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APPLICATION OF EXPERT SYSTEM (FORWARD CHAINING METHOD) IN DIAGNOSIS OF PRINTER FAILURE

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Abstract

Expert systems are used to support solving a problem. An expert system is a system that stores the knowledge and reasoning abilities of an expert entered into a computer so that it can be used to help solve a problem, where the problem requires the expertise of an expert to solve it. This research aims to create a system that is able to make it easier for staff working in fields other than IT to deal with printer problems that often occur. The system to be made is web and android based which can be accessed via a computer or android smart phone that has internet access. In drawing conclusions, the method used is the forward chaining method. Symptoms of damage and rules in the system were obtained from IT staff who are experts in repairing printer damage at M NATSIR Hospital. Later the user will only choose facts according to the symptoms that occur in the printer. Later the results obtained from the system are information on what damage the printer has experienced and what steps must be taken so that services at the hospital do not stop for a long time.

Keywords: Expert system, Forward Chaining, Printer, Web Base, Android

INTRODUCTION

The development of technology in the field of computers and expert systems has enabled a computer to help solve a problem that requires expertise to solve it. Many units use printers at M Natsir Hospital in carrying out health services every day. Frequent use of the printer without stopping sometimes makes the printer experience problems. But the problems that often arise are not serious problems where skilled technicians are needed to solve them. Small problems that often occur can disrupt services at the hospital. From these constraints, an application was created that can provide information about what problems are being faced and what actions should be taken by service staff to overcome problems with the

printer so that services can run again without having to wait for technicians from the IT unit.
The application of expert systems to help solve hardware problems has been widely used, this can be seen from several previous studies (Fauzi, 2018; Imron et al., 2019; Laksana, 2019) regarding expert systems. Expert systems are able to provide information about what actions must be taken to solve problems using the knowledge and reasoning of an expert (Chaining & Factor, 2020; Irawan & Nasution, 2018; Mansyur & Kurniawan, 2017) . One method that is often used in expert systems is the forward chaining method. The forward chaining method has been applied in many studies including being used to diagnose car damage (Mauliana et al., 2017) , detect damage to motorcycles (Nasir & Gultom, 2018) and detect damage to smartphones (Wedyawati & Tusaadiah, 2017) . This method presents facts obtained from an expert that ordinary users can choose and later be able to present conclusions and ways of solving problems faced by ordinary users (Sani et al., 2021; Syaputra & Setiadi, 2020) . In developing this expert system application several UML diagrams will be used. UML diagrams offer a standard for designing an application model and are commonly used in creating web-based applications (Putra, 2018; Sonata, 2019; Suendri, 2018) .

METHOD

The forward chaining method is the method used in this study. To be able to solve problems using this method, application users will choose the options that will be presented by the application based on the symptoms experienced by the user's problematic printer (Disease et al., 2020; Rahmatullah et al., 2018; Yuwono et al., 2017) . The options presented by the application are rules that have been entered into the application database. Each rule is later selected by the application user and tested, then the expert system evaluates the condition of the rule, right or wrong. If the condition of the rule is true, then it is saved, if the condition is false, then it is not saved. Then the next rule test is carried out. This process continues until all rule bases are tested and produce information about the problems encountered.

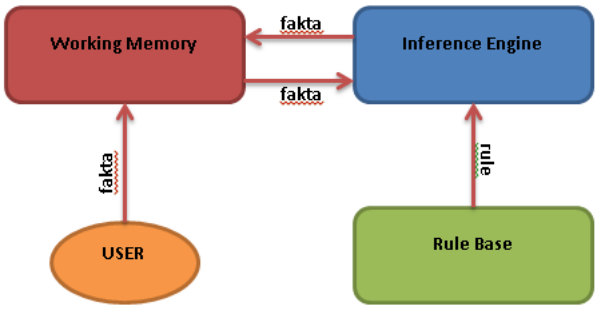

Figure 1. The workflow of the forward chaining

This study applies a data tracking mechanism using Depth First Search (DFS). DFS has often been used to support tracking with the Forward Chaining method, one of which is in determining a healthy menu for pregnant women based on nutrition (Krisnanik et al., 2018)

RESULTS AND DISCUSSION

This research will produce an expert system application that is able to diagnose printer problems. The printer brand that can be diagnosed later is the Canon brand. The types of printers include IP2770, MP258, MP237, IP1980, IP1880, IX4000, IX5000, IX6000.

To make it easier to make rules, the damage symptoms are made in the form of code which is presented in the following table:

Symptom Code	Symptom
KG01	Printer types are IP2770, MP258, MP287, MP237
KG02	Printer type IP 1980, IP1880
KG03	Printer types IX4000,IX5000,IX6000
KG04	Withdrawal of paper on the printer is not a problem
KG05	The printed paper is blank
KG06	Successfully printed on paper, but the printout has characters that are hard to read
KG07	Prints are streaked or faded
KG08	One of the colors does not come out on the printout
KG09	The print results are good, but the printed lines are not neat
kg10	Printer cannot pick up paper
KG11	The paper is jammed, showing E03 on the printer's LED panel
KG12	The printer light blinks 5x or 7x in orange and 1x in green
KG13	Display on the printer LED E04 or E05 or E07
kg14	Printer light blinks 13x or 16x orange and 1x green or the LED on the printer displays E13 or E16
kg15	The printer light blinks 4x or 8x in orange and 1x in green or 7x to blink in alternating colors
kg16	The printer LED displays E08 or P07
KG17	The printer is able to pull paper smoothly

kg18	Printer printouts are not visible
KG19	Printer output is incomplete and characters do not match
kg20	The printout is faded or streaked
KG21	One of the colors on the print does not come out
KG22	The print results are good, but the table lines are not neat
KG23	Printer failed to pick up paper
kg24	The paper is stuck and the indicator light is on 3x orange and 1x green
kg25	Printer light blinks 5x or 7x orange and 1x green
kg26	The printer light blinks 13x or 16x in orange and 1x in green
KG27	Printer light blinks 4x or 8x orange and 1x green
kg28	The printer LED displays A3 and successfully pulls the paper
KG29	Blank printout
kg30	Odd printouts or displaying symbols
KG31	The printout is blurry and streaky
KG32	One of the colors of the print does not come out
KG33	Printer failed to pick up paper
kg34	Printer light blinks 3x
kg35	Printer light flashes 4x
kg36	Printer light flashes 7x
KG37	Printer light flashes 9x
KG38	Printer light flashes 14x

Table 1. Damage Symptom Codes

After each symptom is given a code, then the symptom code can be entered into several rules as follows:

Code Rules	Symptom Code	Information
P1	KG01,KG04,KG05	Ink has run out
P2	KG01,KG04,KG06	Printer driver problem
P3	KG01,KG04,KG07,KG08	Problem with the printer cartridge
P4	KG01,KG04,KG09	Faulty length sensor
P5	KG01,KG10,KG11	The paper puller is jammed
P6	KG01,KG10,KG12	One or both printer cartridges cannot be read
Q7	KG01,KG10,KG13	Printer cartridge not found
Q8	KG01,KG10,KG14	Printer ink will run out
Q9	KG01,KG10,KG15	The printer must be reset by pressing the reset button on the printer
P10	KG01,KG10,KG16	The printer must be reset using the reset tool on the computer
P11	KG02,KG17,KG18	Printer ink is out
Q12	KG02,KG17,KG19	The driver that connects the printer to the computer is having problems
P13	KG02,KG17,KG20,KG21	The printer cartridge is low on ink
P14	KG02,KG17,KG22	The printer sensor near the head has a problem
P15	KG02,KG23,KG24	The printer mechanical device has a problem
Q16	KG02,KG23,KG25	One or both printer cartridges cannot be read
Q17	KG02,KG23,KG26	The printer ink will run out soon
P18	KG02,KG23,KG27	The printer must be reset using the resetter tool on the computer
P19	KG03,KG28,KG29	The ink in the printer cartridge runs out
P20	KG03,KG28,KG30	Printer driver problem
P21	KG03,KG28,KG31,KG32	Problem with the printer cartridge
P22	KG03,KG33,KG34	There is paper stuck in the printer roller
P23	KG03,KG33,KG35	The ink cartridge runs out
P24	KG03,KG33,KG36	There are 2 cartridges of the same color installed in the printer
P25	KG03,KG33,KG37	The printer is unable to read the camera
P26	KG03,KG33,KG38	Cartridge not read

Table 2. Rules

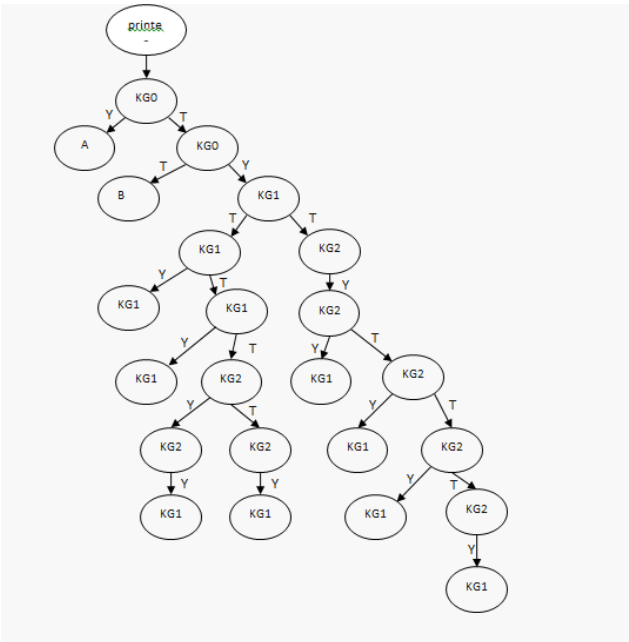

Figure 2. DFS Printer Tree Diagram

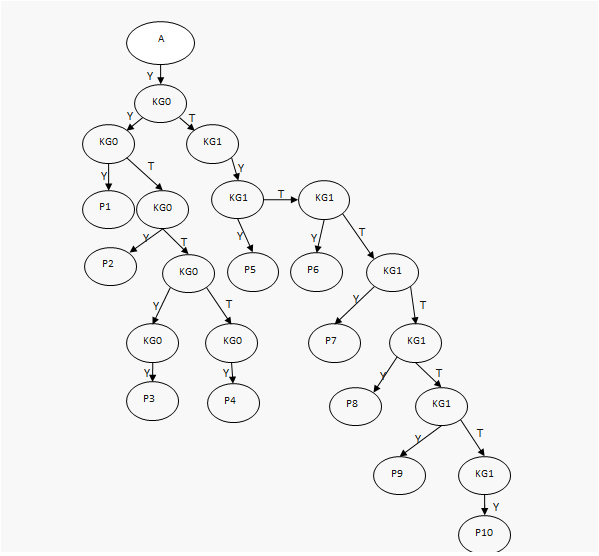

Figure 3. DFS Printer Tree Diagram (A)

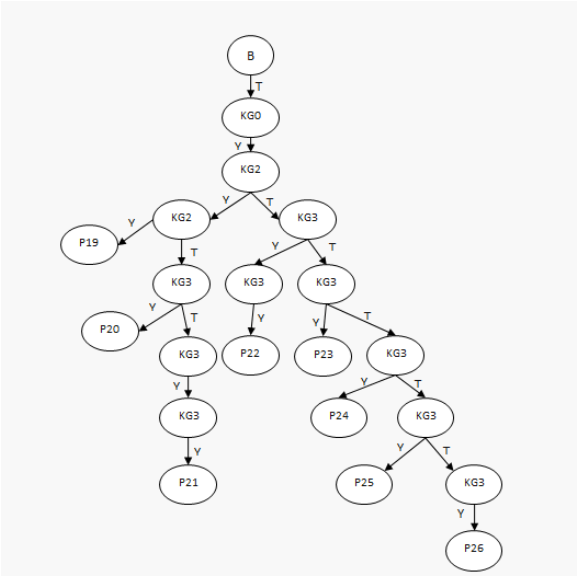

Figure 3. DFS Printer Tree Diagram (B)

The forward chaining method is applied by entering IF-Then rules, where IF is symptom information, and Then is the conclusion of damage.

No.	Failure Symptoms Rules (IF Then)
1	IF Printer types are IP2770, MP258, MP287, MP237 AND There is no problem with the paper withdrawal on the printer AND The printed paper is blank THEN The ink has run out
2	IF The type of printer is IP2770, MP258, MP287, MP237 AND Withdrawal of paper on the printer is not a problem AND Successfully prints paper, but the printed output has characters that are difficult to read THEN Problem with printer driver
3	etc…

Table 3. Rule in IF THEN form

An expert system application built on a web-based basis with a responsive design. Then it is converted into .apk form so that it can be installed on the Android platform. This application can be directly used without certain access rights. Damage symptoms will be displayed in the form of a choice of "Yes" or "No".

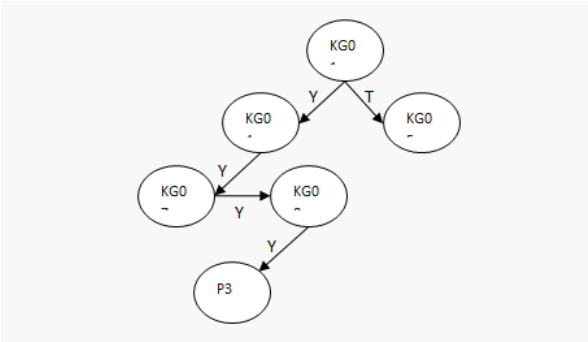

Figure 5. Tracing Towards Diagnostic Results

Testing of this application has been carried out by taking several cases of printer damage. Damage tracking is presented in above.

CONCLUSION

From the test results, the authors draw the conclusion that an expert system with this method can be well applied to a PHP programming language with designs made using UML modeling. The expert system application that has been made is able to draw conclusions according to the rules and search method (DFS) that are applied. It is hoped that this application will make it easier for printer users at the Mohammad Natsir Hospital to diagnose the problems they are facing.

REFERENCE

Chaining, F., & Factor, C. (2020). *205-Article Text-759-1-10-20201025 . 8* (2).

Fauzi, M. (2018). Expert System Detects Keyboard Damage Using Forward Chaining Method. *Kaputama Information Systems Journal (JSIK) , 2* (1), 96–101.

Imron, I., Afidah, MN, Nurhayati, MS, Sulistiyah, S., & Fatmawati, F. (2019). Expert System for Diagnosing Automatic Transmission Motorcycle Engine Damage with the Forward Chaining Method Case Study: AHASS 00955 Mitra Perdana. *Scientific Journal of Batanghari University, Jambi , 19* (3), 544. https://doi.org/10.33087/jiubj.v19i3.74

2

Irawan, MD, & Nasution, MKI (2018). Design of an Expert System for Diagnosing Diseases of Oil Palm Plants Using the Android-Based Bayes Method (Case Study: PTPN 4 Air Batu Plantation). *Journal of Information Technology* , *2* (1), 15. https://doi.org/10.36294/jurti.v2i1.403

Krisnanik, E., Kraugusteeliana, K., & Indriasari, V. (2018). Expert System Model Design Healthy Menu for Pregnant Women Based on Nutrition Using the Cooper Method. *Journal of Information Technology and Computer Science* , *5* (6), 643. https://doi.org/10.25126/jtiik.201856497

Laksana, TG (2019). Damage Detection of Samsung Cellphones Through Expert Systems Using a Combination of the K-Nearest Neighbor Algorithm With Case Based Reasoning. *JIPI (Scientific Journal of Informatics Research and Learning)* , *4* (1), 19. https://doi.org/10.29100/jipi.v4i1.1031

Mansyur, I., & Kurniawan, W. (2017). Web-Based Expert System for Diagnosing Lung Disease in Humans. *Proceedings of the National Seminar on Technology Innovation* , 28–38.

Mauliana, P., Firmansyah, R., & Hunaifi, N. (2017). Toyota Kijang LSX Damage Diagnosis Expert System Using Forward Chaining Method. *Journal of Informatics* , *4* (2), 206–213. http://ejournal.bsi.ac.id/ejurnal/index.php/ji/article/view/2068/pdf

Nasir, J., & Gultom, ZH (2018). Expert System To Detect Damage To Motorcycles Using A Web-Based Forward Chaining Method. *Digital Zone: Journal of Information and Communication Technology* , *9* (1), 42–58. https://doi.org/10.31849/digitalzone.v9i1.1075

Disease, D., Di, C., & Blessings, R. (2020). Forward Chaining Method Implementation For. *Infokam* , *4* (1), 1–4. http://amikjtc.com/jurnal/index.php/jurnal/article/view/219

Putra, HN (2018). Implementation of UML (Unified Modeling Language) Diagrams in the Design of Inpatient Data Applications at the Lubuk Buaya Health Center. *Synchronous : Journal of Informatics Engineering and Research* , *2* (2), 67–77. https://jurnal.polgan.ac.id/index.php/syncron/article/view/130

Rahmatullah, S., Purnia, DS, & Suryanto, A. (2018). Expert System To Diagnose Eye Disease With Forward Chaining Method. *Journal of Engineering and Education Research Center* , *10* (2), 1–7.

Sani, A., Ferdiyansyah, J., Sudarsono, BG, & Yuniarto, D. (2021). Application of the Forward Chaining Method with Case-Based Reasoning on Computer Damage. *Applied Information System and Management (AISM)* , *2* (1), 28–32. https://doi.org/10.15408/aism.v2i1.20207

Sonata, F.-. (2019). Utilization of UML (Unified Modeling Language) in E-Commerce Information System Design Customer-To-Customer Type. *Journal of Komunika: Journal of Communication, Media and Informatics* , *8* (1), 22. https://doi.org/10.31504/komunika.v8i1.1832

Suendri. (2018). UML (Unified Modeling Language) Diagram Implementation in Lecturer Remuneration Information System Design Using Oracle Database (Case Study: UIN Sumatera Utara Medan). *Journal of Computer Science and Informatics* , *3* (1), 1–9. http://jurnal.uinsu.ac.id/index.php/algoritma/article/download/3148/1871

Syaputra, A., & Setiadi, D. (2020). Yamaha Matic Motorcycle Damage Diagnostic Expert System Using Forward Chaining Method. *Jusikom : Musirawas Journal of Computer Systems* , *5* (2), 126–135. https://doi.org/10.32767/jusikom.v5i2.1039

Wedyawati, V., & Tusaadiah, H. (2017).

Expert System Detects Damage to Smartphones. *Science and Technology* , *17* (2).

Yuwono, DT, Fadlil, A., & Sunardi. (2017). Application of the Forward Chaining Method and Certainty Factor in Expert Systems. *Click* , *04* (02), 136–145.