Crops pests and diseases management system using android and GIS platform for the department of agriculture, province of samar

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ABSTRACT

According from the Department of Agriculture, there were 9 types of pests and 8,000 types of diseases currently existing in the province of Samar. The farmers cannot identify the types of pests and diseases that affects their crops. At present, the provincial agriculturists and scientists used surveillance forms and damage reports and manually processed in analyzing and interpreting the results for decision making. The proponent decided to conduct a scientific research and develop a customized mobile application with GIS platform that adequately helped the hitches in the department that adequately solved the present problem. The customized mobile application with GIS platform intensify the data monitoring and analysis of crops pests and diseases in the province of Samar. The research design used was fact-finding techniques that provides reliable and accurate results through mixed methods. In the development of the software, Agile model and Hersh Iterative Four Stages Approaches were used. Furthermore, for the development of GIS map, the proponent used thematic mapping and manifold system. The customized software with GIS map was evaluated under ISO 9126 in terms of Effectiveness, Reliability and Functionality. The results understood that the target users perceived the advantage of customized software with a very high rating or 94.3%.

Keywords: android application, geographic information system (gis), international system organization (iso), system development life cycle (sdlc).

1 INTRODUCTION

The Department of Agriculture is the government agency responsible for the development, improvement, management and conservation of the community farming and livelihood. The department holds the role of monitoring and controlling the use of agriculture farming lands owned by personnel or government property. The type of crops and plants and either used of machines and fertilizers are also monitored. This method helped farmers to maintain strategies and can yield better crop production.

One of this is the province of Samar, that the Agricultural land which vegetables plants encounter pests and diseases causes by insect bites. They destroyed crops such as vegetables, rice corn, potato and other form of crops in the province. Farmers use of different insecticide to control pests' problems but it

affects the health of their children, elderly and pregnant women due to lack of scientific information of pests and diseases management system.

Currently, the monitoring process of the plants pests and diseases is done manually by reviewing all the surveillance forms of every farmer and pests damage reports. It takes a lot of time to determine what kind of pests is rampant in a certain area and how wide is the affected area. It is also for the Provincial Agriculturist in doing the data analysis because of the large number of files that need to be reviewed. Currently, the Provincial Agriculturist used the Population of Specific pest that affects the area and it takes time in analyzing and decision – making for the appropriate solutions to the problem. This mechanism is really time consuming and takes a long process. In fact, by the time that the Provincial Agriculturist will give the action, pests are already destroying the plants and some might migrate to other farms.

Consequently, generation of reports for the monitoring of plants pests and diseases is done by reviewing the surveillance forms and pests damage reports of every municipality. Beneficial insects reports and insect pests are also included in the reports of the Provincial Agriculturist to be submitted to the Regional Crop Protection Center (RCPC). The validation and consolidation of the Agricultural technologist is done weekly. The data analysis is the Provincial Agriculturist can't easily generate comprehensive reports because of the volume of files submitted from the Agricultural technologists and scientists. Generation of reports in the Regional Crop Protection Center (RCPC) is also done by reviewing all the files that was submitted by the Provincial Agriculturist in every province.

2 REVIEW OF RELATED LITERATURE

The Centenary Review Crop losses to pests for Plant Diseases, Rheinische Friedrich-Wilhelms-Universities Bonn, Nussallee 9,D-53315 Bonn, Germany(Revised MS received 9 August 2005) that the productivity of crops grown for human consumption is at risk due to the incidence of pests and diseases. Crop losses due to these harmful organisms can be substantial and may be prevented, or reduced, by crop protection measures. The different types of crop losses as well as on various methods of pest control developed during the last century. The potential losses despite the current crop protection practices are given for wheat, rice, maize, potatoes, soybeans, and cotton for the period 2001–03 on a regional basis (19 regions) and others. Among crops, the total global potential loss due to pests varied from about 50% in wheat to more than 80% in cotton production. The responses are estimated as losses of 26–29% for soybean, wheat and cotton, and 31, 37 and 40% for maize, rice and potatoes, respectively. Overall, weeds produced the highest potential loss (34%), with animal pests and pathogens being less important (losses of 18 and 16%).

According to (Csótó, 2010), monitoring the crops is more effectively as is now is Internet era, where information plays a key role in people's lives, agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (e.g., sensors, farming machinery, meteorological sensors, etc.) in order to become more efficient in production and communicating appropriate information. Juhua Luo (2010) According to this study The crop diseases and insect pests were all important biological hazard in agricultural production, and for many years, they restricted seriously the agricultural sustainable development. Statistics from the UN Food and Agriculture Organization showed the world grain yield lost 10% because of pests and 14% because of diseases for many years. At the same time, the world cotton yield lost 16% because of pests and 14% because of diseases. China is a big agricultural country in the world, so the lose because of diseases and pests were approximately equivalent with the above statistic (Huang Muyi et al, 2003). It was more than important to predict the occurrence and development of diseases and insect pests by different prediction methods (Zeng Shimai,2005). According to prediction result, decision maker s and users could make correct prevention standards and proper treatment measures in order to obtain the maximum economic benefits on the condition of minimum capital investment.

3 METHODOLOGY

3.1 RESEARCH DESIGN

The research design used in this study is descriptive method. It is a fact-finding study that will provide adequate and accurate findings through survey questionnaire to the respondents in the research locale. The data gathered will be analyzed and presented to draw up implication and inferences for the study.

For the development of the whole study, the research design includes the journals, books and unpublished researchers. This allow the researcher gather useful information to come up with a concept and the needed software and hardware requirement specifications. Self-structured questionnaire has been used in gathering the data together with follow-up interview for the validation of data gathered in the realization of the project.

The GIS separates information in layers, and then combine it with other layers of information to come up with new information showing: locations, spatial inter-actions, and geographic relationships of the fixed and dynamic entities that occupy space in the natural and built environments.

3.2 RESEARCH LOCALE

The research area of the study was in the province of Samar last November 2017.

3.3 SAMPLING PROCEDURE

There were 20 agricultural technologist and scientist in the province of Samar as the respondents of the study. The researcher uses a total enumeration sampling to come up more effective and reliable result.

3.4 DATA COLLECTION

The researcher seek permission through a formal communication from the Department of Agriculture to conduct the study. Upon approval, survey questionnaire with follow-up interview to the identified respondents of the study was followed. Then, the answered questionnaire with audio recorded tape by the respondents are collected and stored in the database for the interpretation.

3.5 DATA ANALYSIS

Table 1 Respondents' Evaluation Result Based on Effectiveness, Reliability and Functionality

Preference	**Frequency (Number of Respondents)**	**Percentage**
Effectiveness	18	95
Reliability	15	88
Functionality	20	100
OVERALL RATING		**94.3%**

As shown in table 1, the system has an overall evaluation result of 94.3%n based on the evaluation assessment of the end users. Note that there a total of 20 system evaluators. Moreover, as indicated in the table. The system is fully functional considering that the overall evaluation is at 100%. This indicates that considering the designed functionality and processes, the user is very satisfied in other words the n=basic system processes and executions are in accordance to what is expected. However, the respondents rated only the system at 88 % for the system reliability. According to them, they are not yet satisfied whether the data generated by the system is correct. In fact, they even questions, whether the data inputted in the system database are accurate and even ask further to include the original sources of those information.

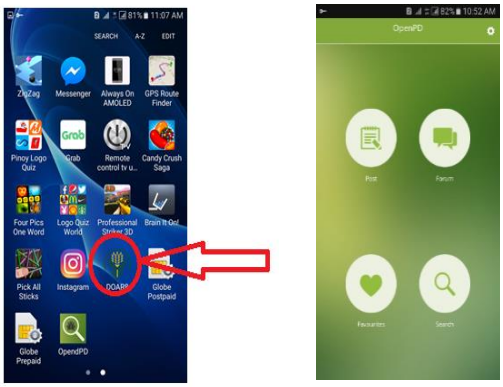
On the side note, although there are some areas where that system is rated not that high but considering the overall rating of 94.3% is already enough so as the system can be used in actual set-up/environment.

4 RESULTS

The system has been developed using Netbins- Eclipse Java Environment Programming Language. The user needs to register an account first before the application can be utilized. Once the user was able to acquire an account, he/she can already proceed in using the developed android based application. The

figure 1(a) below is the executable APK file of the developed system. Note, that the image used corresponds to the Department of Agriculture Logo so as to indicate the system general used.

Figure 1(a-b). The EXE file of the developed Android Application



Whereas figure 1b is the main menu of the developed system. As can be seen in the figure, there are four main functionalities that is – (1) Post, (2) Forum, (3) favorites, (4) Search. The main function POST is used by end user to submit pictures and images of the pest and diseases being taken by the user. The image then will be automatically saved in a central server and at the same time information relating to the image being posted/submitted will be generated. Information that would be generated is about the nature/type of pest/diseases, the extent to which it can affect to the crops, and other information that are within the database record. The information will guide the user of what to do of the presence of the said pest/disease.

FORUM is a message board otherwise known as online discussion where user can hold conversation in the form of posted messages, questions, conversations pertaining to a particular topic. For this particular system, topics in a forum revolves around plant pest and diseases only. Moreover, this system functionality allows the users to interact with each other concerning about crops production and also it allows the users to get information about plant pest and diseases between and among other and other experts specially that information that is not yet recorded in the database.

FAVOURITES is a system functionality that provides specific information that are frequently accessed by the user. It stores also offline information about plant pest and diseases of a particular crops that are recently and frequently accessed by the users. While SEARCH menu is the functionality of the system where the user can search information of a particular plant pest and/or diseases which he is knows but lack knowledge and other related information about that particular plant/pest he/she is searching for.

Figure 2 (a-b). POST sub menu User Interface

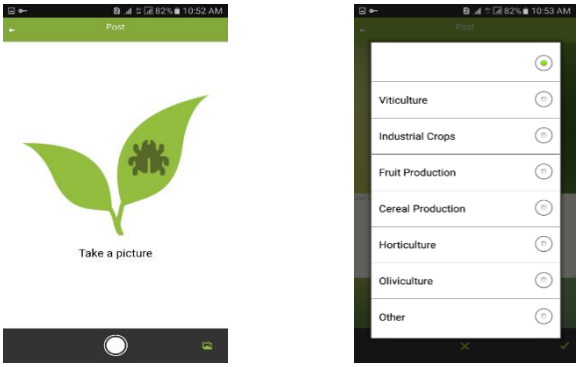


Figure 2-a, indicates that a user need to take a picture of a particular plant pest/disease he/she wants to POST or uploaded to the central server for data processing so as necessary data and information can be provided to him. However, in order for the system to generate a more specific data and information about the uploaded pest/diseases a user may opt to check a particular category of crops where the said pest/disease occurs as shown in figure 2-b.

Figure 3 (a-b) Sample FORUM and POST transaction details

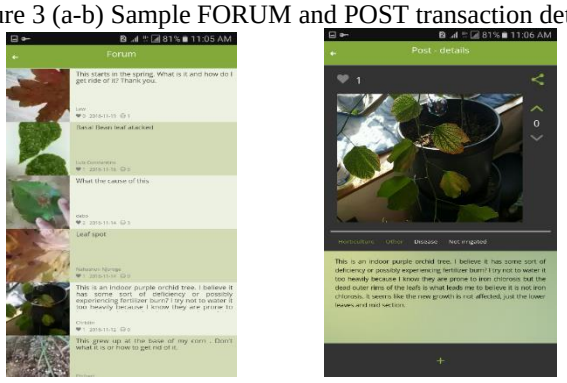


Figure 3 a-b, shows the sample User Interface information page for two transaction processes the FORUM and POST menu operations. As can be reflected information of a particular plant pest and diseases are being provided by the other users as for the case of figure 3-a and the other one is the information provided by the user when wants to post a particular plant pest/diseases that attacks to his plants. Moreover, other information about a particular plant pest/diseases can be auto-generated by the system using a SEARCH menu button of the main system UI. However, when the SEARCH button is utilized the same environment as shown in figure 3-b would be generated/provided by the system.

Figure 4 (a-b) other system UI Interface

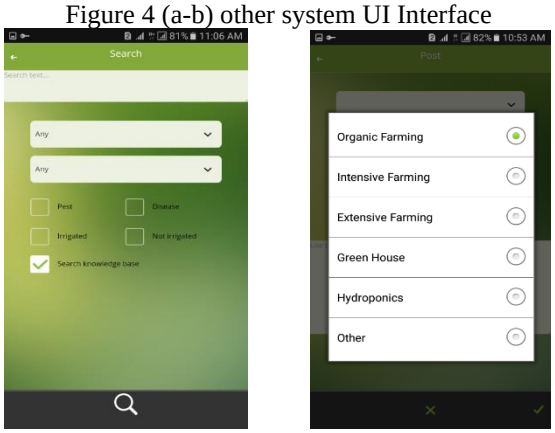
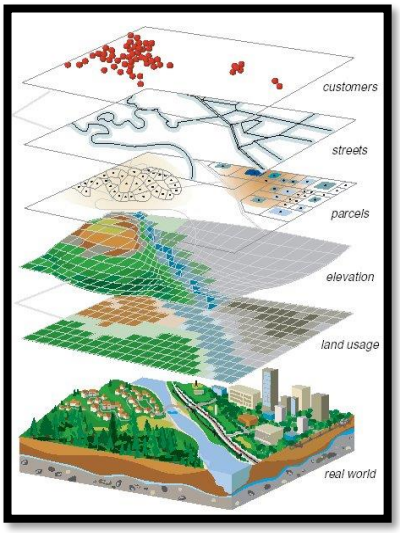


Figure 4 are some system functionality. The figure indicates functions/processes like searching a particular plant pest or diseases based on specific crops/plant and/or type of farming activities.

Figure 5 Geographic Information System Layer



5 CONCLUSION

The main objective of this is to develop and android based application software to be used in crops pest/diseases control and monitoring. And based on the results it is clear that the target users perceive the advantage of the develop system considering the very high percentage rating of evaluation results. Hence, it can be concluded that the system is very functional and easy to use in crops disease/pest monitoring. In this way, there will be no longer waiting for a day or month to get their surveillance feedback result being issued by the provincial agriculturist to solve or perhaps get rid of the crop pest/diseases.

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