AN IMPLEMENTATION OF GRAPE PLANT DISEASE DETECTION

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ABSTRACT

Productivity of plant decreases due to infections caused by variety of diseases. The diseases not only restrict the growth of plant but also reduce quality and quantity of plant. Different technique is adopted for detecting and diagnosis the diseases but the better way is by using Image Processing. Automatic plant disease detection is an important topic in research as it has been proved useful in monitoring large crop fields, and thus automatically detects the leaf disease symptoms as soon as they appear in plant leaves. The proposed system consist of five steps, first RGB image is acquired then image is converted into color transformation structure then structure is converted into HIS image, using threshold value, then the image is segmented using segmentation process and the useful segments are extracted, finally the texture statistics is calculated. From the texture statistics, a disease on the plant leaf is evaluated. The grape leaf disease detection through leaf image and image processing techniques is very useful and inexpensive system especially for assisting farmers in monitoring the big plantation area.

Keyword: - *Classification technique, Disease Detection, Feature Extraction, Image Processing.*

1. INTRODUCTION

India is an agricultural country.70% of population depends on agriculture. Farmer has wide range of diversity to select suitable fruit and vegetable crop. Plant disease has gaining importance as it can cause significant reduction in both quality & gaining quality of agricultural product. So, research on detection of plant disease is gaining importance now a days, which may prove useful in monitoring large fields and thus automatically detection symptoms as they appear on plant [1].Grapes (Vitis vinifera)are an important fruit crop in India. Grapes are the third most widely cultivated fruit after citrus and banana. Grape is one of the most delicious and nutritious fruit. Grapes are widely consumed as fresh fruit in India. It is also used for producing raisins, wine, juice, juice concentrate, squash, beverages, jams and marmalades.

Grape fruit enjoys a pre-eminent status among all cash crop in a country and is principal raw material for flourishing wine industry. It also provide live hood to about 65 million people and is an important agricultural commodity providing remunerative income to millions of farmer in developed as well as in developing country.[2] About 60% of grape are cultivated in India is under rain feed condition. Water stressed seed or plant will cause poor growth leading to low yield as well as expose to disease Due to disease on plant there is loss of 10-30 % of crop. Farmers do the naked eye observation and judge the diseases by their experience. But this is not accurate and proper way. Sometimes farmers need to call the experts for detecting the diseases but this also time consuming way. Most of the disease on plant is on their leaves and on stem of plant. The diseases are classified into viral, bacterial, fungal, diseases due to insects, rust, nematodes etc. on plant. Early detection of diseases is a major challenge in horticulture/agriculture science. Many disease produce symptoms which are the main tools for field diagnosis of diseases showing external symptoms out of a series of reactions that take place between host and pathogen. As such, several important decisions regarding safe practices, the production and processing of plant have been made in the recent past. One of the main concerns of scientists is the automatic disease diagnosis and control [15,16].

Computer vision systems will help to tackle the problem. Computer vision systems developed for agricultural applications, namely detection of weeds, sorting of fruits in fruit processing, classification of grains, recognition of food products in food processing, medicinal plant recognition, etc. In all these techniques, digital images are acquired in a given domain using digital camera and image processing techniques are applied, on these images to extract useful features that are necessary for further analysis.

				
Downey Mildew	Phomopsis	Black rot	Powdery Mildew on leaf	Powdery Mildew on berries

Fig -1: Infected Grape plant images

Plant diseases are caused by bacteria, fungi, virus, etc., of which fungi are responsible for a large number of diseases in plants. In the proposed work, we have focused on recognition of fungal disease from the visual symptoms and classify them using image processing. Fig.1 shows image samples affected by fungal disease symptoms. The paper is organized into four sections. Section 2 gives b brief idea of previous work and techniques adopted for disease detection .Section 3 materials and methods used. Section 4 describes results and discussion. Section 5 gives conclusion of the work.

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2. RELATED WORK

Digital image processing and image analysis technology based on the advances in microelectronics and computers has many applications in biology and it circumvents the problems that are associated with traditional photography. This new tool helps to improve the images from microscopic to telescopic range and also offers a scope for their analysis. It, therefore, has many applications in biology. Many literatures is available for different plant disease detection using different techniques. Some of them are highlighted as below. Various papers are suggesting to diagnosis the cotton leaves using various approach suggesting the various implementation ways as illustrated and discussed below.

In 2008 Meunkaewjinda. A, et.al., proposed the work on cotton leaf disease .Researcher in his work proposed modified self organizing feature map that uses genetic algorithms for optimization segmentation is performed and support vector machines is used for classification. The segmented image is filtered with Gabor wavelet that allows the system to detect and analyze leaf disease color features more efficiently classification of the cotton diseases [1]

In 2011 Hui Li et al., proposed the work based on the Web-Based Intelligent Diagnosis System for Cotton Disease Control system. In their research they used the proposed method in a BP neural network which is based on decision-making system. A research scheme includes system test, in which different 80 samples, including number of main species of diseases, and samples of 10 in each sort were included. The final result shows that the rate of correctness.

The system identifies the symptom was 89.5% in average, and the average running time for a diagnosis was 900ms [3].

In 2011 Ajay A. Gurjar, Viraj A. Gulhane proposed Detection of Diseases on Cotton Leaves and Its Possible Diagnosis. The features could be extracted using self organizing feature map together. Back-propagation neural network is used to recognize color of image. Information is used to segment cotton leaf pixels within the image, now image is well analyzed and depending upon software perform further analysis based on the nature of this image. They concluded that system provides 85 to 91% of exact disease detection depending upon the quality of image [2].

In 2012 P. Revathi and M. Hemalatha proposed Homogeneous Segmentation using Edge Detection Techniques for Proficient Identification of the Cotton Leaf Spot Diseases. They proposed a system that uses mobile to capture symptoms of cotton leaf spot images and neural classifier was used in their technique to diagnose disease in cotton plant. The main objective of their Research work is to use Homogeneity-base edge detector segmentation. It takes the result of any edge detector and divides it by the average value of the area. The division removes the effect of uneven lighting in image and then area is tested by using classifier. [4]

In 2013 Qinghai He et al. proposed the work based on cotton leaf in which three different color models for extracting the injured image. Images were developed, then converted into the RGB, HIS, and YcbCr color model. The ratio of damage (γ) was chosen as feature to measure the degree of damage which is caused by diseases or pests. By implementing different color model comparative results are obtained. The comparison of result shows good accuracy in both color models as well as in YCbCr color space. Out of there two models is considered as the better color model for extracting the infected leaf images [6]

In 2014 Shruti and Nidhi Seth proposed a method of Fungus/Disease Analysis in Tomato Crop using Image Processing Technique. In this paper the image of the crop leaves are taken by a camera and processed for getting a gray colored and segmented image depending upon the nature and size of the fungus. A reference is set for acceptable and rejects crop quality based on the growth of fungus level.[10].

3. PROPOSED SYSTEM

After study various literature review, there is a need to develop real time system which will effectively use to detect diseases on grape plant. The task of plant disease identification and classification is of greater importance in the field of agriculture. Therefore, developing automated techniques for plant disease classification has gained much interest in the field of research now a days. To diagnosis the disease, an image processing system has been developed to automate the identification and classification of various disorders.

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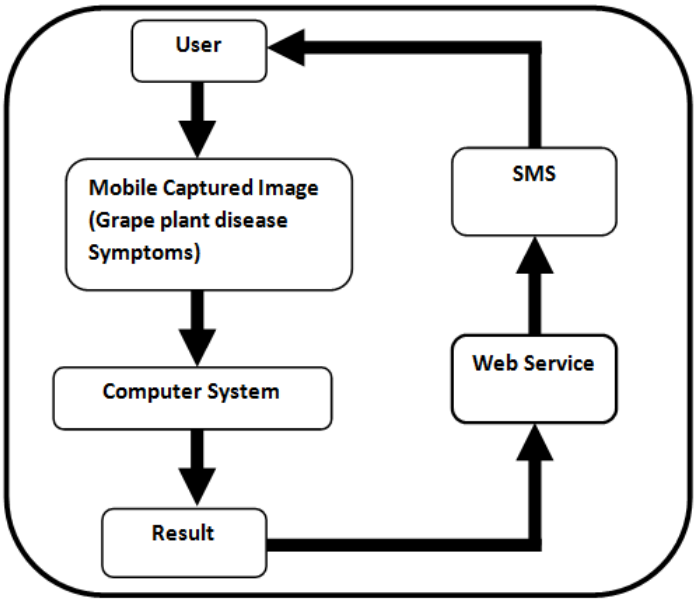


Fig-2: Overall structure of system

3.1 Description of overall system

User who wants to know the type of disease on grape leaf will capture the image and sent to computer system. Computer system will process the image using MATLAB software. At the output we get which disease is detected, stage of that disease along pesticides to use to cure the disease. The result is sent to farmer through web service.

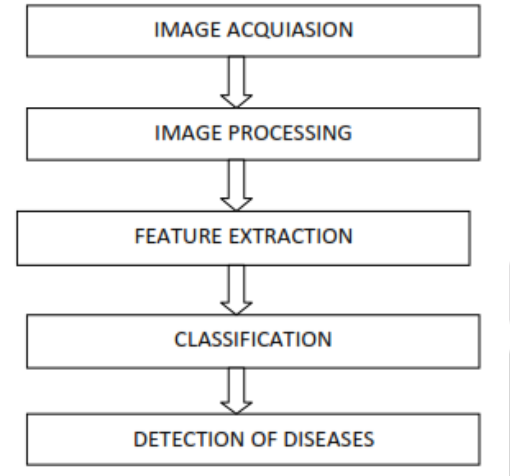


Fig -3: Basic procedure for the Leaf Disease Detection

We propose an image-processing-based solution for the automatic leaf diseases detection and classification. We test our solution on five diseases which effect on the plants; they are: Black rot, Downy mildew, powdery mildew, Phromosis and Leafroll First, the digital images are acquired from the environment using a digital camera. Then image-processing techniques are applied to the acquired images to extract useful features that are necessary for further analysis. After that, several analytical discriminating techniques are used to classify the images according to the specific problem at hand fig.3 depicts the basic procedure of the proposed vision-based detection algorithm in this research

3.2 Description of the software System:

Users who want to know the type of disease on grape leaf will capture the image and sent to receiver module.It is the image send by the user who wants to know the type of disease and stage of the disease. We open this image using imread command in MATLAB software. When the image is taken, the image is transformed into HIS image. Masking of green pixels of hue component take place. Because green pixels are nothing but healthy region of the leaf. It cannot give any additional information for disease classification. Here we

$$\text{Hue}=\begin{cases}\phi & \text{if } B \le G \\ 360-\phi & \text{if } B > G\end{cases} \quad (1)$$

$$\phi = \cos^{-1}\left\{\frac{1/2[(R-G)+(R-B)]}{[(R-G)^2+(R-G)(G-B)]^2}\right\} \quad (2)$$

$$\text{Saturation } (S) = 1 - \frac{3}{R+G+B}[\min(R,G,B)] \quad (3)$$

$$\text{Value}(V) = \frac{1}{3}(R+G+B) \quad (4)$$

After segmentation the area of interest i.e. diseased part extracted. In the next step, significant features are extracted and those features can be used to determine the meaning of a given sample.Then we extract the features of diseased area and classify the disease according to the features. For this we use Spatial Gray-level Dependence Matrices (SGDM matrix) method. By using SGDM matrix method we get five features like Energy , homogeneity, contrast, cluster prominence and cluster shade. But only cluster prominence and cluster shade give significant difference in their value. Value of Energy, homogeneity, contrast of all the diseases is almost same. We are focusing on cluster prominence and cluster shade component.

$$\textbf{Cluster Shade} = \sum_{i=0}^{G-1}\sum_{j=0}^{G-1}\left\{i+j-\mu_i-\mu_j\right\}^3 \times P(i,j|\Delta x,\Delta y) \qquad (5)$$

$$\textbf{Cluster Prominence} = \sum_{i=0}^{G-1}\sum_{j=0}^{G-1}\left\{i+j-\mu_i-\mu_j\right\}^4 \times P(i,j|d) \qquad (6)$$

Image segmentation is process used to simplify the representation of an image into something that is more meaningful and easier to analyse. As the premise of feature extraction and pattern recognition, image segmentation is also the fundamental approaches of digital image processing. In our proposed system we have used split and merge segmentation. Image classification is most important part of image analysis. Classification is the process to categorize all pixels in image into one of several land cover classes. .In our system we have used SVM classifier. After image classification is done comparison of image is done with data base image at the output we get which disease is detected, stage of that disease along pesticides to use to cure the disease. The result is sent to farmer trough web service.

4. Simulation Results:

A) Normal Leaf

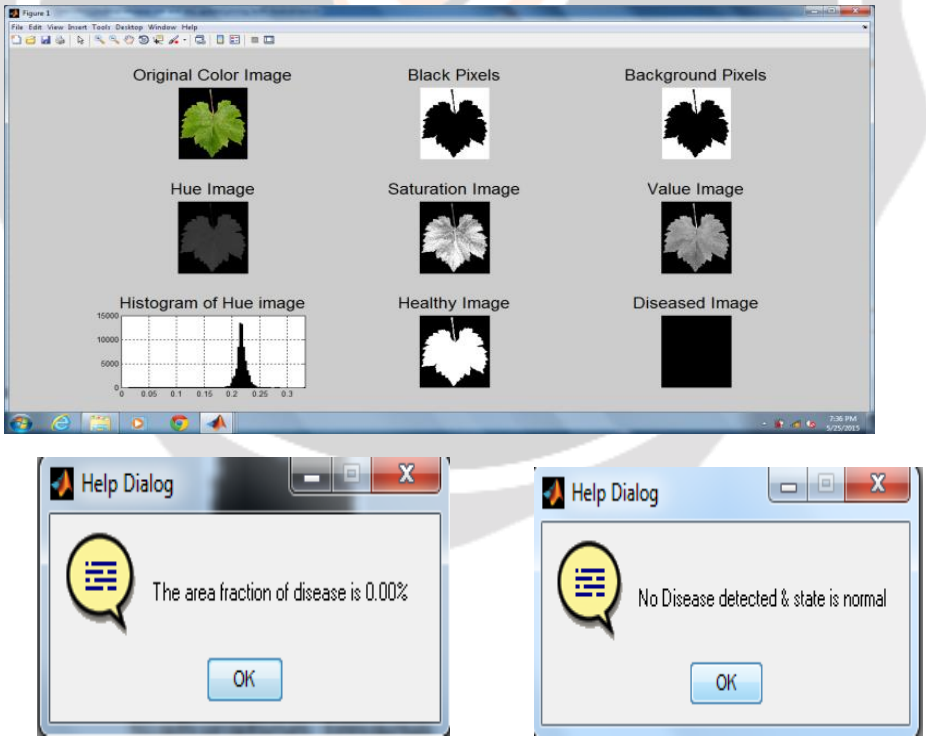


Fig -4: Simulation of Normal Leaf

B) Downey mildew

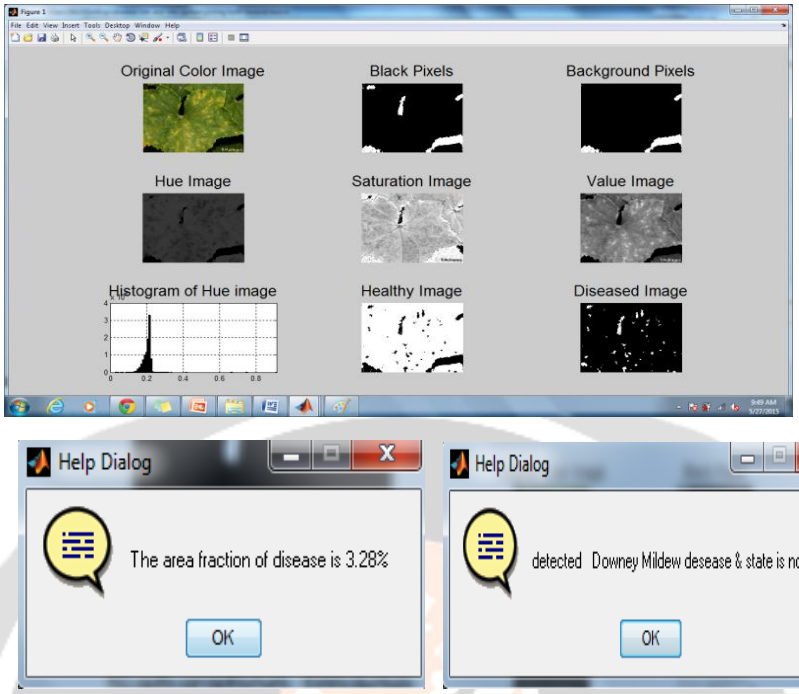


Fig-5: Simulation of Downey Mildew

C) Powdery mildew:

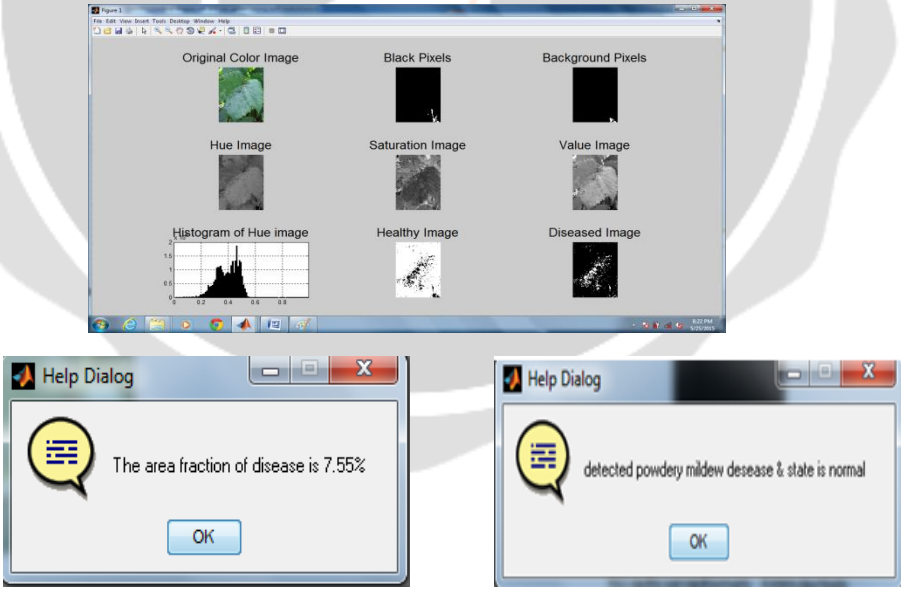
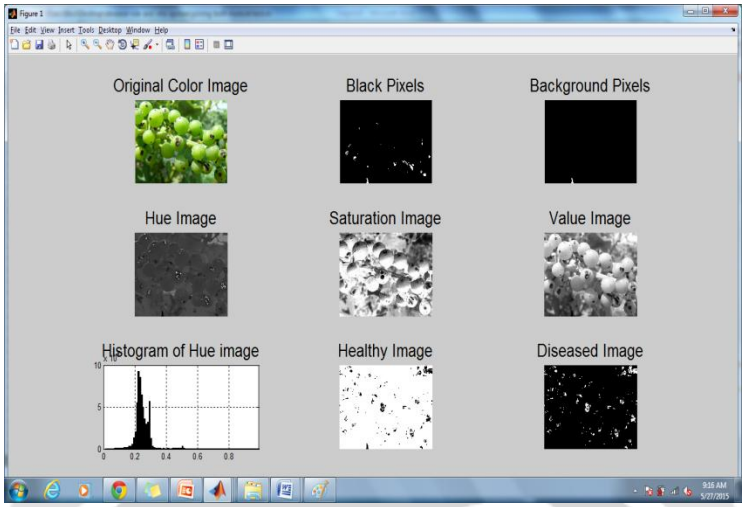


Fig- 6: Simulation of Powdery Mildew

D) Black rot:



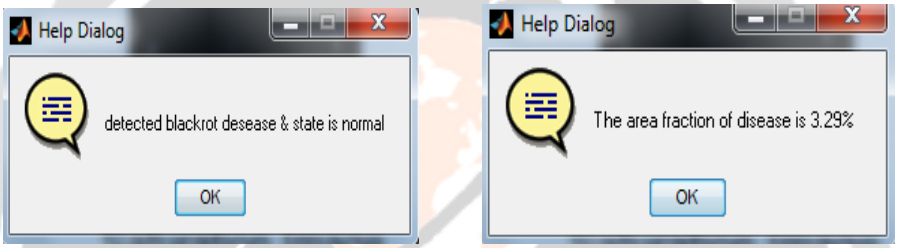
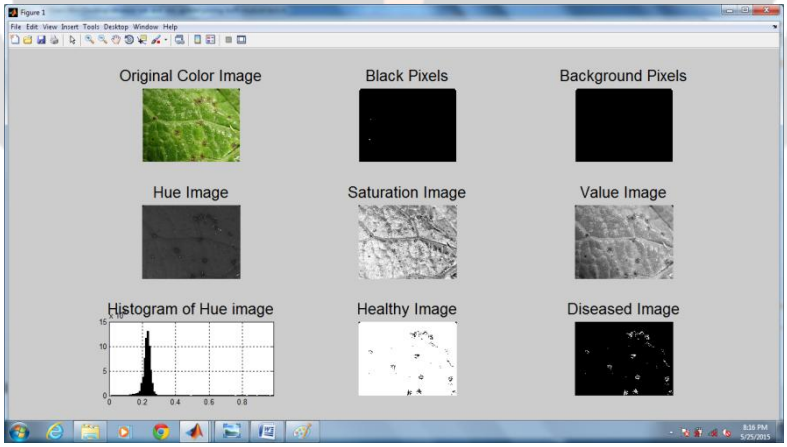


Fig-7: Simulation of Black rot

E) Phromosis:



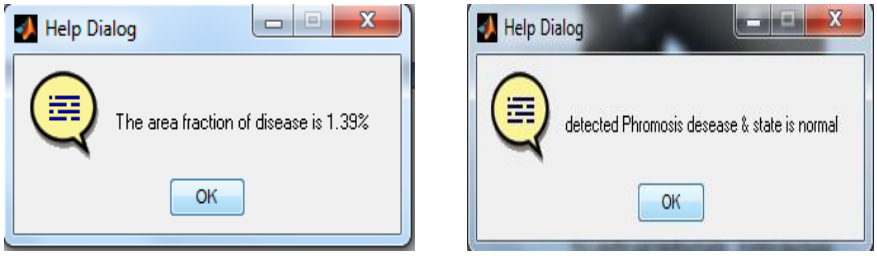
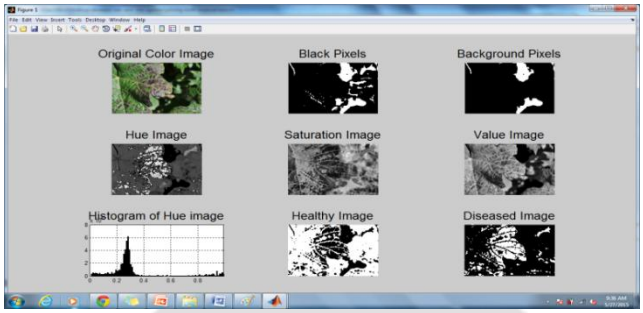


Fig- 8: Simulation of Phromosis

F) Leafroll



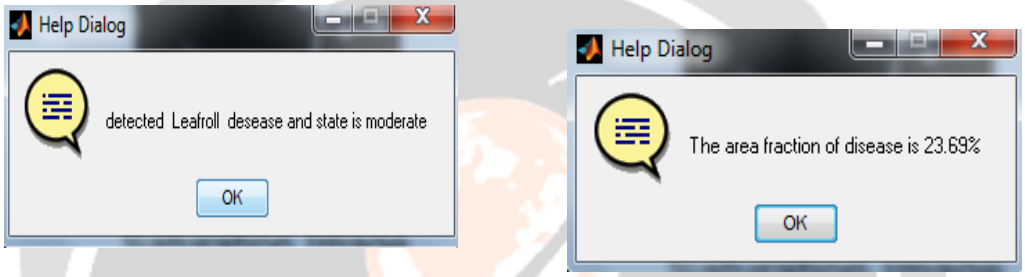


Fig-9: Simulation of Leafroll

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