Expert system for damage diagnosis on laptop using forward chaining method

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ABSTRACT

Expert system is a computer-based system that uses knowledge. Facts and reasoning techniques in solving a problem can usually only be done by an expert in that field. In this case the author examines the damage to the laptop, the laptop is one of the computing equipment that can help humans in carrying out work, the use of laptops has increased according to needs. With the large number of users, the potential for damage to the laptop will also be greater. The problem in this research is how to write a system that can make it easier for users to diagnose damage to laptops. The method used by the author in making this expert system is Forward Chaining. The system to be built is a computer-based system. The diagnosis generated by this system is also equipped with the types of damage and symptoms on the laptop. The system will also analyze the answers to each question posed, so that diagnostic results are obtained based on the existing knowledge in this expert system.

Keywords
expert system, forward chaining, laptop

1. Introduction

The development of an increasingly advanced era like today makes the needs of the community also increase as well. Moreover, it is driven by the very rapid progress of science and technology. For example, with a laptop that makes work easier, all activities can be done quickly and the risk of errors can also be reduced [1]. Laptops also have a lot of diverse features, so we as users also already know these various features, and to find out, use on laptops can be more optimal. Parts of laptop components such as hardware in the long term of course will also be damaged which causes the laptop to be repaired. The solution used is to create an expert system that aims to make it easier for users to diagnose damage to the laptop.

In this case the system in question is one that can be used as an alternative to diagnose damage to laptop hardware which contains information on the laptop that we use as users. In this case, the information in the laptop obtained is the cause (characteristic) of the damage based on the symptoms of each component on the laptop until a solution (diagnostic result) is found.

The system used to diagnose the type of damage to the laptop based on the symptoms experienced. Types of damage to laptops are also found in this system, such as the following examples: damaged power ic, damaged lcd, damaged keyboard. The methodology used in this research is Forward Chaining, where data matching starts from the left side (IF first). In other words, other reasoning starts from the facts first to test the truth.
2. Research Method

The methodology used in this research is Forward Chaining. Forward Chaining is a search technique that starts with known facts, then matches those facts with the IF part of the IF-THEN rules[2]. In this case, it explains things related to the method used by the researcher. Some of them are regarding the materials used, the design of the research, and also the methods used for the research.

A. Problem Definition

In this study, the problem definition starts from the identification of a problem so that researchers can find scientific problems. To be able to understand the problems in the system [3]. The initial step at this stage is to conduct a literature study, namely by looking for data about damage to laptops caused by improper use for long hours from the internet, journals or previous research, meanwhile interviews were conducted with an expert in their field with Mr. Dian Aprianto S.Kom as an expert technician in the field of maintenance, on Friday January 15, 2021[4].

B. Data Collection

Data was collected from the results of previous literature studies and interviews which would then be used in the research.

C. Forward Chaining Method

At this stage the researcher chooses the forward chaining method, the search will start from the antecedents, namely the problems to be faced. Processing will be a series of consequences in the form of a slice of the problem with its causes and also its fix[5]

D. System Development

The system development model that will be used by the researcher is the RAD (Rapid Application Development) development model, this development model is made with several research stages, namely determining the requirements, design, construction, implementation, the following is a flowchart of the RAD stage [6].

In Figure 1. It is explained about a research flow and matters related to the method to be used in this research, namely Problem Definition, Data Collection, Methods used, and System Development.
3. Result and Discussion

A. System Design

The interference engine acts as a guide for the reasoning process of a condition. In the process using reasoning strategies and control strategies. For the control strategy, the researcher uses the Forward Chaining method, where the system will display the characteristics of the symptoms and then from these symptoms it can be concluded that a damage has been experienced by the laptop.

The following are some examples of symptom and damage variable data tables for more details can be seen in the following table [7].

|   | K1 | K2 | K3 | K4 | K5 | K6 | K7 | K8 | K9 |
|---|----|----|----|----|----|----|----|----|----|
| G1| 1  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  |
| G2| 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| G3| 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| G4| 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| G5| 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| G6| 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| G7| 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
| G8| 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |
| G9| 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  |
| G10|0 |0 |0|1|0|0|0|0|0|
Description of variable data damage to the laptop:
(K1) faulty ic power
(K2) broken on vga ic
(K3) faulty inverter/faulty flex cable
(K4) faulty LCD
(K5) is broken on the keyboard
(K6) is broken on the touchscreen
(K7) damaged hard drive
(K8) is broken on the operating system/os
(K9) damaged laptop charger

Description of symptom variable data on laptop:
(G1) laptop not showing image on screen
(G2) engine does not start
(G3) indication that the lamp connected to the charger is not lit
(G4) when the charger is connected, the laptop suddenly turns off
(G5) engine still running
(G6) if connected to external lcd via vga card can display
(G7) the light on the dark screen is dim but can display images
(G8) screen sometimes turns on and off while displaying images
(G9) there are lines on the lcd

Based on the statement in table 1. above, it can be assumed that:

> G1
if > G2 maka > then K1
> G3
> G4

Figure 3. Forward Chaining Method

1. Use Case Diagram

A Use Case Diagram states the visualization of interactions that occur between users (actors) and the system. This diagram can be a good picture to explain the context of a system so that it will be seen more clearly from the boundaries of the system[8].

Figure 4. Use Case Diagram
In this study will explain the function of the actors involved in a system that will be designed. In this system there are only 2 actors, namely admin and user.

2. Activity Diagram

One example of an Activity Diagram is to describe activities, state objects, state transitions and events. In other words, activity workflow diagrams describe the behavior of the system for activities [9].

![Activity Diagram Login](image)

Figure 5. Activity Diagram Login

The explanation above is that the admin activity when the login process starts to enter the application and the system will display the page then the admin logs in, after the login is correct the system will display the main page, if wrong the system will return to the login page.

![Activity Diagram Managing Admin](image)

Figure 6. Activity Diagram Managing Admin
The explanation above is that the admin activity after logging in then the system displays the main page, then the admin can manage the symptoms of the damage, the system will process it, if it is finished pop up data appears successfully changed.

Just like logging in to the admin, entering the application, the system displays the login page, the user enters the username and password, the difference is that the admin can manage such as edit, delete, or add data, the user can only check the laptop by selecting the symptoms.
After the user logs in, the system displays a symptom checkbox menu, the above is an example of a user selecting symptoms G1, G2, G3, and G4 if yes the system will process and will display the results of damage, if not the user selects other symptoms such as G5 and G6 if yes the system will process the same system, otherwise the system will stop because the user did not input the checkbox.

B. Implementation

System implementation is the stage that will be carried out to complete the system design that is in the documentation, so that it will be known whether this system is suitable for the user [10].

1. Main Page Loading

The following is the main login page the first time it appears which will be used to run the program.
2. User Main Page

After logging in through the user, the system will change the appearance of the main page on the user in Figure 10 and in Figure 11 when the user is using the system there is a checklist of several symptoms.

3. Diagnostic Results Display

The following is a display of the diagnosis results page after the user selects several symptoms.
4. Admin Main Page

After logging in via admin, the system displays the main admin page. There are edit, delete, and add symptom data features that can be managed.

![Figure 13. Admin Main Page](image)

5. Add and Edit Data Page

The following is a page to add and edit data. The image above is an example of an admin managing data by adding data.

![Figure 14. Add and Edit Data Page](image)
4. Conclusion

The following conclusions are based on what has been obtained from the results above, namely this application has been built using the PHP and MySQL programming languages for database processing and also this research produces a system that can run on the Windows 7 to Windows 10 Operating System, then this expert system application is still it can be developed even better than what the author made, lastly to use this application you are required to login first before use.

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