Plant Disease Detection Using Raspberry PI By K-means Clustering Algorithm

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Abstract—For the detection and prevention of disease of plants from getting spread, this paper discussed a system using raspberry PI. For the image analysis, the k-means clustering algorithm was used. It has many advantages for the use in big farms of crops and thus it automatically detects signs of disease whenever they appear on leaves of the plant. In pharmaceutical research of leaf disease detection is necessary and important topic for researchbecause it has advantagesin monitoringcrops in field at the form and thus it automatically detect symptoms of disease by image processing by k-means clustering algorithm. The term disease means the type of damage tothe plants. This paper provides the best method for detection of plant diseases using image processing and alerting about the disease caused by sending email, SMS and displaying the name of the disease on the monitor display of the owner of the system.To upgrade agricultural products, automatic detection of disease symptoms is useful. The design and implementation of these technologies which is totally automatic and it will significantlyhelp in the chemical application. It will reduce the cost required for the pesticides and other products.This will lead to increasein productivity of the farming.

Index Terms—Image Processing,GSM, Raspberry Pi, Python.

I. INTRODUCTION

India is well known for its agriculture production. Most of the of the population is dependent on agriculture. Farmers have variety of options to cultivate crops in the field. Still, the cultivating these crops for bestharvest and top quality of production is done in a technical way. So the yield can be increased and quality can be improved by the use of technology.

Generally, whenever there is disease to a plant, we can say that leaves are the main indicator of the disease caused to the plant. Mostly we can see the spots on the leaves of it due to disease. However when the amount of disease to the plant is large then the whole leaf gets covered by the disease spots.

II. DISEASES

Leaf miners are the insect family at larval stage.They feed between upper and lower part of the leaf.

Fig1: Leaf miner disease

Due to insect on very much amount in plant, it is severely damaged. On a single leaf the number of maggots can be six. Therefore, it can severely damage the leaf of plant. It can restrict plantgrowth, leads to reduced yields.

Fig 2: Yellow Spot Disease

Hence we can develop a technique using image processing to detect the disease, to classify it.This will avoid human interference and hence lead to précised unprejudiced decision.

Generally , whatever our observation about the disease is just used for the decision of the disease. A symptom of plant disease is a visible effect of disease on the plant. Symptoms can be change in color, change in the shape or functional changes of the plant as per its response to the pathogens, insects etc. Leaf wilting is a characteristic

symptom of verticilium wilt. It is caused due to the fungal plant pathogens V. dahliaeand Verticillium albo-atrum. General common bacterial disease symptoms are brown, necrotic lesions which gets surrounded by a bright light yellow halo at the edge of the leaf of the plant or at innerpart of the leaf on the bean plants. You are not actually seeing the disease pathogen, but rather a symptom that is being caused by the pathogen.

III. ARCHITECTURE AND FLOW DIAGRAM OF THE SYSTEM

1. ARCHITECTURE OF THE SYSTEM

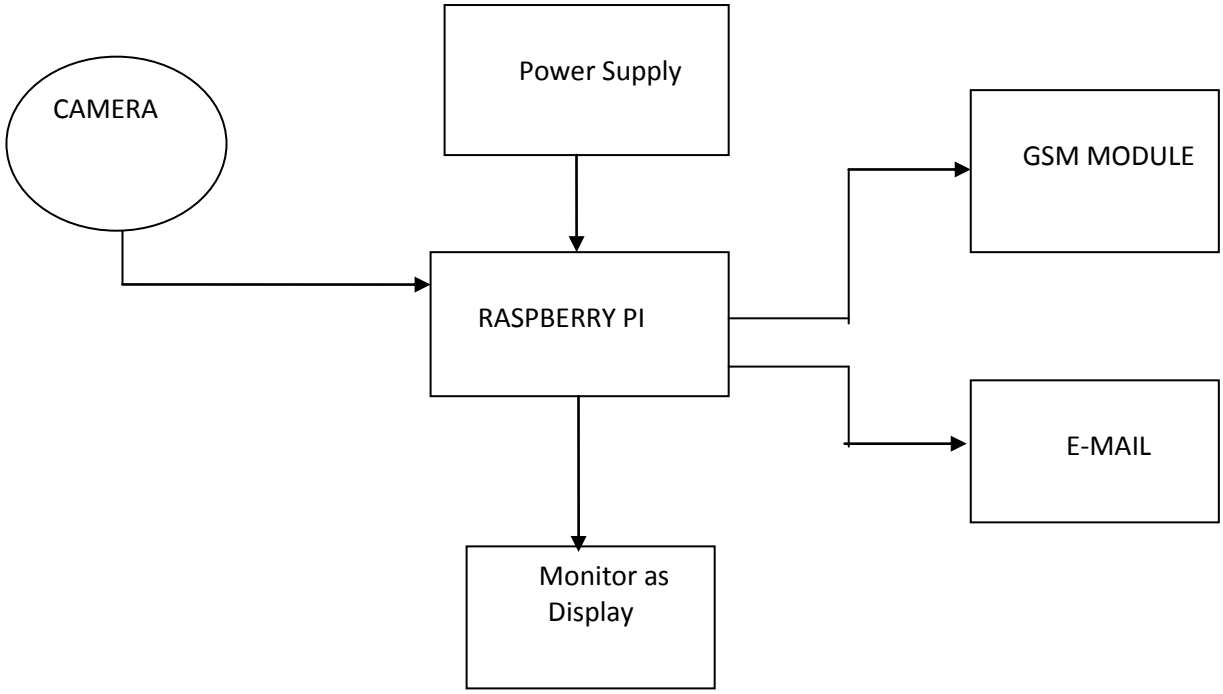


Fig. 3: Block Diagram

A. Block Diagram Description

1. Power Supply

This system requires 5V, 1A power supply. The raspberry pi model B has the special connection provided. Using that USB connection the power supply can be provided.

2. **Camera**

It is used to capture an image of crops, it is directly connected to the raspberry Pi 3 Model B. There are two ways to connect camera to raspberry Pi 3 model B. First one is through USB port and second is 15 pin header provided for camera interface of raspberry Pi3.

3. **Raspberry PI**

Raspberry Pi is small size module like a small computer. The image captured by camera is sent to the Raspberry Pi. Using open CV library, the image is processed and detected by the Raspberry Pi.

4. GSM

It is used to send the SMS to the owner of the system, this message consists of name of the disease detected by the processor.

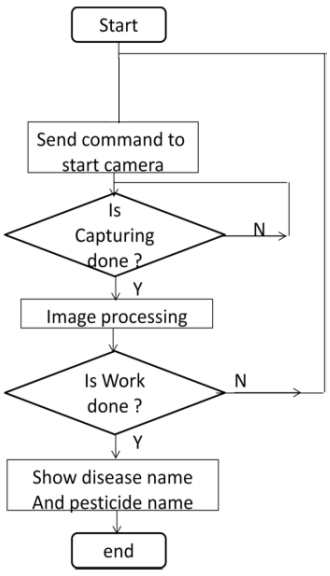
5. Monitor as display

The monitor is used to display the detected disease name and also the pesticide name.

6. **E-MAIL**

The email is sent to the owner of the system. This email contains the disease detected and name of the pesticide.

2. Flow Diagram



IV. ALGORITHM

1. Capture the image in RGB format.
2. Generate color transformation structure.
3. Convert color values from RGB to the space specified in that structure.
4. Apply K means clustering for image segmentation.
5. Masking of green pixels (masking green channel).
6. Eliminate the masked cells present inside the edges of the infected cluster.
7. Convert the infected cluster from RGB to HIS.
8. Generation of SGDM matrix for H and S.
9. Calling GLCM function in order to calculate the features of it.
10. Computation of texture statistics
11. Configure k-nn (classifier) for recognition.

Disease detection by using k clustering method [2].The algorithm provides the necessary steps required for the image detection of the plant leaf.In the first step, generally the RGB images of all the leaves are capturedusing camera. In step 2 a color transformation structureis formed, and thencolor space transformationis applied in step 3.These two steps are to be expectedin order to perform step 4. In this step the images which we have got are processed for segmentation by using the K-Means clustering technique [2]. These four steps come under phase one, the infectedobjectsdetected and determined.

In step 5, the green pixels are detected. Then masking of green pixels is done as: if the green color value of pixel is less thanthe threshold value which we already have calculated, then the red, green and bluecomponents values of the these pixel aremade zero. This is done because these are the unaffected part. That is why there values are made zero which results in reduction in calculations as well.Additionally, the time consumed by the raspberry pi3 for showing the final output will greatly minimized.

In step 6 the pixels having zero value for red, green and blue andthe pixels on the edge of the infected clustersare removed completely. Phase 2contains step five and step number six and thisphase gives addedclarity in the classifying of that disease. This results with good detection and performance, also generally required computing time should bedecreased to its minimum value.

In step number seven, the infected cluster is converted fromRGB form to HSI format.After that , the SGDMmatrices arecreated for every pixel of the image. But this is done for only for H and S images and not for the I images. The SGDM [1] actually measures theprobability that a given pixel at one particular gray level willoccur at a different distance and angle of orientation from otherpixel, however pixel has a second particular gray level for it. Fromthe SGDM matrices, generation of texture statistics for each and every image is done.

Concisely, the features are calculated for the pixelspresent inside the edge of the infected part of the leaf. That means, the part which is not affetced inside the boundary of infected partgets uninvolved. Steps seven to tencome under phase three. In this phasethe features related to texture for the objects being segmented are computed. Finally, the recognition process in the fourth phasewas performed. For each image we have captured the steps in the algorithm are repeated each time. After this the result are transferred to GSM module. Using Raspberry Pi the result is sent as e -mail, and also is displayed on monitor.

V. TECHNOLOGIES

A. OpenCV

OpenCV stands for Open Source Computer Vision. It ismachine learning software library.It contains library of programming functions. Open CV is required for real time applications related with image processing. OpenCV is mostly written in C,C++ languages and its major interface is in C++ language, however it still retains a less widespread though very much wide interface with C language.

B. Python

Python ismodest, easy to learn. It is required for the programming of code related to raspberry Pi. Python is a language that supports modules as well aspackages. Also it hasa Python interpreter along with the standard library. They are available in both source as well as binary form for free to all platforms, and can be freely distributed to all. Python is a scripting Language that means it allows to execute the code line by line.

C. Tomcat server

There are two types of servers.

1. Application server
2. Web server

It is an open source web server that is developed by Apache Software Foundation. In our system the database contains images of the infected and healthy leaves taken from various angles. This data base is large. Also for image processing, some processes need java based systems. So we use this Tomcat server.

VI. EXPECTED RESULT

For thedetection, leaves of diseases powdery mildew, downy mildew, black rot are selected. The database of healthy leaves and diseased leaves is created at the server. This is necessary to compare the images with diseased and healthy leaves. Hence by comparison, the

disease type is classified. Figure 5,figure 6,figure 7 shows the expected output which mainly includes segmented image, grayscale image, feature extracted image of the fig4.

Fig.4: Downy mildew

Fig. 5: segmented image

Fig 6: Grayscale image

Fig. 7: Feature extracted image

VII. CONCLUSION

Basically there are three main types of Leaf disease, they are Bacterial, Fungal and Viral. It is amportant in plant disease detection to have the accuracy in the palnt disease detection but at the same time the process should be of high speed. Work can be extended by the use of quadcopter for the capturing of images of leaves of the different plants in the farm at field level. This system can be connected to the server for further processing.

The objective of this work is the detection, classification of leaf diseases using image processing tools and all information about the disease is sent to the farmer's mobile phone through the GSM module. To increase the speed and accuracy of detection as well as classification of leaf diseases we using Raspberry pi 3 model B module. One more important benefit of this system is that it gives the name of the pesticide required to use in order to prevent the disease form spreading.It providing exact name of pesticide as per the disease, to save labor price by eliminating need of labor for regular observation of plants to check whether it is affected by any disease or not . This system will largely contribute in growth in the yield of the farms.

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