Green Leaf Disease Detection Using Image Processing and IOT

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Abstract- India is an agricultural country and about seventy percent of our population depends on agriculture. One-third of our national income comes from agricultural. So, the disease detection of plants plays an important role in the agricultural field. Majority of the plant diseases are caused by the attack of bacteria, fungi, virus etc. If proper care is not taken in this area, it may lead to serious effects on plants and adversely affects the productivity and quality. This paper proposes an image pattern classification to identify the disease in leaf with combination of texture and color feature extractions. Firstly, normal and diseased images are collected and pre-processed. Then, features of shape, color and texture are extracted from these images. After that, these images are classified by Support Vector Machine (SVM) classifier. Image processing toolbox of Matlab is used for measuring affected area of disease and to determine the difference in the color of the disease affected area. The algorithm can be used to classify the leaves and the classified outcomes are separated using Arduino based Conveyor Belt system. This reduces the important task of monitoring of farms crops at very early stage itself to detect the symptom of diseases appear on plant leaves.

Indexed Terms- Support Vector Machine, Image Processing, Matlab, Arduino, Conveyor Belt.

I. INTRODUCTION

The goal of this paper is to detect the symptoms of the diseases at the early stage so that we can reduce the use of fertilizers. Traditionally farmers identify the diseases by naked eye observation method. In this method disease is visually detected by the experts, who have the ability to detect subtle changes in leaf color. This method is very laborious, time consuming and impractical for large fields. So, a fast and accurate approach to identify the plant diseases is needed. We can analyze the image of diseased leaf by using computer image processing technology and extract the features of disease spot according to color, texture and other characteristics from a quantitative point of view. The steps followed to detect leaf diseases are image acquisition, image pre-processing, disease spot segmentation, feature extraction and disease classification.

II. LITERATURE SURVEY

Savita N. Ghaiwat and Parul Arora examined the different classification techniques that can be used for plant leaf disease classification. For given test example, K-pop nearest-neighbor (KNN) method is seems to be suitable as well as the simplest of all the algorithms for class prediction. If training data is not linearly separable, then it is difficult to determine optimal parameters in SVM, which appears as one of its drawbacks and SVM is more complex to understand and implement. The main disadvantage of KNN algorithm is that it is a slow learner and also it is not robust to noisy data. (1)

S Arivazhagan et al. Proposed a software solution for automatic detection and classification of plant leaf diseases. The proposed algorithms efficiency can successfully detect and classify the examined diseases with an accuracy of 94 percentages. Experimental results on a database of about 500 plant leaves confirm the robustness of the proposed approach. The classification is first done by using Minimum Distance Criterion (MDC). A comparative study on different species of plant leaves were done based on their disease detection accuracy. (2)

Anand H. Kulkarni et al. Presents a methodology for early and accurate plant diseases detection, using Artificial Neural nNetwork (ANN) and diverse image processing techniques. As the proposed approach is based on ANN classifier for classification and Gabor filter for feature extraction, it gives better results with a recognition rate of up to 91%. An ANN based classifier classifies different plant diseases and uses the combination of textures, color and features to recognize those diseases. (3)

III. PROPOSED METHODOLOGY

First, the images of various leaves are acquired using a digital camera. The image-processing techniques are applied to the acquired images to extract useful features that are necessary for further analysis. After that, several analytical techniques are used to classify the images according to the specific problem at hand. The block diagram below depicts the basic procedure involved. In the initial step, the RGB images of all the leaf samples were picked up.

The step-by-step procedure of the system is as follows:

1. RGB image acquisition.
2. Convert the input image from RGB to HSI format.
3. Masking the green-pixels.
4. Removal of masked green pixels.
5. Segment the components using Otsu's method.
6. Obtain the useful segments.
7. Computing the texture features using Color-Co-Occurrence methodology.
8. Classification of the disease using Genetic Algorithm.

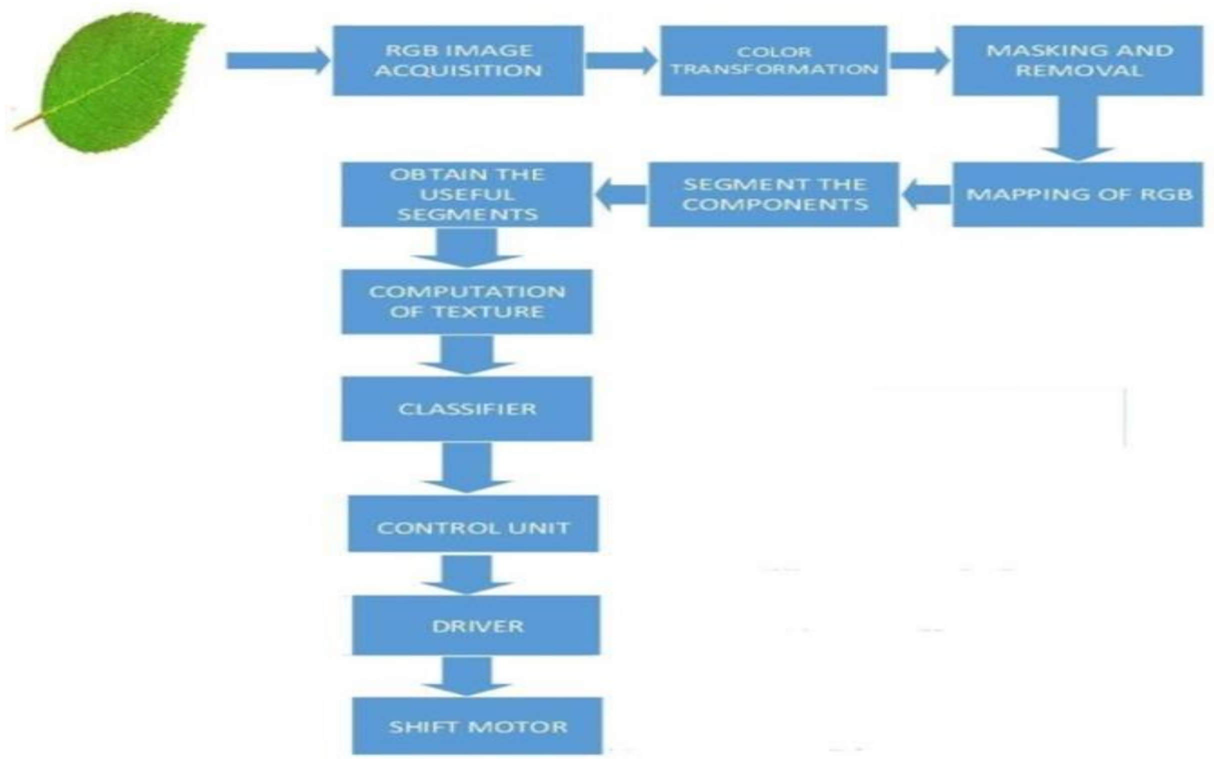

Figure 1: Block diagram of proposed methodology

1.1 Color transformation structure:

First, the RGB images of leaves are converted into Hue Saturation Intensity (HSI) color space representation. The purpose of the color space is to facilitate the specfication of colors in some standard, generally accepted way. HSI color model is popular color model because it is based on human perception. Hue is a color attribute that refers to the dominant color as perceived by an observer. Saturation refers to the relative purity or the amount of white light added to the hue and Intensity refers to the amplitude of light. After the transformation process, the H component is taken into account for further analysis.

1.2 Masking green pixels:
In this step we identify the greenest colored pixels. After that, based on the specified threshold value that is computed for these pixels, the mostly green pixels are masked as follows: if the green component of the pixel intensity is less than the pre-computed threshold value, the red, green and blue components of this pixel is assigned to a value of zero.

1.3 Removing the masked cells:
In this step, the pixels with zero red, green, blue values were completely removed. This is helpful as it gives a more accurate disease classification and significantly reduces the processing time.

1.4 Segmentation:
From the above steps, the infected portion of the leaf is extracted. The infected region is then segmented into a number of patches of equal size. The size of the patch is chosen in such a way that the significant information is not lost. In this approach, patch size of 32*32 pixels is taken. The next step is to extract the useful segments. Not all segments contain a significant amount of information. So, patches which are having more than fifty percent of the information are taken into account for the further analysis.

1.5 Color Co-occurrence method:
The color co-pays occurrence texture analysis method is developed through the SGDM. The gray level co-occurrence methodology is a statistical way to describe the shape by statistically sampling the way certain gray-levels occur in relation to other gray levels. These metrices measure the probability that a pixel at one particular gray level will occur at a distinct distance and orientation from any pixel given that a pixel has a second particular gray level.

1.6 Texture features:
Texture features like contrast, energy, local homogeneity, cluster shade and cluster prominence are computed for the Hue (H) content of the image as given in below equations (1) to (5):

Contrast: N, j 10 (i, j) 2 C (i, j) (1)
Energy: N, j 10 C (i, j) 2 (2)
Local Homogeneity: N, j 10 C (i, j) /(1 (i j) 2) (3)
Cluster Shade: N, j 10 (i M x j M y) 3 C (i, j) (4)
Cluster Prominence: N, j 10 (i M x j M y) 4 C (i, j) (5)

1.7 Classifier:
Genetic algorithms belong to the evolutionary algorithms which generate solutions for optimization problems. Algorithm begins with a set of solutions called population. Solutions from one population are chosen and then used to form a new population. This is done with the anticipation, that the new population will be enhanced than the older one. Solutions which are selected to form new solutions (offspring) are chosen according to their fitness the more appropriate they are, the more probability they have to reproduce. And finally, the success of the classification is done by using classification gain and the following equation is used for this:

Gain (percentage) = number of correct classification / total number of test images * 100

1.8 Control and Diver Unit:
The output from the classifier block is fed to the microcontroller unit. The microcontroller checks the result and decides to shift the motor to directions accordingly with the driver IC using conveyor belt. A driver IC is used to drive the dc motor. The healthy leaves can be collected in a basket and used for further applications.

IV. IMPLEMENTATION

This paper deals with a new type of early detection of pests system. Images of leaves affected by pests are acquired by using a digital camera. The leaves with pest images are processed forgetting a gray colored image and the nusing images egmentation, image classification techniques to detect pests on leaves. The image is transferred to the analysis algorithm to report the quality. The technique evolved in this system is both image processing and soft computing. The images are acquired by using a digital camera of approximately 12M-Pixel resolutionin 24-bits color resolution. The images are then transferred to a PC and represented in MATLAB software. The RGB image is then segmented using blob like algorithm for segmentation of pests on leaves. The segmented leave part is now analyzed forest imating pest density in field. The Support Vector Machine classifier is used to classify the pest types. It is also implemented in FPGA kit by converting the MATLAB coding into HDL coder. In FPGA, the input image is downoaded to the memory. It reads the image from memory, process it and display the output image on monitor. A softwarer out in ewas written in MATLAB. In which training and testing performed via several neural network classifier. Texture features classification methods are K-nearest neighbor, Radial basis function, Artificial neural networks and Back propagation network.

In Figure 2 we have to take a leaf image it undergoes image pre-processing it is a process of improving the image and configures it for a sub-sequent process by removing the noise and unwanted objects by improving the visual appearance. Feature extraction of a image contains a lot of information only some of this information can be used and it extracts features from it. In training samples there are two types training samples and testing samples. In training samples the classifier is trained using the training samples to extract the weights. In testing samples the system then examines the accuracy of the system. Knowledge base in this we collect all the information that is required for detection. In detection the accuracy of the healthy leaf will be more compared to the diseased leaf and hence the diseased leaf is detected.

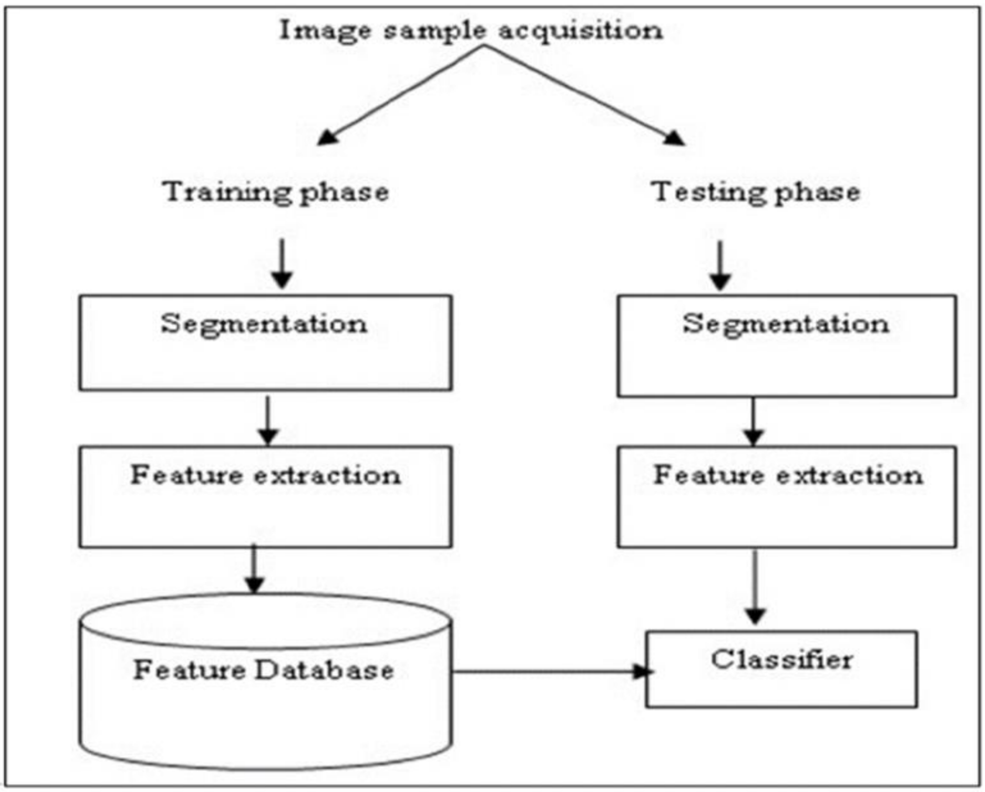

Figure 2: Proposed Block Diagram for Classification of Fungal Diseases

V. RESULTS

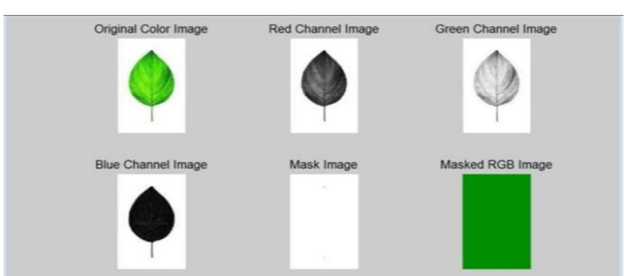

Figure 3: Masked Image of Fresh Leaf

The sample of fresh leaf which is not affected by any disease is shown in figure 3. After performing the color transformation from RGB to HSI. Then image is separated in red, green, blue components. Later, then the green pixels are masked and removed using a specific threshold value. Then R, G, B components are mapped to the threshold image.

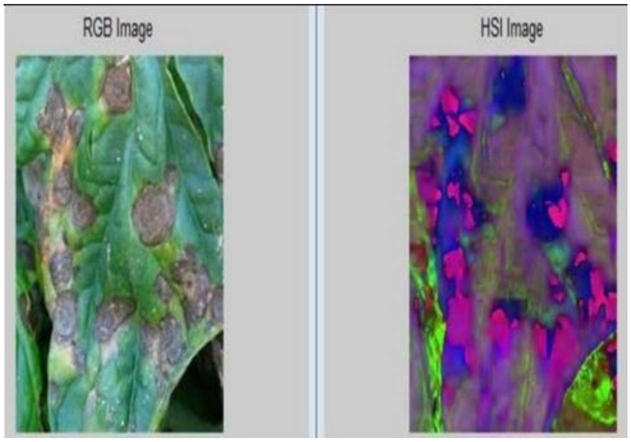

Figure 4: a. RGB to HSI transformation of the input image

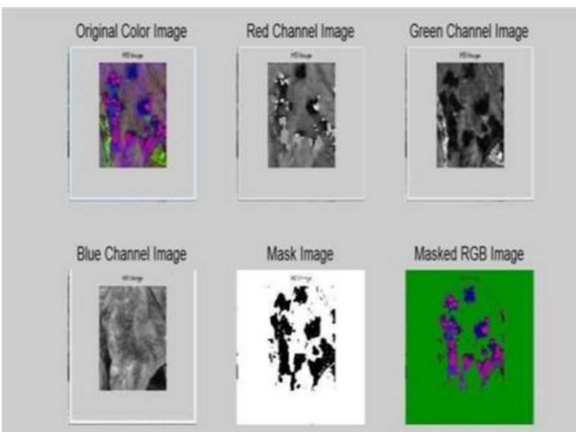

Figure 4: b. Masked image of defected sample

As a sample, a pepper plant leaf that is infected by late blight disease is given as input to the algorithm is shown in figure 4a. Color transformation structure on the input image is performed. Then the green pixels are masked and removed using a specific threshold value. Then the R, G, B components are mapped to the masked image.

Figure 5: A sample of segmented image

Image Segmentation is used to distinguish the foreground from the background. Simple thresholding using Ostu's method is used to separate the affected areas using various image parameters.

CONCULSION

The main approach of this paper is to recognize the diseases. Speed and accuracy are the important characteristics required for disease detection. Hence, the extraction of this work will focus on developing the advanced algorithms for fast and accurate detection of leaves with disease. This paper gives the survey on different diseases classification techniques that can be used for plant leaf disease detection and an algorithm for image segmentation technique used for automatic detection.

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