Expert systems diagnosing of banana pests and diseases use case-based reasoning method with android

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Abstract. Designing a Case-based reasoning (CBR) android application is a method used to build a knowledge-based system. Source of system knowledge is obtained by collecting handling cases by an expert or expert. In this study the author makes or analyzes Banana Plant disease through the symptoms experienced by the Plant so that it can help a person or farmer in diagnosing the types of diseases and pests of banana plants based on their symptoms. The advantage with the application of this method is that farmers do not need to ask symptoms and diseases to an expert. This application is expected to make it easier for farmers to recognize the types of pests and diseases of banana plants and also this application has a clear calculation of the pests and diseases of banana plants. This application can be done offline

1. Introduction

Expert systems are computer-based applications that are used to solve problems as thought by experts. Experts referred to here are people who have special skills that can solve problems that cannot be solved by ordinary people. (2015, Sibagariang S)

In this study, a method will be applied to help determine the disease of banana plants based on their symptoms, namely Case-Based Reasoning Method. The purpose of making this application is to implement the Case-Based Reasoning Method in analyzing banana plant disease through the symptoms experienced by the plant so that it can help someone in diagnosing the type of disease based on its symptoms.

Case Based Reasoning is a method to solve problems by remembering the same events (similar) that have happened in the past and then using that knowledge / information to solve new problems, or in other words solving problems by facing solutions that have been used in the past then (2013, Suriyanti).

Android is a mobile operating system that adopts the Linux operating system, but has been modified. Android was taken over by Google in 2005 from Android, Inc. as part of a strategy to fill the mobile operating system market. Google took over all the results of Android's work including the team that developed Android. (2015, Sibagariang S)

This research is based on problems in the agricultural field, especially on the problems of detecting pests and diseases that exist in Banana plants. Pests and diseases are always found in every plant that is no stranger to farmers, but the problem is whether the pest or disease causes significant or no loss.
Based on the background described above, it can be concluded that the formulation of the problem in the study is:
1. How to implement the System Case-Based Reasoning Method in an expert System in diagnosing Banana Plant pests and diseases?
2. How to make an expert system for diagnosing Android-based Banana Plant pests and diseases?
3. How does this expert system make it easy for users to know about pests and diseases in banana plants?

By optimizing the use of science and technology, especially computers in decision support systems, determining which parts are in demand, the authors can present a hypothesis as follows:
1. By diagnosing pests and diseases using an expert system as a tool, it can facilitate farmers in diagnosing banana plant diseases. So that farmers can make the right decisions in their diagnosis.
2. By using this expert system, temporary diagnostic results will be obtained that are more relevant and in accordance with predetermined criteria. So that the results of the diagnosis can be taken into consideration in decision making by farmers.
3. It is hoped that this expert system will help users to gain knowledge about pests and diseases in banana plants.

In order for this report to be as expected and this study does not deviate from our goals and is more directed in the process of collecting data and information needed, the scope of the problems used as research objects needs to be constrained, namely the design of expert systems that can diagnose pests and diseases Banana plants use the Android-based Case-Based Reasoning method.

2. Resource Method

Software (software) is a computer program that is associated with software documentation such as documentation of needs, design models, and how to use (user manual). A computer program without being associated with documentation cannot be called software. A software is also often called a software system. The system means a collection of components that are interrelated and have one goal to be achieved.

System software means a system that has components in the form of software that has a relationship with each other to meet customer needs. Customers (customers) are people or organizations that order or buy software (software) from software developers or it can be assumed that customers (customers) are people or organizations who voluntarily spend money to order or buy software. Users or users of software are people who have an interest in using or using software to facilitate their work. (U.S. Rosa and Shalahudin.M, 2014)

2.1. Artificial Intelligence

Artificial intelligence is one part of computer science that makes machines (computers) able to do work as and should be done by humans.

2.2. Expert System

An expert system is a branch of artificial intelligence. Expert systems as artificial intelligence combine knowledge and facts and search techniques to solve problems that normally require expertise from an expert.

2.3. Case Based Reasoning

Case based reasoning (CBR) is a method to solve problems by remembering similar / similar events that have happened in the past then using that knowledge or information to solve new problems, or in other words solving problems by adopting solutions -solutions that have been used in the past.

2.3.1. Case based Reasoning Stage

In general there are 4 stages of the process in case based reasoning:
1. Retrieve
When new problems occur, the system will first retrieve. This process will carry out two steps of processing, namely the introduction of problems and the search for similarities of problems in the database.

2. Reuse
This process the system will use information on previous problems that have similarities to resolve new problems and reuse information and knowledge in the case to solve the problem. In the process of reuse it will copy, select, and complete the information that will be used.

3. Revise (review the proposed solution).
This process of information will be calculated, evaluated, and repaired again to overcome errors that occur in new problems.

4. Retain
This process will index, integrate, and extract new solutions. Furthermore, the new solution will be stored in a knowledge base to resolve future problems. Of course, the problem that will be solved is the problem that has similarities with it.

![CBR Phase Cycle](image)

**Figure 1.** CBR Phase Cycle

2.4. Android
Android is a Linux-based mobile operating system that includes operating systems, middleware and applications. Android provides an open platform for developers to create their applications.

2.4.1. Android Studio
According to (Juansyah, Andi, 2016), in his journal Android studio is an official IDE (Integrated Development Environment) for the development of Android applications and is open source or free. The launch of Android Studio was announced by Google on May 16, 2013 at the Google I / O Conference event for 2013. Since then, Android Studio has replaced Eclipse as the official IDE for developing Android applications.
Figure 2. Android Studio

Android studio itself was developed based on IntelliJ IDEA which is similar to Eclipse accompanied by the ADT plugin (Android Development Tools). Android studio has features:

1. The project is based on Gradle Build
2. Refactory and fast bug fixing
3. New tools called "Lint" in the editor can monitor the speed, usability, and compatibility of applications quickly.
4. Supports Proguard And App-signing for security.
5. Having an Android application GUI is easier.
6. Supported by the Google Cloud Platform for each application developed

2.5. Database

The database is a collection of files that are interrelated and interacting, those relationships if indicated by the key of each file that exists. One database shows a data set that is used in a company's scope, agency. Database processing is a way that is done on files that are in an agency where the file can be compiled, sorted, taken at any time and can be displayed in the form of a report so that it can process the files containing the information neatly.

2.6. Banana Plants

Banana plants are commercially grown in a number of countries that have hot and humid climates or are in humid summer, with not too cold and dry winters stretching from Georgia (bekasi Soviet Union) at 43 ° North Latitude to Corrientes at 27 ° South Latitude in Argentina.

2.6.1 Pest and Disease

The following are pests and diseases that often attack banana plants:

1. Ladybug sucker banana leaves (Helopeltis spp.)
   Helopeltis antonii and Heliveltis theivora, Family Miridae, Order Hemiptera TEA LEAF BUGS Leaf sucker ladybugs or Helopeltis attack young shoots. These ladybugs pierce and suck on the banana leaves so that they become black patches. There are many natural enemies of Helopeltis. His nymph was killed by a jumping spider, nymph of praying grasshopper and other predators. Adults who fly captured by dragonflies and spiders make nets. Life cycle The lifespan of eggs from the beginning to adulthood is 3 to 5 weeks. The adult period can be up to 2 weeks.
   An egg of 1.5 millimeters is inserted into the veins of banana leaves or branches of the shoots hidden from predatory attacks. The egg is also inserted into the tip of the newly trimmed green branch. The number of eggs is about 80 per female. The nymph ("mikung") is reddish-orange in color. Dewasanya ("indun") is black and white to black red for antonii or black-green for theivorous. Adults Helopeltis have a small pole like a needle that protrudes from the middle of the back (thorax).
2. Banana Plant Disease

The following are diseases that attack banana plants:

a. Root disease

Roots that are important in banana plants are: (1) Grape red root disease; (2) Brick red root disease; (3) Black root disease; (4) Root neck disease; (5) Divided cancer. The five diseases are transmitted through contact with a sick root with healthy roots or through fungal threads that spread freely in the soil or in rubbish above ground level (split cancer fungus). Symptoms in affected plants are yellowing, wilting, deciduous and finally dead plants. To find out the cause, it must go through a root check. The stem of a banana plant is split from the bottom to the top, the wood becomes dry and soft rot so it is easily destroyed (split cancer). Elements that affect the spread of the disease are the height of the place, the type / condition of the soil and the type of protective tree. Control is carried out by planting protective trees that are resistant, dismantling the affected banana plants, maintaining the cleanliness of the garden and giving Trichoderma sp. 200 grams per tree in the former plant disassembled holes and surrounding plants at the beginning of the rainy season, repeated every 6 months until no symptoms of root disease are found in the area. The surrounding banana plants are given manure or organic fertilizer.

b. Leaf Pox Disease

Banana leafpox caused by E. vexans can reduce the production of wet shoots by 50 percent because it attacks young leaves or twigs. Generally attacks occur on peko shoots, first, second and third leaves. The initial symptoms appear to be small translucent spots, then patches widen with a colorless center bounded by a green ring, greener than the surroundings and protruding downward. The center of the spot becomes dark brown and finally dies so that a hole occurs. Diseases are spread through wind-borne spores, insects or humans. Disease development is influenced by high air humidity, wind, height of garden location and plant properties. The amount of leaf feathers on peko can enhance resistance to smallpox. Disease control is done by a shade arrangement so that sunlight can enter the garden. Pruning bananas in the dry season so that freshly cut plants can develop because at this time banana pox is difficult to develop. Arrangement of picking cycle less than 9 days can reduce the source of new transmission because the affected attack has already been picked. For prevention, it is better to plant resistant banana clones such as PS 1 and RB 1.

c. Leaf rot

Late blight is caused by C. scoparium and G. cingulata which attack banana plants in nurseries, which can result in the death of cuttings of banana. Seedlings are attacked, brown patches appear on the parent leaves, starting from the end or from the leaf armpit.

d. End Dead Disease

longiseta which attacks plants mainly through damaged wounds or parts of leaves. Symptoms in the leaves begin with small brown spots, then widen. The center of the spots is grayish with brown edges.

The meaning of research is simply how to know something that is done in a certain way with a systematic procedure. So the authors form the research framework as follows:
3. **Result and Discussion**

Testing and implementation of the system aims to see whether the system designed is in accordance with what is desired or not, after testing and implementation, the quality of a system will be seen. The program display is a sub-chapter that explains the commencement process until the program is finished executing, the points in this sub-chapter will explain how a form is executed and what functions are contained in the form.

1. **Display of the Main Menu**
   - Is the initial display of the main menu that displays this main menu there are several menus that can be accessed by the user. Display main menu can be seen in the following picture:

   ![Display of the Main Menu](image)

   **Figure 4. Display of the Main Menu**

2. **Display Consultation Menu**
   - The consultation page contains consultation instructions and one button to start the consultation. Display consultation can be seen in the following picture:

   ![Display Consultation Menu](image)
3. Display of Symptom Selection
The Symptom Selection Display contains symptoms of pests and diseases experienced by banana plants and is chosen to carry out diagnoses. Display of symptom selection can be seen in the following picture:

![Symptom Selection Display](image1)

**Figure 5.** Display Consultation Menu

4. Display of Consultation Results
The results page of the consultation contains information on the percentage similarity of each banana plant pest and disease. Display of consultation results can be seen in the following picture:

![Consultation Results Display](image2)

**Figure 6.** Display of Symptom Selection
5. Display of Banana Leaf Suction Ladybug Process
Display of Banana Leaf Sucking Ladybug Process contains detailed information on pests or diseases, case symptoms, calculation of cases and solutions. The appearance of the thrips pest process can be seen in the following picture:

![Figure 8. Display of Leaf Sucking Ladybug Process](image)

6. Display Pest Disease Menu
Display of Disease Menu Pest can be seen in the following picture:
4. Conclusion

From the description of the problem above, and based on the analysis of the existing chapters, conclusions can be drawn as follows:

1. Designing an expert system can simplify diagnosing banana pests and diseases, from tracing the symptoms that are felt to the diagnosis of a pest or banana plant disease based on previous facts.
2. An expert system with the CBR method can provide a solution or method for controlling pests or diseases of banana plants so that it can help the effectiveness of time and cost of the user in dealing with pests or diseases that occur.
3. This expert system searches using the CBR (Case Based Reasoning) method to produce a solution for banana plants or agricultural people who are experts in diseases and plant pests.

From the study above, the author expects further research, because there are some shortcomings in the application and there are still many that have not been discussed because of the limited time and limitations of the author in compiling this scientific work.

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