A Mobile Application in Regional Language (PUNJABI) for Identification and Management of Diseases in Mungbean

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Abstract: **The developed Android application aims to disperse the knowledge among farmers about the symptoms of various diseases and insects based on images, which alleviates the identification as well as management of diseases in Pulse crops at primary stage for farmers. Image processing has done by using OpenCV in Android in order to identify the type of diseases based on symptoms affected on Pulse crops, which are be caused by different pathogens produced by leaves as well as roots. The image matching helps the farmers when they are being unable to make out the difference between their real infected crop and the images displayed in application that exhibits the same disease symptom. Then farmer can upload their own captured image and get the matching result based on image matching with various images stored in the database. The efforts have been made to reduce the production costs as the farmers adopting various disease control policies, which incur intensive use of pesticides. Besides, this would bring the booming state in mungbean farming in Punjab, which ahead leads to flourished economic revenues. Moreover, the farmers will get notifications regarding Pulse diseases management.**

Keywords: **Android, Image processing with OpenCV, Mungbean diseases, Punjabi language.**

I. INTRODUCTION

Crop diversification is vital for sustaining the long term productivity of rice-wheat cropping system of Punjab. Pulses are best candidates for diversification. Pulses are consumed as *Dal* which is protein rich and cheap. Pulses are rich source of iron, improve soil health and also offer the potential for increased income for small scale farmers. Although several high yielding varieties of *Rabi* and *Kharif* Pulse crops have been released by PAU over the years, its production can be maximized by recommended protection technologies. Pulse crops are attacked by several insects and diseases about which farmers should have the knowledge. As the main reason for less productivity of Pulses is lack of awareness that result in poor yield and that the farmers do not want to take the risk. Extension can play a vital role in popularization of pulses in Punjab. So there is a need of a system for the ease of farmer to control the damage before it gets aggravate.The proposed mobile application provides knowledge to farmers about symptoms of various Mungbean diseases and insects based on images with just one tap of finger so that they can take precautions accordingly. It declines the harvest losses and increases the production of Mungbean in Punjab. This application will make farmers be able to identify Pulse crop diseases and insects. Moreover, farmers can acquire prevention methods and control methods with the help of this technology. The main objective is to develop an application to be simple in regional language keeping in mind the low literacy level among farmers. As before, Pulse crop diseases identification methods were used but most of the farmers were unable to avail the information. Our application provides disease symptoms with images captured by experts inbuilt itself. Apart from this, notifications will be sent to farmers regarding disease prevention. However, "e-Pulse Farming" the mobile app, boosts the mungbean yield by making farmer be able to detect the infected pulse crop diseases at primary stage. As, earlier crop diseases were identified through visual examination. This is only possible after major damage has already been caused to crop, so in that case treatments will be limited or of no use. To save the crop from damage, farmers should have knowledge related identification of diseases and insects even before its incidence becomes high. Pests and diseases are constant risks for primary producers as they can have serious impact on agricultural production and market access. This application will display the images of infected mungbean symptoms in an organized manner which farmer can explore and opt the required information such as causes, prevention methods and control measures.

II. RELATED WORK

Phadikar and Sil (2008) described a software prototype system for rice disease detection based on the infected images of various rice plants. The images of the infected rice plants are captured by digital camera and processed using image growing, image segmentation techniques to detect infected parts of the plants. Then the infected part of the leaf has been used for the classification purpose using neural network. The

methods evolved in this system are both image processing and computing technique applied on number of diseased rice plants.

Gonzalez and Anduzar (2009) concluded that identification of weed seedlings is a different task. An expert system to help farmers and extension workers to identify weed species in cereals has been developed. The expert system uses a hierarchical classification and a mix of the text description, photographs and artistic pictures. The system is supported by a database containing information about 41 weed species and 128 color images. The expert system was evaluated following the conventional expert system evaluation methodologies. The results of the validation indicated that non-expert users were able to make identification using the expert system. A total of 149 identifications.

Lai *et al* (2010) developed a system for corn diseases. Diagnosis and treatment of pest were also included. In this system, colored image database was prepared to interact with farmers effectively. Visual color image displays with questions and answers from expert system, enable to identify any disease and gives right treatment. This can be used for other plant pests or diseases by making small changes to the database.

Devraj and Jain (2011) studied the design and development of an expert system for the diagnosis and control of diseases in Pulse crops (PulseExpert), PulseExpert is an operational automatic diagnostic tool that helps farmers and extension workers to identify diseases of major Pulse crops viz., Chickpea, Pigeonpea, Mungbean and Uradbean (highly consumed Pulse crops) and suggests the appropriate control measures.

Krasula *et al* (2011) described several MATLAB based applications useful for image processing and image quality assessment. The Image Processing Application helps user to easily modify images, the Image Quality Adjustment Application enables to create series of pictures with different quality. The Image Quality Assessment Application contains objective full reference quality metrics that can be used for image quality assessment. The Image Quality Evaluation Application represents an easy way to compare subjectively the quality of distorted images with reference image. Results of these subjective tests can be processed by using the Results Processing Application. All applications provide Graphical User Interface (GUI) for the intuitive usage.

Phadikar *et al* (2012) developed an automated classification system based on the morphological changes caused by brown spot and the leaf blast diseases of rice plant. To classify the diseases Radial distribution of the hue from the centre to the boundary of the spot images has been used as feature. The feature extraction for classification of rice leaf diseases is processed in the following steps: firstly images acquired of diseased rice leaves from fields. Secondly preprocessing the images to remove noise from the damaged leaf and then enhanced the quality of image by using the mean filtering technique. Thirdly Otsu's segmentation algorithm was applied to extract the infected portion of the image and then radial hue distribution vectors of the segmented regions computed which are used as feature vectors. Here classification performed in two different phases. In first phase uninfected and the diseased leaves are classified based on the number of peaks in the histogram. In the second phase the leaf diseases are classified by Bayes classifier.

III. MATERIALS AND METHODOLOGY

ANDROID: Android is an open source operating system (OS) based on the Linux kernel and is initially designed for touch screen mobile devices like smartphones, table computers, specialized user interface for Android TV, android enabled vehicles and android wear. It was developed by the Open Handset Alliance, led by Google and other companies. It is used to run on different devices powered by Android and has been used in games, cameras, PC's and other electronic devices. It provides intuitive user interface and SQLite, a light weight relational database, is used for data storage purposes. Android applications are developed in java language using Android Software Development Kit (SDK). Android uses .apk files for distribution and installation of mobile applications. Android application package (APK) is a file format used for installing software on the Android operating system. It has various platform versions ranges from A to L and Android 6.0 Marshmallow has used to develop the proposed "e-Pulse Farming" mobile based application as it is the latest version released in October 2015. Android programming language is based on Java language. To develop the application java language has used which is the official language for Android development. Larger parts of Android and its APIs are designed in Java. Moreover, C/C++ can be used to develop the Android application using the NDK but usually Android mobile applications are developed in Java programming language using SDK. Apart from this, Android code is not platform independent unlike Java. Java is object-oriented language revolving around real world objects and it is run on JVM regardless of computer architecture whilst in Android it is run on the built-in virtual machine named 'Dalvik'. To execute the program for Android application written in Java, Dalvik virtual machine is used. Dalvik is an original virtual machine built-in Android and is optimized for mobile devices. The Java source code is compiled into bytecode and then it is interpreted into Dalvik bytecode. Dalvik bytecodes are executed in .dex (Dalvik Executable) and .odex (Optimized Dalvik Executable) formats. However, Java source code is compiled into .class file on Java platform and still it is stored in .class file on Android platform too. But after that "dx " tool is responsible for conversion of .class file into .dex and .odex formats. The .dex file is optimized for memory usage as it uses shared constant values used within the class such as string values, field, variable, class, interface and method names.

IMAGE PROCESSING: Fast Retina Keypoint (FREAK) is a binary descriptor, which has used to detect the key points in images and then to compare the histograms constructed from the images to find out the similarity between images. The hamming distance is calculated between the histograms. Image comparison with minimum distance results the maximum chances of matching of images. The distance is limited upto 1500.

Data Flow Diagram : The user module and administrator module has been designed in the following manner.

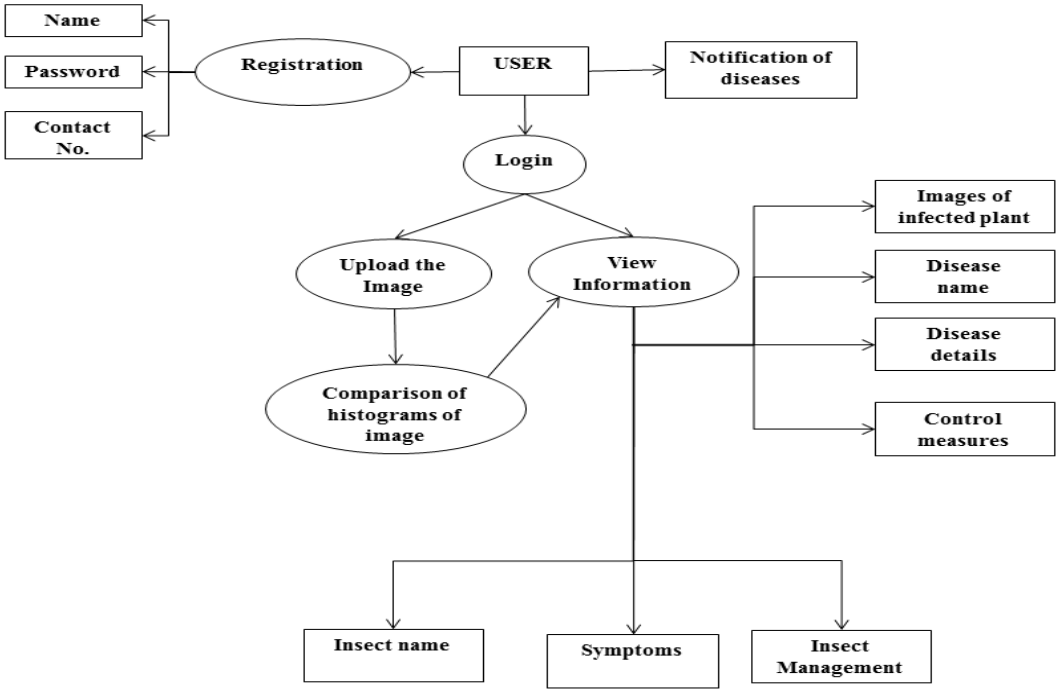

Fig.1 Data flow diagram for user

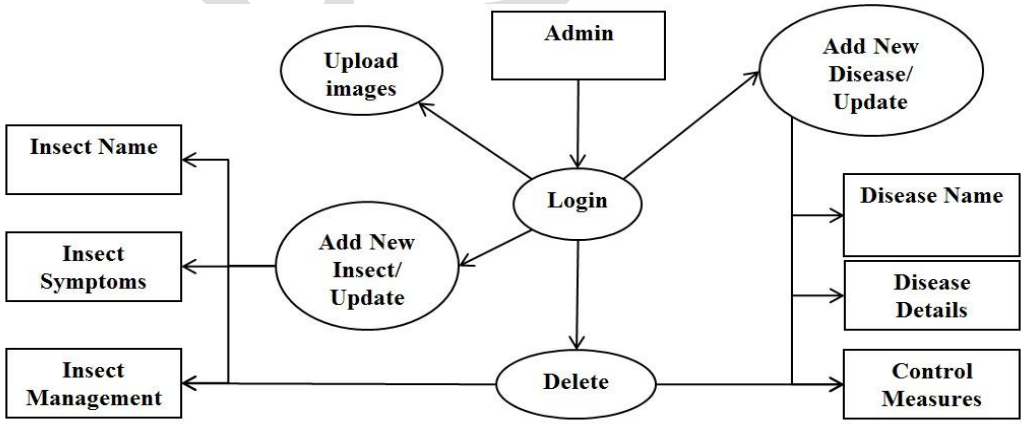

Fig. 2 Data flow diagram for admin

IV. RESULTS AND DISCUSSION

Image comparison algorithm has been performed on images of infected Pulse crops, which are stored on server in database. Each image is uploaded in .jpg format and collection of images is used as data set. This application caters the farmers required information regarding diseases along with images captured by experts within fraction of time.In this proposed application, image matching depends on various factors are hamming distance which has calculated, number of descriptors are calculated and compared as well. However, the histograms are constructed and compared as in the application if the comparison lies between 0 and 1500 a limit then it results the images may be possible similar, if it is equals to 0

then it shows the exact matching and if it exceeds the limit then the images are not similar. The minimum distance weighs the exact outcome. Somehow, the results may fluctuate because of daylight effects. OpenCV library has been used for image processing in Android. The application aims to bring a booming state in Pulse crop production, which would widen the perspective of the farmers and prove as a lucrative for economic revenues. This system provides a user-friendly environment. Moreover, farmer can avail the services with apparent ease, as there is no linguistic barrier. The application is developed in simple and efficient manner keeping in mind the farmer's perspective. Besides this, sometimes it is difficult to identify the symptoms of diseases and usually farmer relies on experts for getting information regarding control measures and precautions, which is somehow a time stealer even it is difficult to minute the intricacies of the agricultural magazines. Therefore, the proposed application is a remedial solution to help the farmer with just one click of button on their mobile phones. The farmers can either make use of uploading image feature or view the images stored in database with required information. When farmer upload their image which would match with the images saved in database and in response collates the matching result. Farmer can get notifications and the displayed information of diseases details in order to identify the diseases in their Pulses before its damage gets aggravate. Adding on to it, there is plethora of applications regarding agricultural field but the effort has been made for the proposed application to get this different with the feature of local language Punjabi that allows farmers to make use of this application effectively. The simple and effective GUI (Graphical User Interface) has been designed for both the modules are user and admin. Admin can add more pulses, update the information, delete undesirable content and upload more pictures depict symptoms of diseases.

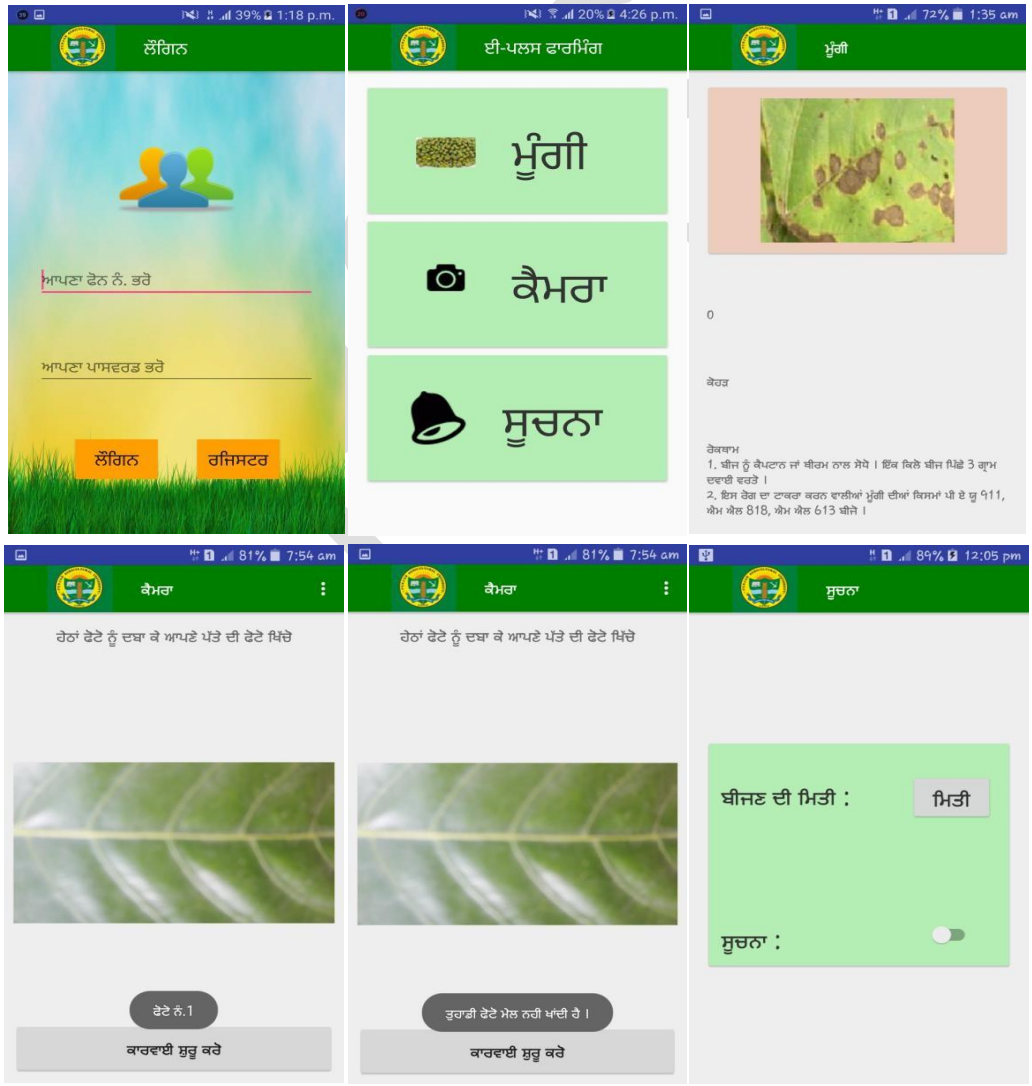

Fig. 3 Screenshots of Mobile Application

V. CONCLUSION

Ever since the contemporary era came into limelight, technology is ruling the roost so if technology can be utilized in Pulse farming then the livelihood of farmers would be improved as well as the economic conditions of farmers would also be enhanced. All these factors would ameliorate the economic revenues of the country. The "e-Pulse Farming" application facilitates the farmers with better remedial solutions for mishaps occurred in crops due to diseases. With the help of this application farmer can get information with just one click. Eventually, farmers will end up their farming activities efficiently and effectively.

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