International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 6, Issue 10, ISSN No. 2455-2143, Pages 239-248
Published Online February 2022 in IJEAST (http://www.ijeast.com)

LEAF DISEASE DETECTION USING DEEP LEARNING MODELS

Dr. D. Hema Latha, Azmath Mubeen
Asst. Professor, Dept of Computer Science,
University College for Women, Hyderabad, Telangana, India

Abstract: **The major problem that the farmers around the world face is losses due to mites, infection or a nutriment inadequacy. The farmers rely on the facts that they get from the agricultural departments for the diagnosis of plant leaf infection. This is a complicated job. The current work on leaf-based image classification has shown remarkable results.The suggested system helps in recognition of plant disease and provides remedies that can be used as a defense mechanism to counter the disease. The data acquired from the world wide is properly segregated and the different plant species are identified and are renamed to form a proper database then obtain test-database which consists of various plant diseases that are used for checking the accuracy and reliancedegree of the work. The suggestedapproach is proficient of detecting the disease of majorly 5 crops that are maize, sugarcane, wheat, and grape. In this research paper, the suggested system implements the MobileNet model, a sort of Convolutional Neural Network for classification of leaf disease.We have implemented Convolution Neural Network (CNN) which comprises of variousstages which are used for prediction. An architype drone prototype is also constructed which can be used for live coverage of large agricultural landswhere a close-up picture capturing camera lens is attached and will capture images of the plants which will act as input for the program, based on which the software tells us whether the plant is fit or not. Our software and the model for training have reached a precision level of 78%. In the proposed research work the code designed provides the name of the plant species with the remedy that can be taken as a cure.**

Keywords— **Leaf disease, healthy plant, Feature extraction, Training, Classification, MobileNet, CNN**

I. INTRODUCTION

Agriculture acts as a key player in India's financial growth. Work to practically half of the nation's workforce is given by Indian agribusiness area. India is known to be the world's largest producer of pulses, rice, wheat, spices and spice products. The standard of the products produced by the farmers determine their economic growth, which relies on the plant's growth and the yield they get which will make the process of ailment recognition and classification with the help of leaf images automated. Along these lines, in field of horticulture, location of malady in plants assumes an instrumental job. Plants are exceptionally inclined to illnesses that influence the development of the plant which thusly influences the nature of the rancher. So as to identify a plant illness at extremely beginning stage, utilization of programmed ailment discovery procedure is favorable. The indications of plant illnesses are prominent in various parts of a plant, for example, leaves, and so on. Manual recognition of plant infection utilizing leaf pictures is a dreary activity. Consequently, it is required to create computational techniques which will make the procedure of ailment discovery and order utilizing leaf pictures programmed. Plant ailments are significant components since its influences individual just as creatures and so forth. That is the reason as it can cause huge decrease in both quality and number of harvests in e cultivation. In this way, identification and grouping of ailments is a significant and critical errand. Generally, planters recognize the sicknesses by unaided eye perception strategy. To detect and identify the plant disease [1] at an early stage only and control those few of the investigators have implemented image processing techniques. At the point when a few sicknesses are not obvious to unaided eye but rather really, they are available; at that point it is hard to recognize it with the unaided eye.

Furthermore, when it is noticeable it will be past the point where it is possible to recognize malady and can't help any longer. Prior, magnifying lens is utilized to recognize the illness, yet it become troublesome as to watch every single leaf and plant. In this way, the quick and compelling way is a remote detecting system. Discovery and acknowledgment of illnesses in plants utilizing AI is productive in giving side effects of distinguishing maladies at it's soonest. For huge scale ranchers visit checking and early recognizable proof of infection is absurd and it brings about an extreme episode of the illness and vermin development which can't In this circumstance ranchers are compelled to utilize the toxic synthetics to annihilate the ailment so as to hold the harvest yield. This issue can be settled via robotizing the observing procedure by utilization of cutting-edge picture preparing strategies and AI. The main aim of this work is to i) detect unhealthy region of plant leaves particularly Tomato Plant.

Ii) Classification of plant leaf diseases [2] using texture features. iii) Code developed to analyze the leaf infection.

1.1 Diseases

Leaf diggers [3] are the creepy crawly family at larval stage. They feed among upper and lower some portion of the leaf. Figure 1.1 and 1.2 shows the leaf with leaf miner disease.

Fig 1.1 Leaf miner disease

Because of creepy crawly on particularly sum in plant, it is seriously harmed. On a solitary leaf the quantity of worms can be six. Hence, it can seriously harm the leaf of plant. It can restrict plant growth, leads to reduced yields.

Fig 1.2 Leaf miner disease

Hence, we can develop a robot, using image processing to detect the disease [4], to classify it. This will prevent manual intervention and therefore advance towards summarized unbiased decision. The main objective of the research work is to build a Leaf identification suite based on certain features extracted from photography. Thus, here itproposes a method in which the plant is detected based on its leaf patterns such as region, histogram leveling and border detection and classification. The main purpose of this program is to use Open-CV resources.

In fact, there are many benefits of merging Open-CV with the leaf detection program [5]. The outcome demonstrates this system to be an ingenious and a proficient attempt. Further we have given a discussion on image preprocessing and acquirement that contains the image preprocessing and enhancement, histogram equalization, edge detection. Moreover we initiate texture analysis and extreme rate feature extraction of leaf images to classify leaf images i.e., parametric calculations and then followed by results.

II. PROPOSED SYSTEM

This suggested research work's goal is making the programmed approach effortlessly accessible to the farmers who are using the gadget for timely discovery of the infections in plants. Following the assessment of the infections the solution is delivered to the farmer/owner of the field in the form of SMS. The means engaged with malady identification are Digital picture securing, Image pre-handling (commotion expulsion, Color change, and histogram adjustment), K-implies Segmentation, Feature extraction, and characterization utilizing the help vector the handling that is finished by utilizing these parts is isolated in to two stages.

The means engaged with malady identification are Digital picture securing, Image pre-handling (commotion expulsion, Color change, and histogram adjustment), K-implies Segmentation, Feature extraction, and characterization utilizing the help vector The handling that is finished by utilizing these parts is isolated in to two stages.

2.1 Methodology

Image acquisition: The sample images of the diseased leaves are collected and are used in training the system. To train and to test the method, unhealthy leaf images and few healthy images are taken. The images will be stored in some standard format. The image background should provide a proper contrast to the leaf color. Leaf infection dataset is prepared with both black and white setting, established on the proportional analysis. Dark back drop image gives improved results and therefore it is applied for the disease identification leaf.

Image pre-processing: Image taken by a digital photographic camera is pre-processed employing interference removal with averaging filter, color transformation and histogram equalization.

Masking green pixels: While the majority of the greenish color pixels indicate to the healthy leaf and it does not add any value to the disease identification techniques, the green pixels of the leaf are eliminated by a specific masking technique, this technique considerably diminishes

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 6, Issue 10, ISSN No. 2455-2143, Pages 239-248
Published Online February 2022 in IJEAST (http://www.ijeast.com)

processing period. The green is pixel covering is an elective stage in our disease identification technique as the diseased part of the leaf is able to be completely isolated in the segmentation process.

2.1.1DiseaseIdentificationUsingCNN:
Image is processed using the Basic CNN to detect the diseases in leaves. The data training in our CNN model has to satisfy following constraints:

1) There should be no missing values in our dataset.

2)The images should be converted into black and white format before feeding it into the convolution layer because reading images in RGB would involve a 3-D num Py matrix which will reduce the execution time of our model by a considerable amount.

3)Any kind of corrupted or blurred images should also be trimmed from the database before feeding it into the neural network [6].Now we have learned the data pre-processing rules, let us dive right into the working of the convolutional neural network.

2.2 Architecture

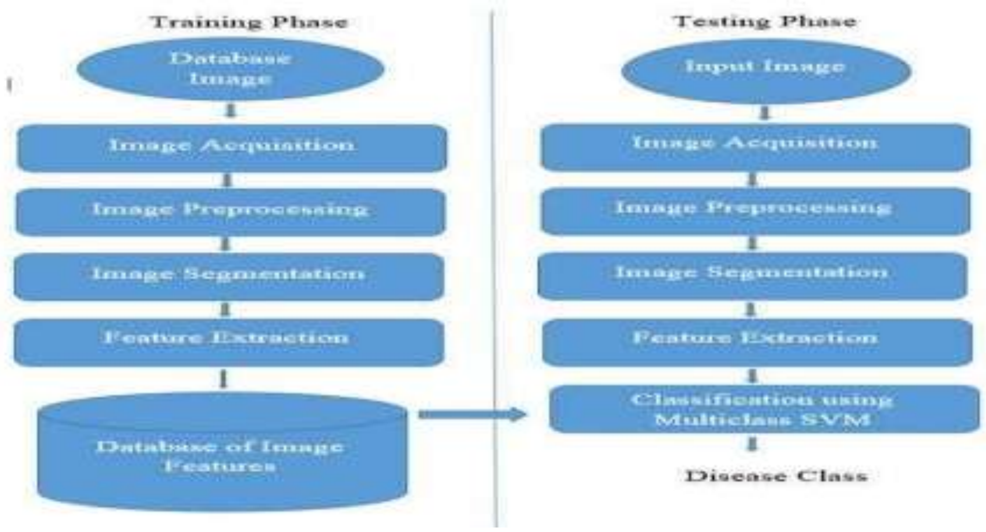

Fig 2.2: ML Model with Two phases

Figure 2.1, shows the architecture of the proposed system in terms of Machine Learning with training phase and testing phase.

2.3 Image Processing

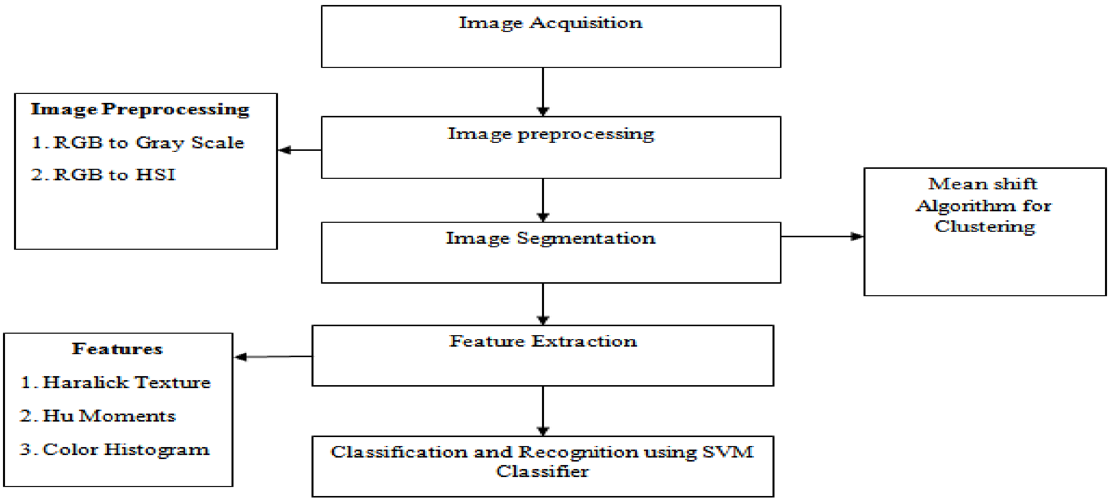

Fig: 2.2 Image processing

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 6, Issue 10, ISSN No. 2455-2143, Pages 239-248
Published Online February 2022 in IJEAST (http://www.ijeast.com)

Image acquisition: The diseased leaf image is obtained with the help of camera, the image is obtained from a specific consistent distance with adequate light to study and classify the leaf. The example pictures of the ailing leaves are gathered and are utilized in preparing the frame work. To prepare and to test the framework, ailing leaf pictures and less sound pictures are taken. Figure 2.3. Shows the images acquired. Figure 2.4 shows the HSI image of the Gall midge or Gall Gnat infected leaf. Gall Gnat or Gall midge also known as Cecidomyiidae is a family of flies which feed on the plant tissue.

Fig 2.3. Acquired images.

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 6, Issue 10, ISSN No. 2455-2143, Pages 239-248
Published Online February 2022 in IJEAST (http://www.ijeast.com)

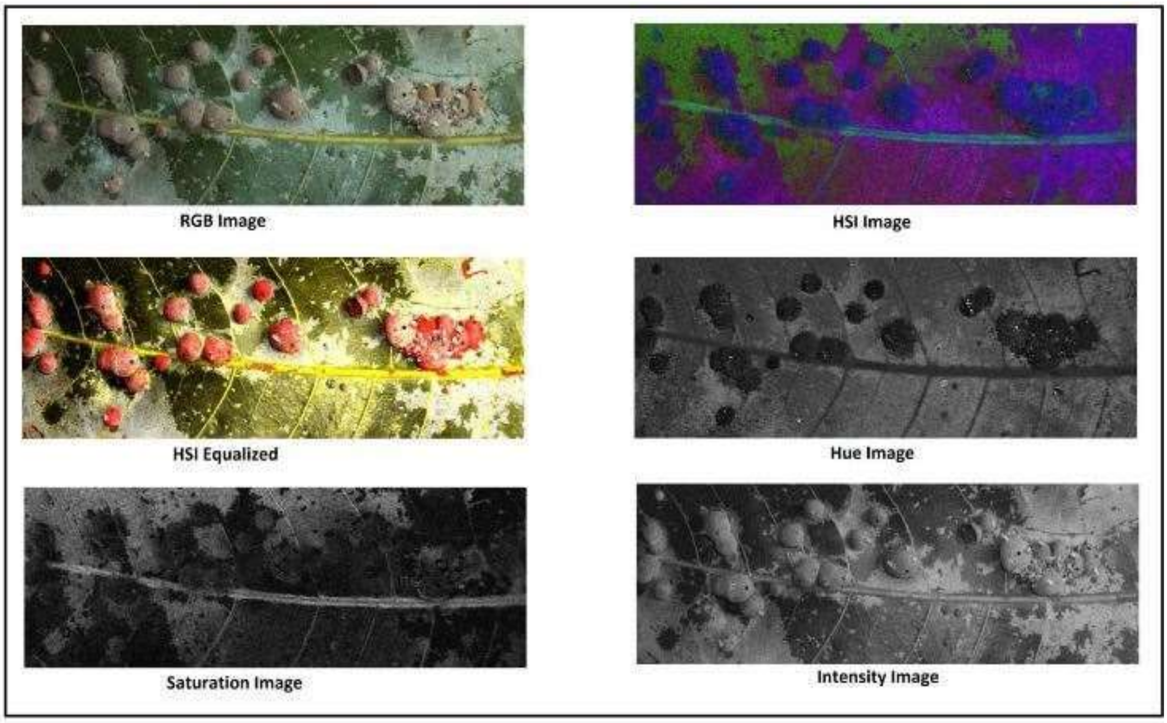

Fig 2.4 Hue Saturation and Intensity (HIS) image of gall gnats infected leaf.

Masking green pixels: As many of the green colored pixels represent the leaf in good condition and not add any value to the disease identification techniques, the green pixels of the leaf are removed by a certain masking technique; this method considerably diminishes processing time.

Algorithm
Step1:Initialize the Mean shift vector.
Step2:Move the density estimation window by m(x)
Step3: Compute the Mean shift vector after shift that is m(x).
Step4:Continueuntil convergence.
In this project, k-means [7] is a clustering method used to get the clusters of k numbers which matches the specified characters like to segment the leaf.

Algorithm Steps
1. Capture the image in RGB format.
2. Generate color transformation structure.
3. Convert shading esteems from RGB to the space determined in that structure.
4. Apply Kimplies bunching for picture division.
5. Veiling of green pixels (concealing green channel).
6. Dispose of the veiled cells present inside the edges of the contaminated bunch.
7. Convert the contaminated bunch from RGB to HIS.
8. Generation of SGDM matrix for Hand S.
9. Calling GLCM function in order to calculate the features of it.
10. Computation of texture statistics
11. Configure KNN (classifier) for recognition."

The image processing can be used in agricultural application for following purposes:
- Detecting leaves with disease [8].
- Quantify area that is affected.
- Finding the shape of affected area.
- Determine color of the affected area.
- Then the Texture analysis is done by finding size and shape of leaf.

The framework comprises of a portable application, which will empower the ranchers to take pictures of plants utilizing their cell phones and send it to a focal server where the focal framework in the server will dissect the photos dependent on visual manifestations utilizing picture preparing calculations so as to quantify the ailment type. A specialist gathering will be accessible to check the status of the picture examination information and give recommendations dependent on the report and their insight, which will be sent to the rancher as a warning in the application.

Disease detection [9] by using k clustering method. The calculation gives the vital advances required to the picture recognition of the plant leaf. In the first step, generally the RGB images of all the leaves are captured using camera.
In step 2 a color transformation structure is formed, and then color space transformation is applied in step 3.These two

steps are to be expected in order to perform step 4. In this step the images which we have got are processed for segmentation by using the K-Means clustering technique. These four steps come under phase one, the infected objects detected and determined.

In step 5, the green pixels are detected. Then masking of green pixels is done as: if the green color value of pixel is less than the threshold value which we already have calculated, then the red, green and blue components values of the these pixel are made zero. This is accomplished as these are the unaffected part. That is the reason there values are made zero which brings about decrease in estimations also. Furthermore, the time devoured by the raspberrypi3 for demonstrating the last yield will enormously limit.

In step 6^{th} e pixels having zero value for red, green and blue and the pixels on the edge of the infected clusters are removed completely. Phase 2 contains step five and step number six and this phase gives added clarity in the classifying of that disease. This results with good detection and performance, also generally required computing time should be decreased to its minimum value.

In step number seven, the infected cluster is converted from RGB form to HSI format. After that the SGDM matrices are created for every pixel of the image. But this is done for only for H and S images and not for the images. The SGDM actually measures the probability that agivenpixelatoneparticulargraylevelwilloccuratadifferentdist anceandangleoforientation from other pixel; however pixel has a subsequent specific dim level for it. From the SGDM matrices, generation of texture statistics for each and every image is done.

Concisely, the features are calculated for the pixels present inside the edge of the infected part of the leaf [10]. That means, the part which is not affected inside the boundary of infected part gets uninvolved. Steps seven to ten come under phase three. In this phase the features related to texture for the objects being segmented are computed.

Lastly, the acknowledgement process in the fourth phase was achieved. For each image captured the steps in the algorithm are repeated each time. Subsequently this the outcome are transferred to GSM module. Using Raspberry Pith e result is sentase-mail, and also is displayed on monitor. The segmentation of RGB image using k-means algorithm is shown in fig 2.5. The images are segmented to get a clear picture of the disease in the leaf.

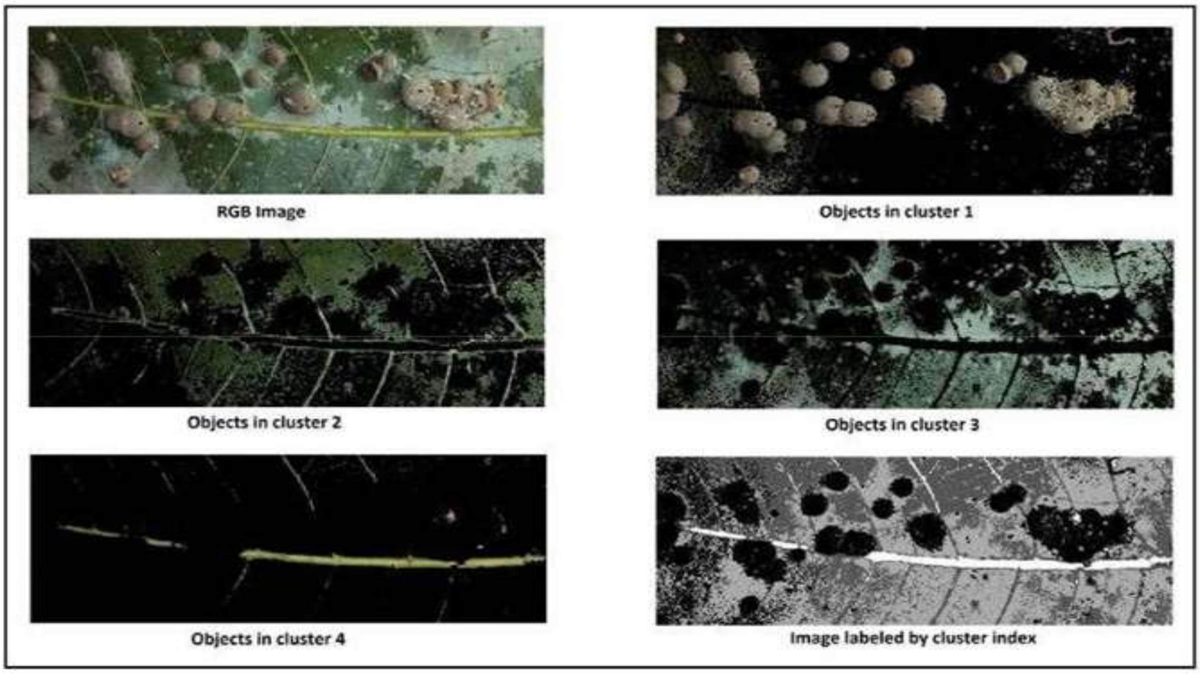

Fig.2.5 RGB image segmenting using the k-means algorithm

Feature Extraction:

It is a significant apparatus for recurrence investigation. The co-occurrence takes this analysis to next level where in the intensity occurrences of two pixels together are noted in the matrix, making the co-occurrence a tremendous tool for analysis. From gray-co-matrix, the features such as Contrast, Correlation, Energy, Homogeneity' are extracted. Table 2.1 lists the formulas of the features and also shows the extracted feature of some five leaves that will be used by the machine learning model to detect the disease.

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 6, Issue 10, ISSN No. 2455-2143, Pages 239-248
Published Online February 2022 in IJEAST (http://www.ijeast.com)

Table 2.1. Features of the extracted leaf

	Harlick Texture	Hu Moments	Color Histogram
Leaf 1	0.00102153	0.0054532	0.02005432
Leaf 2	0.0002128	0.02287866	0.06454578
Leaf 3	0.03322122	0.049896	0.0545464
Leaf 4	0.00025452	0.2651594	0.000554556
Leaf 5	0.0323202	0.00012125	0.046545446

III. EXPERIMENTAL RESULTS

In figure 3.1 we can see the screen which allows selecting the picture of the diseased plant.

Figure.3.1. Output Screen for Selecting picture to test the disease

In Figure 3.2 we can see the screen to select the leaf image for analysis of the disease and fig3.3 shows analyzing the leaf image.

Figure.3.2. Selecting leaf image for analysis

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 6, Issue 10, ISSN No. 2455-2143, Pages 239-248
Published Online February 2022 in IJEAST (http://www.ijeast.com)

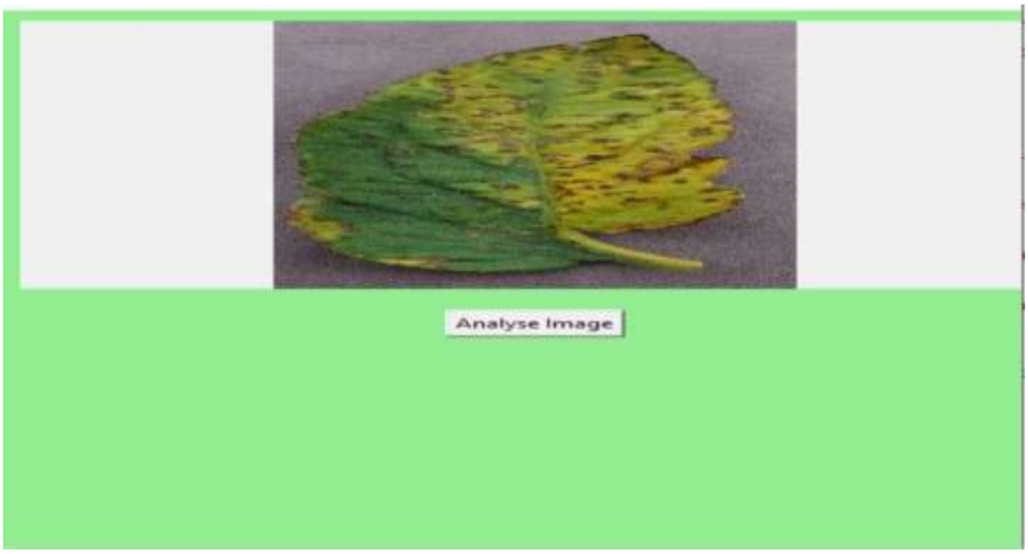

Figure.3.3. Analyzing the Leaf Image

In figure 3.4 we can see the status of the leaf after it has been analyzed and figure 3.5 displays the remedies for the unhealthy leaf based upon the analysis done.

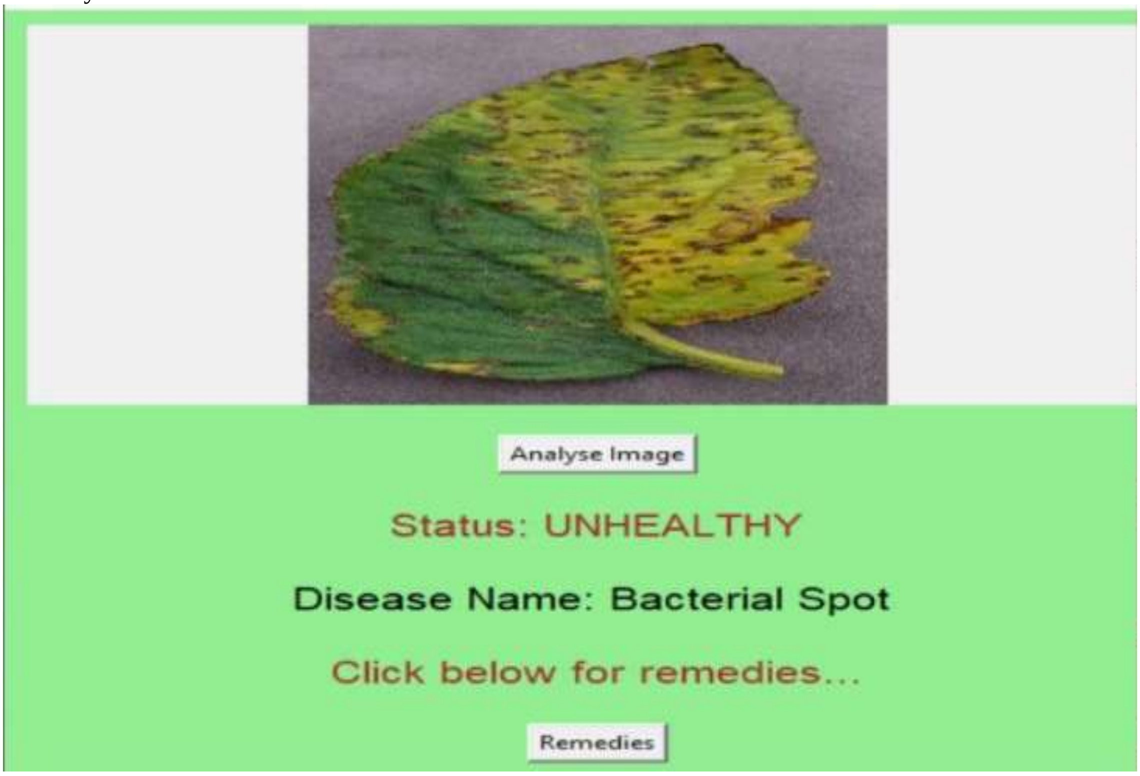

Figure.3.4. Analyzing the disease in the leaf

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 6, Issue 10, ISSN No. 2455-2143, Pages 239-248
Published Online February 2022 in IJEAST (http://www.ijeast.com)

Figure.3.5 Displaying remedies for the affected plant

IV. CONCLUSION AND FUTURE SCOPE

Conclusion

The proposed system was developed taking in mind the benefits of the farmers and agricultural sector. The developed system can detect disease in plant and also provide the remedy that can be taken against the disease. By proper knowledge of the disease and the remedy can be taken for improving the health of the plant .The proposed system is based on python and gives an accuracy of around 78%.The accuracy and the speed can be increased by use of Google's GPU for processing. The system can be installed on Drones so that aerial surveillances of crop fields can be done.

Future Scope

Using new different technologies and method we can make more faster and efficient application for user. The system presented in this project was able to perform accurately, however there are still a number of issues which need to be addressed. First of all, we consideronly four diseases in this research work therefore the scope of disease detection is limited. In order to increase the scope of the disease detection large datasets of different disease should be use. In future works, we are intending to utilize provincial pictures and improved CNN models so as to improve the arrangement execution. Furthermore, we will as semble pictures of various sickness esso as to enhance the database. The principle objective for ensuing exploration will build up a savvy cell phone application that can recognize different plant sicknesses. This application, which will furnish programmed plant ailment conclusion with visual examination, could be of extraordinary advantage to clients with next to zero information on the plants that they are developing. The proposed framework might be actualized by including additional administrations like close by government stores, value list for the pesticides, close by open market and some more.

Future work ought to be centered on recognizing illnesses in different areas of the plant and various periods of the sickness. The created model could be a piece of choice emotionally supportive network and all things considered give reasonable conditions to ideal choices. It can likewise be in corporate into a versatile application and give a cheap answer for recognizing plant maladies by just snapping a picture of the plant leaf.

V. REFERENCES

[1]. PEST DETECTION ON LEAFS USING ROBOT AND PROCESSING – LABVIEW.

[2]. HTTPS://CUSTOMWRITINGS.CO/PEST-DETECTION-ON-LEAFS-USING-ROBOT-AND-PROCESSING-LABVIEW/

[3]. S.Raj Kumar , S. Sowrirajan," Automatic Leaf Disease Detection and Classification using Hybrid Features and Supervised Classifier", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering,vol.5,Issue6,2016..

[4]. Tatem, D. J. Rogers, and S. I. Hay, "Global transport networks and infectious diseasespread," Advances in Parasitology, vol. 62, pp. 293–343, 2006. View at Publisher · View at Google Scholar· View at Scopus.

[5]. J.R.Rohr,T.R.Raffel,J.M.Romansic,H.McCallum,and P.J.Hudson,"Evaluating the links between climate, disease spread, and amphibian declines," Proceedings of the National Academy of Sciences of the United States of America, vol. 105, no. 45, pp. 17436–17441,2008.ViewatPublisher · View at Google Scholar ·View at Scopus.

[6]. T. Van der Z wet, "Present worldwide distribution of fire blight," in Proceedings of the 9thInternationalWorkshop on FireBlight,vol.590,Napier,New Zealand, October2001.

[7]. H.Cartwright, Ed., Artificial Neural Networks, Humana Press, 2015.

[8]. Mrunalini R.etal., An application of K-means clustering and artificial intelligence in pattern recognition for crop diseases, 2011.

[9]. S. Sankaran, A. Mishra, R. Ehsani, and C. Davis, "A review of advanced techniques for detecting plant diseases," Computers and Electronics in Agriculture, vol. 72, no. 1, pp. 1–13,2010.ViewatPublisher ·View at Google Scholar· View at Scopus.

[10]. P. R. Reddy, S. N. Divya, and R. Vijayalakshmi, "Plant disease detection technique tool—a theoretical approach," International Journal of Innovative Technology and Research, pp. 91–93, 2015. View at Google Scholar.

[11]. A.-K. Mahlein, T. Rumpf, P. Welke et al., "Development of spectral indices for detecting and identifying plant diseases," Remote Sensing of Environment, vol. 128, pp. 21–30, 2013.