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Proficient acquaintance based system for citrus leaf disease recognition and categorization

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Abstract -Disease management in plant is a challenging task. Most diseases are seen on the leaves or stem of the plant. Proper disease identification must be undertaken so that crop yield losses may be minimized. Plants may be affected by different diseases which are to be handled by the farmers within time to increase their productivity. An automatic plant disease identification system can be helpful for the farmers to identify the disease and their cures within time. Most of these diseases can be identified using the leaves of the plants. The proposed system will automatically detect the symptoms of diseases as soon as they appear on plant leaves. It is an efficient disease diagnosis system that focuses on plant disease identification by processing acquired digital images of lemon leaves. These images are made to undergo a set of pre-processing methods for image enhancement. The enhanced image is segmented and canny edge detection is used to extract the region of interest i.e., diseased portion. Later, a satisfying set of visual features from the region of interest are extracted by applying histogram for detecting diseases accurately. The advisory helps farming community in effective decision making to protect their crop from diseases and increase their productivity. There by, the proposed approach improves crop yield and uplifts the economy of farming community.

Keywords: ***Classification, Canny Edge Detection, Extraction, Threshold, Segmentation.***

I INTRODUCTION

India is a cultivated country where large number of people life is based on agriculture. Farmer has huge range of diversity to select suitable crops. The farming of different crops for optimum yield and quality product is highly important. It can be improved with the help of technological support. The lemon is a small evergreen tree native to Asia. Lemon was the primary commercial source of citric acid before the development of fermentation based processes. Lemon is sedative and antispasmodic used for medicinal purposes. The main cause for the disease is the leaf of the lemon tree. Most of the disease on lemon tree is based on leaf. The previous system is an automated system for recognizing plant species based on leaf images corresponding to three plant types. They are analyzed using two different shape modeling techniques, The first technique is based on the Moments-Invariant (M-I) model and the second on the Centroid-Radii (C-R) model .The system has used a method for the extraction of shape, color and texture features from leaf images and training an neural network classifier to identify the exact leaf class. The main problem is misclassification and less accuracy .So that the farmers couldn't identify the disease at initial stage. In this paper we develop the advance computing environment to identify the diseases using infected images of lemon leaf. Images of leaves are taken from digital camera, smart phones and processed using image growing. The software can exactly differentiate the difference of colour present on these leaves .Depending upon that difference, further comparison is made with the database stored image features. Then the part of the leaf sport will be used for the classifying and testing the leaves for detecting disease. This technique would classify the disease based on threshold value and intimate the farmer about the disease and its remedies.

1.1 Image Analysis in Agriculture

Image Analysis can be useful for the following purposes

1. To identify diseased leaf.
2. To measure disease affected area.
3. To find out the boundaries and color of the affected area.
4. To determine size & shape of leaf.
5. To identify the Object correctly.

1.2 Types of Lemon Tree Diseases

Citrus canker caused by a bacterial pathogen, is a serious disease of most citrus varities. Citrus canker is highly contagious and can be spread rapidly by wind-driven rain, lawnmowers, and human movement. Citrus canker can be controlled by copper fungicides. Citrus greening is one of the most destructive diseases of citrus. Citrus greening is caused by systemic phloem inhabiting bacterium. Citrus greening bacteria are transmitted by the citrus psyllid. Proper care of trees including irrigation, weed control, soil-applied fertilizer, foliar nutrition, and effective psyllid control may keep the trees productive. Greasy spot spores germinate on the underside of the leaves. It penetrate the leaf tissue, and cause cellular swelling resulting in blister formation on the lower leaf surface. Leaves are susceptible ,once they are fully expanded and it remain susceptible throughout their life. The sprays are needed to control greasy spot. The first spray should be scheduled in May-June and the second in July-August. Thorough coverage of the underside of leaves with copper fungicides plus oil the farmers can control greasy spot.

Citrus leafminer ,is a disease that is caused by the larvae. The hatching citrus leaf miner larvae enter the leaf tissue and begin feeding beneath the epidermal (surface layer) cells. The Citrus leaf miner generally does not noticeably affect growth and yield of mature trees. Biological control through natural enemies and the introduced parasitoid wasp makes a significant contribution in suppressing the problem. However, young trees are vulnerable to severe leafminer damage because of frequent leaf flushes.

Citrus black spot is a fungal disease caused by Guignardia citricarpa. This Ascomycete fungus affects citrus plants throughout subtropical climates, causing a reduction in both fruit quantity and quality. Anthracnose is a primary colonizer of injured and senescent tissue.. The disease is especially troublesome on fruit that are harvested early and degreened for over 24 hours because ethylene stimulates the growth of the fungus.

II RELATED WORK

Automatic detection of plant diseases is an important research topic as it may prove benefits in monitoring large fields of crops, and thus automatically detect the diseases from the symptoms that appear on the plant leaves. This enables machine vision that is to provide image, process control and classify the diseases to intimate the farmers about the disease and its remedies. The objective of this paper is to concentrate on the plant leaf disease detection based on the features of the leaf and classify the disease. K.S.Raghuvanshi et al.[1] attempted to automatically grade the disease on the Pomegranate plant leaves. The paper proposes an image processing methodology to deal with one of the main issues of plant pathology i.e disease grading. The results are proved to be accurate and satisfactory in contrast to manual grading and hopefully take a strong leap forward in establishing itself in the market as one of the most efficient and effective process.

Radhiah Binti Zainon [3] has developed a prototype system for detecting the paddy disease which are Paddy Blast Disease, Brown Spot Disease, Narrow Brown Spot Disease. All the paddy sample will be passing through the RGB calculation before it proceed to the binary conversion. All the segmented paddy disease sample will be converted into the binary data in excel file before feeding through the neural network for training and testing. Consequently, by employing the neural network technique, the paddy diseases are recognized about 92.5 percent accuracy rates. Helly et al. [4] developed a new method in which Hue Saturation Intensity (HIS) - transformation is applied to the input image, then it is segmented using Fuzzy C-mean algorithm. Feature extraction stage deals with the color, size and shape of the spot and finally classification is done using neural networks Al-Bashish et al. [6] developed a fast and accurate method in which the leaf diseases are detected and classified using k-means based segmentation and neural networks based classification. This neural network classifier could successfully detect and classify the diseases with a precision of around 93%. S. Arivazhagan et al.[7,] has developed four main steps .

Colour transformation structure for the input RGB image is created, and then the green pixels are masked and removed using specific threshold value followed by segmentation process, computing the texture features using colour co-occurrence method for the useful segments. Finally the extracted feature are passed through the classifier. Support vector machines are a set of related supervised learning method used for classification and regression. The detection accuracy is improved by SVM classifier. The two class problem is then extended to multi class problem where the detected leaf diseases are then classified into various categories. By this method, the plant diseases can be identified at initial stage itself and the pest control tools can be used to solve pest problems while minimizing risks to people and the environment.

Bauer et al.[8] has developed a Automatic classification of leaf diseases.It is done based on high resolution multispectral and stereo images. Sugar beet leaves are used in this approach. Segmentation is the process that is carried out to extract the diseased region and the plant diseases are graded by calculating the quotient of disease spot and leaf areas. Jayamala K. Patil et.al[11] has developed method advances in image processing for detecting plant leaves diseases for increasing throughput & reducing subjectiveness arising from human experts in detecting the plant disease .It is very speed and accurate. Hence there is a scope for working on development of innovative, efficient & fast interpreting algorithms

2.1 Existing System

Plant leaf recognition using neural network classifiers is an automated system for recognizing plant species based on leaf images. Plant leaf images corresponding to three plant types, are analyzed using two different shape modeling techniques, the first based on the Moments-Invariant (M-I) model and the second on the Centroid-Radii (C-R) model .Here they have used a method for the extraction of shape, color and texture features from leaf images and training an neural network classifier to identify the exact leaf class selection of proper image input features to attain high efficiency with less computational complexity. Neural networks are used as classifiers for discrimination. This work has been implemented using the image processing and neural network toolboxes Useful for quick and efficient classification of plant species. Used by the forest department to classify the plant species.

III EFFICIENT KNOWLEDGE BASED SYSTEM

The proposed system is to automate the detection of disease in lemon leaf in order to easily find out the diseases so that farmers need not check manually and randomly. This system reduces their effort. Many diseases can't be found in manual detection and by using some techniques. If we keep an automated efficient knowledge based system, all diseases can be easily found by capturing image of the picture continuously and comparing it with the database which is known as classifiers used to find the defect in all parts of the leaf. The captured images in RGB format is converted to gray scale using MATLAB.

The gray scale images are segmented into binary images using gray level threshold segmentation. Feature extractions of segmented leaves are done by using canny edge detection. The threshold value of the leaf can be calculated using Histogram algorithm. The threshold value is compared with normal threshold values of the leaf stored in classifiers. By using the value we can easily say that the leaf is infected or not. The threshold value of normal leaf ranges between 30-32, If it is infected the value differs from this value. Now classification occurs, a database is created which is called classifiers in MATLAB. In the classifiers we will store the disease name with the threshold value and remedy. If it's infected, then alarm will be generated in order to intimate the owner about the disease occurrence. LCD is used to display the disease name and remedy to the owner. Thus the system is used for automatically detecting and classifying diseases which are occurring in lemon leaf.

3.1 The step by step procedure of the proposed system

1. RGB image acquisition
2. Convert the input image from RGB to Grey scale format.
3. Masking the green pixels
4. Removal of masked green pixels
5. Segment the components
6. Obtain the useful segments
7. Computing the features using canny edge methodology
8. Evaluation of texture statistics
9. Obtain Histogram for various textures
10. Compare it with Threshold values
11. Send values through Serial communication to Microcontroller
12. Generate SMS based on disease affected on leaf to owner
13. Display Remedies for affected disease in LCD

3.2 Proposed Work

3.2.1 Image acquisition

The RGB color images of lemon leaf are captured using a camera. The digitization and storage of an image is referred as the image acquisition. After the image has been obtained, various methods of processing can be applied to the image to perform different vision tasks required today. However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, even with the aid of some form of image enhancement. All the images are saved in the JPEG format.

3.2.2 Image Pre-Processing

Pre-processing task involves some procedures to prepare the images enhancement. Pre-processing images commonly involves removing low frequency background noise, normalizing the intensity of the individual particles images, removing reflections, and masking portions of images .Leaf image is in RGB color format. The RGB image is converted to a gray scale image.

3.2.3 Segmentation

Image segmentation refers to the process of partitioning the digital image into its constituent regions or objects so as to change the representation of the image into something that is more meaningful and easier to analyze.Image segmentation based on gray-level threshold segmentation is adapted and the binary image is obtained.

3.2.4 Feature extraction

General descriptors such as number of the object, area of the shape object, width and length of the object, and area of image, are important characteristics to describe its shape. Those characteristics are used to extract feature in the RGB space, in which the colour at each pixel is represented as a triplet (R, G, B), where R, G and B are respectively the red, green, and blue value from a colour image capturing device. The features correspond to colour characteristics are the mean and variance of the gray level of the red, green and blue channel of the spots;and other features correspond to morphological and geometrical characteristics of the spots. By using segmentation technique it is easy for us to extract the features of disease leaf of the image. The image analysis here focuses on the shape. Feature extraction has done using canny edge detection algorithm

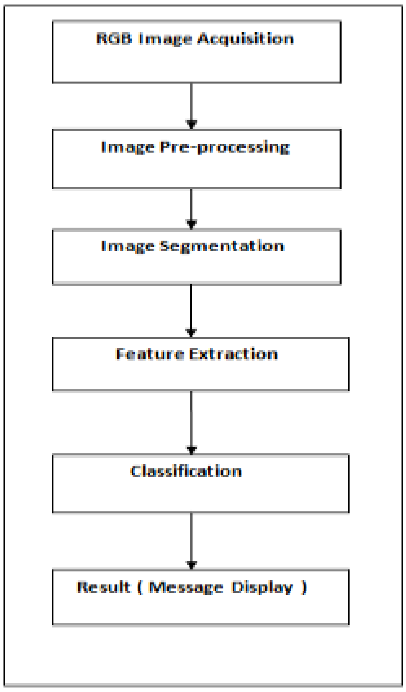

Fig 2: Flow of proposed Work

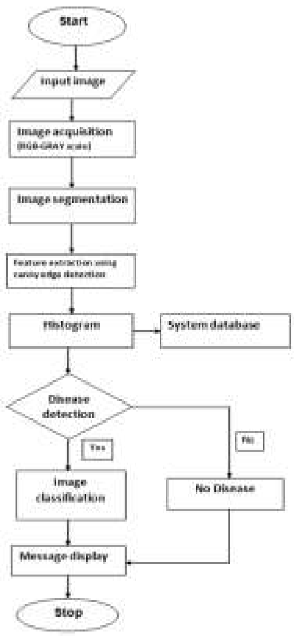

Fig 3:Disease Detection Process

RGB-Gray Conversion G= rgb2gray (Z)

Gray=0.2989*R+0.5870*G+0.1140

3.2.5Classification

Images are classified by comparing to the database image Based on affected threshold value the leaf disease is identified. If the leaf is infected, specific disease name and remedy is send to the owner as well as displayed in LCD.

3.3 Canny Edge Detection

The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images .The general criteria for edge detection includes

1. Detection of edge with low error rate, which means that the detection should accurately catch as many edges shown in the image as possible
2. The edge point detected from the operator should accurately localize on the centre of the edge.
3. Given edge in the image should only be marked once, and where possible, image noise should not create false edges.

The algorithm work includes this process:

1.Smoothing: Blurring of the image to remove noise.

The equation for a Gaussian filter kernel with the size of 2k+1*2k+1 is shown as following:

$$\mathbf{G} = \sqrt{\mathbf{G}_x{}^2 + \mathbf{G}_y{}^2}$$

$$\mathbf{\Theta} = \operatorname{atan2}(\mathbf{G}_y, \mathbf{G}_x)$$

$$H_{ij} = \frac{1}{2\pi\sigma^2} * \exp\left(-\frac{(i-k-1)^2 + (j-k-1)^2}{2\sigma^2}\right)$$

2.Finding gradients: The edges should be marked where the gradients of the image has large magnitudes. The computed edge strengths are compared to the smoothed image where: Gx and Gy are the gradients in the x- and y-directions respectively

3. Non-maximum suppression: Only local maxima should be marked as edges.

The purpose of this step is to convert the “blurred” edges in the image of the gradient magnitudes to “sharp” edges. The algorithm is for each pixel in the gradient image:

i. Round the gradient direction θ to nearest 45◦, corresponding to the use of an 8-connected neighborhood.

ii.Compare the edge strength of the current pixel with the edge strength of the pixel in the positive and negative gradient direction. I.e. if the gradient direction is north (Θ = 90◦), compare with the pixels to the north and south.

iii.If the edge strength of the current pixel is largest; preserve the value of the edge strength. If not, suppress (i.e. remove) the value.

4.Double thresholding: Potential edges are determined by thresholding. The Canny edge detection algorithm uses double thresholding. Edge pixels stronger than the high threshold are marked as strong; edge pixels weaker than the low threshold are suppressed and edge pixels between the two thresholds are marked as weak.

5. Edge tracking by hysteresis: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

3.4. Experimental Result

Threshold calculation:

I1= imread('leaf.jpeg');

thresh = graythresh (I1);

The input image is digitized and masked to get clear RGB format. The RGB image is converted into gray scale image.

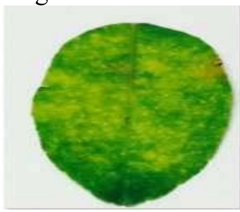

Fig 4: Image of lemon leaf

Fig 5:rgbimage acquisition

Fig 6:gray scale image

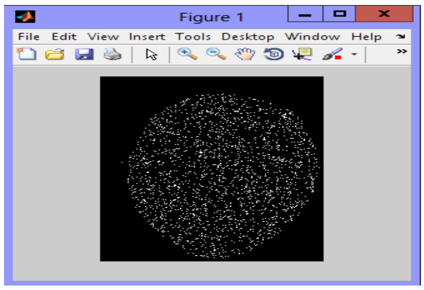

Fig7: feature extraction using canny edge detection

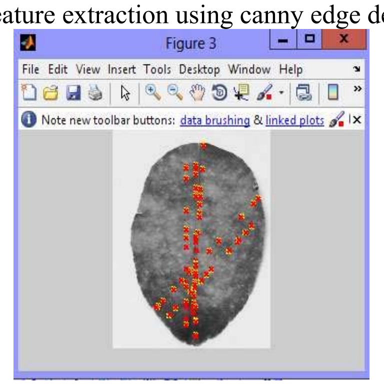

Fig. 8: identification of diseased area and change.

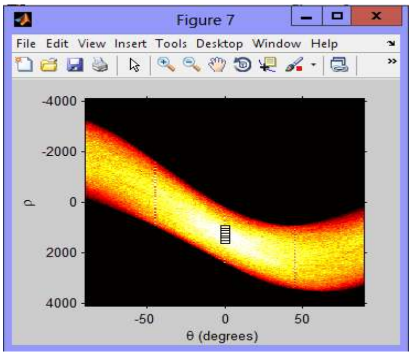

Fig. 9: Histogram Plot Inclination of Normal Leaf

Later the image is segmented into binary image using gray level segmentation. Feature is extract to detect the diseased portion of leaf. The graph defines amount of diseased area and variation in the leaf.

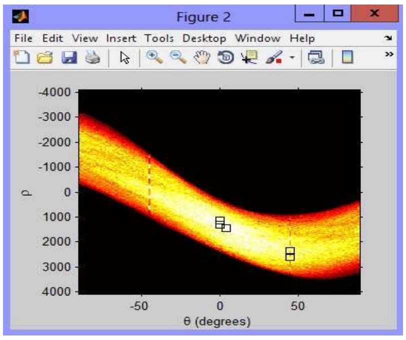

Fig 10: Plot Inclination of Diseased Leaf.

Threshold value is calculated based on database table; the leaf is classified and identified the disease

Diseases	Value
Normal	**30**
Anthracnose	**24.04**
Black spot	**23.02**
Citrus canker	**22**
Citrus greening	**27**
Greasy spot	**43**
Leaf miner	**23.34**
Texas citrus greening	**32.5**

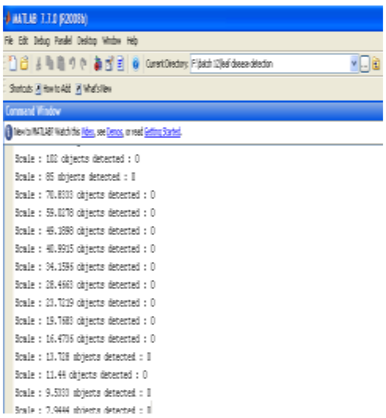

Fig 11: Threshold Value Scaling

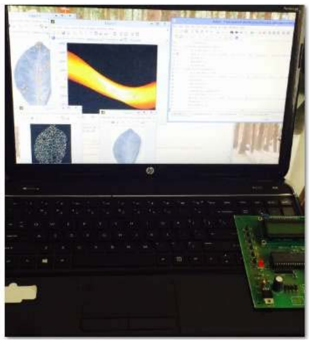

Fig 12: Experimental Setup

A system is developed for disease detection by comparing the threshold values obtained with database "classifier" to classify the type of disease. From the result it can be observed that accurate value of diseases are obtained and the system eliminates the misclassification of diseases in existing system

IV CONCLUSION

The proposed system helps us to detect and classify all the major diseases of lemon leaf. The advantages of the system are efficient, fast and accurate in detecting the disease by scaling the threshold values. The threshold value differs for each disease according to their features and range of affected areas. Hence the developed system is very useful for detecting the disease automatically and informing the farmer about the type of disease .It also provides the actions to be taken as remedy in order to save their crops.

REFERENCES

[1] Tejal Deshpande1, Sharmila Sengupta2, K.S.Raghuvanshi"Grading & Identification of Disease in Pomegranate Leaf and Fruit" International Journal of Computer Science and Information Technologies, Vol. 5 , 2014, 4638-4645 ISSN-0975-9646

[2] Meunkaewjinda, A.; Kumsawat, P.; Attakitmongcol, K.; Srikaew, A., "Grape leaf disease detection from color imagery using hybrid intelligent system," Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology, 2008. ECTI-CON 2008. 5th International Conference on, vol.1, no., pp.513, 516, 14-17 May 2008: 10.1109/ECTICON.2008.460048

[3] Radhiah Binti Zainon" Paddy Disease Detection System Using Image Processing"Dec 2012

[4] Helly, M. E., A. Rafea, and Salwa-El-Gammal. 2003. An integrated image processing system for leaf disease detection and diagnosis. in Proc. IICAI, pp.1182-1195

[5] P.Revathi, M.Hemalatha, "Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Techniques" ISBN, pp 169-173, 2012 IEEE.

[6] Dheeb Al Bashish, Malik Braik, and Sulieman Bani- "A Framework for Detection and Classification of Plant Leaf and Stem Diseases

[7] S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini, "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features", CIGR, vol. 15(1), pp. 211-217, March 2013.

[8] Bauer, S. D., F. Korc, W. Forstner. 2011. The potential of automatic methods of classification to identify leaf diseases from multispectral images. Precision Agriculture, 12: 361-377.

[9] P.Revathi M.Hemalatha," Advance Computing Enrichment Evaluation of Cotton Leaf Spot Disease Detection Using Image Edge detection ", ICCCNT'1226t _28t July 2012, Coimbatore, India, IEEE-20180

[10] H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh, "Fast and Accurate Detection and Classification of

Plant Diseases" IJCA, vol. 17(1), pp. 31-38, March 2011, IEEE-2010.

[11] Jayamala K. Patil, Raj Kumar, "Advances In Image Processing For Detection of Plant Diseases" JABAR, vol. 2(2), pp. 135-141, June-2011.

[12] Ms. Kiran R. Gavhale1, Prof. Ujwalla Gawande2," An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques" IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661, p- ISSN: 2278-8727Volume 16, Issue 1, Ver. V (Jan. 2014)

[13] Mrunalini R. Badnakhe, Prashant R. Deshmukh, "Infected Leaf Analysis and Comparison by Otsu Threshold and k-Means Clustering" IJARCSSE, vol. 2(3), pp. 449-452, 2012