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A Plant Disease Detection System Using Image Processing

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Abstract: India is agricultural country where approximately 18% of crop yield is lost worldwide due to pest attack every year which is valued around Rs. 90,000 million. Large use of pesticides harms the soil, has acute toxicity to humans and animals, changes in pest status in agro-ecosystems, high cost of control practices, residue problems in environment, etc. Whiteflies are well-known harmful insects present on leaves of plant, excrete sticky honeydew, cause yellowing or death of leaves and harm the crop yield. The increase of whiteflies has been mostly relied on visual judgment by farmers. The visual judgment by farmers for density of whiteflies has been less accurate because of the different levels of identification skills. Also, it takes long time for detection of Whiteflies present on leaves in laboratory. Due to economic importance of crops and strong impacts of damage levels, detection of whiteflies at early stages has become important.In proposed solution, using android application, we are calculating affected area of plant and based on affected area we are calculating severity of disease. Also we will suggest treatment in Hindi for detected disease. Detection of plant diseases is an important research topic as it may prove benefits in monitoring large field of crops, and thus automatically detect diseases from symptoms that appear on plant leaves. Thus automatic detection of plant disease with the help of image processing technique provides more accurate and robot guidance for disease management. Comparatively, visual identification is less accurate and time consuming.

Keywords: Image Processing, Plant Disease, HSV(Hue Saturation Value), Machine Learning.

I. INTRODUCTION

India is an agricultural country, wherein about 70% of the population depends on agriculture. Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. However, the cultivation of these crops for optimum yield and quality produce is highly technical. It can be improved by the aid of technological support. The management of perennial fruit crops requires close monitoring especially for the management of diseases that can affect production significantly and subsequently the post-harvest life.Agriculture has become much more than simply a means to feed ever growing populations. Plants have become an important source of energy, and are a fundamental piece in the puzzle to solve the problem of global warming. There are several diseases that affect plants with the potential to cause devastating economic, social and ecological losses. In this context, diagnosing diseases in an accurate and timely way is of the utmost importance.There are several ways to detect plant pathologies. Some diseases do not have any visible symptoms associated, or those appear only when it is too late to act. In those cases, normally some kind of sophisticated analysis, usually by means of powerful microscopes, is necessary. In other cases, the signs can only be detected in parts of the electromagnetic spectrum that are not visible to humans. A common approach in this case is the use of remote sensing techniques that explore multi and hyper spectral image captures. The methods that adopt this approach often employ digital image processing tools to achieve their goals. However, due to their many peculiarities and to the extent of the literature on the subject, they will not be treated in this system Most diseases, however, generate some kind of manifestation in the visible spectrum. In the vast majority of the cases, the diagnosis, or at least a first guess about the disease, is performed visually by humans. Trained raters may be efficient in recognizing and quantifying diseases; however, they have some associated disadvantages that may harm the efforts in many cases.

Our research focuses on the detection of plants diseases based on edge detection and color matching histogram technique. We need two very significance characteristic that is mainly concern with the accuracy of detection and speed to recognize the image diseases. Based on the color space, histogram, and edge detection techniques, we can able to find the disease of plant. Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually.

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It requires tremendous amount of work, expertize in the plant diseases, and also require the excessive processing time. Hence, image processing techniques are used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification.

II. RELATED WORK

Harshal Waghmare et al.In [1] has proposed technique for identi_cation of plant disease using pattern recognition and leaf texture analysis. They mainly focus on Grapes plant leaf disease detection in which system takes single leaf of plant as a input and after background removal segmentation is performed. The segmented leaf image is then analyzed using high pass filter to detect the disease. Then texture of segmented leaf is analyzed using fractal based texture feature.Proposed system uses Multiclass SVM(Support Vector Machine) technique for classification of diseases which are observed on grapes plant. The proposed approach provides accuracy of 96.6% and conveys advice of agriculture experts easily to farmers.

Jitesh P. Shah et al.In [2] presents a survey of various techniques and discusses important concepts of Image Processing and Machine Learning for plant disease detection.This system is mainly intended to detect three rice diseases namely bacterial leaf blight, brown spot and leaf smut. Using communication technologies and computer system, an automated system can be design that can provide early notification of diseases.

Shivani P. Tichkule et al.In [3] has used K-means clustering to detect infected plants and Neural net works for obtaining accuracy in detecting and classifying diseases.It alsospecifies Agrobot technique for plant disease detection. Agrobot or agricultural robot is an agricultural robot used for performing various agricultural tasks. It performs almost all agricultural tasks from seeding to spraying pesticides. Implementation of Agrobot requires advance digital devices like webcam, battery, processor, DC motor driver, DC motor. This increases yield, decreases cost of labor and also reduces human efforts. Image processing technique detects diseases based on various symptoms like change in shape, size and color of crops.

E. Borges et al.In [4] Electric Impedance Spectroscopy, EIS has been used to identify electric properties of plant tissue, mainly to verify fruits and their respective qualities, effect of temperature and maturation process. By driving an alternating electric current, AC, the information on the internal structure is achieved and then as current passes trough samples, changes in amplitude and phases of current are recorded. It is possible to determine impedance of sample by observing such changes, which is then characterized by imaginary and real part in complex plane. This allows to conclude that every single sample has its own impedance spectrum. Preliminary test performed are most promising to demonstrate EIS system as an efficient technique for plant disease detection.

Arti N. Rathod et al.In [5] this paper advance computing system is proposed to recognize diseases using infected images of leaf. Digital camera mobiles are used to capture images and processed using growing image then the part of leaf spot is used for classification purpose. The proposed technique is suitable to detect the diseases in various parts of plants like leaf, steam, fruit etc. This system effectively quantifies the affected area by the disease, finds the boundaries of affected area, determines color of the affected area, determines size and shape of leaf and identifies objects correctly. Four main steps are performed in this system, color transformation structure is created for input image and then green pixels are removed using some threshold value then segmentation process is performed and _nally extracted features are passed through classifier.

Rajleen Kaur et al.In [6] proposed work specifies automatic detection of diseases and part of disease present in images and in agriculture crop production. Support Vector Machine (SVM) classifier is used in this approach. Here SVM contains two databases; first is training dataset and second is train dataset. Original image is capture _rstly and then it is used for processing. Then it gives us black and background pixels of segmented image. Thirdly healthy part is segmented and disease part of image is detected. This system can also provide disease and gives the name of the disease. The main aim of this work is to provide enhancement in classifier computation in neural network. This system provides better accuracy and I future can be used with filter to provide more accuracy.

Sachin D. Khirade et al. In[7] discussion about methods used for detection of diseases using leaf images is given along with segmentation and feature extraction algorithms. The proposed system follows speci_c steps for detection of diseases like image acquisition, image pre-processing, image segmentation, feature extraction in image and detection and classi_cation of plant disease.

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Rajat Kanti Sarkar et al.In [8] this paper, an automatic seeded region growing (SRG) is proposed for colored images of plans. Euclidean distance algorithm is used for computing color differences between adjacent regions. System uses two dimensional lookup table for labeling the neighbors for region merging. By traversing the given image vertically and horizontally lookup table is created and any change in pixel pattern is noted in lookup table. Results of experiments shows that the SRG algorithm along with the region merging gives better result compared to other segmentation techniques.

Rong Zhou et al. In [9] proposed system presents method for robust and early leaf spot detection in bet and sugar. This system uses hybrid algorithm of template matching and support vector machine. Proposed method provides robust and feasible early disease detection and frequent quantization under natural situations.

Zulkii Bin Husin et al.In [10] paper presents the way of early detection of chili diseases using leaf feature inspection. For determining the health status of each plant its leaf image is captured and processed. This system is very effective and inexpensive and helps formers in monitoring big plantation area.

Sachin Khirade and A. B. Patil [11] discussed about the main steps of image processing to detect disease in plant and classify it. It involves steps like image acquisition, image preprocessing, image segmentation, feature extraction and classification.

For segmentation, methods like, otsu's method, converting RGB image into HIS model and kmeans clustering are there. Among all, k-means clustering method gives accurate result. After that, feature extraction is carried out like, color, texture, morphology, edges etc. Among this, morphology feature extraction gives better result. After feature extraction, classification is done using classification methods like Artificial Neural Network and Back Propagation Neural Network.

Bhog and Pawar [12] have incorporated the concept of neural network for the classification of cotton leaf disease analysis. For segmentation, K-means clustering has been used. Different cotton leaf diseases are like Red spot, white spot, Yellow spot, Alternaria and Cercospora on the Leaf. For experimentation, MATLAB toolbox has been used. The recognition accuracy for K-Mean Clustering method using Euclidean distance is 89.56% and the execution time for KMeans Clustering method using Euclidean distance is 436.95 second.

Ms. Kiran R. Gavhale et al. [13] presented number of image processing techniques to extract diseased part of leaf. For Pre-processing, Image enhancement is done using DCT domain and color space conversion is done. After that segmentation take place using k-means clustering method. Feature extraction is done using GLCM Matrix. For classification of canker and anthracnose disease of citrus leaf, SVM with radial basis kernel and polynomial kernel is used.

III. MOTIVATION AND OBJECTIVE

Motivation: Farmers are the backbone of India. Realizing the significance of the problems associated with plant disease. System model for disease detection of leaf agricultural development in India motivated this work to develop a user friendly application for the person associated with agriculture development.

Objectives: The objectives are as follows: To develop an application that is cost efficient.To make an efficient use of image processing techniques. Provide solution with least hardware requirement.

To develop an Android application that is cost efficient, as android phones are widely available at low costs.Minimize the use of resources as farmers can't afford costly equipment.Easy to use and accurate so that farmers can adopt the application quickly.

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IV. DESIGN METHODOLOGY

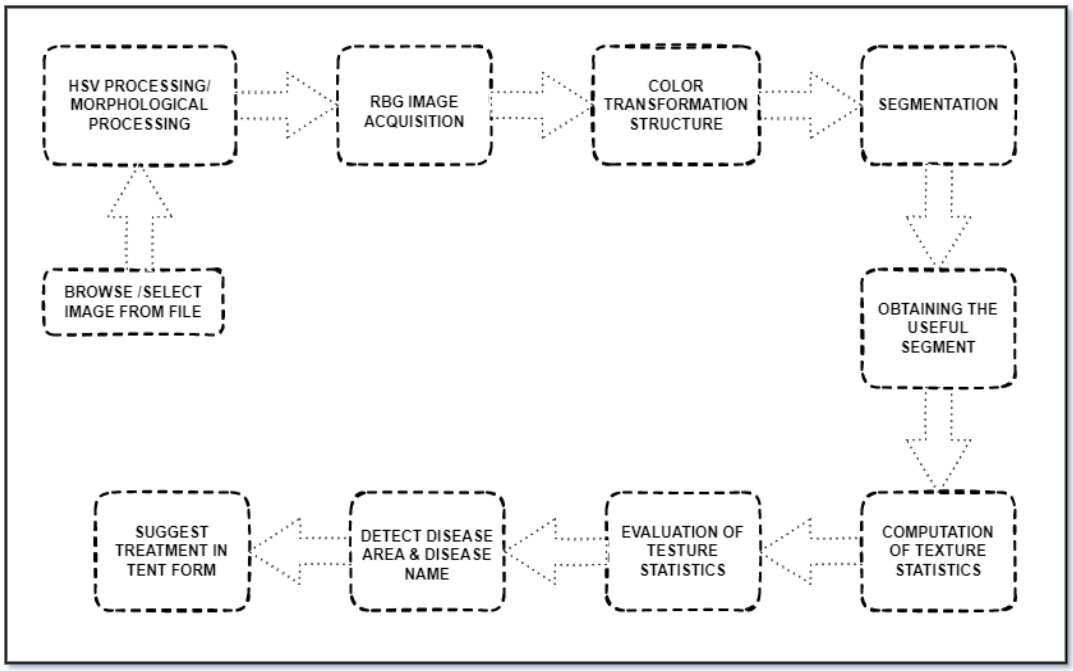

Fig. 1 Architectural Design of the proposed system

The design methodology and the system implementation process are as follows:

Image Acquisition: This is the first step where the image of the plant leaf is captured using a camera or retrieved from a database.

Browse/Select Image from File: This step involves selecting an image file from your computer or a database. The type of image file will depend on the specific research project. you might use plant imaging data to detect diseases in plant.
Pre-processing - In this stage, the image is subjected to processes to enhance its quality for further analysis. This may involve noise reduction, contrast enhancement, or background subtraction.

HSV Processing/RGB Image: Images are typically stored in RGB (red, green, blue) format. However, HSV (hue, saturation, value) might be a better way to represent color for image segmentation depending on what you're researching. In this step you would convert the image from RGB to HSV.

Morphological Processing: This step involves applying a series of mathematical operations to the image data to extract specific features or characteristics. There are many different morphological operations that can be used, such as erosion, dilation, opening, and closing. The specific operations used will depend on the research question.

Segmentation - Here, the region of interest (ROI) in the image, which is the leaf, is separated from the background. This is achieved through color segmentation techniques like K-means clustering or thresholding.

Color Segmentation: This step involves partitioning the image into different regions based on color. This is useful for tasks like identifying objects in an image or segmenting disease in a leaf image.

Morphological Processing - Morphological operations are applied to improve the quality of the segmented image. This may involve erosion to remove small objects or dilation to enhance object boundaries.

Color Transformation - The image might undergo a color space transformation from RGB to HSV. This is because it can be easier to isolate diseased areas in the HSV space.

Feature Extraction - In this step, relevant features are extracted from the segmented leaf ROI. These features can be color features (derived from the HSV image) or texture features which can be extracted using statistical methods.

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Disease Detection - A machine learning model, which has been trained on a dataset of diseased and healthy leaf images, is used to classify the segmented leaf ROI as healthy or diseased.

Evaluation - The performance of the system is evaluated using metrics such as accuracy, precision, and recall.

Suggest Treatment - Based on the disease classification, the system can recommend appropriate treatment options for the plant disease.

Plant disease detection systems based on image processing techniques offer a rapid, non-destructive method for disease identification in agricultural fields. This can lead to early intervention and improved crop yields**.**

V. PURPOSE AND SCOPE

In The Purpose of proposed system is to provide use of new technology in agricultural sector. There are many issues to farmers regarding diseases of plants, many times they do not get proper guidance to detect and cure diseases of plants. So due to this, farmers are facing problem of loss in production rate. Proposed system helps user in detection and prevention of plant diseases with the use of Android application, which is very useful, simple and efficient technology can be used by any user facing problem related to plant disease. India is an agricultural country, where most of the population depends on agricultural products. So the cultivation can be improved by technological support. Diseases may cause by pathogen in plant at any environmental condition. In most of the cases diseases are seen on the leaves of the plants, so the detection of disease plays an important role in successful cultivation of crops. There are lots of techniques to detect the different types of diseases in plants in its early stages. Conventional methods of plant disease detection in naked eye observation methods and it is non-effective for large crops. Using image processing the disease detection in plant is efficient, less time consuming and accurate. This technique saves time, efforts, labours and use of pesticides. Hope this approach will becomes a little contribution for agriculture fields.

Scope: Agricultural field is a base of Indian economy, most of the population is dependent on income from agribusiness. So for improvement in this field it is important to provide new technologies to increase profit ratio.We are proposing this system for better performance to agricultural area.

Scope of proposed systems are: To make an efficient use of image processing techniques, Provide solution without extra hardware requirement,develop an Android application that is cost efficient, minimize the use of resources and make system easy to handle and accurate.

VI. CONCLUSION

In this system, Image processing-based approach is proposed for plant diseases detection. This proposed system describes different techniques of image processing for several plant species that have been used for detecting plant diseases. The disease of the plant is known at an early stage and the cure is suggested using different languages (Hindi, Marathi, etc).

Agricultural field is a base of Indian economy, most of the population is dependent on income from agribusiness. So for improvement in this field it is important to provide new technologies to increase profit ratio. We are proposing this system for better performance to agricultural area.

The application of image processing in Plant disease detection facilitates early disease detection, enabling timely interventions to mitigate crop losses and ensure sustainable agricultural practices. By leveraging computer vision, researchers have developed systems capable of accurately identifying disease symptoms from digital images, providing farmers with invaluable insights into their crop health.

VII. ACKNOWLEDGMENT

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REFERENCES

[1]Waghmare, Harshal & Kokare, Radha & Dandawate, Yogesh.[2016] Detection and classification of diseases of Grape plant using opposite colour Local Binary Pattern feature and machine learning for automated Decision Support System.

[2]Jitesh P. Shah, Vipul K. Dabhi [2016] A Survey on Detection and Classification of Rice Plant Diseases

[3]Shivani K. Tichkule [2016] Plant Diseases Detection Using Image Processing Techniques

[4]E. Borges,[2016] Early Detection and Monitoring of Plant Disease [1]Harshal Waghmare, Detection and Classification of Diseases of Grape Plant Using Opposite Colour Local Binary Pattern Feature and Machine Learning for Automated Decision Support Systems by Bioelectric Impedance Spectroscopy

[5]Arti N. Rathod [2015] Image Processing Techniques for Detection of Leaf Disease

[6]Rajleen Kaur[2015]An Enhancement in Classifier Support Vector Machine to Improve Plant Disease Detection

[7]Sachin D. Khirade[2015] Plant Disease Detection Using Image Processing

[8]Rajat Kanti Sarkar[2015]Segmentation of Plant Disease Spots Using Automatic SRG Algorithm: A Look Up Table Approach

[9]Rong Zhou[2013] Early Detection and Continuous Quantization of Plant Disease Using Template Matching and Support Vector Machine Algorithms

[10]Zulkifli Bin Husin[2012] Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques

[11]Sachin D. Khirade, A. B. Patil, “Plant Disease Detection Using Image Processing,” IEEE, International Conference on Computing Communication Control and Automation, Pune, pp 768-771, 2015.

[12]Bhong, Vijay S., and B. V. Pawar. "Study and Analysis of Cotton Leaf Disease Detection Using Image Processing." International Journal of Advanced Research in Science, Engineering and Technology, 2016.

[13]Ms. Kiran R. Gavhale, Prof. Ujwalla Gawande, Mr. Kamal O. Hajari, “Unhealthy Region of Citrus Leaf Detection Using Image Processing Techniques,” IEEE, International Conference for Convergence of Technology, Pune, pp 1-6, 2014.