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Real Time Identification of Crop Diseases, Pest Damage and Nutrient Deficiency System

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Abstract- This report presents a survey on identification of different crop diseases using segmentation performed and the disease identified will be displayed on LCD, along with the essential fertilizers needed for the treatment of the disease. Once the disease is identified, there will be a mechanism for automatic sprinkling of fertilizers. The purpose of implementing such a system is to reduce the efforts of the farmers and to provide them with good yield in appropriate time. Farmers need not monitor the crops continuously. Moreover, manual monitoring of crops and their disease identification requires more time and expert supervision. The accuracy of the results obtained from expert supervision may not be reliable. In small villages, due to unavailability of experts, naked eye observation becomes costly as well as time consuming. So, analyzing these major drawbacks of naked eye observation, we have implemented a cost effective system which provides with accurate disease identification and their treatment in appropriate time.

Index Terms-Disease detection , MATLAB Software , Atmega16 controller , Pesticide Sprinkling.

1. INTRODUCTION

The method which gives less accuracy and is considered as a slow approach for detection of plant disease is based on naked observation. Due to availability of experts in various countries, detection of plant disease is expensive. It requires more chemicals for curing which are toxic to animals, insects and birds which are considered to be helpful for agriculture. Detecting the symptoms of diseases in early stages is an important part of automatic detection. In this paper, a MATLAB based system is used where we focused on leaf diseased areas along with image processing techniques. It starts with image capturing. Both the healthy and unhealthy images are captured and stored. Further these images are sent for image enhancement then for segmentation using the K-means clustering method for the formation of clusters. For training and classification various features are extracted. Hence diseases are recognized. This paper gives brief summary on importance of plant disease detection. It also provides a review on crop disease detection techniques . It provides methodologies used in the proposed system based on MATLAB. Hence, it finally provides an experimental result.

Authors mentioned the technique of apple fruit disease detection with various diseases such as apple blotch and apple rot. Euclidean distance is used to find the infected region and then fruit image conversion from RGB to L*a*b color space takes place. Texture features , color & shape are extracted and for fusion of more than two features feature level extraction is carried out. Global color histogram and color coherence vector are the two features to be extracted. Texture features such as Gabor Features, Local binary pattern, complete local binary pattern and local ternary pattern are used. Finally random forest classifier is applied for classification result[1].

Authors have used the technique of apple fruit disease detection and diseases such as : Blotch Fungal disease ,Rot Infections, Apple Scab are used. After image acquisition means method, detection in the region of interest and selection of only infected part takes place. After this process, extraction of features takes place along with the storage of database using support vector machine [2].

Authors mentioned the technique of Pomegranate diseases such as: , Anthracnose, Bacterial Blight and Alterneria. Pre-processing involves morphological operations, filtering and RGB and image resizing. YCbCr, L*a*b, and HSV are used for creating clusters in segmentation. Color, texture features and morphology are used for extraction and texture and morphology is used in for obtaining boundary of image using gabor filter. Minimum distance classifier (MDC) is used for training and classification of diseased or non- diseased image whereas shape vectors are extracted from healthy fruit image [3].

Authors mentioned the technique of mango fruit disease detection. They provided the video for mango fruit disease and histogram is computed by converting original image into binary.In image segmentation, Watershed algorithm is used to identify the defected regions and then features extraction takes place using blob extraction through

the template matching algorithm . Normalized correlation method is used for disease classification and then displays the defected region in the image[4].

Authors described technique for sugarcane leaf disease detection and various diseases such as : Downy mildew , Red stripe Red rot Brown Spot ,Sugarcane Mosaic and Downy Fungal. Pre-processing involves the conversion of RGB to grayscale removing the unwanted images. Location of the Potentially infected and Healthy area takes place by segmentation. Various disease detection techniques such as Multiclass SVM, Linear , Non-linear and are applied [5].

Authors mentioned the technique of Tomato leaves diseases detection and diseases such as : Early Blight & Powdery mildew. Pre-processing of the image involved various techniques such as background removing for image enhancement, image resizing ,smoothness, noise removal and image isolation . For feature extraction purpose of the feature vectors in classification, Gabor wavelet transformation is used which is applied in the Laplacian Kernel , Cauchy Kernel and Invmult Kernel in SVM for the purpose of training for disease identification & output decision [6].

Authors presented various techniques where pre-processing takes place by removing objects & spot detection algorithms & noise in image. Configuration of boundary takes place in segmentation for finding the leaf infected part. After this process, color co-occurence methods and H&B components are used for extraction of various features. Formation of binary images takes place from grey images using the Otsu threshold algorithm and then classification of diseases takes place along with identification through both back propagation network and artificial neural network[7].

Authors used the techniques for the detection of Scorch disease & Spot wherein conversion of color values to space value & creation of color transformation structure takes place. Removing of the masked cells from the boundaries by making of green-pixels after applying K-means method takes place. Extraction of the colour features such as Texture & edge colour, and finally for recognition and disease classification neural network is used[8].

2. BLOCK DIAGRAM

2.1. Camera

We can determine image quality from the following three elements : image processing engine performance, CCD image sensor pixel count and performance and Lens performance.

2.2. MATLAB

The proposed system starts by capturing the digital high resolution images and then storing the healthy and unhealthy images.

2.3. USB *to serial communication*

PL2303 chip is used for communication. It is a small USB to TTL serial tool. It can be used to connect some serial device to PC via USB port.

2.4 Microcontroller

Leaf disease algorithm detects the disease and passes to the microcontroller. Atmega 16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family.It is a 40-pin IC which uses only low power for working. So,it is suitable for embedded system design which uses 5V DC power supply.

2.5 Relays

Relay functions as AC power switches, and keep the control signals electrically isolated. Relays are used for controlling motor such as solid-state relay

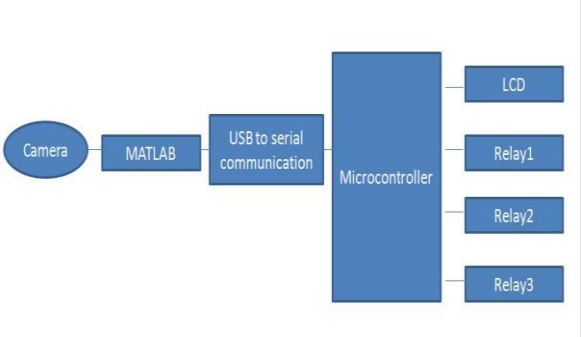

Figure 1 : Block Diagram

3. PROPOSED METHODOLOGY

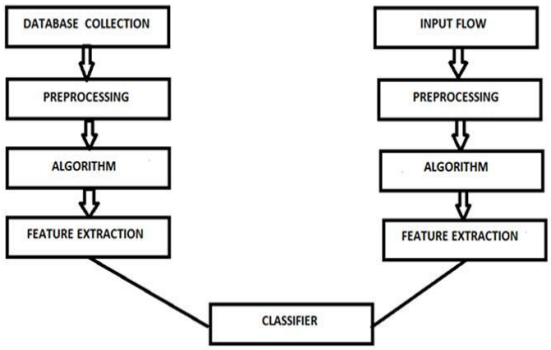

Figure 2 : Proposed methodology

A. Image Acquisition / Database Collection-

Image acquisition is a method in which digital image is processed and is captured using digital camera and stored in digital media for further processing of MATLAB operations. It is also used for retrieving an image from hardware , and then it is passed for further process. Using digital camera we captured healthy and diseased images of leaf and crop.

B. Image preprocessing-

Image preprocessing is used for improvising the image data which contains an unwanted distortion. This method uses various techniques such as Filtering of noise, Image conversion, changing image size and shape, morphological operations and
enhancing image. Usage of various MATLAB codes for enhancing the contrast, resizing of the image and RGB to grayscale conversion is done for further operations like creating clusters in segmentation.

C. Image Segmentation-

This method is used for converting digital image into many segments and then image rendering take place. In this method , for partitioning of images into clusters ,we used K-Means clustering method, wheras classification is carried out by minimizing the sum of square of distance between data objects and clusters.

D. Feature Extraction-

In this procedure, desired feature vectors such as Morphology, color, texture and structure are extracted. This method involves number of resources which are required for describing a large set of data, and from this data statistical texture features are decided using the GLCM formula. Number of gray levels is the essential part in GLCM. The statistics are arranged in the order of first, second and higher for number of intensity points in each combination.

E. Training & Classification-

SVM works on the principle of maximizing the minimum distance from the separating hyper-plane to the nearest example. Basic SVM supports only fundamental classification, whereas in extension multiclass classification is possibly used. Additional constraints and parameters are added in these extensions for optimizing the problems so as to handle the separation of different classes.

4. CIRCUIT IMPLEMENTATION-

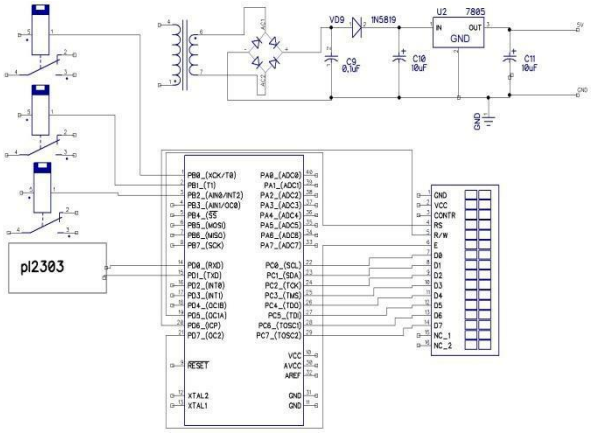

Figure 3 : Circuit Diagram.

5. SOFTWARE IMPLEMENTATION-

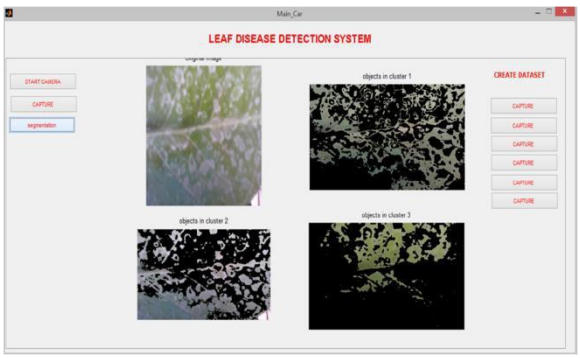

Figure 4: Graphical user interface.

6. CONCLUSION

This paper provides the identification of crop diseases and their treatment in cost-effective way. The leaf disease can restrict plant growth, resulting in reduced yields and loss of vigor by using image processing we can find out the type of the disease and according to that disease the system can spray the pesticides on the crop. K-means clustering algorithm and SVM techniques are the methodologies used in the proposed system.

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