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Leaf Disease Detection using Image Processing Technique

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Abstract: The analysis of the plant diseases may involve the detection of the abnormalities introduced in the plant leaves, which may or may not be visible to the naked eyes. With the layman's idea of the problems in plants, one cannot proceed with any random solution in the form of any pesticide or fertilizer, unless there's a sheer and accurate understanding of the disease spots and proper pattern recognition which otherwise would lead to a catastrophic situation where besides the loss of the money, the plant will remain untreated and the diseases will also get more time to spread. In order to combat this situation effectively, an artificial intelligence technique has been employed in this paper using k-means clustering (segmentation). The work begins with image acquisition, image enhancement and restoration, and information extraction from images for further computer analysis.

Keywords: Disease spot, Pattern recognition, K-means clustering, Image processing, Segmentation.

I. INTRODUCTION

Though industry has been playing a vital role in Indian economy, the contribution of the agriculture to the Indian economy still cannot be denied. Agriculture is one of the largest sectors of our Indian economy, in terms of generating employment as well as for the provision for the food for the ever increasing population. Even though the contribution of agriculture to the GDP is vividly vast, it suffers from serious problems out of which the frequent failure of the crops is the one of the biggest problems and therefore is of utmost importance.

The green plants provide most of the world's molecular oxygen and are the basis of most of the earth's ecological systems. As diseases of the plants are inevitable, detecting diseases in plants assumes importance. The disease in plant may be due to biotic(fungi, bacteria, viruses/viroids, nematodes) or abiotic reasons(temperature, moisture, nutrition, toxicity, cultural). Plant diseases vary in how much trouble they cause, depending on a variety of conditions, including the susceptibility of the plant and the organism's disease cycle.

Maize is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. In India, maize, a kharif crop is the third most important crop after rice and wheat. The major threats to these crops are weeds, pests and diseases. Therefore, for achievement of higher yields it's extremely essential to undertake the weed, pest and disease management on a serious note.

Several diseases occur in maize crops during various seasons. BLSB, Pythium stalk rot, Bacterial stalk rot, PFSRs, Polysora rust and Downy Mildews are the major constraints to be handled efficiently for better yields. Estimated losses due to major diseases of maize in India is about 13.2% of which foliar diseases, stalk rots, root rots, ear rots cause major yield losses. The commonly found diseases in the maize crop can be mentioned as under:

i. Turcicum leaf blight (Exserohilum turcicum): The disease is prevalent in cooler conditions with high humidity conditions in which long, elliptical, grayish green or tan lensions appear on lower leaves progressing upwards.

ii. Maydis leaf blight (Drechslera maydis): It is the major disease in the areas having warm humid temperate to tropical climate in the cropping period. Lesions on the leaves elongated between the veins, tan with buff to brown or dark reddish brown borders.

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iii. Polysora Rust (Puccinia polysora) : It is reported from the coastal areas where mild temperature and high relative humidity prevail. Light cinnamon golden brown circular to oval pustules appear on leaf densely spread on the upper surface of leaf. Development of pustules on lower surface is more as compared to upper surface.

iii. Post Flowering Stalk Rot of Maize (PFSR): Disease appears when the crop enters in senescence phase. The pathogen commonly affects the roots crown regions and lower internodes. When split open, the stalk shows pink-purple discolouration.

iv. Downy Mildews (DM): This group of the pathogens constitutes one of the most important factors limiting maize production in India. In Brown stripe downy mildew (BSDM), narrow, chlorotic or yellowish stripes with well-defined margins and delimited by the veins appear on leaves. Downy or wooly cottony whitish growth is visible in early morning hours on lower surfaces of the lesions. Severely infected plants give yellowish appearance even from a distance. Most of the infected plants die at about knee-high stage.

II. LITERATURE REVIEW

Many research papers have already been published for detection of diseases in leafs of plants which focus primarily on various segmentation techniques like Threshold method, Method of K-means clustering, histogram based method.

S. No	Title	Publication	Year	Author
1.	Plant Disease Detection Using Image Processing Techniques.	IJIRSET	2015	Y. Sanjana
2.	Automatic Detection and Classification of Plant Disease through Image Processing	IJARCSSE	2013	Pramod S. landge
3.	Fast and Accurate Detection and Classification of Plant Diseases	IJCA	2011	H. Al-Hiary
4.	A Review Of Plant Leaf Disease Detection And Classification Based On Digital Image Processing Techniques	IJTEEER	2013	Dhawale Sariputra
5.	Image Processing Techniques for detection of leaf disease.	IJARCSSE	2013	Arti N.Rathod
6.	Detection of leaf diseases by calculating leaf area through pixel number statistics.	IJERT	2013	Hrushikesh Dattatray Marathe

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III. PROPOSED METHODOLOGY

Automatic detection of diseases in the plant leaves is an evolutionary and important topic of research as it may be helpful for proper monitoring of large fields with precision, which wasn't possible with the conventional techniques employed by farmers so far.
The proposed methodology can be briefed int the form of following points:

1. Image acquisition.
2. Image preprocessing.
3. Image enhancement
4. Image segmentation.
5. Feature extraction.

The methodology involves a hardware implementation of the image processing domain of MATLAB software. A surmountable camera is used for the purpose of image acquisition, which captures the image and provides it for further analysis and comparison with a standard image. The RGB image is then correspondingly converted to its gray scale image. The gray scale image is then subtracted from the standard image, which in turn will ensure the tracing of the abnormalities and the disease spots, if any.
The gray scale image is then converted into its corresponding black and white image as majority of the image handling operations of MATLAB software are defined for the black and white images. The white patches will represent the presence of infected spot and correspondingly, a signal will be sent to the controller. Via the principle of serial communication, the controller then ensures the activation of pesticide sprayer depending on the signal it receives from MATLAB. If no spot is identified in the acquired image, then we can proceed with the next slot of plant leaves concluding that the previously analysed plant leaf was disease-free.

IV. RESULTS

The below figures represent the implementation of the above proposed methodology:

- Analysis of a healthy leaf:

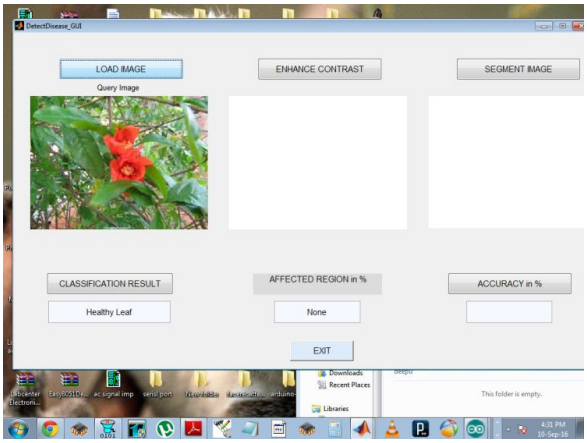

Fig. 1. Image Acquisition.

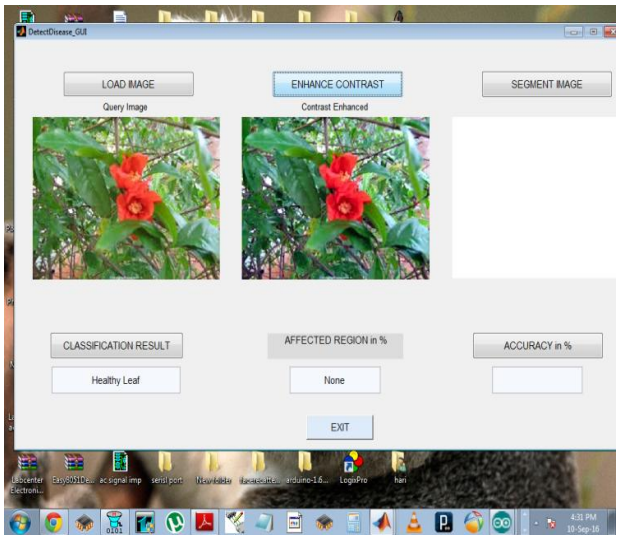

Fig. 2. Image preprocessing

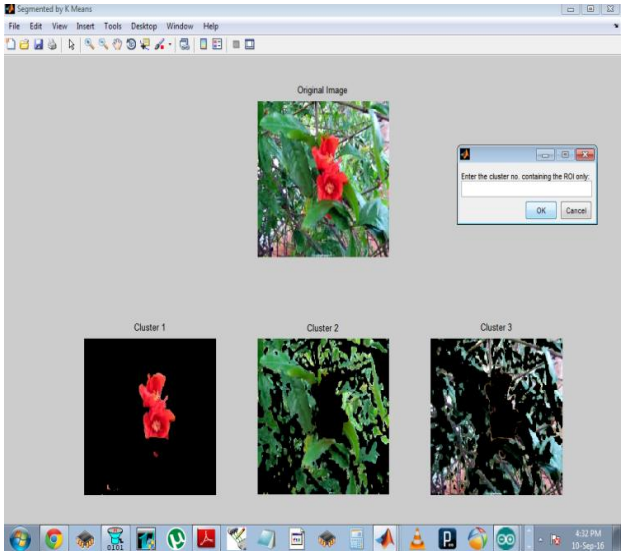

Fig. 3. Division of digital image into different clusters

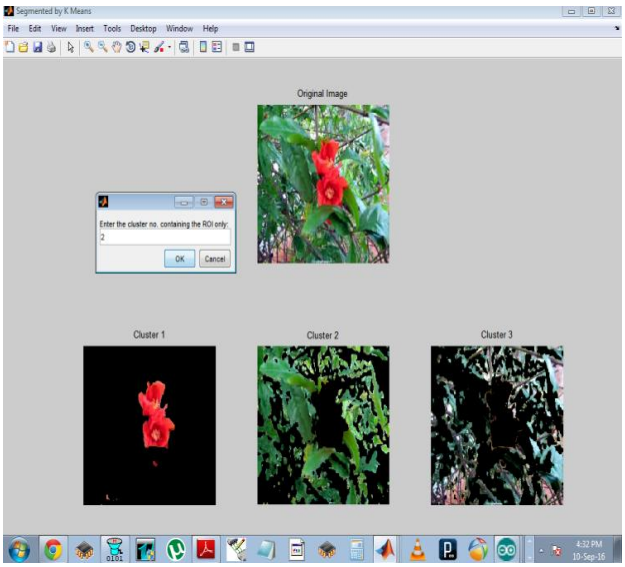

Fig. 4. Selection of a particular cluster.

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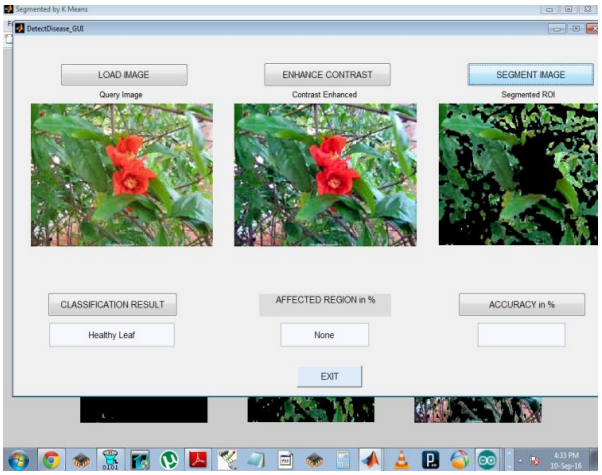

Fig. 5. Analysis of the segmented image.

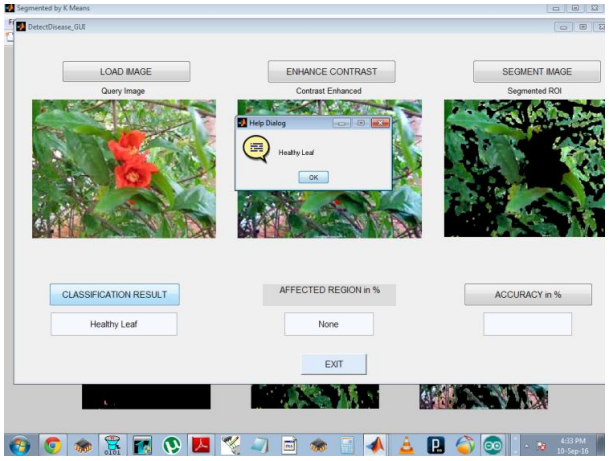

Fig. 6. Final result.

- Analysis of a diseased leaf:

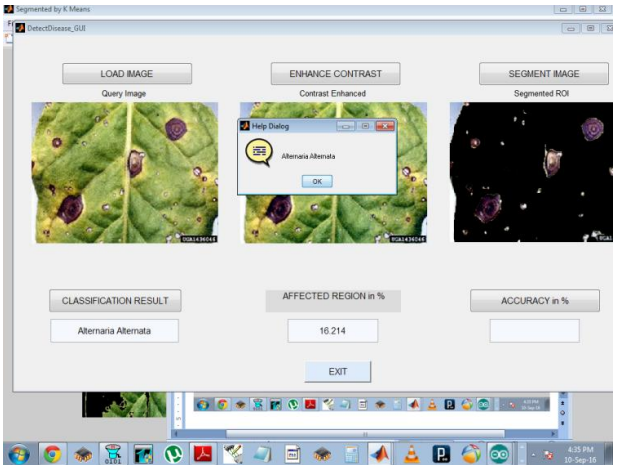

Fig. 8. Disease detected using K-means clustering.

V. CONCLUSION

The conventional methodology of naked-eye observation is an inefficient way of identifying the diseases in crops on a large basis. The image processing technique provides a more reliable and accurate alternative to the conventional naked-eye observation, which is subject to person-to-person analysis. The digital images of the maize crop analysed in MATLAB provided a path for detection of disease spots that showed symptoms of a particular disease. The overall concept of disease detection using image processing will help the farmers during their daily struggles on disease outbreaks.

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BIOGRAPHY

Piyali Chatterjee, pursuing my final year of Electronics and Telecommunications engineering from Bhilai Institute of Technology, Durg, Chhattisgarh. This is my first research paper in IJIREEICE.

B. Harikishor Rao Completed B.E in "Mechatronic" from CSIT in 2013. Right now he is working as a mentor and teacher in CISAT CENTER FOR INDUSTRIAL SOLUTION AND ADVANCE TRAINING He is also the founder Of the Innovation 4 U group.