Supervised Learning, Decision Trees.

1 INTRODUCTION

The Internet of Things (IoT) is a network of physical objects that can be readily accessed from internet. The IoT "thing" may be a car with integrated sensors, all objects would have their own IP address in this situation, which they can conveniently find useful. IoT may be seen in a variety of industries, including agriculture. Smart Cities, Smart Environment, Smart Water, Smart Metering, Security and Emergency, Industrial Control, Home Automation, E-Health, and other IoT applications are examples.

Farming is one of the most important industries that make use of the technology the IoT stage by utilizing various procedures that are involved in farming but due to the lack of awareness some of our farmers are still implementing their traditional methods to grow their crops that includes usage of fertilizers, an adequate amount of liquid for crop and the area of concerns is to be checked clearly, then remaining problems will be extracted automatically Real-time monitoring of field condition parameters such as temperature, humidity, and light easily over the field can be used to efficiently solve the aforementioned problems.

Our proposed model is built using Raspberry Pi in this paper. The Raspberry Pi is a single chip microcomputer which can be attached to a computer screen and for television. The board

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comprises the WLAN module and the easy access to hardware and software through the Local Area Network (WLAN). The DTH11 detects variations in temperature and moisture and it is integrated with an eight-bit control system. A soil sensor was then utilized to gather quantitative water present in the soil. Utilized the PIR to locate the motion and Raindrop sensor to acquire the precipitation records personally. Introduced thing Speak is a cloud where we Save progress in real time. Thing Speak is IoT platform stage administration to permits investigation of real time information streams in the cloud.

The observing framework assumes a crucial part in expanding the creation of the harvest and also used to eradicate various problems that occurred during farming. The system uses a compatible device that is capable to collect the data form the Raindrop, Soil moisture, PIR, and DHT11sensors information. At that point consequently post the gathered sensors data to the thingspeak. Now we can download the data from Thing Speak Android Application to screen the continuous advancement of our checking framework using the android app

2 LITERATURE SURVEY

In this paper create wireless systems that allow them to monitor the present climate factor such as temperature, moisture, rain levels, and wind speed, in real time. Based on previous stored metadata, they make weather forecasts for the future. The efficiency and operation of the humidity, temperature, and humidity sensors were extracted from this paper. and weather sensing data, and used this information into radish crop farming, extending the farming's implementation.[1]

A WSN is utilized in this article to farm monitoring system with cameras to get a near image of plant. They applied above why system based on a wireless channel made up of smart routers in this article, which would improve the project's working model and principle, but our analysis is even easier than the procedures shown in the above-mentioned research. To improve the implementation, we employed artificial intelligence to achieve an accurate result at the end and would have a decent operating system.[2]

The principal objective of this paper is to grow a brilliant radish based farming strategy, Obtaining randomly sensor information from the farm would be useless for crop monitoring They developed a method in which we incorporated certain sensors to assist us in crop monitoring. Only by using sensors will we be able to grow entire radish crops. It creates an IoT-based multi - sensor surveillance system also with assistance of numerous sensors, storing data that is randomly acquired from the field. [3].

They've looked into and created a number of apps for crop health monitoring. The created applications were agricultural smartphone apps based on functioning software such as Android and iOS. In our research, we discovered that simply developing an application is insufficient for achieving good outcomes in smart farming. We must know everything there is to know about farming, and we must evaluate and comprehend crop production from seedling to harvest, as well as cooperate cooperatively. In this article, we propose an application that will allow us to obtain the set off characteristics and status of the yield from any remote location using AI and computerized reasoning. [4].

They have worked on the usage of the framework in farming. Especially in the domain of the IoT, the demonstrations incorporate the design of the administration framework of information for the smart farming process [5].

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This article discusses how the Web of Things may be used to connect sensor networks with agriculture, allowing agronomists, farmers, and crops to form relationships without regard to their geographical location or differences. It describes the overall design of sensor networks for integrating agriculture with the Internet of Things. [6].

Precision agriculture is the subject of this article, which is built on remote sensor groups and the Internet of Things. They are mostly interested in smart technology and agricultural applications. The author has devised a strategy for the irrigation system's development. Farmers can quickly identify and check the many types of fertilisers, irrigation, and other necessities. Based on the temperature and soil moisture sensor, they utilised non-wired technology to redberry and glasshouse in the glasshouse. [7].

They have used an affordable method that gives us an inner view to the real-time situation for the crop. In this method they deployed the IoT and machine learning to cultivate the reasonable smart yielding module. The system incorporates accurate results and automatically monitor the fields, so that low human interventions. Internet of things is now in the phase to connect the base station module framework. AI ongoing examination is to anticipate state of the fields dependent in their previous information [8].

This emphasis of the crop which is used with the Big data application so that crop yielding is growing to increased rapidly. So that, the best and suitable quality a good price. The farming methods introduced in this paper especially in the use of big data to be considered data analysis as the main advances in afterwards, the incorporate of the estimation of large information technology [9].

This article contains talks and research on crop management and instructions for developing a crop using machine learning, one of the most sophisticated agricultural advancement approaches. They utilised a controlled learning calculation that prioritizes getting the findings over anything else. The seed data for the crops is collected here, together with relevant factors such as temperature, humidity, and most content. They've created an Android app. Users are urged to provide factors such as temperatures and precise geographical information in order to begin the process. [10].

The support provided by machine learning and IoT applications in agriculture data simulation, gathering and decision taking knowledge for smart yielding is the subject of this paper. This paper also depicts the general situation moves for innovating smart yielding techniques and their most least requirements to cultivate differences in the desert areas of India. [11].

The paper focuses on the model of the smart agricultural system that shows the required water for yielding of a crop , by the machine learning code. The produced algorithm has an efficiency and mostly precise in improving technical learning is applied to data gathered through the help of sensors to finalize the result quickly. The information which is gathered will be emailed to the farmers, so that they can take decision regarding water supply in future.[12].

The main contents of this paper are the investigations on the improvement of the sprout's artificial atmospheric sensations. They discharged bodies and very low-level oxygen RF discharged bodies. Seeds of sprouts are radiated for the irradiation is 19-68% without the radiation. Many oxygen's lives should be involved in the growth simulation technique [13].

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3 DEVICE CONFIGURATION

The proposed system is created in such a way that when someone looks at it, they can immediately comprehend the figure and gain a general sense of the design. The major point of what the project is built for may be seen by looking at the structure. Various sensors have been employed to collect data from the crop in order to monitor its health as it grows. The system is meant to track the development and health of the radish crop from seeding through harvesting. A Raspberry PI module is used to interface the sensors, as seen in Figure 1.

4 SYSTEM METHODOLOGY

Connecting and configuring the Raspberry Pi, Soil Moisture Sensor, DHT11, PIR, and Raindrop Sensor to monitor temperature, soil moisture, humidity, and motion detection to automatically upload sensor data to the cloud.

4.1 CONSTRUCTING A THINGSPEAK PLATFORM:

Thingspeak is a cloud-based IoT research platform the necessary information and displays live data streaming in the cloud. Thingspeak is an free IoT platform for online information verification. The ThingSpeak cloud is used to constantly store sensor data in this system. Create a free account on the ThingSpeak cloud and add a new channel with two fields for temperature and humidity. The API key from the ThingSpeak cloud is then composed by the copy. In your code, include the write API key.

4.2 IMPLEMENTATION OF ML:

The Machine Learning (ML) is a kind of Artificial Intelligence which utilizes the technology to skill up the given data instead of programming., basically the process is not so easy as compared to the remaining. The algorithms should train the systems with the given datasets, then there will be more efficiency and precise along with the sets. It is the output produced one when you lead your machines with required machine-learning algorithms. There will be practical result after training when there is an inputs.

ML may be approached in a variety of ways:

1. Deep Learning method.
2. Reinforcement Learning method.
3. Unsupervised Learning method.
4. Supervised Learning method.

The presence of pests and illnesses in the crop is precisely detected using deep learning technology. CART, a machine learning system, can also reliably forecast the likelihood of future pest assaults or illnesses. The integration of neural networks offers algorithms, previously trained models, and other operations for the development of a train that allows them to view and recreate traditional neural networks.

We can easily apply deep learning for training sets that are smaller to create by doing transfer learning with existing deep neural networks and importing models from Tensor Flow.

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4.3 CART Algorithm:

1. The Cart model rendering the binary tree.

2. Regression and Classification is well known for Cart algorithm in machine learning.

3. The algorithms and data structures are formed with the help of binary tree. The first input variable & point in that variable like undertake it is numeric variable.

4. The prediction are based on the leaf node in tress which contain output variable(X). The represented dataset with input(x) of weight in Kilograms and height in centimeters.

5. The selecting input variables are created with the help of CART model involves in it and split points with variables prior to tree is constructed.

6. The specific split and cut-point should be chosen by greedy algorithm, input variable to minimize a cost function, predefined stopping criterion used to assist tree construction for each tree's leaf node

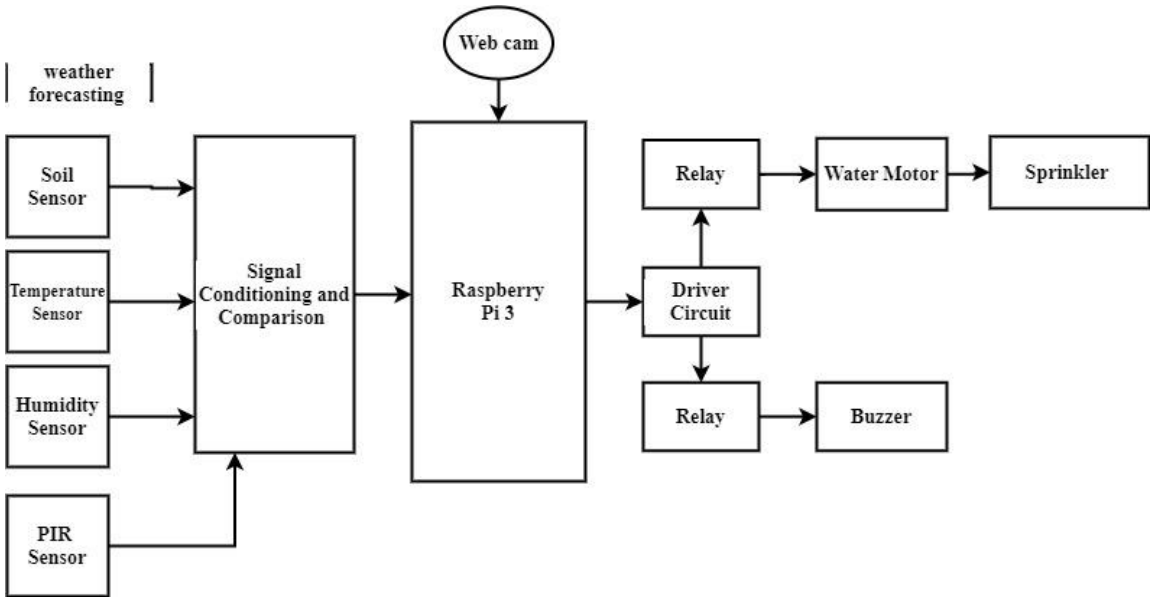

Fig 1. System Architecture

Table 1:comparision of the machine learning algorithm

Characteristics	classification algorithm for building a decision tree	C4.5 Algorithm	ID3 Algorithm

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Types of information	Data on continuous and nominal characteristics.	Systematic and ongoing	Systematic
Speedy	Medium	fast	Slow
Prunings	Post prunings	Pre prunings	No prunings
Boostings	YES	NO	NO

4.4 Maintaining the tree:

The stopping criteria are crucial because it has a significant impact on your tree's results. After you've learned about to the tree, you can utilize pruning to improve its efficiency.

The numerous of splits in a decision end-tree is used to determine its complexity. Trees with fewer branches are preferred. They are simple to comprehend, and they are less likely to overfit your results. The printing and display them to subject to availability experts.

Working with each node of the tree and evaluating outcome of the fastest and simplest pruning method is to remove it using a test set. Only the leaf nodes are excluded if the total fetch function on the entire test decreases. When there are no more changes to be made, you avoid deleting nodes.

More advanced pruning techniques, Reducing price difficulty, for example,determine if the sub-tree can remove the nodes based on size.

5 EXPERIMENTAL INVESTIGATIONS

The major objective of this research is to investigate, From the planting phase until the harvesting process, assess and monitor the radish crop's health. From the first day of planting till harvests, the crops will be observed. We use a variety of sensors in the field and collect crop data numerous times dependent on periods of time. As previously said, we have interfaced sensing devices such as temperature and moisture sensors, soil moisture sensors, and so on. Sensors installed throughout the fields track changes in light, humidity, form, and growth of the crop. Any animal that the sensor detects is analyzed, and the farmer is alerted through a signal. As a result, remote sensing will aid in disease prevention and crop monitoring. We'll set certain predetermined threshold values so that when the sensors detect other values, we can examine the plant's health right away. The crop grows in 3-4 weeks under typical weather conditions, while it takes approximately 6-7 weeks in colder climates. A webcam is fixed so that the farmer can view the crop through his mobile and check the crop condition at any time. An irrigation system is fixed to the crop is for water distribution at regular intervals of time without man help needed for providing the irrigation. If the captured images were taken by the camera detect any uneven or any change in the growth or leaves it gives a signal indicating that there is some pest or disease effected to the crop to help that stop in the initial stage to save the total crop from being affected by the pest or disease.

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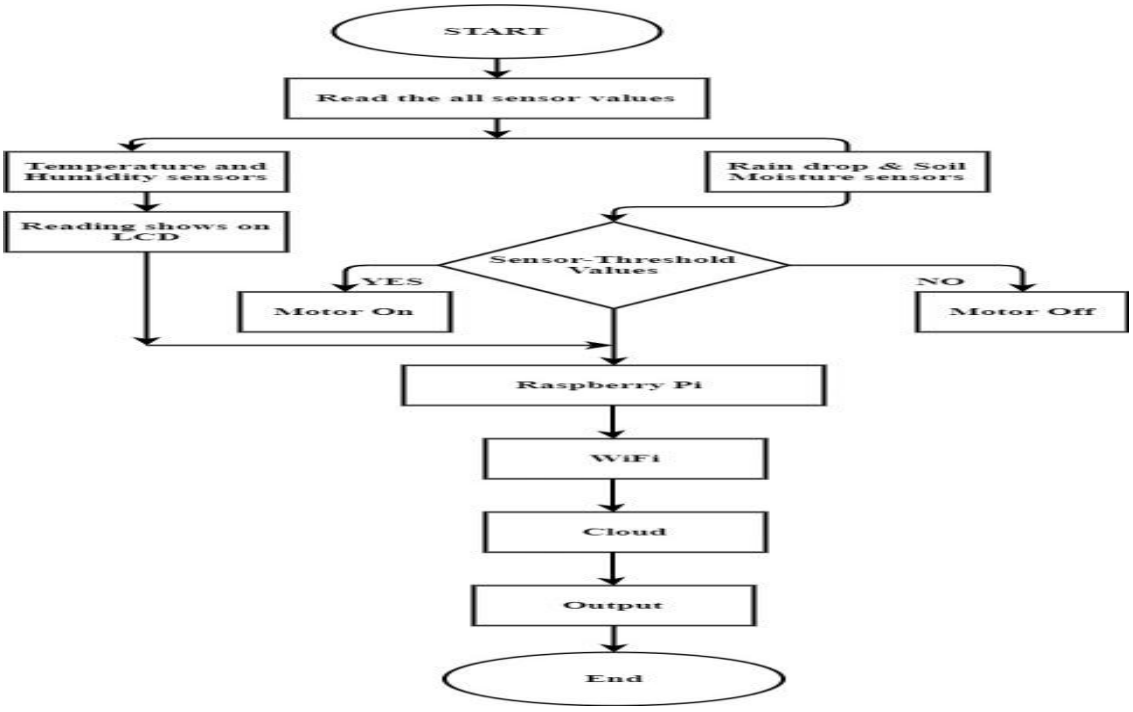

Fig 2. Flow Chart

Fig 3. Radish Crop in its Intermediate Stage Fig 4.Radish Crop Development

We may infer from this section that, while some machine learning models/architectures have been created for hyperspectral image classification in the context of plant disease detection. In Fig.4 the images are taken at the intermediate stage of the crop the green-colored area indicates the healthy part of the plants and in Fig.5 the terminal image of the crop indicates the healthiness.

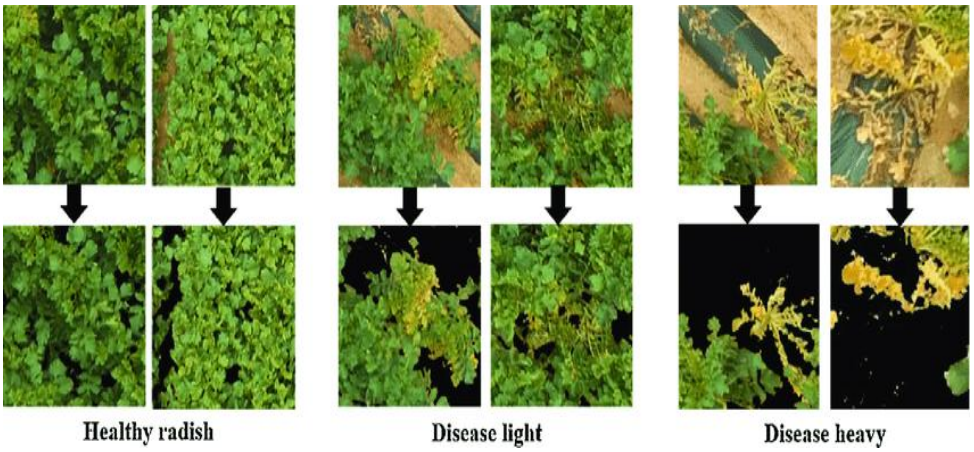

Fig 5. Disease Detected Using ML Algorithm

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The above Fig.6 indicates 3 stages of the crop are captured using the ML Algorithm:

1 Healthy crop: The image depicts a stage in which the crop is at a good stage of growth with none of the other complications.
2 Disease (Light): the image depicts a stage where the crop is slightly affected by the disease named fusarium which when affected turns the leaves of the crop from green to light yellowish colour.
3 Disease (heavy): the image depicts a stage where the complete crop got affected by the fusarium disease which kills the crop totally where the total crop turns in yellow colour.

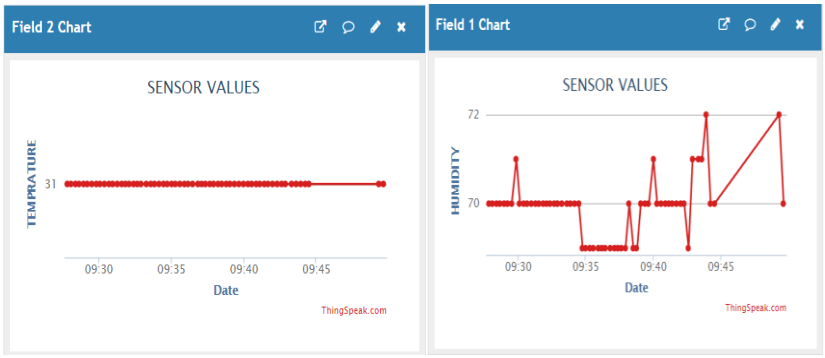

Fig 6. User Interface Graph in ThingSpeak Cloud

6 OUTCOME OF THE SYSTEM

To avoid crop damage, soil moisture percentage, temperature, and humidity are all monitored. This gadget may be used to monitor any type of crop. Temperature monitoring in stores containing vegetables and fruits. Use this technique to keep track of the moisture content in your building. Temperatures of machines in the factory are being monitored to prevent harm.

CONCLUSION

The article uses the DHT11 sensor to build an easy and low-cost monitoring system. Temperature sensor, moisture, and soil moisture sensors connected to the Microcontroller board to gather data on environmental changes and transfer it to the cloud via WIFI, as well as monitor the data progress via the internet. When it comes to retrieving live data, the stick is extremely efficient and precise. The agriculture stick proposed in this paper would help farmers increase crop yield and need to take better care of food staging by assisting them in getting reliable live feeds of environmental results.

FUTURE SCOPE

Future work will concentrate on increasing the number of sensors on the field to collect additional data, particularly in the area of pest control, as well as incorporating a GPS module into this device to improve the farming by using the IoT technology to improve the Agriculture quality. Now-a-days, Internet of things is increasing rapidly with the help of smart techniques and technologies. The revolution regarding smart agriculture should bring change in agriculture in India. The only practical means to overcome these limitations is to conduct a detailed inventory and measurements studies at each potential source in technology. The total annual

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quantity of agricultural food material must be established through data inventory through onsite visits.

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