Design of Expert System for Diagnosis Damage Computer Hardware

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Abstract. Expert systems are developed in line with the existence of information technology. The development of expert systems aims as a tool to provide solutions in lives. Expert systems can also help in making better solutions. With the rapid technological advancement at this time, raising an idea or idea to try to implement one of expert system application program into activity of service quality of computer technician by using method of Cased Based Reasing (CBR). This expert system application built can help technicians find solutions quickly and save time. Users and technicians simply enter the symptoms of damage that occurs in computer hardware. Through the built application helps in providing solutions to damage to computer hardware so as to facilitate the user or technician to get the solution quickly.

1. INTRODUCTION

The development of information technology now runs very fast and plays an important role in various ways. The ability of computers to remember and store information can be utilized without having to depend on obstacles such as those possessed by humans. By storing information and a set of adequate rules of reasoning it allows the computer to give conclusions or make decisions whose quality is the same as the ability of an expert in a particular scientific field.

Expert Systems are knowledge-based programs that provide expert quality solutions to problems in a specific domain. Development of expert systems aims as a means of helping to provide solutions in life. One example is a case of computer damage is a case that requires the help of an expert (technician) in solving problems by relying on the knowledge they have. Now technicians need a long time to diagnose computer damage, even technicians often delay their work just to produce solutions to computer damage. Based on these problems, a software will be created to deal with cases of computer hardware damage that can help technicians to diagnose computer damage by saving time and getting solutions quickly.

2. THEORETICAL BASIS

2.1 Basic Concepts of Expert Systems

According to Sri Winiarti (2008), the basic concept of an expert system contains several elements, namely:

1. Expertise

Expertise is a special knowledge that is owned by a person through training, learning, and experiences experienced in a particular field for a long period of time. Knowledge can be in the form of facts, theories, rules and strategies for problems.
2. Expert or expert (Expert)
   An expert is someone who is able to explain a response, learn new things around the topic of the problem, rearrange knowledge if deemed necessary, solve problems quickly and precisely. An expert must have the ability to solve problems in a particular field he is handling, then provide an explanation of results and their relation to existing problems.

3. Skill Transfer (Transfering Expertise)
   The purpose of an expert system is to transfer expertise from an expert to a computer then to the community. This process includes 4 activities, namely acquisition of knowledge (from experts or other sources), representation of knowledge to computers, conclusions from knowledge and transfer of knowledge to users.

4. Conclusion
   The specialty of the expert system is its ability to provide advice, namely by placing expertise into the knowledge base and creating programs that are able to access the Knowledge base so the system can provide conclusions.

5. Rules (Rule)
   Generally expert systems are rule-based systems, namely knowledge that consists of rules as a problem solving procedure.

2.2 Case Based Reasoning Method
   Case based reasoning is one method to build an expert system by making decisions from new cases based on solutions from previous cases. The concept of the Case Based Reasoning method is found from the idea of using documented experiences to solve new problems.

The cycle or process that occurs in the CBR can be seen in the following figure 2.1:

![Figure 1. CBR Cycle](image)

The formula used to find the value of similarity in the CBR can be seen:

\[
\text{Similarity (K, S)} = \sum_{i=1}^{n} f(K_i, S_i) \cdot W_i
\]

Keterangan :

K = New case
S = Cases in storage
n = Number of attributes in each case
i = Individual attributes between 1 and n
f = Similarity I function between case p and case q
w = Weight given to the i-attribute

Three different functions of the CBR system are based on the level of user involvement (Althoff, 2001), namely:
1. CBR system as a diagnosis
   Where users use CBR in the system that is used as a tool to determine the results of diagnosing a problem.
2. CBR system as a support for CBR performance in a system is used as a decision support for problem solving. This type is very widely used in the scope that requires a very deep analysis in solving a problem. In this type, the base of cases used in the CBR must be very large.
3. CBR system as Knowledge Management In this type of CBR use is used to: Manage knowledge obtained from experts or experts in a field. This is because an expert cannot be used as a reference in solving a problem when his age and illness factors have been suffered. (Mulyana and Hartati, 2009).

3. DESIGN
   3.1 Analysis of the Problem
   At this time many computer users who do not understand computer damage, are caused by lack of knowledge of computer technology, besides that many computer users who directly deliver their computers to computer services, without finding out in advance the damage costs wasted. Sometimes the damage to the computer is not too serious and can be overcome by the user himself.
   Therefore, based on the analysis of the problem above, it is hoped that this system will become an alternative choice for consultation and information, both for computer mechanics and for computer users in need. And the problem analyzed is about the damage that occurs to computer hardware and its symptoms and handling of the damage.

   3.2 Analysis of the source of knowledge
   The source of knowledge in this expert system which consists of various types of computer hardware damage, various symptoms and solutions obtained from various sources of information such as books, journals, internet and the results of interviews with several mechanics at several computer service points.

| id_damage | Name of damage             |
|-----------|----------------------------|
| P001      | power supply is disrepair  |
| P002      | Motherboard disrepair      |
| P003      | Damaged Ram Memory         |
| P004      | damaged hard drive         |
| P005      | Monitor disrepair          |
| P006      | Processor disrepair        |
| P007      | cd / dvd disrepair         |
| P008      | Soundcard disrepair        |
| P009      | vga card disrepair         |
| P010      | mouse disrepair            |
Table 2. Description on symptoms

| id_symptoms | name_symptoms |
|-------------|---------------|
| G001        | turned on there is no display on the monitor |
| G002        | the computer does not respond when turned on |
| G003        | the LED on the CPU does not turn on |
| G004        | the fan on the power supply doesn’t rotate |
| G005        | the LED lights on the CPU turn on |
| G006        | the led light blinks |
| G007        | the power supply fan rotates |
| G008        | the processor fan rotates |
| G009        | no beep sound when turned on |
| G010        | there is no initial bios display |
| G011        | the bios alarm sounds |
| G012        | often suddenly die for no reason |
| G013        | the LED lights on the CPU turn on |
| G014        | the release of the blue screen |
| G015        | an error message appears in the bios |
| G016        | strange sound from the hard drive |
| G017        | a hang or crash occurs when running the application |
| G018        | the fan on the power supply does not turn on |
| G019        | always scandisk when booting |
| G020        | Many file corrupt |
| G021        | not until Windows restarts again |
| G022        | device not detected in bios |
| G023        | there is a horizontal / vertical line in the middle of the monitor |
| G024        | black block appears and the image is not symmetrical |
| G025        | burning cd / dvd failed in the middle of the road |
| G026        | close the cover cd / dvd is difficult to open |
| G027        | can read cd / dvd but can’t copy |
| G028        | accessing the contents of the computer cd response is long |
| G029        | Device driver information is not detected in the device manager, even if it has been installed |
| G030        | the sound still does not come out from the server driver and the device settings have been carried out as directed |
| G031        | error message appears when running the audio application |
| G032        | the release of a blue screen on Windows OS (the message content is always different depending on certain conditions) |
| G033        | the sound still doesn’t come out even though the driver and device settings have been done according to the instructions |
| G034        | the mouse pointer does not respond to mouse movements |

3.3. How to Settle the case using the formula of Cased Based Reasoning

Based on the table above there are 10 cases of damage with various predetermined symptoms.
Suppose there are new cases with symptoms of damage symptoms experienced as follows:
1. Hangs or crashes when running the application.
2. There is a strange sound from the hard drive.
3. Many files are corrupt.
4. Not to enter the application but the OS has restarted again.
5. There is no initial bios display.
If the above table contains 10 cases of damage, then this new case will be matched with the ten cases of damage, which will result in the largest similarity value which will be selected as the final result. The table shows that the biggest similarity value is in case 4, which is a damaged hard drive. If the search process for similarity values done manually is as follows:

1. Similarity between 1 old case and new case. If there are similar symptoms between the new case and the old case 1 then it is given a value of one if it is not given a value of 0.

\[
\text{Similarity} = \frac{G001 \times 0 + G002 \times 0 + G003 \times 0}{\text{Max 3: 4}}
\]

\[
\text{Similarity} = \frac{0}{4} = 0
\]

Information:
G001, G002, G003 = symptoms that exist in old cases Max 3: 4 = 3 is the number of symptoms present in the old case while 4 is the number of symptoms present in the new case. Max between four and three is four, then the four will be the divider. In this case the number of similarities between the old and new cases is only 0.

2. Similarity between 2 old cases with new case

\[
\text{Similarity} = \frac{G006 \times 0 + G007 \times 0 + G009 \times 0 + G008 \times 0 + G013 \times 0}{\text{Max 4: 5}}
\]

\[
\text{Similarity} = 0
\]

3. Similarity = \frac{G010 \times 1 + G011 \times 0 + G014 \times 0 + G015 \times 0}{\text{Max 4: 4}}

\[
\text{Similarity} = \frac{1}{4} = 0.25
\]

This step is repeated until the old case is 10, so that later the greatest similarity value will be found.

4. IMPLEMENTATION AND TESTING

The system implementation phase is one of the stages in the system development life cycle, where this stage is the stage so that the information system is ready to be used.
4.1 Application Testing Phase

4.1.1 Main course

The page from the main menu of the Computer Damage Diagnosis Expert system as shown below:

Figure 2. Main Menu

4.1.2 Damage page

This damage page is intended for experts in managing damage data. In this page the expert will add, delete and change the damage data.

Figure 3. Display of Damage Pages

4.1.3 Diagnosis page

It is a page that will be a place for diagnosis. In this page a list of existing symptoms will be displayed and the user's task is to select or check symptoms based on the damage experienced by the computer.

Figure 4. Diagnosis Form
4.1.4 Diagnosis Process Page

On this page the symptoms that have been selected will be processed according to the provisions of the case based reasoning formula so that it will bring up the kind of damage that is experienced by the user's computer.

![Image of Diagnosis Process](image1.png)

**Figure 5.** Display of the Diagnosis Process

4.1.5 Diagnosis Results page

On this page is the final step of the diagnosis process carried out. On this page will display the type of damage experienced and will be given a handling solution of the damage.

![Image of Diagnosis Results](image2.png)

**Figure 6.** Display of the Diagnosis Process

4.1.6 Diagnosis Results Report Page

This page contains reports of results that have been violated by the user.
5. CLOSING

5.1 Conclusions

In the process of designing and creating an expert system application program to detect damage to computer hardware using the Cased Based Reasoning method, there are several conclusions that can be conveyed by the author as a result of evaluating the development of the system in this research report. The conclusions are as follows:

1. This system can analyze the type of damage to computer hardware based on the symptoms entered by the user.
2. Application expert system to detect damage to computer hardware, can make an initial diagnosis of a damage and provide information about functions, symptoms and solutions.
3. Using this system can be used as an alternative solution for the community to make early diagnoses of symptoms of damage to the computer before consulting directly to experts.

5.2 Suggestions

Given the various limitations experienced by the author, especially the problem of thought and time, the authors suggest for the development of research in the future as follows:

1. In maintaining data accuracy in this application, it is necessary to update the knowledge base periodically.
2. The system built has a need for further development in order to provide more benefits to the wider community.

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