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Image Processing Based Leaf Disease Detection Using Raspberry Pi

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***Abstract*- Green plants are very much important to the human environment; they form the basis for the sustainability and long term health of environmental systems. In this project, we have proposed a system using raspberry pi to detect healthy and unhealthy plants & alerts the farmer by sending email. The main objective of this project is detection of diseases at the early stage. We mainly focus on image processing techniques. This includes a series of steps from capturing the image of leaves to identifying the disease through the implementation in raspberry pi. Raspberry pi is used to interface the camera and the display device along which the data is stored in the cloud. Here the main feature is that the crops in the field are continuously monitored and the data is streamed lively. The captured images are analyzed by various steps like acquisition, preprocessing, segmentation, clustering. This turn reduces the need for labor in large farm lands. Also the cost and efforts are reduced whereas the productivity is increased. Automatic detection of symptoms of diseases is useful for upgrading agricultural products. Completely automatic design and implementation of these technologies will make a significant contribution to the chemical application.**

***Keywords*- Image processing, Raspberry Pi, Python.**

I. INTRODUCTION

India is notable for its generation of horticulture. The majority of the masses depends upon horticulture Farmers have a variety of cultivation options in the field. These crops are still cultivated in a technical manner for the best harvest and the highest quality of production. Thus, the yield can be increased and the use of technology can improve quality.

Generally speaking, when a plant has disease, we can say that leaves are the fundamental marker of the plant's disease. We can generally observe the spots on her leaves due to illness. However, when the plant has a lot of infection, the whole leaf is secured by the sickness spots. India is quick creating nation and farming is the spine for the nation's advancement in the beginning times. Because of industrialization and globalization ideas the field is confronting obstacles.

Over that the mindfulness and the need of the development should be imparted in the brains of the more youthful age.Presentlymulti day's innovation assumes essential job in every one of the fields yet till today we are utilizing some old procedures in horticulture. Recognizing plant ailment wrongly prompts colossal loss of yield, time, cash and nature of item. Recognizing the state of plant assumes a vital job for fruitful development. In former times ID is done physically by the accomplished individuals yet due to the such a significant number of natural changes the forecast is getting to be extreme. Sowe can utilize picture handling procedures for recognizable proof of plant malady. By and large we can watch the side effects of ailment on leaf, stems, blossoms and so forth so here we use leaf for distinguishing proof of sickness influencedplants.

II. LITERATURE REVIEW

Image acquisition, pre processing of images, extraction of features, recognition and order of plant infection are the essential strides for ailment discovery utilizing image Processing. High quality and clarity of enhanced images compared to the original image The created handling plan comprises of four primary stages as in The accompanying two stages are included progressively after the division stage.

In the initial step we recognize the mostly green hued pixels. Next, these pixels are conceal dependent on explicit limit esteems that are processed utilizing Otsu's technique, at that point those for the most part green pixels are veiled. The other extra advance is that the pixels with zeros red, green and blue qualities and the pixels on the limits of the tainted group (object) were totally expelled. The trial results exhibit that the proposed strategy is a

powerful procedure for the location of plant leaves infections. The created algorithms proficiency can effectively recognize and arrange the inspected illnesses [1].

The primary colors of the color image are red, green and blue. Because of its range, it is hard to implement the application using RGB. They therefore convert RGB to gray pictures. Detection of plant disease by some automatic technique is beneficial as it reduces extensive monitoring work in large crop farms and distinguishes the side effects how low - level image features such as color and discusses the Gabor filter and ANN respectively for feature extraction and classification [7].

An Overview of the Research on Plant Leaves Disease location utilizing Image Processing Techniques by **Kiran R. Gavhale, and U. Gawande, Gavhale and Gawande (2014)** introduced audits and outlines picture preparing procedures for a few plant animal groups that have been utilized for perceiving plant illnesses. The real systems for identification of plant infections are: back proliferation neural system (BPNN), Support Vector Machine (SVM), K-closest neighbor (KNN), and Spatial Gray-level Dependence Matrices (SGDM). These strategies are utilized to investigations the solid and ailing plants leaves [8].

Astute Diagnose System of Wheat Diseases Based on Android Phone by **Y. Q. Xia, Y. Li, and C. Li , In 2015, Xia and Li** have proposed the android structure of shrewd wheat ailments analyze framework. In this procedure, clients gather pictures of wheat maladies utilizing Android telephones and send the pictures over the system International Journal of Pure and Applied Mathematics Volume 119 No. 14 2018, 879-884 ISSN: 1314-3395 (on-line adaptation) url: http://www.ijpam.eu Special Issue ijpam.eu 879 to the server for sickness determination.

Subsequent to accepting illness pictures, the server performs picture division by changing over the pictures from RGB shading space to HSI shading space. The shading and surface highlights of the sicknesses are to be controlled by utilizing shading minute framework and the dark dimension co-event grid.

The favored highlights are contribution to the help vector machine for acknowledgment and the recognizable proof outcomes are encouraged back to the customer [9].

Usage of RGB and Gray scale pictures in plant leaves malady discovery– similar investigation by **Padmavathi and Thangadurai (2016)** have given the near consequences of RGB and Gray scale pictures in leaf ailment discovering process.

In recognizing the contaminated leaves, shading turns into a vital component to discover the malady power. They have considered Grayscale and RGB pictures and utilized middle channel for picture improvement and division for extraction of the sick bit which are utilized to recognize the sickness level. The plant ailment acknowledgment display, in view of leaf picture order, by the utilization of profound convolution systems has created. 13 sorts of infections are distinguished from the solid leaves with the ability to separate leaves from their environment [10].

Khirade et al. [11] has examined some division and highlight extraction calculation that can be utilized for the recognition of plant maladies by utilizing the picture of their leaves. It is hard to recognize the plant infections physically because of prerequisite of unreasonable time, learning of plant illnesses and much measure of work. The creator hasseparated the whole procedure of plant leaf infections location into five stages: Image securing, Preprocessing, Segmentation, Feature extraction and Final arrangement of maladies. Picture procurement utilized the change structure for RGB leaf picture.

At that point picture is pre-prepared to evacuate the commotion and upgrade the picture differentiates. Division is accomplished for the parceling of picture into different component parts utilizing k-implies grouping, Otsu channels and so forth. This fragmented picture is additionally utilized for highlight extraction and after that last order is performed utilizing different arrangement procedures. Along these lines, plant infections can be proficiently distinguished.

Sannakki et al. [12] has utilized feed forward back engendering Neural Network based method for the determination and order of sicknesses in grape leaf. Creator has utilized the picture s of grape leaf with complex foundation for the finding as info. Further anisotropic dissemination is utilized to expel the clamor of the picture which is additionally divided utilizing k-implies grouping. At long last outcomes are watched utilizing neural system. Results are investigated wool mold and fine buildup pictures with reproduction in MATLAB. Disarray network is considered with the genuine positive and false positive parameters for the approval of results. The creator professed to have the preparation exactness of 100% whenever utilized tint includealone.

Kutty et al. [13] has utilized the neural system based framework to order the watermelon leaf illnesses of Downey Mildew and Anthracnose. Creator has determined the genuine positive rate, genuine negative rate and in general exactness for the proficiency of the proposed idea This arrangement depends on the shading highlight extraction from RGB shading model which is acquired from the recognized pixels in the district of intrigue.. The general execution is portrayed with ROC bend having AUC estimation of 0.5. The genuine characterization result likewise delineates the estimation of 75.9%.

Rothe et al. [14] has proposed design acknowledgment strategies for the discovery and order of cotton leaf illnesses of Alternarnia, Myrothecium and Bacterial Blight. The dataset pictures are taken from the field of Central Institute of Cotton Research Nagpur. Dynamic form based division calculation is utilized for the violation of unhealthy spots. Creator has likewise recommended some component bearings to the comparable idea for the harvests of wheat, orange, citrus and maize and so on.

Pearson, Roger C et al [15] Among all plant leaf sicknesses, those brought about by infections are the most hard to analyze, infections produce no indications that can promptly watched and regularly effectively mistook for supplement lacks and herbicide injury A phids leaf hoppers, whiteflies and cucumber scarabs creepy crawlies are normal transporters of this disease, Example Mosaic infection, search for yellow or spots on foliage, leave may be wrinkled, twisted and development might behindered.

III. DISEASES

A Leaf miners are the larval stage insect family. They feed between the top and bottom of the leaf.

Fig 1. Leaf Minor Disease.

Because of the huge measure of bug in the plant, it is truly harmed. The quantity of slimy parasites can be six on one leaf. It can thusly genuinely harm the plant leaf. It can restrain plant development, inciting lower yields.

Fig 2. Anthracnose Diseases.

We can build up a picture handling system torecognize and arrange the sickness. This counteracts human impedance and consequently prompts an exact, fairchoice. When all is said in done, whatever our observation on the ailment is used only for the sickness decision. A plant disease sign is a conspicuous effect on the plant. Signs can change the shading, change the shape or change the plant's ability as demonstrated by its response to pathogens, bugs, etc.

The contracting of the leaf is a feature. Verticilium wither symptom. It is realized by V.dahliae and Verticillium alboatrum infectious plant pathogens.

Generally fundamental signs of bacterial contamination are dull shaded,necrotic wounds included by a magnificent light yellow brilliance on the edge of the plant leaf or inside the leaf on the bean plants. You don't see the pathogen of the illness, yet a reaction achieved by the pathogen.

IV. STREAM DIAGRAM OF THE SYSTEM

1. Block Diagram:

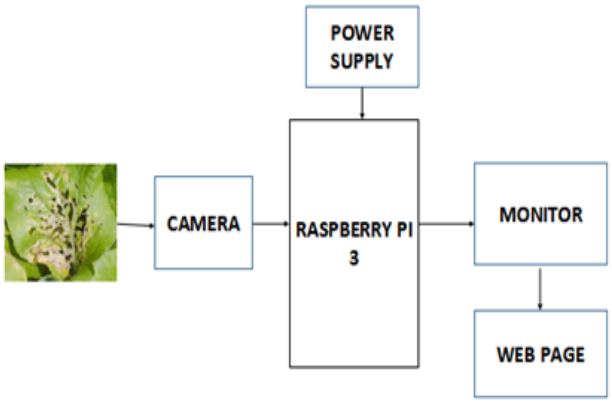

Fig 3. Block diagram of plant disease detection.

2. Block DiagramDescription:

2.1 Power Supply: A 5V, 1A control supply is required for this framework. The exceptional association is accommodated the raspberry pi demonstrate B. The power supply can be given by utilizing that USB association.

2.2 Camera: Used to catch a yield picture, it is legitimately associated with the Pi 3 Model B raspberry. There are two different ways to associate the camera to the Pi 3 display B raspberry. The first is by means of USB port and the second is a 15pin header for raspberry Pi3 camerainterface.

2.3 Raspberry PI: Raspberry Pi is a little PC like module. The camera caught picture will be sent to the Raspberry Pi.Using Open CV library; Raspberry Pi forms the picture and recognizesit.

2.4 Screen as presentation: The screen shows the name of the infection identified and the name of the pesticide.

2.5 Email: The email will be sent to the framework proprietor. This email contains the identified infection and the pesticide's name.

3. Flow Diagram:

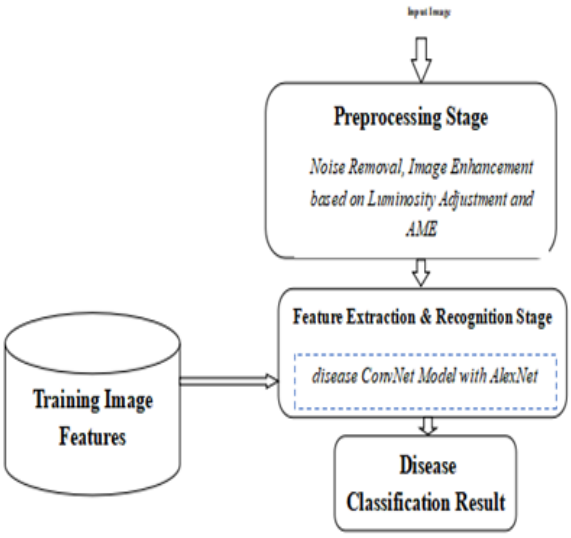

Fig 4. Flow diagram of leaf disease detection.

V. ALGORITHM

- Capture the RGB format image.
- Produce structure of shading change.
- Convert RGB shading regards to the predefined space in that structure.
- Apply K means image segmentation Grouping.
- Green pixel masking (green channel masking).
- Eliminate the masked cells within the infected cluster edges.
- Convert the RGB to HIS infected cluster.
- SGDM matrix generation for H andS.
- To calculate its features, call GLCM function.
- Texture statistics computing
- Recognition configures k – m (classifier).

Disease detection using the method of K Means Clustering [2]. The algorithm provides the vital strides to recognize the plant leaf Image. In the underlying advance, the RGB pictures of all leaves are for the most part caught by camera. In stage 2 a shading change structure is framed and afterward shading space change is connected in stage 3.

So as to perform stage 4, these two stages are to be expected. So as to perform stage 4, these two stages are not out of the ordinary. These four stages are in stage one, identified and controlled by the infected objects.

The green pixels will be recognized in step 5. Then green pixel covering is done as pursues: if the pixel's green shading esteem is not exactly the limit esteem that we have officially determined, at that point the pixel's red, green and blue part esteems are made zero.

This is done because this is the part that has not been affected That is the reason esteems are made zero which additionally prompts a decrease in counts. Also, the time eaten up by the raspberry pi3 to show the last yield will be phenomenally diminished.

The pixels with zero a motivating force for red, green and blue and the pixels at the edge of the debased bundles are completely ousted in step 6. Phase 2 consolidates stage 5 and stage 6, and this stage gives included clarity in the gathering of this infection. These outcomes with extra ordinary acknowledgment and execution should be lessened to its base regard; similarly concerning the most part required figuring time.

The contaminated group will be changed over from RGB structure to HSI position in step number seven. Starting now and into the for eseeable future, the SGDM frameworks will be made for each pixel of the picture. In any case, this is cultivated for pictures of H and S and not I.

Truly, the SGDM [1] measures the likelihood that a given pixel will happen at a particular dim measurement at a substitute partition and presentation edge from the other pixel, anyway pixel has a second explicit diminish level. For every single picture, surface measurements are produced from the SGDM frameworks. Inside the edge of the corrupted bit of the leaf, the features are resolved for the pixels present. That suggests uninvolved the part that isn't influenced inside the breaking point of sullied parts. Stages 7 to 10 under stage three.

In this phase the texture related characteristics are calculated for the segmented objects. Finally, the process of recognition was performed in the fourth phase. The ventures in the calculation are rehashed each time for each picture we captured. The result will be transferred to the GSM module after this. The result will be sent as an e mail using Raspberry Pi and will also be displayed on the monitor.

VI. TECHNOLOGIES

1. OpenCV:

OpenCV represents Computer Vision Open Source. It contains the library of programming capacities for is AI programming. Open CV is required for picture handling applications continuously. OpenCV is created generally in C, C++ and its guideline interface is in C++ language, yet regardless of all that it holds a less no matter how you look at it yet wide C language interface.

2. Python:
Is modest Python, simple to learn. It is required for raspberry Pi - related code programming. Python is a language that supports both as packages and modules. Besides the standard library, it also has a Python interpreter. They are available to all platforms free of charge in both source and binary form, and can be unreservedly disseminated toeveryone. Python is a language scripting that empowers line - by - line execution of the code.

3. Tomcatserver:
There are two server types

- Server ofapplications
- Webserver

Apache Software Foundation is developing an open source web server. The database includes images of the infected and healthy leaves from different angles in our system. This is a large database. Some processes also require java based systems for image processing. So we are using this server from Tomcat.

4 . KERAS 2.2.4:
Keras is an API designed for human beings, not machines. Keras follows best practices for reducing cognitive load: it offers consistent & simple APIs, it minimizes the number of user actions required for common use cases, and it provides clear & actionable error messages.

VII. EXPECTED RESULT

Leaves of illnesses are chosen for recognition as fine buildup, fleece mold, dark Dot. The server makes the database for solid leaves and sick leaves. To contrast the pictures and wiped out and solid leaves, this is essential.

The sort of illness is along these lines arranged by examination. Figure 6, Figure 7, Figure 8 demonstrates the normal yield, which incorporates for the most part portioned picture, grayscale picture, removed picture highlight of Fig 5.

Fig 5. Downy Mildew.

Fig 6. Segmented Image.

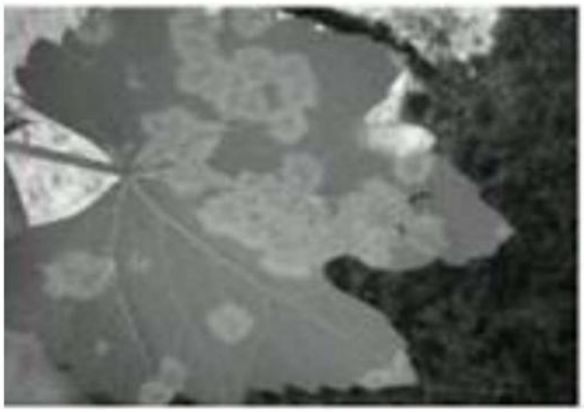

Fig 7. Grayscale Image.

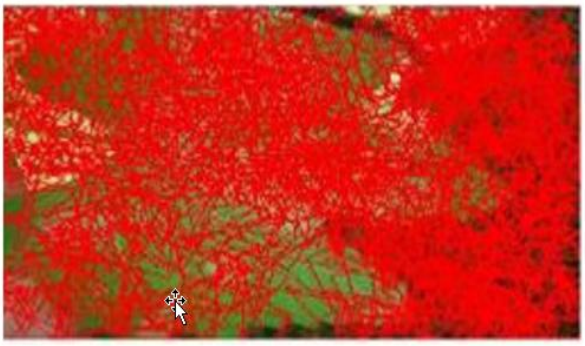

Fig 8. Feature Extracted Image.

VIII. CONCLUSION

The project deals with identifying the disease affected leaf.There are essentially three fundamental kinds of Leaf ailment, Bacterial, Fungal and Viral. The precision of plant ailment recognition is essential in plant ailment location, however the procedure ought to be rapid in the meantime Work can be stretched out by utilizing quad copter at field level to catch pictures of the leaves of the different plants in the farm.

This is achieved through the machine learning Algorithm. If the leaf is affected by disease, then the information is shared through the IoT web Page. This helps the farmer to find a solution without coming towards the field.

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