Monitoring and Protection Precision Approaches Systems of Agriculture for Crop Health Early Disease Detection Using Internet of Things (IOT): A Survey

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ABSTRACT

Precision Agriculture has been playing a significant role in the refinement of plants' health. It makes certain the soil and crops get all they want for optimum health and productivity. Additionally, the phrase refers to reducing sickness, pests, and unwelcome inundation. IoT is widely used in many fields like health monitoring and agriculture. This review article examines several studies that employ IoT-based plant monitoring systems for the detection of crop leave diseases and the monitoring of other crop parameters. Machine learning algorithms like SVM, CNN, and Deep learning have been instrumental in identifying plant diseases. Algorithms like VGG-net, Res-net, CNN and image processing techniques have proved to be significant in recognizing many plant diseases and also extend survey about various sensors used in IoT based crop monitoring. The main focus of this paper is to make an analysis of various techniques used in IoT based crop monitoring and leave disease detection systems.

Indexed Terms— Internet of Things, SVM, CNN, Deep Learning, Machine learning IoT's .

INTRODUCTION

Agriculture is a practise that provides all types of foods and fabrics to people around the globe. Especially, in our country agriculture is considered as backbone of economy. This technology is growing day by day that today it has become an indispensable part of everyone's life and it can also be used in the field of agriculture to increase productivity of crops and improve the quality of crops. Crop diseases are caused due to various fungus and microorganisms due to impure soil and improper amount of water. But utilising IoT, it is suggested that the leaves be continuously monitored, with problems being identified and treated at an early stage.

This study has the potential to increase agricultural yield in both quality and quantity. Each author in the survey study that follows employs a different method for putting IoT-based agricultural disease diagnosis into practise. In this paper, review all techniques used in various paper.

The section 1 gives a detailed introduction about need for technology in agriculture. The section 2 literature review of all the papers. The 3 section is a tabular description about the literature review. The last section gives the conclusion of the paper.

II. LITERATURE REVIEW

In paper [1] the authors propose a concept of smart farming using IoT technology to monitor air temperature, humidity and other factors that affect plant growth. In previous paper, a framework is used for pump switching control which is implemented using advanced fuzzy logics. The DH11 temperature and humidity sensor, capacitive soil moisture sensor, and ultra Sonics sensor are among the different sensors employed in the suggested system.

The three important input membership functions in this paper are air humidity measured in percentage (%), soil moisture in percentage (%) and temperature in celcius (o c). The output membership function is only the watering time in seconds. In paper [2] the authors give an integral technology of IoT, Machine learning and drone technology for agriculture. Each technology has its own importance. In the proposed solution, the IoT sensors provide the real-time status of environmental parameters impacting the crop's Vegetation Indices (VIs). Deep neural network with two hidden layers was found to be the most optimal model among all the selected models, providing an accuracy of (98.4%). The crop health maps were validated through the ground surveys and agriculture experts due to the absence of reference data. The drone technology gives a multispectral data for crop health monitoring. This datum has to be integrated because they are not heterogeneous but also has different temporal fidelity.

The optimal integration of these sensing modalities has been addressed in this paper. In paper [3] an IoT framework using various sensors and cameras has been used to continuously monitor the crops and leave diseases. Machine learning techniques like Support vector machine and convolution neural network are helpful in irrigation and nutrition planning.

To survey paper proposes EPRPC (Ensemble classification and pattern recognition for crops) for early leaf disease detection uses Ensemble Non-Linear Support Vector Machine (ENSVM). The paper also performs comparative study between various ML techniques like SVM, CNN, naïve bayes and k- nearest neighbour and deep learning with each other ensuring real time crop monitoring system.

In paper [4] the authors mainly focus on LWD (Leaf Wetness Duration) , the main reason for fungal disease. But commercially available LWD sensors have operational issues like weight of sensor and contact resistance between leaf and sensor. To overcome this issue the author has fabricated IoT enabled IoT sensor on flexible substrate. In terms of both price and accuracy, the LWD sensor made from a flexible substrate works well for in-situ leaf disease management. The author of study [5] uses IoT and artificial intelligence to find RiceTalk disease in paddy plant. Using IoT sensor makes real time disease detection effective rather than doing image-based detection. The IoT sensors are used in finding min/max and the range measures for relative humidity and the average measure for temperature that have significant effects on rice blast prediction. The proposed system is very effective in detecting RiceTalk disease.

The author of paper [6] has successfully linked IoT with image processing and environmental sensors to monitor plant health. The paper uses raspberry pi based IoT system that are used for disease classification and also used in updating environmental parameters like air temperature, humidity and soil moisture in MySQL database in a real time. Multiclass SVM is used for classification of disease. The accuracy of the disease classification achieved by the article while using IoT sensors is 97.33%. In paper [7] author proposes a scheme that places the nodes over the simulation environment for capturing the plant leaf images. The proposed system has a sink Node which helps in collecting images through IoT based sensors for leave image detection. The images are pre-processed and segmentation is done. Then the leave disease is classified using Sine- Cosine algorithm-based Ride Neural Network (SCA based Ride NN).

In paper [8] the author aims at reducing the frequent use of pesticides and fungicides that not only affect the crop quality but also causes environmental pollution. In IoT based correlation is performed between weather and pest that majorly occur a certain weather condition. Thus the system provides disease and pest related information to the farmer at early stage so that it is easy to control them.

In paper [9], the author suggests an Internet of Things-based plant monitoring system for applications in precision agriculture, such as the management of endemic diseases. The IoT sensors are used to monitor the environmental parameters such as temperature, humidity which helps in controlling various fungal and bacterial diseases. The system can be very useful in reducing the use of chemical fertilizer that is harmful to humans in a long term.

In paper [10] author presents IoT based image processing technique for finding disease in citrus plants.

There are four types of citrus leaf diseases:

(i) Citrus canker,
(ii) Anthracnose,
(iii) Overwatering,
(iv) Citrus greening.

The proposed methodology uses image acquisition as first step for capturing image by digital camera in high resolution to create database. Colour space conversion and image enhancement is done in image pre-processing. Discrete cosine transform domain is used for colour image enhancement. Two types support vector machine (SVM) classifiers: SVMRBF and SVMPOLY are used for differentiating citrus leaf diseases.

In previous paper [11] concentrate on the damaging pest known as the wheat aphid, which is widespread in northwest China. Hyper spectral measurements of leaves are used for detecting Wheat Aphid density in that area. The density of more than 60 leaves is used in previous paper. The survey paper obtained 48 SFs derived from vegetation indices, derivation spectral transform and CWT, and tested their potential in estimating aphid infection density in winter wheat at leaf level.

In paper[12] author concentrates on tomato plants. Here author uses image processing technique for tomato leaf disease detection. The two types of disease concentrated in the paper are early blight and powdery mildew. In previous paper a 0V7670 camera module is used to capture leaf images and then the images are pre-processed and segmented to improve image quality. Then Support Vector Machine (SVM) algorithm is used for finding the disease. SVM is employed using Invmult Kernel function.

In paper [13], the author created an IoT-based monitoring system for controlling epidemic illness in precision agriculture. An agricultural monitoring system like this one offers environmental monitoring services that keep the crop-growing environment in top condition and can foresee epidemic disease outbreak conditions in advance. The sensors are connected using Arduino UNO through Wi-Fi Module.

III. REVIEW TABLE

s.no.	Paper Title	Methodology	Research Gaps	Limitation	Future Work
1	Crop GrowthMonitoring System Based on Agricultural Internet of Things Technology, 9 May 2022	Iot fuzzy loggy, ccd camera ,single sensor camera.	1)A few issues that need to be addressed. First, smart farms can optimize the production outcomes by improving the application of nutrients to the soil and reducing the amount of pesticides and water used in irrigation. These are currently major challenges for the system.	Environmental factors including water stress, nutrient deficiency, high or low temperatures, chemical (Al-toxicity, salinity) and physical soil constraints (e.g. compaction), and biotic factors reduce crop yield.	1) future enhancement, we would like to attain more data so that we can run training and testing of the data. We will also validate the data with different subset. The fuzzy systems itself will be adjusted to be applicable for all types of crops.
2	Towards Smart Agriculture Monitoring Using Fuzzy Systems Fuzzy Logics	Sensors, Fuzzy logic, Agriculture, Internet of Things, Temperature sensors, Monitoring, Wireless sensor networks	2) The second issue is maintaining the connectivity with the final output, whereby the application layer involves the IoT and provides management information to farmers.	Lower time of water control .due to less energy of plants.	In future developed Arduino IDE and Arduino Nano, which receives the data from the master controller and performs the ON/OFF of the relay.
3	Deep LearningBased Object Detection	SVMRBF and SVMPOLY	The reason is that we increased the number of	maximum volume of fuzzy control, the watering	Future works will include images of natural plants that should

	Improvement for Tomato Disease		anchors, resulting in an increase in the calculation of the RPN module, and the detection time of the whole Fast-RCNN also increased correspondingly. However, the detection time is the detection time of the Fast-RCNN overall framework, and the increased time of the anchor frame was only a small part of it. From the overall point of view, the increase in detection time was not much.	consumption was not able to reduce efficiency.	be collected for detection. And Future works should combine these factors to carry out multifaceted diagnoses, which will help the development of smart agriculture.
4	IoT Enabled, Leaf Wetness Sensor on the Flexible Substrates for In-Situ Plant Disease Management	LWD sensors for fungal disease	The low dimension of the fabricated LWS designed considering bed dimension of Tulsi plant leaves and less performance of the fabricated flexible LWS in terms of accuracy.	The limitation is the endpoint is when the value of the signal is greater than the threshold right before it becomes less than the same. We have captured these two points for all the events that have occurred in the given signal. We collected data over a month's time period during which our sensors could capture 17 events for our study.	As a future scope, we will collect data for one crop cycle and make the early prediction of the plant disease using the fabricated LWS.

IV PROBLEM STATEMENTS

1. **Limited Early Disease Detection:** These methods of disease detection in precision agriculture often fail to identify diseases at their initial stages, leading to significant yield losses and resource wastage.
2. **Inadequate Real-time Monitoring:** Traditional monitoring approaches lack real-time capabilities, hindering the ability to promptly respond to changing crop health conditions and environmental factors.
3. **Data Complexity and Integration:** The integration of data from various IoT sensors, weather forecasts, and historical data sources presents challenges in terms of data heterogeneity, compatibility, and efficient analysis.
4. **Accuracy and Precision:** Achieving accurate and reliable disease detection while minimizing false positives and false negatives is a complex task that requires sophisticated algorithms and models.
5. **Scalability Challenges:** The implementation of IoT-based systems across large agricultural areas or multiple farms requires solutions that can scale effectively without compromising detection accuracy.
6. **User Accessibility and Interface:** Designing an intuitive user interface that provides actionable insights and recommendations to farmers, regardless of their technical expertise, is crucial for adoption and success.
7. **Resource Optimization Needs:** The efficient allocation of resources such as water, fertilizers, and pesticides based on disease severity and crop health requires data-driven decision support systems to ensure sustainable farming practices.

V. CONCLUSION

The paper provides a thorough overview of several Internet of Things (IoT)-based plant monitoring and disease detection systems. The various advantages of using a real time IoT based system is discussed in detail. Different Machine learning algorithms like CNN, RNN, ANN, SVM, Deep learning are effective in leaf disease classification. Thus, using technology in agriculture is beneficial in improving the crop quality as well as saves the time of farmers.

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