IOT based Plant Leaf Disease Detection System and Email Alert Using Raspberry PI

Dr.P. Padmaja[1], Kavya Gandu [2], Vasamsetti Vyshnavi[3], Lakshmi Guptha[4]
[1]*Professor, ECE Dept., Teegala Krishna Reddy Engineering College, Hyderabad*
[2,3,4]*student, ECE Dept., Teegala Krishna Reddy Engineering College, Hyderabad*

Abstract **- This paper framework utilizing raspberry PI to detect and prevent plant disease from spreading. The k means clustering algorithm was used for image analysis. It has numerous focal points for use in vast harvest ranches and in this way distinguishes indications of sickness naturally at whatever point they show up on plant leaves. In pharmaceutical research, the recognition of leaf ailment is essential and a critical theme for research, because it has the advantages of monitoring crops in the field in the form and thus automatically detects symptoms of disease by image processing using an algorithm clustering k - means. The term disease refers to the type of plant damage. This method gives best strategy to recognizing plant infections utilizing picture preparing and alarming the ailment brought about by email, SMS and showing the malady name on the framework proprietor's screen display. Automatic detection of symptoms of disease is useful for upgrading agricultural products. Completely automatic design and implementation of these technologies will make a significant contribution to the chemical application. The cost of pesticides and other products will be reduced. This will lead to an increase in farm productivity.**

Index Terms **- Automation, Irrigation, IOT, Raspberry Pi, ESP-8266, Sensors, Intruder Detection System, Image processing, segmentation.**

I. INTRODUCTION

The framework utilizing raspberry PI to detect and prevent plant disease from spreading. The k means clustering algorithm was used for image analysis. It has numerous focal points for use in vast harvest ranches and in this way distinguishes indications of sickness naturally at whatever point they show up on plant leaves. In pharmaceutical research, the recognition of leaf ailment is essential and a critical theme for research, because it has the advantages of monitoring crops in the field in the form and thus automatically detects symptoms of disease by image processing using an algorithm clustering k - means. The main objective is to implement best strategy to recognizing plant infections utilizing picture preparing and alarming the ailment brought about by email, SMS and showing the malady name on the framework proprietor's screen display.

II.LITERATURE SURVEY

A brief overview of existing work in various papers, which have been referred for implementation. The usage of image processing technology for plant disease degree grading eliminates the subjectivity of traditional classification methods and human-induced errors. Thus, the estimation credibility is improved, and accurate data are provided for disease studies. The method is also convenient, which simply needs computers, digital cameras with the Combination of necessary software programs to realize for the disease batch grading. The accurate detection and classification of the plant disease is very important for the successful cultivation of the crop, and this can be done by using image processing. The basic steps for disease detection using image processing include image acquisition, image preprocessing, feature extraction, detection, and classification of plant disease. Enhanced images have high quality and clarity than the original image. Colour image have primary colors red, green and blue. It is difficult to implement the application using RGB because of its range. Hence, they convert RGB to grey images. Detection of plant disease through some automatic technique is beneficial as it reduces a large work of monitoring in big farms of crops and at very early stage itself detects the symptoms of the disease. They have presented a survey on various classification techniques. Abdul hallis et al in their paper, have used MATLAB for feature extraction and image

recognition. Here digital camera is used for image capturing. Mrunalini and Prashant. R.Deshmukh Compares with threshold and the K means clustering algorithm for infected leaf analysis. The clarity of k means clustering is more accurate than other method. J.K.Patil in his paper describes the possible approach for extraction of low level image features like color and texture. Anand kulkarni in his paper discusses the Gabor filter and ANN for feature extraction and classification, respectively. Haiguang Wang in his paper stresses on the principal component analysis. PCA could reduce the dimensions of the obtained data under the premise of retaining the total data information, reduce the nod. of neurons in the input layer and increase the speed of neural networks. Maintaining the Integrity of the Specifications.

III.PROPOSED WORK

The module which is used here is Raspberry PI, which is a single board computer. The advantage of using Raspberry PI is that it is a fast processor with low power consumption. It is highly reliable with compactness. Here used object-oriented Programming language which is Python as it is a high level scripting based programming language. The main advantage of using python as a coding language is that the python interpreter and the extensive standard library are available both in source or binary form without charge for all major platforms

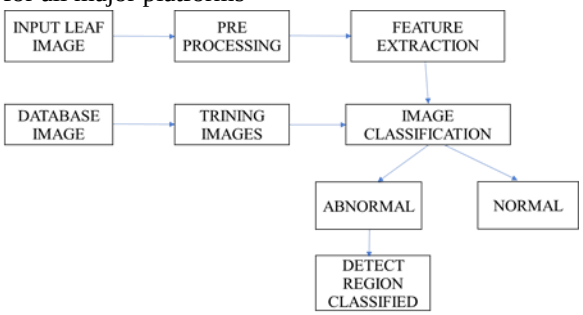

Figure 1. Block diagram

With the help of Image processing technique, condition of plant can be detected. To detect the condition following steps are used: Fig 8. Steps to detect condition of leaf 1.RGB image: Basically, the Human eye perceives the rays from an environment and identifies the color. This identification of color is through wavelength sensitive cells of an eye there are three different types of cells one for red color one for green color and another for blue color. This is the reason why the color image is stored in three different color types of matrix. This type of color matrix is called RGB.

IV.TYPES OF LEAF DISEASE

To survey major types of diseases are as follows

A. Black Spot:

Symptoms of Black spots are

- The yellowish color on leaf
- Drop of Leaf in premature stage
- Decline in growth of leaf

Figure 2. Black spot disease

B. Botrytis Blight

This type of disease is mainly caused by fungi. Symptoms of BOTRYTIS BLIGHT are:

- Brown color spots on leaf
- Dropping of buds from plant

Figure 3. Botrytis Blight

C. Leaf Spot

Symptoms of LEAF SPOT are

- Spots on the leaf are generally brown but depending on the type of fungus spots color may vary.
- Concentric rings and dark circles may fi

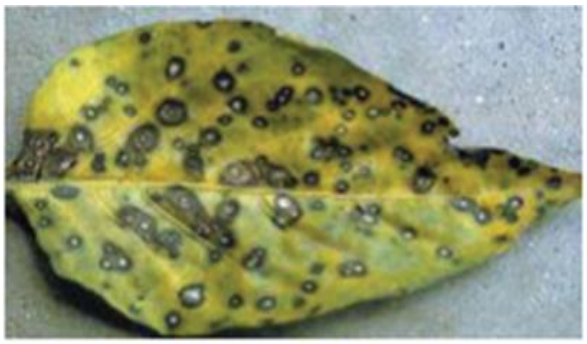

Figure 4. Leaf Spot

D. POWDERY MILDEW

This disease throws the needed nutrients away from the plant. Symptoms of POWDERY MILDEW are:

- White or gray layer on leaf and stem of plant
- Yellowness of leaf
- Premature leaf drop

Figure. 5. Powdery Mildew

E. Rust

Symptoms of rust disease are

- Defoliation of leaves of plants
- Rust is generally brownish-yellow color
- Dieback of branches
- Stunted growth of plant

V.IMPLEMENTATION

In implementation, the hardware and software used are described as

A. Raspberry PI

Raspberry Pi is one of the most popular controllers in industry. It is like a minicomputer which consists of USB port, input output pins, WIFI port, HDMI port, SD card reader and much more functionality. The Raspberry PI has a Broadcom BCM2835 on a chip (SoC), which includes an ARM1176JZFS 700 MHz processor, Video core IV GPU and was hipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but it uses an SD card for booting and persistent storage. The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language in raspberry Pi board. Various types of sensors can be connected together, Input from sensors is saved in raspberry pi through accessing sensors using python or java programming, in this prototype python programming is used.

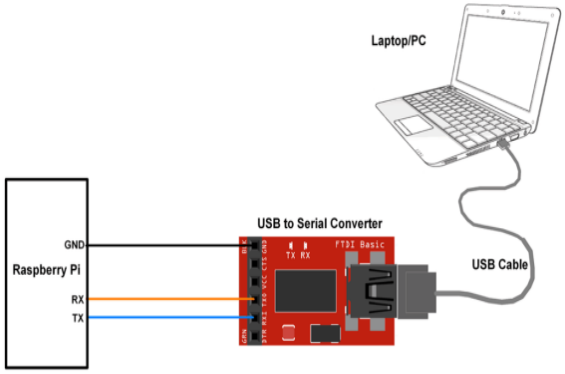

Figure. 6. Connection Diagram

Installation of raspberry pi:

a. Installation of OS (Raspbian OS for Raspberry PI) b) Installation of OpenCV for Image processing
b. Installation of all drivers required for camera Sensors Interfacing with Raspberry pi
c. Usb port Camera

B. Software Used

- Operating System Raspbian is free operating system used for raspberry pi. Its installation guide is available on raspberry pi official website. Reason for choosing Raspbian is OpenCV installation and working is Very easy in this OS.
- SERVER named Apache server is used for getting data and send it to the website.
- Python language which is a basic language of processors and controllers such as Arduino, raspberry PI, etc. All the coding related to sensor would be done in this language. This language is very easy to implement because it's coding look like basic C language. System has been using 3.3 versions of python IDE

- OPEN CV is a C++ library for image processing and computer vision.
- Image processing is the technique which processes the image and can find whatever we want by applying various methods which include in OpenCV libraries, for example, masking, segmentation, and feature extraction etc.

RGB image are basically, the Human eye perceives the rays from an environment and identifies the color. This identification of color is through wavelength sensitive cells of an eye there are three different types of cells one for red color one for green color and another for blue color. This is the reason why the color image is stored in three different color types of matrix. This type of color matrix is called RGB.

K-mean clustering is the technique which separates the image into k numbers of cluster or types according to data input based on k centroid. This algorithm is mainly used when distinguish between colors are present. Here in this image black dots are centroid of various types of color in image. The basic k-means algorithm is fairly straightforward. Given a set of n data points, k initial cluster centers are selected. Each point is then assigned to the cluster center that it is closest to. The cluster centers are then updated to be the average of all the points assigned to that cluster. This process repeats until the clusters are stable and is summarized in Algorithm.

VI RESULTS AND CONCLUSION

Leaf disease detection is successfully done by using Image processing techniques. All observations and tests are completed, and this proves that this is the solution for smart agriculture. This system definitely improves the yield of the crops increases the overall income of the farmer. 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. For further handling, this framework can be associated with the server. The point of this work is to identify, group leaf ailments utilizing picture preparing instruments and send all data about the sickness through the GSM module to the farmer's mobile phone.

Following are the results of leaf disease detection.

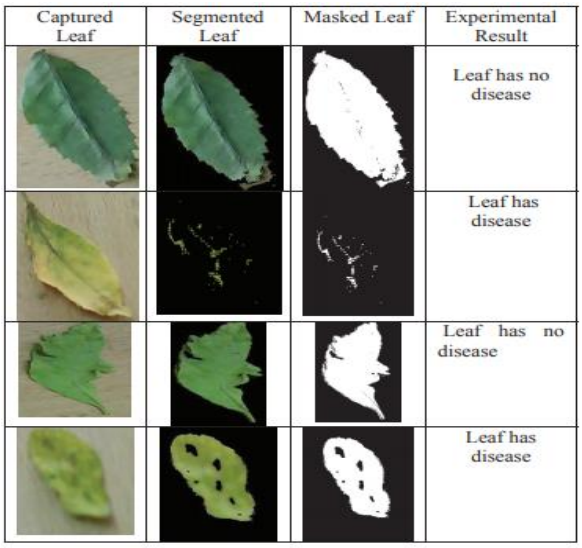

Figure.7. Output Results Observed

REFERENCES

[1] Sachin. D.Khirade, A.B.patil," Plant disease detection Using image processing,"2015, International conference on computing communication control and automation, IEEE.

[2] Monica Jhuria, Ashwani kumar and Rushikesh Borse," Image processing for Smart farming, detection of Disease and Fruit Grading," proceeding of the 2013, IEEE, second international conference on image Information processing.

[3] Vijai singh, Varsha, A.K.Mishra "Detection of unhealthy region of plant leaves using image processing and genetic algorithm", 205, ICACEA, India. K. Elissa, "Title of paper if known," unpublished.

[4] Patil.J.K,Raj kumar,"Feature Extraction of diseased leaf images 2012,journal of signal and image processing.

[5] Hongshe Dang, Jinguo Song, Qin Guo, "A Fruit Size Detecting and Grading System Based on Image Processing," 2010 Second International Conference on Intelligent Human-Machine Systems and Cybernetics, pp83-8.

[6] Chetan Dwarkani M, Ganesh Ram R, Jagannathan S, R. Priyatharshini, "Smart Farming System Using Sensors for Agricultural Task Automation", 2015 IEEE International Conference on Technological Innovations in ICT

for Agriculture and Rural Development (TIAR 2015).

[7] Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar, "IoT based Smart Agriculture", International Journal of Advanced Research in Computer and communication Engineering Vol. 5, Issue 6, June 2016.

[8] Priyanka Soni, Rekha Chahar, "A Segmentation Improved Robust PNN Model for Disease Identification in Different Leaf Images", IEEE International Conferenc e on Power Electronics, Intelligent Control and Energy Systems (ICPEICES-2016).

[9] Apeksha Thorat, Sangeeta Kumari, Nanda kishor D.Valakunde "An IoT Based Smart Solution for Leaf Disease Detection,"2017 International Conference on Big Data, IoT and Data Science (BID) Vishwakarma Institute of Technology, Pune, Dec 20-22, 2017.

[10] Prof. Sanjay B. Dhaygude, Mr.Nitin P.Kumbhar,"Agricultural plant Leaf Disease Detection Using Image Processing", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 1, January 2013.

[11] Jagadeesh D. Pujari, Rajesh Yakkundimath, Abdulmunaf S.Byadgi, "Identification and Classification of Fungal disease Affected on Agriculture/Horticulture Crops using Image Processing Techniques ", Computational Intelligence and Computing Research (ICCIC), 2014 IEEE International Conference on 18-20 Dec. 2014, IEEE, Coimbatore, India.

[12] G.Sahitya, Dr.N.Balaji, Dr. C.D Naidu, "Wireless Sensor Network for Smart Agriculture", Applied and Theoretical Computing and Communication Technology (iCATccT), 2016 2nd International Conference on 21-23 July 2016, IEEE, Bangalore, India.

[13] Vijai Singh, Varsha, Prof. A K Misra, "Detection of unhealthy region of plant leaves using Image Processing and Genetic Algorithm", 2015 International Conference on Advances in Computer Engineering and Applications (ICACEA) IMS Engineering College, Ghaziabad, India.

[14] Sudeep Marwaha, Subhash Chand, Arjit Shaha, "Disease diagnosis in Crops using Content based image retrieval", Intelligent Systems Design and Applications (ISDA), 2012 12th International Conference on 27-29 Nov. 2012, IEEE, Kochi, India.

[15] Sahitya. Roy, Dr Rajarshi. Ray, Aishwarya Roy, Subhajit Sinha, Gourab Mukherjee, Supratik Pyne, Sayantan Mitra, Sounak Basu, Subhadip Hazra, "IoT, Big Data Science & Analytics, Cloud Computing and Mobile App based Hybrid System for Smart Agriculture", Industrial Automation and Electromechanical Engineering Conference (IEMECON), 2017 8th Annual, IEEE, Bangkok, Thailand.

[16] Sachin D. Khirade, A. B. Patil, "Plant Disease detection using Image Processing", 2015 International Conference on Computing Communication Control and Automation.

[17] Prathibha S R1, Anupama Hongal 2, Jyothi M P3, "IOT based monitoring system in smart agriculture", 2017 International Conference on Recent Advances in Electronics and Communication Technology.

[18] K.Lokesh Krishna, Omayo Silver, Wasswa Fahad Malende, K.Anuradha, "Internet of Things application for Implementation of Smart Agriculture System", International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2017).

[19] John A. Stankovic, Life Fellow, IEEE "Research Directions for the Internet of Things", IEEE Internet of Things Journal (Volume: 1, Issue: 1, Feb. 2014).

[20] Lin xuefeng, Wu Shengliang, "Study on ntegrated development of modern agriculture evaluation", Business Management and Electronic Information (BMEI), 2011 International Conference on 13-15 May 2011, Guangzhou, China.

[21] Jobin Francis, Anto Sahaya Dhas D, Anoop B K, "Identification of leaf diseases in pepper plants using soft computing techniques", Emerging Devices and Smart Systems (ICEDSS), Conference on, 4-5 March 2016, Namakkal, India.