A Novel IoT Enabled System For Detection of Infected Leaf for Smart Agricultural

Abhishek Shukla[1]

Research Scholar ,
Computer Science & Enginnering
Dr. C. V. Raman University
Bilaspur, India   *cvruabhishek2013@gmail.com*

Dr. Rohit Miri[2]

Associate Professor
Computer Science & Enginnering
Dr. C. V. Raman University
Bilaspur, India

Abstract

As we know 2020 is a year which created lots of issues with every type of the business. Even it affects the agricultural eco system. Due to COVID-19 there is very less man power is available and farmers who are doing forming in larger way, they need lots of man power to monitor & maintain their farmers. Due to lack in man power its very difficult for the formers to monitor their farms from remotely, so there is need of system which is able to provide smart agricultural features like temperature & humidity monitoring remotely apart from that farmer have the power to monitor the quality of their leaves. So, in this paper we present an IoT enabled system which is able to track the temperature & Humidity from the remotely apart from that it is also able to capture the image of the leaf and send to server where in server using Computer vision & machine learning system, we will track the leaf quality. In this paper we proposed a hardware unit which is basically using ESP32 Cam and DHT11. Here ESP-32 work as smart CAM which is able to track the image of the leaf and send those real time image to the server. Here we are using think speak to store the accuracy level parameters of each leaf record. Similar we will store temperature & humidity real time data on the think speak server. Think speak server is powered by math work.

Keywords

Agricultural, Feature Extraction, Digital image processing, Computer vision, Image Classification

1. INTRODUCTION

In every day creation and life, we frequently need to know the temperature and dampness estimation of the specific spot. On the off chance that we utilize link to send information, it will cost a ton, however the remote correspondence costs less, it sets up an association between the structures in an extremely brief timeframe, and blunder rate is very low. In this way, in the climate which link can't be utilized, the remote correspondence is more useful. Furthermore, if the collector is made into hand-held, the adaptability will increment significantly. As of now, this sort of low force remote information transmission innovation is generally utilized in modern and common field. Web of Things (IoT) is relied on to change our existence by drawing in us to screen and control key contemplates in our condition using gadgets prepared to do distinguishing, managing and distantly sending information to Wireless hoarding like cloud which stores, isolates and presents this information in huge structure. From the cloud this data can be gotten to through different front end UIs, for example, Internet or versatile applications, subordinate upon reasonableness and necessities. Web lies at the focal point of this change anticipating its movement in beneficial, solid and smart correspondence of information from contraptions to the cloud and from the cloud to the end clients. In this new viewpoint, the chance of the ordinary end structure or host in the Internet is changed and has consolidate contraptions or things starting now and into the foreseeable future the name Internet of Things. The "things" are ready for recognizing and communicating information, for example, temperature, weight, tenacity, clamor, spoiling, object region, persevering vitals, and so on Characteristic checking is an essential IoT application which consolidates watching the including condition and revealing this information for sensible present moment measures, for example, distantly controlling the warming or cooling gadgets and entire arrangement information assessments and measures.

With the occurrence to snappy Internet, a routinely extending number of people all over are interconnected. Web of Things (IoT) makes this a walk further, and accomplices people similarly as electronic gadgets which can talk among themselves [26].In India rural is assume a significant function in Indian economy, in India there is loads of ranchers are there who are buckling down, those ranchers are the main column for the Indian economy. Presently according to the horticultural there is parcels issues are there which is face by Indian rancher and those issues are downpour, crop, leaf disease these issues are make a major wreck on their cultivating. In India there is heaps of various sort of ranchers are there who are as yet not utilizing innovation and doing cultivating in old strategy, the greater part of those kind of ranchers are very insight however at some point new kind of infection influence the plat and because of that those composers

faces enormous misfortune which impact there life. Aside from cultivating some time backwoods likewise face contamination issue which make bunches of issues in whole timberland and because of that the creature who devour those plant additionally influenced by loads of illness. Comparative if any plant is influence by illness and those harvest is eaten by human because of that human additionally face bunches of issue which is some time very peril for there life. The impacted tree has a blocked turn of events and fails miserably inside 6 years. Its impact is found in Alabama, Georgia parts of Southern US. In such circumstances early area might have been beneficial. The agrarian land mass is some different option from being a dealing with sourcing these days. Indian economy is significantly poor of agrarian productivity. Henceforth in field of cultivating, disclosure of disease in plants accepts a huge work. To recognize a plant disease in early on stage, usage of customized contamination area strategy is valuable.

As we likely ammindful Plants and common items are the fundamental wellspring of essentialness for the human similarly as animals. Leafs of various plants and flavors are important to mankind due to their therapeutic attributes. Countries like Asia and Africa where over portion of people depends after cultivating creation for work, convey benefit and food security [9]. It is assessed that 30 to 40% of yields are lost each year through the creation chain [26]. Incidents from diseases also have a critical monetary impact, causing a drop in compensation for crop creators, higher entireties for customers what's more, dealers. A lot of studies have been done under changed environmental conditions, in different regions, to survey the incidents happen in view of different diseases.The rest of the paper is organized as follows. Necessary literature survey related previous research on leaf fault detection are given in II detection based previous work are given in section ii whereas section III describes Methodology&IMPLEMENTATION FOR THE PREVIOUS EXISTING & PROPOSED APPROACHES. Experimental results and its analysis are given in section IV. Finally, section Vconcludes the paper.

2. LITRECTURE REVIEW

As we most likely am mindful green is the guideline source to build up any country. For country the essential issue is leaf problem this issue will make a heaps of issue to farmers. So around there is loads of assessment is going on, so as indicated by the past examination the Ghaiwat et al. presents focus on various social affair systems that can be utilized for plant leaf ailment game-plan. For given test model, k-closest neighbor framework is evidently legitimate also as least problematic of all figurings for class measure. On the off chance that plan information isn't straightly specific, by then it is hard to pick ideal limits in SVM, which shows up as one of its disadvantages [1]. Creators in paper [2] portray that there are fundamentally four stages in made dealing with plan, out of which, initial one is, for the information RGB picture, a hiding change structure is made, considering the way that this RGB is utilized for hiding age and changed or changed over image of RGB, that is, HSI is utilized for hiding descriptor. In second step, by utilizing limit respect, green pixels are made sure about and eliminated. In third, by utilizing pre-enlisted limit level, expelling of green pixels and veiling is developed for the obliging parts that are eliminated first in this development, while picture is isolated. Plus, in last or fourth key improvement the division is finished. Mrunalini et al. [3] presents the procedure to depict and see the specific illness through which plants are influenced.

In Indian Economy a Machine learning based assertion structure will end up being phenomenally valuable as it spares endeavors, cash and time as well. The methodology given in this for fuse set extraction is the disguising co-event system. For altered affirmation of pollutions in leaves, neural structures are utilized. The methodology proposed can from an overall perspective help an unmistakable region of leaf, and is evidently tremendous framework, if there should be an occasion of steam, and root diseases, placing less proportions of imperativeness in calculation. As appeared by [14] delicate taking care of methodologies, for example, counterfeit neural structures (ANN), hereditary programming, and comfortable premise can be utilized as an elective methodology for displaying complex direct of materials, for example, graphene. These figurings require input preparing information for taking care of issues. These enlisting frameworks produce critical reactions for entangled improvement issues subject to the information. In different models feed-forward game plan of three layers can be utilized. Root-mean-square fumble methodology can be utilized to pick the measure of neurons in covered layer.[15] Vijai[16], Agricultural profitability is something on which economy fundamentally depends. This is the one clarification that burden territory in plants expect a significant movement in agribusiness field, as having tainting in plants are particularly typical. In the event that genuine idea isn't taken here, by then it causes authentic repercussions for plants and because of which particular thing quality, whole or advantage is affected. For example a disease named little leaf infirmity is a hazardous ailment found in pine trees in United States. Region of plant tainting through some tweaked framework is helpful as it lessens a huge work of seeing in massive properties of yields, and at beginning period itself it perceives the

responses of illnesses for example right when they show up on plant leaves. This paper presents a figuring for picture division strategy which is utilized for changed territory and depiction of plant leaf illnesses. Konstantinos[17], In this paper creator use CNF models and dependent on that model they peform the disease identification measure on plat leaf. The all around high achievement rate makes the model an incredibly obliging rebuke or early advice instrument, and a way of thinking that could be moreover loosened up to help an arranged plant sickness perceiving proof framework to work in guaranteed improvement conditions. Komal[18], This paper presents, Image dealing with strategies are broadly utilized for the exposure and strategy of diseases for different plants. The structure of the plant and proximity of the contamination on the plant address a test for picture arranging. This appraisal acknowledges SVM (Support Vector Machine) based picture arranging way to deal with oversee examination and solicitation three of the rice crop infections. The technique includes two stages, for example preparing stage and sickness gauge stage. The way of thinking sees illness on the leaf utilizing orchestrated classifier. The proposed examine work improves SVM limits (gamma, nu) for most noticeable benefit.

The outcomes show that the proposed approach accomplished 94.16% accuracy with 5.83% misclassification rate, 91.6% review rate and 90.9% precision. These revelations were separated and picture managing methods talked about to stress forming. Florian[19], The assessment introduced in this paper relies upon the in-field affirmation of foliar esca signs during summer, showing an ordinary "striped" structure. Without a doubt, in-field affliction affirmation has demonstrated momentous potential for business applications and has been enough utilized for other agrarian requirements, for example, yield assessment. Division with foliar responses accomplished by different infirmities or abiotic stresses was additionally considered. Tanzeel[20], This paper by and large viewed as current utilization of quantifiable AI procedures in machine vision structures, assessments every system potential for unequivocal application and addresses a review of edifying models in various developing districts. Proposals of express certifiable AI strategy for unequivocal clarification and objectives of every system are in addition given. Future instances of genuine AI headway applications are talked about. Gittaly[21], This paper, address an extensive spotlight on confusion assertion and social affair of plant leafs utilizing picture preparing approachs Abu Bakar[22], This paper depicts an arranged framework for exposure of infirmities on leaves called Rice Leaf Blast (RLB) utilizing picture arranging strategy. It joins the picture pre-preparing, picture division and picture assessment where Hue Saturation Value (HSV) hiding space is utilized. To confine the region of interest, picture

division (the most fundamental undertaking in picture arranging) is applied, and structure insistence subject to Multi-Level Haya[23],

The paper reason for this assessment was to build up a schematic show to look at the disease scene. P. infestans were segregated and perceived subject to morphological attributes, serological and species-express PCR measures. Ten models were orchestrated and inspected morphologically and serologically (dipstick). Delima[24], In this paper producer present the red Onion is a tuber plant that is ordinarily utilized by the individuals of Indonesia, both as flavors and home created drugs. Jihen[25], Plant infirmities are immense factors as they understand bona fide reduction in quality and proportion of agribusiness things. Thusly, early disclosure and confirmation of these diseases are immense. To this end, we propose a huge learning-based methodology that robotizes the course toward social affair banana leaves illnesses. Specifically, we utilize the LeNet working as a convolutional neural structure to mastermind picture illuminating documents. So subject to that there is essential where farmer can check what sort of illness are there on there crops.These are past explores which are identified with the leaf issue discovery.As per the previous approach we found some of the research gaps which need to be solve those research gaps are:

- **No any IoTenable system**
- **Not able to get real time temperature & humidity data with leaf quality**
- **Latency Issue**
- **Not Applicable for most of the leaf: Current solutions**
- **Lack in Quality**
- **Time & Quality management issue**
- **Lack in Accuracy**
- **No real time hardware system**
- **No any real time integrated camera system**

3. METHADOLOGY & IMPLEMENTATION

In this section we talk about the our proposed approach of our architecture & algorithm, which is able to detect the infection on leaf image in real time and also able to get temperature & humidity real time data as our proposed system is IoT enabled, here we also talk about the previous existing approaches.

Previous Approaches:
3.1 Vijay [16]:
As per this algorithm author use the followings technique:

1. Image Acquisition: Using this process leaf image is convert into the digital encoded form.
2. Removal of Distortion
3. Threshold: To get Green pixel
4. Based on green pixel find infection on leaf

3.2 Konstantinos[17]:

As per this algorithm author use the followings technique:

1. Convolutional neural network models
2. Deep learning approach to detect the health of the leaves.
3. Training: Here they use the training model based

3.3 Komal[18]:

As per this algorithm author use the followings technique:

1. Image acquisition process
2. Preprocessingapproach which is based on sift algorithm

3.4 Jihen[25]:

As per this algorithm author use the followings steps:

1. Image Resize
2. Color Transformation
3. Feature Extraction Model
4. Classification Model

Based on these steps author detect the fault on the leaf. Here author use the feature extraction and image classification, model technique. As we know present era there is need of fast processing system so for the implementation of those previous algorithm, we use python as a language, here we use some common library for implementations of existing approaches are those are:

1. Numpy
2. Matplot
3. OpenCv
4. Pillow
5. Scikit-image

These are some library which we use for the implementation of existing algorithms.

Proposed Algorithm Approaches:

As we know now a days in agricultural field, there is lots of issues are there, but on all those approach leaf infection detection is most critical issue, it's very difficult to find leaf infection, there is need of some of the automated system which is able to find the leaf infection. As we know if plant leaf is infected so it will affect the outcome product of that plat which is increase lots of financial issue for the farmer if they are not able to detect the issue in correct time. So based on that we proposed an novel algorithm which is able to detect the infection of infected leaf. As per our proposed approach are able to find the green pixel and based on green pixel we do the segmentation process and at final result we find the infection on infected leaf.

As per our propsoed approch therse are the step we take toi get the result:

The step-by-step procedure of the proposed system:

- Insert Image
- Image acquisition
- RGB to HIS Color Transformation
- Green-pixels masking
- Removal of masked green pixels;
- Segmentation the components
- Obtain useful segments;
- Evaluating feature parameters for classification;
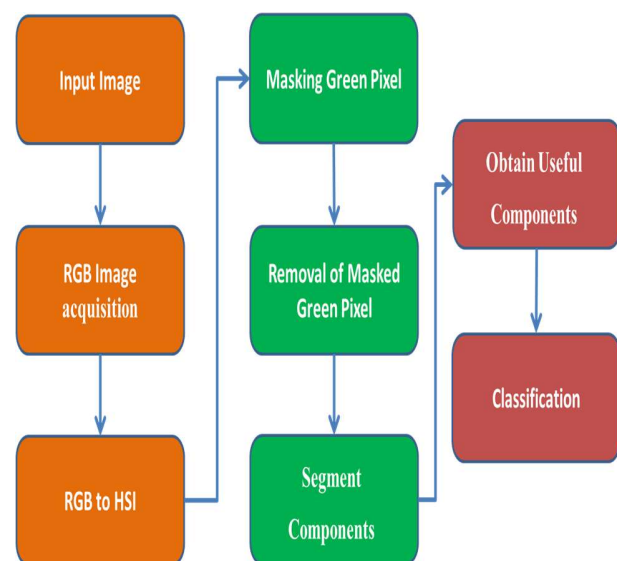- Configuring SVM for Infection detection.

Figure. 1 Proposed Approach Block Diagram

Proposed Architecture Approaches:

Here we present our proposed architecture which is able to capture the real time image of the leaf and send that image to the cloud server where cloud server have our proposed algorithm which is able to get the leaf accuracy analysis, apart from that we also integrate Temperature & Humidity factor which provide the real time farm analysis to the farmer which is really great help for them in present COVID-19 situation.

Here we use the followings components:

1. **ESP 32 CAM**
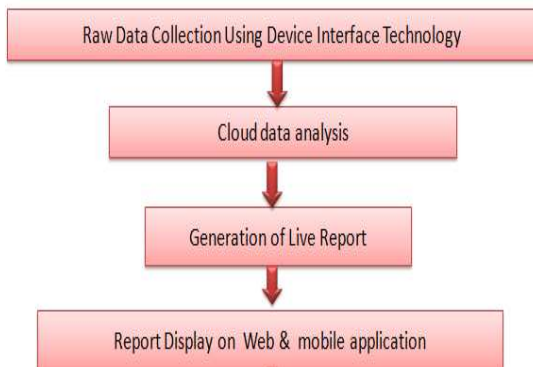2. **DHT11**
3. **Lithium 180mah Battery**

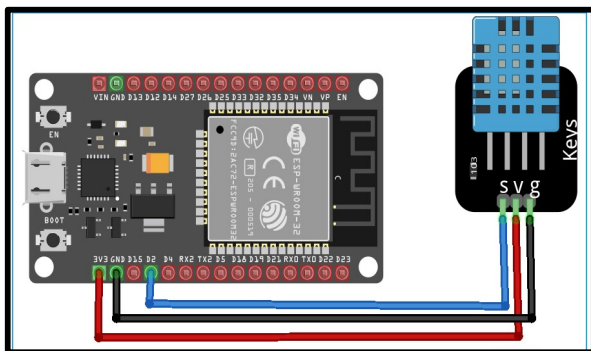**Figure. 2** Proposed Approach Flow Diagram

Figure. 3 ESP32 & DHT11 Connection

Figure. 4 ESP32 with Cam

4. RESULT & ANALYSIS

In this section we introduce the relative investigation of all with past existing methodology. As we can see figure 5 is test image and there is total 34infected part on the leaf and on fig 4.2 leaf image have 18 infected part , we apply this test image as an input in all approaches and based on that we will do the comparative analysis Here we did the analysis of followings approaches based on followings parameters:

1. Time Complexity
2. Error Level (% Accuracy)

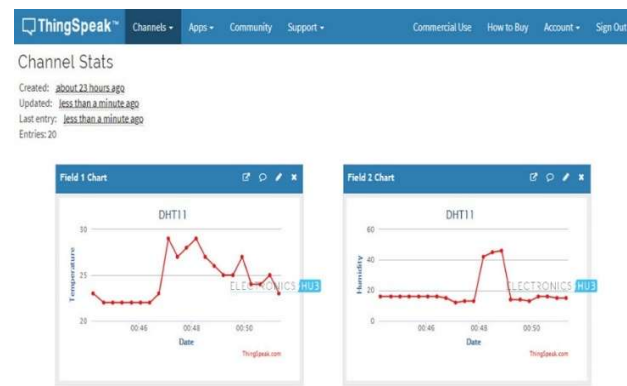Thingspeak Temperature & Humidity Real Time Data:
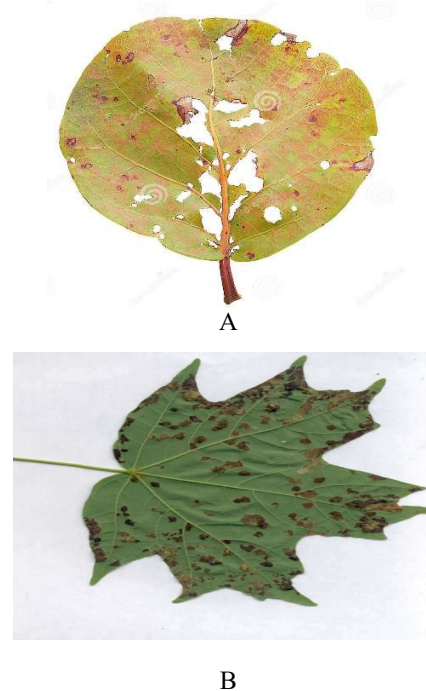

Figure. 5 Thingspeak Result Data

A

B

Figure. 6 Test Images A (Test Image 1), B (Test Image 2)

Table 4.1 Error AnalysisFor Test Image A

Process	Time (mSec)
Proposed	27
Vijay	37
Konstantinos	43
Komal	61
Jihen	49

Table 4.2 Error Analysis For Test Image B

Process	No. of Real Fault	No. of fault detected by approach	% Accuracy
Propsoed	25	20	80.00
Vijay	25	16	64.00
Konstantinos	25	17	68.00
Komal	25	13	52.00
Jihen	25	10	40.00

Table 4.3 Time AnalysisFor Test Image A

Process	No. of Real Fault	No. of fault detected by approach	% Accuracy
Propsoed	105	89	84.76
Vijay	105	72	68.57
Konstantinos	105	76	72.38
Komal	105	67	63.80
Jihen	105	61	58.09

Table 4.4 Time Analysis For Test Image B

Process	Time (mSec)
Proposed	29
Vijay	42
Konstantinos	46
Komal	68
Jihen	53

Here Table 4.1 shows the comparative analysis of accuracy, as per the analysis we can see proposed approach is best in terms of accuracy level as compare to other approaches.

Here Table 4.2 . 4.3& 4.4 shows the comparative analysis of time, as per the analysis we can see our proposed approach is best in terms of time parameters. as compare to other approaches. Similar Table 4.3 shows the comparative time analysis where our proposed approach is again best in terms of all the other approaches.

5. CONCLUSION

As we alredy know about the COVI-19 and due to COVID-19 how's the human life change & now its called a new life. In this life human are more dependent on the technology. Similar agricultural industry is also impacted by COVID-19 so now a days most of the farmers are using technology. In this paper we present an IoT enabled Leaf defect detection with real time temperature & humidity data. As per our propose architecture & algorithm in terms of all other approaches our prosed approach is far better. Here we are able to get the accuracy between 80-95%, apart from that in terms of time complexity we are able to generate result in quick time as per the previous approach we are able to improve the time complexity by 20-30%.

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