Developing Rice Disease Analysis System on Mobile via iOS Operating System

Rujijan Vichivanives, Kittiya Poonsilp, Canasanan Wanavijit

Abstract—This research aims to create mobile tools to analyze rice disease quickly and easily. The principle of object-oriented software engineering and objective-C language were used for software development methodology and the principle of decision tree technique was used for analysis method. Application users can select the features of rice disease or the color appears on the rice leaves for recognition analysis results on iOS mobile screen. After completing the software development, unit testing and integrating testing method were used to check for program validity. In addition, three plant experts and forty farmers have been assessed for usability and benefit of this system. The overall of users' satisfaction was found in a good level, 57%. The plant experts give a comment on the addition of various disease symptoms in the database for more precise results of the analysis. For further research, it is suggested that image processing system should be developed as a tool that allows users search and analyze for rice diseases more convenient with great accuracy.

Keywords—Rice disease, analysis system, mobile application, iOS operating system.

I. INTRODUCTION

RICE is the major food of Thailand. It is planted by farmers in the wetlands. They sometimes encounter the problem of rice diseases which can be found in a variety of rice grains, As a result, growing the rice plants are not successful and the rice yields are not enough to consume. Therefore, farmers should have the tools to analyze a symptom of rice diseases to prevent the disease just in time. Finally, farmers will get enough quantity in agricultural production of rice and good quality for domestic consumption and export.

Rice disease analysis system is developed on mobile equipment, such as a smartphone or a tablet. The researchers create database and application software via the iOS operating system. Farmers can use this tool at their work area to search data about rice disease, ways to prevent and correct the cause of rice disease by rice expertises' suggestions.

The remainders of this paper are organized as follows: Section II presents the research methodology of this work; Section III presents the results; finally, Section IV presents the conclusion and suggestions.

R. Vichivanives is with the Faculty of Sciences and Technology, Suan Sunandha Rajabhat University, 1 U-tong Nok Road, Dusit, Bangkok 10300, Thailand (corresponding author to provide e-mail: rujijan.vi@ssru.ac.th).

K. Poonsilp, Jr., is with the Faculty of Sciences and Technology, Suan Sunandha Rajabhat University, 1 U-tong Nok Road, Dusit, Bangkok 10300, Thailand (e-mail: kittiya.po@ssru.ac.th).

II. RESEARCH METHODOLOGY

In this research, we used the following methodology:

A. Literature Review

Related theories are divided into four parts:

- Part 1: Related data about the cause and the prevention of rice disease [1].
- Part 2: Knowledge-based system development on mobile sites by choosing relational database management system with MySQL [2] via iOS [3].
- Part 3: Mobile application development with tool of Visual Studio.NET [4] and Objective-C Language [5].
- Part 4: Comparison with related research in software development [6].

B. Tools Preparation

These tools were used in the analysis system:

1) iOS Mobile Equipment: iPhone or iPAD.
2) MySQL software: It was used to store and retrieve data in the database.
3) Photoshop: It was used to design and create a mobile screen, showing a menu list and results.
4) Visual Studio.NET: It was used for the program coding and creating the user interface.

C. Population

For the population, the researchers determined two groups: The first group comprised of three plant experts from Bureau of Rice Research and Development, Rice Department. The second group comprised of forty farmers in different areas of Thailand.

D. Hypothesis

From defining the population in two groups, we set two hypotheses:

- *First hypothesis:* The viewpoints of the experts towards the use of using the mobile application to analyze rice disease are at a good level.
- *Second hypothesis:* The satisfaction of the users towards the mobile design of rice disease analysis system is at a good level.

E. Information Extraction

The researchers selected the farm area in Phranakorn Si Ayutthaya for studying and collecting information about rice genes and rice disease from various textbooks including websites. Then all information was extracted from those resources to be used for useful information collected in a form of two-dimensional table of database so that the information

can be searched out for later use.

F. System Analysis and Design

For the system analysis and design, the researchers chose UML (Unified Modeling Language) as a tool to model the system, which comprised the following diagrams:

1. Use Case Diagram: It was used as a tool to define the scope and requirement of the system.
2. Class Diagram: It was used as a tool to define the database which was in the forms of two dimension tables; these aided in designing the information system to show class, attribute, method and relationship with related classes.
3. Activity Diagram: It was used as a tool to define the system working processes and activities that occur in the system.

Fig. 1 shows Use Case Diagram and Fig. 2 shows Activity Diagram of this application.

The interface was designed by the researchers mostly in the forms of selecting a menu list and buttons. The users can select a menu list by touching on the required area of the mobile, so the result on the mobile screen will display by application functions.

G. Application Design and Developing

Homepage and related pages are linked to show the analysis results as a user request on the mobile site under the system for the design and development of the mobile application.

H. Program and Structure Design

For the design of structure in the mobile application, the researcher divided the program structure into three modules:

1. The presentation of related knowledge
2. The presentation of the analysis results
3. The presentation of the disease prevention.

Fig. 3 shows Package Diagram of this application.

I. Program Validity Checking

In order to check the validity of the applied program, there should be a validity checkup of three working parts as follows:

- *Part one:* The researchers created a test case for each condition to perform the unit testing. Each test case works in the form of circling until getting the correct result.
- *Part two:* The researchers asked the three plant disease experts to make validity testing of the program and to give suggestions for the future modification.
- *Part three:* The tested program that was checked by the experts was disseminated to farmers who can access the application as their requirements and they can comment on it by filling in a questionnaire, so that the research result can be modified for the future use.

J. System Assessment

The system assessment was categorized into two parts as follows:

- *Part One*: The three experts of Rice Department assessed the system of the mobile application. They were requested to answer questionnaires given five average levels assessment: very good, good, average, low and need improvement.
- *Part Two*: The users assess the system by completing the questionnaire. The analysis results were collected by the researchers for finding percentage of users' satisfaction.
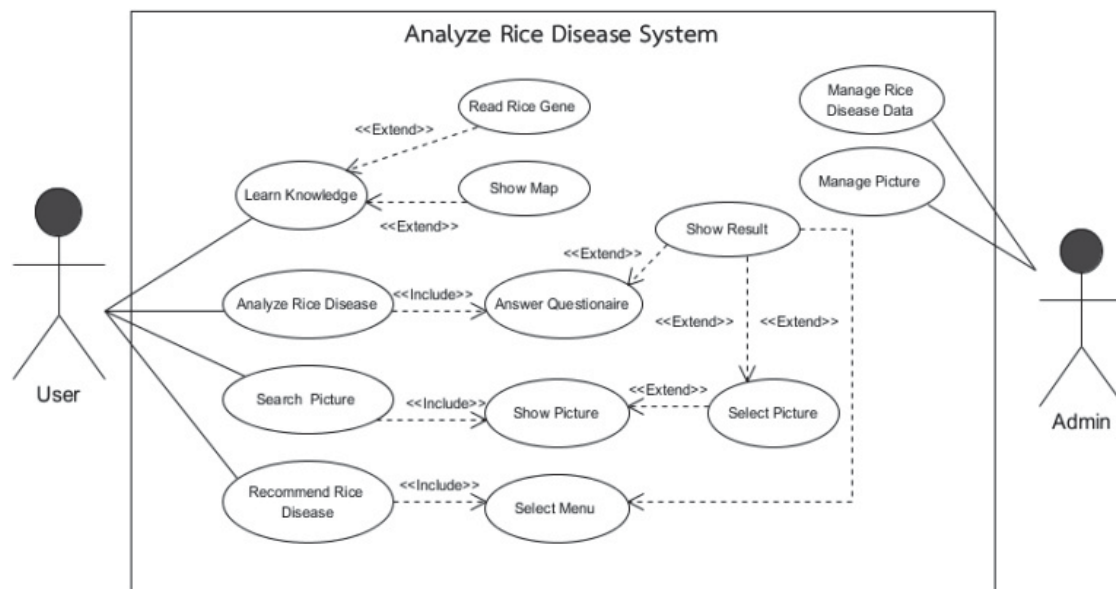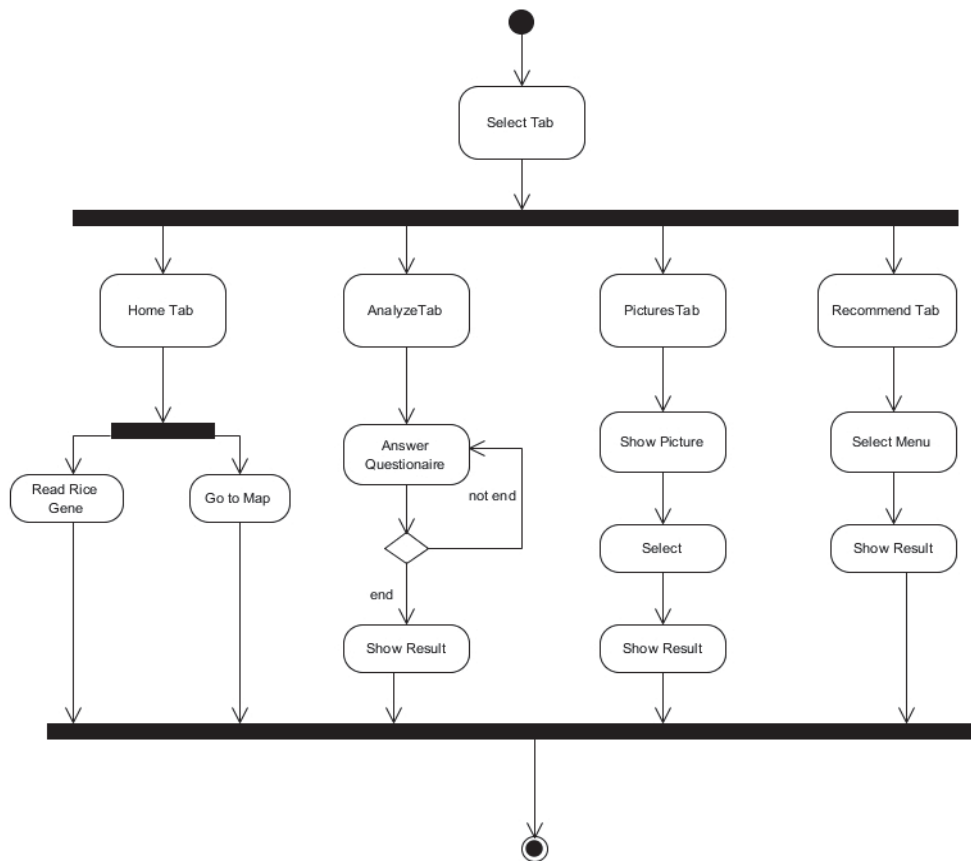

Fig. 1 Use Case Diagram
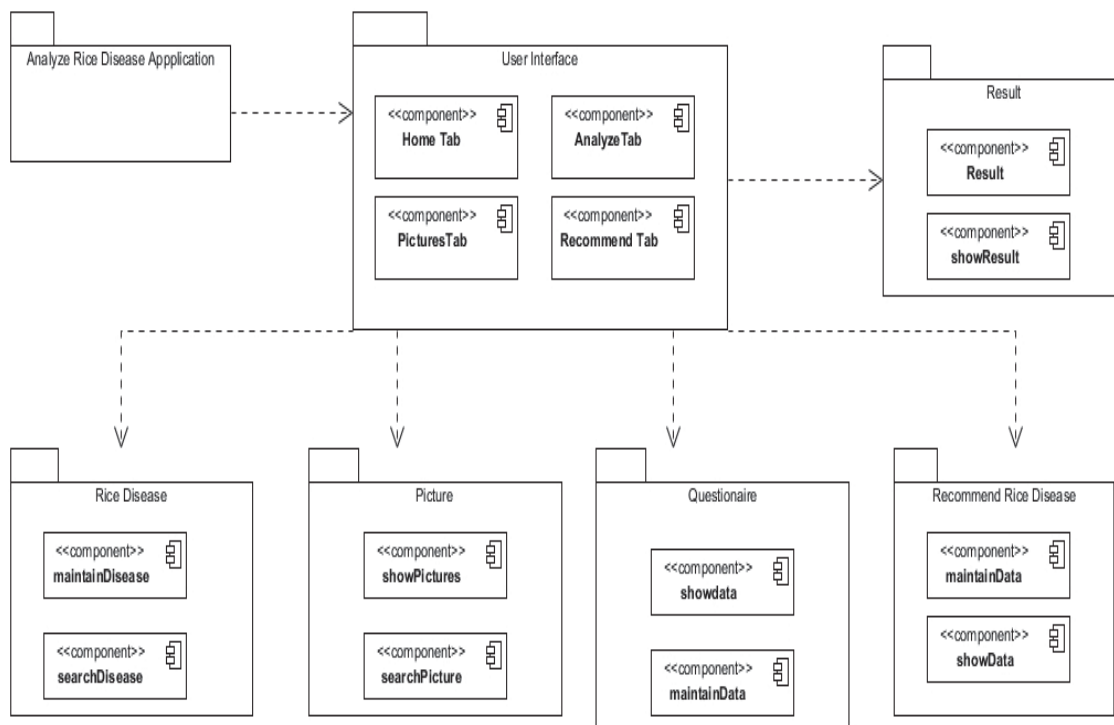
Fig. 2 Activity Diagram

Fig. 3 Package Diagram

III. RESULT

After the researcher implemented the research study according to the research methodology from step A to J, the research results were categorized into three parts:

Part one: The knowledge-based development: There is a collection and a filing the information of rice genes, rice diseases, symptoms, and analysis results, which can be displayed in GUI of iPHONE or iPAD. Finally, the designed database is perfectly integrated with users' provided information.

Part two: The applied program development: The GUI of the mobile pages is divided into four items*:*

1. Home Page

There are buttons and icons for linking to another related page as shown in Fig. 4.

Fig.4 The Screen of Home Page

2. Knowledge-Based Page

There is information on rice genes and rice disease, including the recommendation for preventing rice disease. Fig 5 shows two sample of Rice Knowledge Screen.
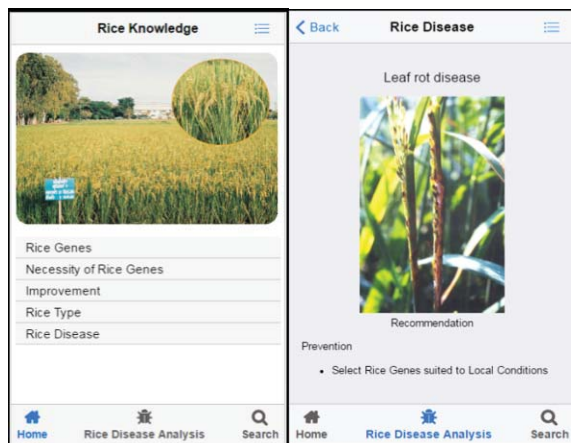

Fig. 5 Rice Knowledge Screen

3. Search Page

There is a menu list for selecting the required rice gene, section of plant and color of leaves and symptoms of the disease. Figs. 6-8 show the menu list for selecting section of plant, color of leaf and symptom of disease.
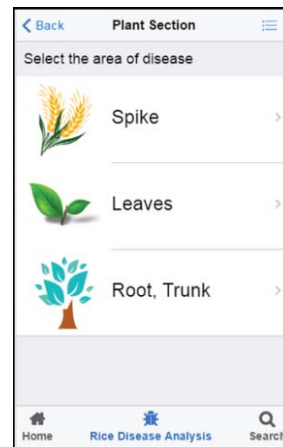

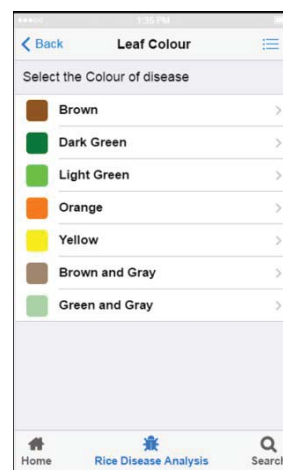Fig. 6 Menu list for selecting Section of Plant

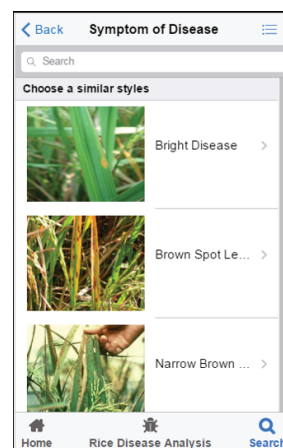Fig. 7 Menu list for selecting color of leaf

Fig. 8 Menu list for selecting symptom of disease

4. Result Page

After the user selected any parts of Search Page, there is a result page shown on mobile screen later.
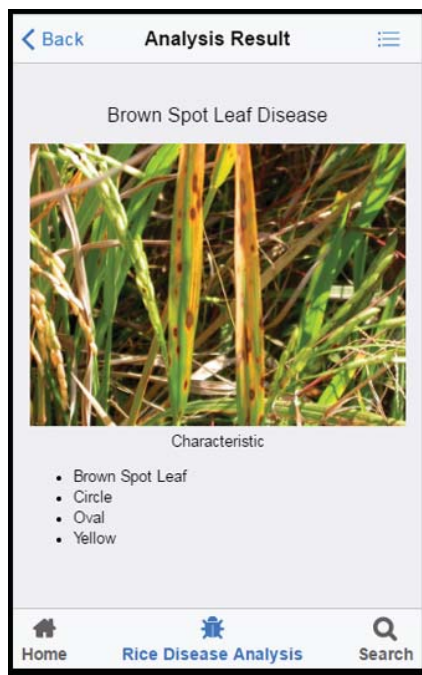

Fig. 9 The result page of Rice Disease

Finally, the four items of this development have already been implemented perfectly.

Part three: The system assessment: There was two groups of users, experts and farmers who assessed this application, so the results of their satisfaction with the system were divided into two parts:

1. *Part one*: The viewpoints of three plant experts towards the knowledge, rice disease analysis and prevention methods are at a good level which is in accordance with the hypothesis.

2. *Part two*: The satisfaction of forty farmers towards the knowledge, analysis result and prevention methods is at a good level which is in accordance with the hypothesis.

The assessment results in their viewpoints and satisfaction are shown in Table I.

TABLE I
THE ASSESSMENT RESULT ON THE SATISFACTION OF THE USERS

Items of assessment	Percentage	Level
1.Interesting of Application	72	very good
2.Moderness of Application	50	very good
3.Usability of Application	62	good
4.Correcting of Result Analyzing	50	good
5.Searching for Rice Disease Name	67	good
6.Beneficial of Application Usage	55	good
7.Satisfactory of Application's User	57	good

When focusing on the average value of users' viewpoints, the percentage of 57 is considered at a good level.

IV. CONCLUSIONS AND SUGGESTIONS

The results of this study and suggestions to those who want to expand the research findings are as follows:

A. Research Conclusions

The mobile application is useful as a knowledge-based and an analysis tools for users' convenience, especially it can be done anytime and anywhere. In addition, it is suggested that this application can help farmers for prevention of rice disease. If farmers know the cause of disease and the symptom of disease, the rice disease can be prevented. As a result, the productivity and quality of rice from the farm in Thailand will be higher.

B. Suggestions

The plant experts at Rice Department suggested for application development which increases more accuracy of the analysis result. For further research, it is suggested that image processing system should be developed as a tool that allows users to analyze and prevent rice diseases by using this application to search for related knowledge for plant diseases.

REFERENCES

[1] Bureau of Rice Research and Development: Rice Department. Ministry of Agricultural and Cooperatives, *Rice Knowledge Bank*. Bangkok: Office of Printing Mill. The War Veterans Organization of Thailand Under Royal Patronage of His Majesty the King, 2004.
[2] P. DuBois, *MySQL Developer's Library (4t)h ed.)*, New York: Pearson Education, 2009.
[3] Unity Ads, Integration of iOS-Knowledge base, New York: Pearson Education, 2012.
[4] A. Sur, *Visual Studio.net 2012 and .NET 4.5 Expert Development Cookbook*. New York: PACKT Publishing. 2013.
[5] S. G. Kochan. *Programming in Objective-C (6th)*. Addison-Wesley: New York. 2014.
[6] Sittichailapa, T. & Rattanachai, R., *The Development of Model Learning Media of Sorting Algorithm*.Procedia-Social and Behavioral Sciences Vol. 197, 25 July 2015, 1064-1068, 2015.