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PLANT DISEASE DETECTOR

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***Abstract*— nowadays agriculture crops face many problems like traits or diseases. Each year plant diseases, viruses and fungal attacks lead to crop losses up to 30% of total production. Clearly control of plant disease depends on accurate and rapid detection and identification of the disease. Detection is the process of identifying the presence of symptoms of disease. Farmers in India have minimal access to agricultural experts, who can inspect crop for identifying disease and provide advice about disease. Delayed expert responses or advice to queries often reach farmers too late which are useless. Automatic detection of plant disease is important as it beneficial to monitor large field of crops and identifies the presence of disease symptom on the plant leaf or stem. In this project we develop Mobile app for automatically detecting plant disease through image processing technique with the objective of providing fast, accurate, ease of use and inexpensive solutions to farmers.**

Keywords— crop; plant disease; detection; mobile app

I. INTRODUCTION

India is an Agricultural country. Agriculture business in India has been always a priority. About 70% of India's population is dependent on the business of farming for employment. Two-thirds of the people who work in agriculture or agriculture related industry. Around 30% of the population of their indirect food, clothing, shelter depends on the income of farming. India is the second largest in the world for producing and exporting farm output. Agriculture sector share one-third of the country's GDP (Gross Domestic Product) and is its single largest contributor. Agricultural export contributes one-fifth of the total exports of the nation. In Indian economy, Agriculture is the Leading Contributor and also major component in the development of socio-economic Conformation of India. The Agriculture Sector cannot be overlooked because more than 50% of the manpower in India is employed only in this from last 30-40 years as per the United Nations Food and Agriculture Organization (UNFAO). Therefore, agriculture has always been a priority in India's Five Year Plans. The agriculture yield is not very much distinctive for developing countries like India and other and thus giving a scope for research in this area. Following are some of the causes of low productivity of agriculture in India.

- Illiteracy, lack of socio-economic progress, inadequate or inefficient finance for farm production and Lack of its sales and marketing facilities.
- For the adoption of modern agricultural technology and modern equipment in India is still not as much as you want.
- Plant diseases, insects and pests.

Agriculture Plays very important role in economic and social affairs of people in India. Indian agriculture basically characterized as a means of subsistence is changing fast as per market demands both domestically and international. The crop yield losses, on field and during post-harvest caused by pests, disease and weeds are of paramount importance. The responsibility of protecting food crops from diseases and pests in the challenging environment is rising with increase in human population and its needs. The crop losses due to pest are assessed to be ranging approximately between 20 to 30% of crop productions. The commercial farmers in developed countries are able to handle difficult situations up in the best way with the high input cost due to the increasing area of production, manpower and others by the application of proper knowledge base developed with the latest technology, whereas it is not so in developing countries like India. This is targeted to fill the gap between commercial farmers in developed and developing countries and to provide with the latest technological assistance to farmers. Information Technology has a key role to play in all facets of Indian agriculture. Nowadays there are lots of technologies like remote sensing, geoinformatics, wireless sensor networks and digital image processing etc. which are providing the support to Indian agriculture and farming sector. The latest technological application in this most deprived sector can help the Indian farmers for improving the efficiency and productivity of agriculture. The technology may provide the E-powering tool for Indian farmers in decision making, who lives in the rural areas. Mobile Technology with image processing techniques plays a major role in Indian agriculture sector. The requirement of mobile phone based application for targeting Indian farmer specific requirements and needs in rural India which depends on agricultural sector. This requirement provides a prospect chance to research community to study for agro-economic development of Indian rural areas. The mobile application solutions based on Indian farmer's needs and demand are a major challenge for technical and social research community with rural agro-economic constraints. Image processing techniques can be used to detect the plant disease at an early stage with the help of captured images by any imaging device. An expert system can be designed to provide the best care at the early stages with the help of the disease present and its security level. In developing countries most of the farmers identify the disease on the basis of their

experience, but some time, even expert farmers and plant pathologist are not able to recognize the exact disease present in the agriculture product. This problem can be solved using mobile based expert system in which the farmer only needs to capture the image of the disease leaf and on the basis of texture features the developed system will identify its type and severity. Various image processing techniques were used in agriculture like fruits and vegetable recognition, weed and soil segmentation, disease quantification, disease classification, disease identification. The need of the rural farmers is the exact information about disease, seeds, fertilizer, insects and cures. The dissemination of Information and Communication Technologies (ICT) in developing countries provides much opportunity to transfer knowledge and information. Mobile phones are easily available to across the nation because of price, usage in day today work. Mobile phone uses in developing countries play a vital role for the enhancement of agriculture business. From recent years, the modern mobile phones become more powerful and handy and also support wide variety of services.

II. METHODOLOGY

The proposed system designed as mobile application. The work commence with capturing image (plant leaf) with require information such as plant information, field information (state information) using Android Mobile phone with camera (more than 8 mp)and through internet connectivity send to the server. Server side image processing is done on input image to find the infected part on leaf. Generally, the proposed stages divided into four modules viz.

- Client Module (Front End)
  1) Client Module (Mobile Application)
- Server Module (Back-End)
  2) Feature Extraction Module
  3) Training Database
  4) Decision Making Module

Fig. 1 Proposed systems Architecture

The different image processing steps like image enhancement, image segmentation are applying on input image. Then different texture feature values are calculated from processed image. At last extracted feature values entered into the pre trained Artificial Neural network (ANN) as input to classify the test image. Finally predicted result (disease) send to user. [Fig.2]

A. Image Acquisition (Mobile Application program):

The application program is developed with Android programming language using Eclipse framework. The application program provides user interface to Farmers. The image is taken directly from the android device back camera [More than 8 mega pixel]. In this step, the captured image of the plant leave is chosen as a input from developed app, with field information, plant information and send to the server for processing [Fig.3]. The acquired images can be stored in different format such as PNG, JPEG, and BMP etc. This acquired image then undergo through various different image processing techniques at the server where feature are extraction for further analysis.

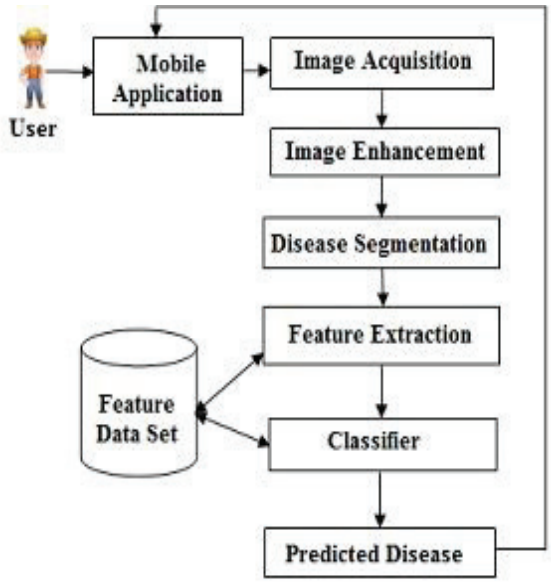

Fig.2. Flow structure of proposed system

B. Feature Extraction Module

Feature extraction is done on leaf image just to remove background and green pixels as to enhances the infected part and predict the appropriate cure on it.

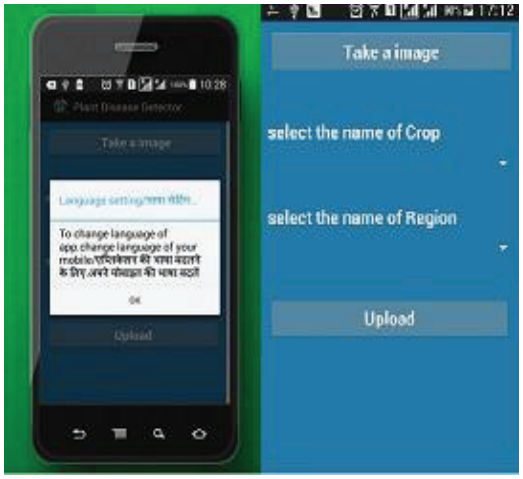

Fig. 3 UI of proposed system

a) Image Enhancement (Background Subtraction): In this process, Image enhance is done based on removing background, shadow and light reflections. Shadow or light reflection detection and removal are an important task when dealing with color outdoor images. It is still a challenging

problem especially from the images with complicated background such as with some interference and overlaps between two adjacent leaves. For the Background Subtraction EM algorithm for Gaussian Mixture [EMGM] was used. First background from acquired image is removed and then non-green pixels as shown in Fig.4

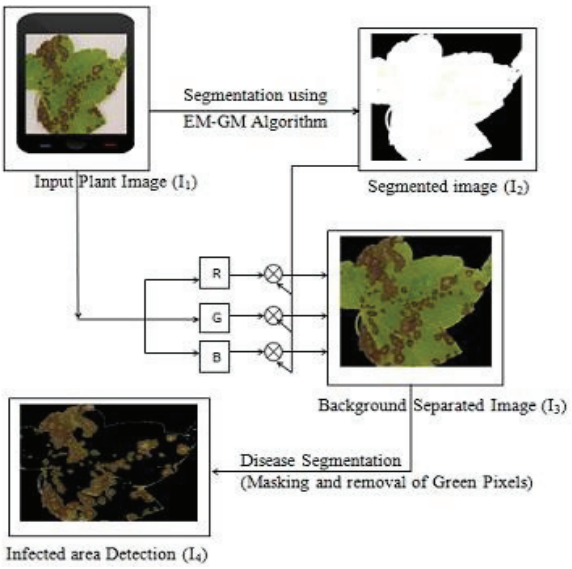

Fig.4. Flow Diagram of Infected Part Detection

b) Masking and Removal of green-pixels (Disease Segmentation) setting Threshold: Masking and removing the green pixels is important in the disease segmentation step because it describes the healthy part of the leaf image. For masking image pixel value are set to zero. To mask and remove green pixels from leaf image, need to set some specified or varying threshold value [t]. Assign zero value to RGB (Red, Green and Blue) component of pixel of an image, if the pixel intensity of green factor of pixel component is less than computed threshold value. Because these pixels are not useful for disease identification and classification step as it represent healthy part of leaf as shown in fig 4. Image segmentation is simply done to separate foreground and background of image, by setting background as 0 and foreground as 1 on gray level filtering of image.

c) Texture Feature extraction: Texture is important feature for classification and retrieval of an Image. Texture feature is characterizing the surface and structure property of an image which can be utilize in image processing. Image is generally made from pixels and texture property can be said as group of pixels. In this approach CCM[5] (color co-occurrence method/Harlick method) method used for texture feature extraction which used for classification of plant disease. As shown in fig 5, with help of texture extraction method, we had combined the black pixel part as one group and brown pixel part as another group.

C. Feature Database (Feature Dataset depending on plant disease images

For the detection and classification of plant disease require large number of image database. The images are used for testing and training purpose. The image library consist more than 750 images of different plants with 7 different features of each. Dataset was designed on the basis of disease classes of different plants. Some images were captured, generated by different research centers of Maharashtra and some are collected from Google images. The efficiency and accuracy of classifier is totally dependent on image database.

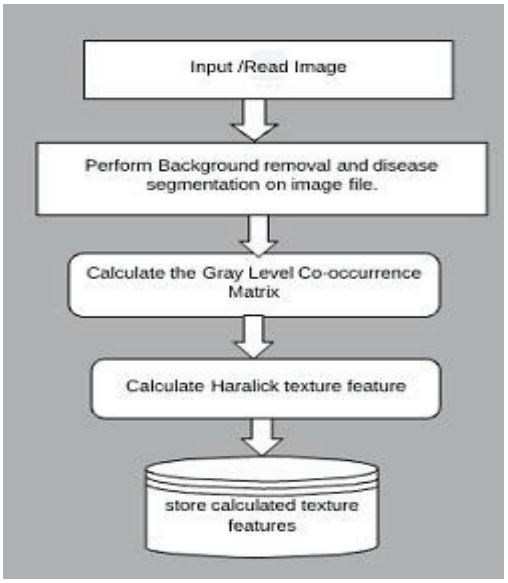

Fig.5. Flow Diagram of Texture Feature Extraction Module

D. Decision Making Module (Classification)

Decision making module predict the disease using the pre trained classifier and test data. The decision making module perform two steps, training and classification.

a) Image classification: It is the method where first we train any classifier with the features of images with known category. Any new image is classified using its feature vector and trained classifier. The proposed approach classification not only describes whether the leaf is diseased or not but also identify the disease that affect to the leaf. ANN was used as classifier to generated or trained using the feature database.

- Step 1: Define the classification class: Different classification classes can be defined on the basis of features and characteristics of image.
- Step 2: Feature selection: Unique features should be select or establish to discriminate between the different classification classes etc.
- Step 3: Sampling of training data: The appropriate decision rules should be determined by sampling the training data. The classification techniques such as Supervised or unsupervised should be selected using training data sets.
- Step 4: Train the classifier: From the appropriate training data, train the corresponding classifier for classification.
- Step 5: Classification: Using the pre-trained classifier or decision rules classification will be takes place.

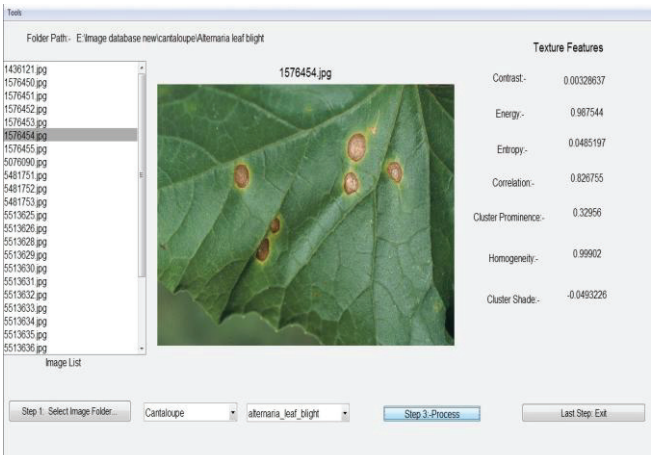

Fig.6. Haralick Texture Features (Trained Data)

b) Training Data for classification: To train, two matrices are considered, the input vector matrix and the target vector matrix. The input matrix is the P x M matrix where P is feature vector size and M is image database size. The corresponding target matrix is the Rx M matrix where R is disease class size and M is image database size. Each corresponding target matrix column consist 0 or 1. For first disease class in corresponding Target matrix column element consists 1 (other elements are zeros).

- Artificial Neural Network (ANN): An ANN is the information processing model based on the human brain (nervous system). It consist large number of interconnected components (neurons) that work for solving specific problems. ANN is highly parallel and distributed processing paradigm. ANN is train using training feature data and trained classifier used to classify the testing feature data. Validation is used for verify the accuracy of trained classifier. Before start the training, Proper Network should be set up which include the type of network (Feed forward networks or radial basis network) and method of training. Designing ANN model models follows the following steps:
  1) Build the Network
  2) Create Classifier: Train the Classifier and Testing the data with trained classifier
- ANN Network: Used feed forward neural networks of two layers with one hidden layer, in which number of neurons for hidden layer was 10. Complex problem require more neurons and more layers. The input to the neural network is feature vector matrix and its corresponding target vector matrix. The output is disease class representing these diseases (for example Alternaria blight (early blight),Downy mildew, bacterial pustule, frogeye leaf spot, powdery mildew, purple seed stain, septoria leaf spot, healthy leaf etc.). The disease class is different for each crop.
- Classifier: The images samples are divided into different sets like training, testing and validation. The training set used for NN training (train the classifier).The validation set used for check the validity of trained network. At last phase trained neural network applied on testing samples.

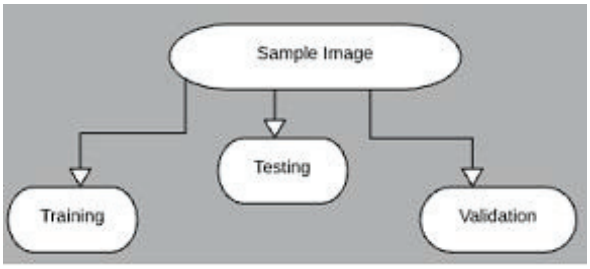

Fig.7. Classifier Sets

Some functions used by ANN for training in MatLab are:

x= input matrix, t= target matrix;
net = patternnet (10);
net= train (net,x,t);

E. Predicted Diseases:

The input or captured image entered by farmer, undergo this phases, tested against the classifier to predicted the infected part and to get appropriate remedial action, which is then send back to farmer. [fig.8]

Fig.8. Predicted Disease

III. CONCLUSION

Detecting the disease is mainly the purpose of this system. There is main characteristics of disease detection are help to farmers with speed and accuracy using Information and Communication Technology (ICT). The method reported in the thesis can be used to design a plant disease detector for farmers for the early detection of plant disease infection and getting appropriate cure remotely.

In proposed system we define the application of texture analysis for detecting plant diseases with the help of different image processing technique. There is require to working on development of automatic, efficient, fast and accurate system which is use for detection of disease and provide the solutions.

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