Expert System Diagnosing Damage to Canon Ir5000 Copier With Forward Chaining Method

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Abstract

A photocopy machine is a machine that works mechanically to fulfill the function of copying one document on a machine into another paper in black-and-white copies. During the copying process, various defects often occur, so a technician is needed to repair it. While waiting for the arrival of a technician to repair a damaged machine, it takes some time. Therefore, we need a strategy that can quickly find out the type of photocopier damage and how to handle it to help repair the damage to the photocopier. with the transfer of expertise by experts to be transferred again to other people who are not yet experts is the main goal of the system. In the process of drawing conclusions the system uses the Forward Chaining algorithm where the system will display symptoms of photocopy machine damage to be selected by the user, which can finally determine the solution to the damage to the machine. The results obtained from making this application are easier to obtain by making an expert system to diagnose photocopier damage and can be used and studied easily by the general public. for handling the problem of damage to the Canon IR 5000 photocopier using the Sublime Text Application as supporting software in terms of designing the layout of the application design, using the MySQL Database as a database design place and XAMPP v3.2.1 to run the database server and php.

Keywords: *Strategy, Machine, Photocopy, Forward Chaining, Expert System*

1. Introduction

The development of technology has shown rapid progress from year to year, and the human way of thinking is also advancing along with the times, as well as the development of computers. Computers are one of the tools that we can use to support work activities. With the help of technology, computers can be used to assist humans in solving problems, one of which is the use of expert system applications. Basically an expert system is commonly referred to as an expert system, which means an information system that contains knowledge or a knowledge base from experts, so that it has the ability and can be used for consultation[1],[2]. Knowledge obtained by experts based on actual problems is then implemented into the system as the basis for an expert system to answer questions (consultation). An expert system can be implemented as a device for diagnosing human disease or machine damage, one of which is a copier[3],[4]. This study uses a forward chaining method that can help users repair photocopier damage without going through the intermediary of a technician or expert. The Forward Chaining method is a search method or forward tracking technique that starts with existing information and combines rules to produce a conclusion or goal[5],[6]. This forward tracking is especially good when working with problems that start with an initial record of information and want to reach a final solution, because the entire process will be done sequentially forward. Forward chaining is an inference method that makes reasoning from a problem to its solution[7],[8]. If the premise clause matches the situation (values TRUE), then the process will state the conclusion. Forward chaining is data-driven because inference begins with available information and only conclusions are obtained[9],[10],[11]. If an application produces a tree that is wide and not deep, then use forward chaining[12]. As we all know, photocopier damage is the most common thing in every office or company engaged in the printing industry. The damage needs to be dealt with quickly and precisely, because it is very detrimental to users, most of whom are photocopier users who are the company's strategic decision makers. So if not handled immediately will be detrimental to the entire company. The process of diagnosing photocopier damage must go through an in-depth and sequential inspection stage. Symptoms of damage are so confusing that it is difficult to distinguish one damage from another. Because everything is a unified copier system.

2. Research Method

This research method is carried out systematically in order to get a good workflow and can be used as a guide for the author in carrying out this research so that the results achieved do not deviate from the desired goals and can be carried out properly according to the objectives described previously

2.1. Data Analysis

Data analysis is an effort to manage data into information so that the characteristics of the data are easy to understand and useful, especially problems that will be related to the research raised. The data analysis method in this study refers to the

forward chaining method of explaining forward tracking which will start with existing information and combine the rules to produce conclusions. Forward tracking looks for facts that comply with the If – Then rules. The symptom data used in the expert system to diagnose photocopier damage amounted to 17 symptoms. For more details, see the table below:

Table 1. Symptoms of Photocopy Machine Damage

Code	Symptom	Code	Symptom
E01	Error code 014-005 appears	E10	Blank photocopy
E02	Error code E000315-000d appears	E11	The photocopy bends
E03	Striped LCD screen	E12	Curved photocopy
E04	Touchscreen buttons shift	E13	The photocopy has black spots
E05	*Touchscreen is blurry and scratched*	E14	Photocopy of striped side
E06	LCD is on but features are not displayed	E15	Paper sticks together when copying back and forth
E07	The photocopy has a black line	E16	Paper sticking to each other or paper jam
E08	Slanted photocopy	E17	The back of the machine there is a clunk sound
E09	The photocopy is shifted or doesn't fit	E10	Blank photocopy

Below are also the causes of damage to the IR5000 copier, as follows:

Table 2. Causes of photocopier damage

Code	Cause of Damage
K01	1. Motor fixing off 2. Weak fixing motor rotation 3. Short circuit
K02	short circuit
K03	Due to improper use, or pressure from blunt objects
K04	Due to improper use
K05	Due to improper use, or pressure from blunt objects.
K06	The Flex Cable on the LCD is broken
K07	Dirty machine glass or lens
K08	Because the roller register is worn or smooth
K09	1. Fix master position 2. Check the register roll settings
K10	The Toner / Ink Tube is damaged, and one of the upper/lower wire worms is broken
K11	Because of the claw (Claw) or nail axit that is in the heating section.
K12	Paper moisture level is too high, Bushing Fixing is destroyed
K13	The drum machine is in a leaky or short-circuited condition
K14	After the Tilt Wire Worm & Regist Rool Magnet Settings Are Uneven.
K15	Troubled Duplex Flapaper
K16	Troubled Exit Flapaper Damage
K17	The stirrer in develop is off, and the stirrer in develop doesn't work perfectly

After paying attention to the table of damage and causes of damage to the photocopier, below we can see the table of solutions to the problem of damage above, namely:

Table 3. Solutions for photocopier damage

Code	Solution
G01	1. Turn off the machine first so that there is no short circuit in the cables. 2. Pull out Unit 1 or Heating Unit first. 3. Open the heater ger cover first by removing all the bolts. 4. Then remove the cables that are plugged into the heater switch. 5. Remove the bolts that are plugged into the heater ager 6. After that take the heating ger slowly so that no cables are pulled. 7. Observe the heater, if the condition is still possible to repair then please try to repair it, but if the condition is not suitable for use, it must be replaced with a new one.
G02	1. Restart the photocopier by clicking the photocopy machine's power button and then unplug the electrical contact, wait about 5 minutes then turn it back on 2. Press the *28* button (the * sign on the additional function) then press Copier > Function > Clear > Err then OK
G03	By replacing the roller register
G04	Replacing the LCD Screen
G05	Changing Touchscreen
G06	Replacing the LCD Screen
G07	What you have to do is to clean the glass and also the lens on the copier until it's really clean, because dust is usually easy to stick to that part.

Code	Solution
G08	By replacing the roller register
G09	Pay attention to the master and the condition of the register roll
G10	Need to replace the toner / ink tube for replacement of the sensor so that the toner can go to the developer, One of the upper / lower wire worms is replaced
G11	Pay attention to the position of the paper when it is inserted into the machine, clean the claws by hand, usually these claws are dirty because of the remaining toner. Check the Approve Nail Section.
G12	By replacing damaged fixing bushings with new components. Replace paper with drier paper.
G13	Repairing drum parts or replacing drums on a copier
G14	Seeing or feeling the condition of the register roll, if it is loose or uneven, you have to replace the register roll.
G15	Replace the Duplex Flapaper
G16	Changing Play Paper Exit
G17	Disassemble the develop, repair it back to its proper place, and pay attention to the inside of the develop, look at the toner and lava stirrer if it is broken it can be replaced. If it's still good, then fix the layout and clean it if there's ink/dust stuck to it.

2.2. Activity Diagram

Activity Diagram is a diagram that describes the various flow of activities in the system that is being built, how each flow starts from a decision that might occur and how the system designed ends. Activity diagrams can also describe a parallel process that may occur in several executions. The following activity diagram can be seen in Figure 1 below this:
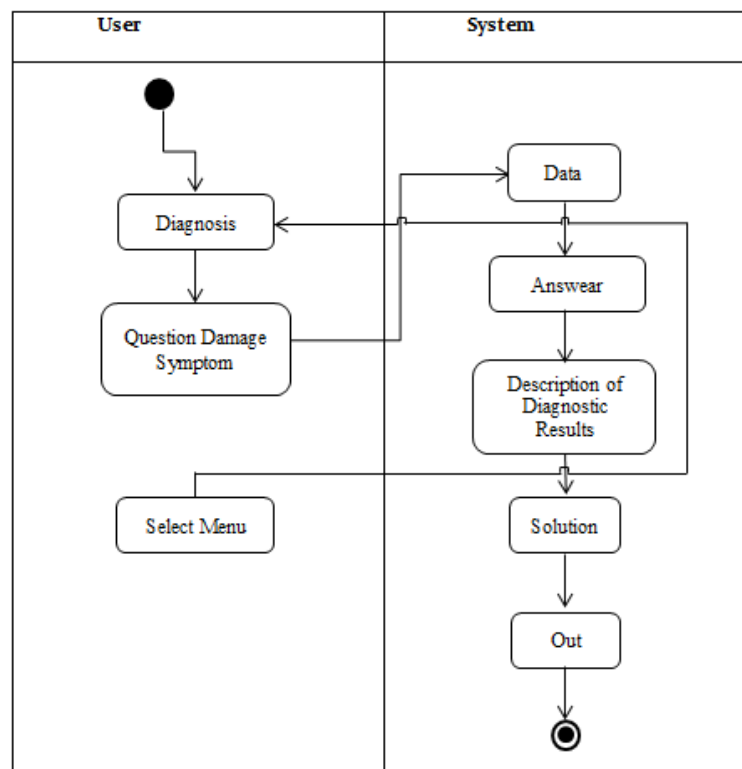

Figure 1. Activity Diagram

3.   Results And Discussion

According to Tamba Saut and Sitanggang Delima (2018), system implementation is the implementation of the design results in the form of software. In the implementation of this system will be explained about the use of the application made. The description of the application made includes the appearance of the application, the functions in the application, and how to use it. The expert system detects damage to the IR5000 photocopier using the Forward Chaining method which will be built and has several menus that will be used to run the system. The menus on the main menu page such as User Data are used to show the User Data processing page, the damage symptom menu is used to show the Data processing page for the Photocopy Machine Damage Symptoms, the damage cause menu is used to show the Damage Cause Processing page and the damage solution data menu for Refers to the Data Processing Damage Solution page.

The output of this system design is a photocopy machine malfunction diagnosis which contains consultation by the user, a solution provided by an expert in the form of Damage Symptoms, Causes of Damage, and Solutions recommended by the system. The following display can be seen in Figure 2 below:
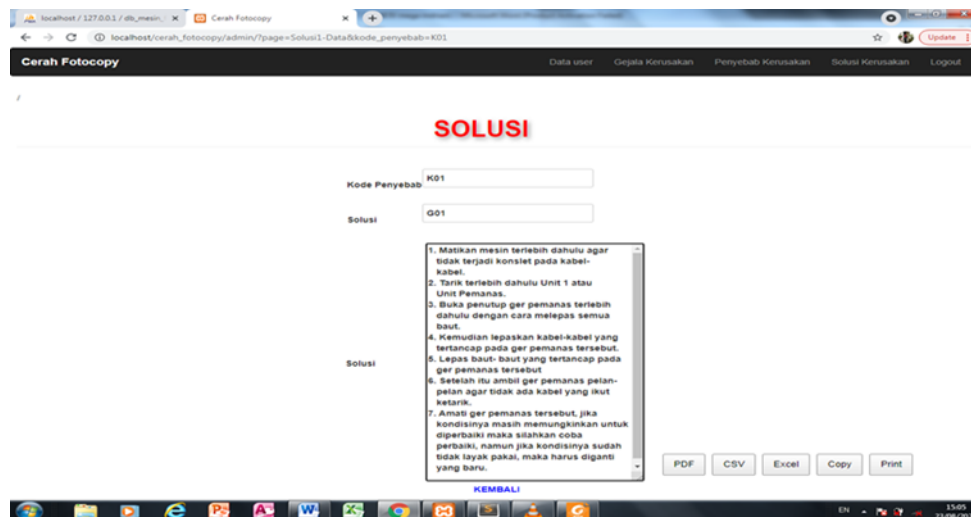
Figure 2. Output System

Based on the picture above, it is explained that the Cause Code is K01 where K01 is a dead fixing motor, the fixing motor rotation is weak and short, then the solution code is G01 where G01 is a solution to the damage in K01. The solution is to turn off the engine first so that there is no short circuit in the cables. First, pull out Unit 1 or the Heating Unit, Open the heater ger cover first by removing all the bolts, then remove the cables plugged into the heater ger, Remove the bolts that are plugged into the heating ger, after that take the heating ger slowly so that no cables are pulled along and observe the heating ger, if the condition is still possible to repair then please try to repair it, but if the condition is not suitable for use, then it must be replaced with a new one.

If you want to print the results of the diagnosis, click the print button on the right side of the solution, the results of the diagnosis are successfully printed according to the consultation that was made.
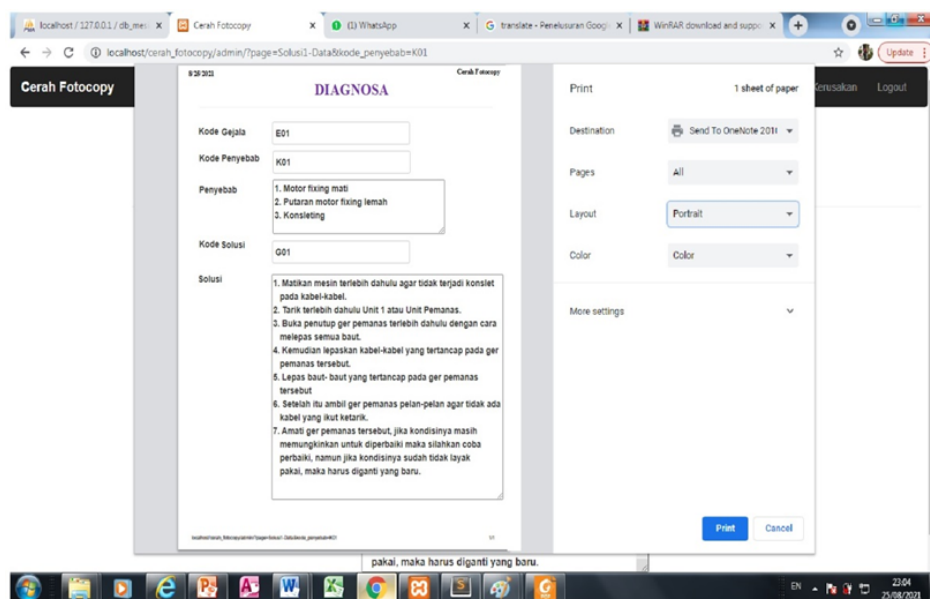

Figure 3. Diagnostic Results

From the picture above, it can be explained that the results of the diagnosis will be displayed if the user needs a report of the results of the damage.

4. Conclusion

Based on the results of the research that has been done, it can be concluded that the application of an expert system with the forword channeling method made with a web programming language can be used to assist users in detecting photocopy machine damage based on the symptoms given and can find out how to overcome the damage to the photocopier..

Acknowledgement

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