Mobile Application for Information Retrieval on Pest and Disease in Crops

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Abstract—*Pest and disease attack in crops is one of the major issues of agriculture. Lack of proper information regarding thte crop protection among the farmers incur huge crop loss. To reduce the knowledge gap between farmers and researchers, a proper information retrieval system is needed. To achieve this goal, a mobile application has been developed to provide information to the farmers about the problems due to diseases, insect-pests, nematodes, weeds and physiological disorder. The application has been developed on the android platform. The application has been tested for the maize crop and provided the intended results as specified.*

Keyowrds: Crop protection, Information retrieval system, Mobile application, Android, Maize

INTRODUCTION

One of the major issue of today's Indian agriculture is crop-yield losses due to insect-pests, diseases, weeds and abiotic stresses. It has become one of the greatest threats to our food security. The farmers require the proper information and knowledge about the potential pest and disease attack during the cultivation of the crops and proper crop management practices to prevent, avoid, and escape these problems. The recent advancement in the Information and communication technology (ICT) has shown a significant role in dissemination of information from the research lab to the farmer's field [1]. Various technologies such as information-retrieval systems, GIS, expert systems, decision support system, knowledge-bases etc. have been evolved for transferring information and knowledge regarding different crops management practices through the internet. AGRIdaksh is one of such information-retrieval systems, developed by ICAR-IASRI, which provides specific information about agricultural crops to the user [2].

In last few year development of mobile application has become a passion due to the advancement of the smartphone technology across the globe. The interest of common people have been shifted from traditional desktops and laptops, to smartphones and tablets. Mobile applications are becoming popular in agriculture sector too, with the potential for further advancement in agriculture [3, 4, 5 & 6].

So this work is aimed on the development of the mobile application on the android platform to provide detailed information about the disease, insect-pests, weed, nematode and physiological disorder for different crops. The application will also provide information about state-wise pest and disease resistant variety selection for crops. There is an image and video upload facility for the user as queries. And finally, the application has been tested based on the data available in the database.

MATERIALS AND METHODS

GENERAL FRAMEWORK

The proposed mobile application will act as an information retrieval tool to the users for the aspect of crop protection. It has been developed on the android framework [7]. Its architecture follows the n-tier architecture of software development consisting several layers (Fig. 1). The mobile application is connected with the database server through the web services. The web services provide the accessibility of the database to the mobile application.
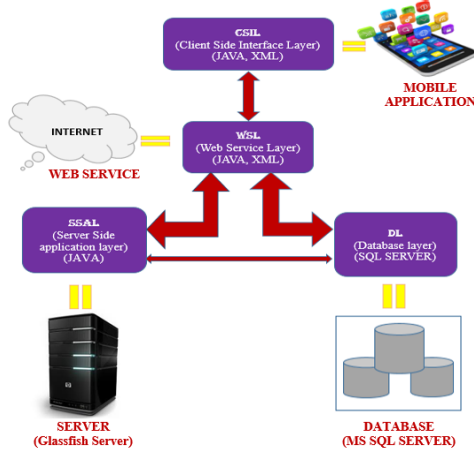
Fig. 1: General Framework of the Application

IMPLEMENTATION

CLIENT SIDE INTERFACE LAYER (CSIL)

The CSIL is the user interface of the android application that directly interacts with the users. It is implemented by JAVA programing language and XML using Android studio IDE. The application has been developed with minimum SDK version of API 15: Android 4.03 (Ice Cream Sandwich) [7]. The CSIL consists of forms for accepting inputs from the user, list of items in Dropdown view, items inside Radiogroup view, Buttons, ImageView, Video View etc. This layer shows the detailed information about crop protection and resistance with images varieties in the mobile screen. The flow of information in the client-side layer for crop protection information has been shown in the following figure (Fig. 2).
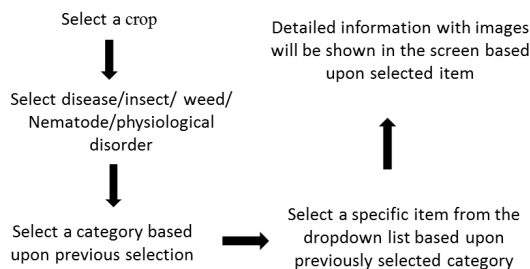

Fig. 2: Flow of Information in the Application

Web Service Layer (WSL)

The web service layer acts as an intermediate layer between the mobile application and database layer. The application gets the information from the

database in the server through the web services. Web service consists of several web methods that exposes data from the database to the outside world. For this application, SOAP (Simple object access protocol) web service has been used [8]. It is xml based messaging protocol used for transfer of data between systems. A SOAP client library called kSOAP 2 has been used. kSOAP 2 library provides interfaces to the android application to integrate the SOAP functionality within it and to parse WSDL and SOAP messages [9]. This layer has been implemented by JAVA programing language along with the several web service annotations. The list of web services developed are given in following table no-1.

Table 1: web Services and Web Methods

Web Service Name	Functionalities
DiseaseWebService	Prtovides web methods for accessing disease information of crops
InsectWebService	Provides web methods for accessing information about insect pest of crops
NemaWebService	Provides web methods for accessing information about nematodes
WeedWebService	Provides web methods for accessing information weed infestation
PhyDisWebSevice	Provides web methods for accessing information of physiological disorders in crops

Server Side Application Layer (SSAL)

There will be a server side application layer which will have the core classes that will provide some functionalities such as database connection, interaction with different layers etc.

Database Layer (DL)

The database layer stores and maintains the database of the application. The database contains privilege information about insect-pests, diseases, weeds, physical disorder etc. It has been implemented with MS SQL server 2012. The database design of the application has been presented by level 1 ER diagram (Fig.3).
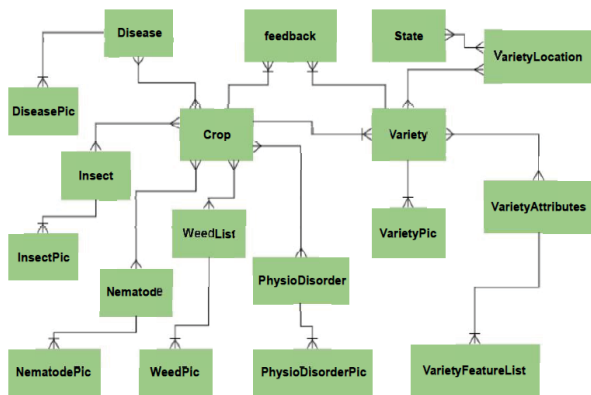
Fig. 3: Level 1 ER Diagram of ohe Database

RESULTS AND DISCUSSION

The mobile application has been successfully developed for crop protection information as well as information about resistant varieties of crops. The database for this application contains the data for the maize crop and has been tested with these data with the successful results. This application contains mainly following features such as-

(a) An interface for detailed information retrieval along with images of disease, insect-pest, nematode, weed and physiological disorder of the crops (Fig.4).

Fig. 4: Crop Protection Information Retrieval Interface

(b) Information retrieval interface regarding the insect-pest and disease resistant varieties of the crops (Fig. 5). The resistant varieties are available state wise for different crops.

Fig. 5: Resistant Variety Information Retrieval Interface

(c) The application includes a well-defined query/feedback interface for the users (Fig.6). The users can submit their queries regarding the crop protection problems or they can give us any suggestion about the application as feedback. Users can submit their queries in form of text or by capturing images of the problem. Users can also record videos from their smartphone and send to them through the application.

Fig. 6: Qeury/Feedback Interface

At present, the mobile application shows crop-protection and resistant variety information of maize crop only as the database contains data for Maize crop. In near future the data for other crops such as tomato, tobacco and mushroom would be incorporated within the database and can be seen in the interface of the mobile application. The developed android application would be of great

use to the farmers to deal with crop losses due to the biotic agents and making farming a profitable venture.

REFERENCES

[1] Pongnumkul, S., Chaovalit, P., & Surasvadi, N. (2015). Applications of smartphone-based sensors in agriculture: a systematic review of research. *Journal of Sensors*, 2015, Article ID 195308, http://dx.doi.org/10.1155/2015/195308.

[2] Yadav, V. K., Marwaha, S., Kumar, S., Kumar, P., Kaul, J., Parihar, C.M., & Supriya, P. (2012). Maize Agridaksh: A Farmer Friendly Device. *Indian Research Journal of Extension Education,* 12(3), 13-17.

[3] Deodhar, M., Bhave, R., Bhalodia, K., & Rathod, M. (2018). Android Application for Crop Yield Prediction and Crop Disease Detection. *International Journal of Science and Engineering.* 3(1), 145-149.

[4] Intaravanne, Y., & Sumriddetchkajorn, S. (2015). Android-based rice leaf color analyzer for estimating the needed amount of nitrogen fertilizer. *Computers and Electronics in Agriculture*, 116, 228-233.

[5] Patel, V. B., Thakkar, R. G., & Radadiya, B. L. (2014). An android application for farmers to disseminate horticulture information. *International Journal of Computer Applications*, 88(4), 1-4.

[6] Permale, H. K., Masturah, M. T., & Abdullah, A. H. (2018). Automatic Irrigation Monitoring System Using Android Based Application. *Journal of Telecommunication, Electronic and Computer Engineering*, 10(1-14), 129-132.

[7] Introduction to Android: Available at: https: //developer.android.com/guide/index.html

[8] Soap Web Service-Introduction: Available at: https://javapapers.com/web-service/soap-web-service-introduction/

[9] kSOAP 2 API: Available at: http://kobjects .org/ksoap2/doc/api/index.html