Expert System For Personal Computer Mendiagnosakerusakan Method Using Certainty Factor

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Abstract—Along with the development of information technology, computers today have developed rapidly so that they require a higher technology world. Nowadays computers can be made in the category of human needs, Because they can help or human Facilitate work in various fields. The use of computer laboratories at Sei Bamban YAPIM Private Vocational School is very dense, so the level of computer damage is greater, both in terms of hardware and software. Here the author will discuss Expert Systems to Diagnose Damage to Personal Computers, the Certainty Methods Method is one of the Expert System Methods to Be Able to diagnose damage to a Personal Computer. In this case the Certainty Factor method is used to diagnose damage to the Personal Computer through existing symptoms. The damage is then be changed in the form of applications. To create an application the author uses Microsoft Visual Studio 2010. This thesis will explain the damage report and solutions for Personal Computer.

Keywords: Expert System for Diagnosing Personal Computer Damage, Certainty Factor Method,

1. Introduction

The development of Information Science and Technology is currently very influential in the world of education, business and in everyday life. many benefits from the development of Science and Information Technology as the ease of accessing information quickly, as a medium of learning in education, and so on. Expert System (Expert System) is a computer-based system that uses knowledge, facts and techniques in solving problems that normally can only be solved by an expert in the field. Vocational School (SMK) Private YAPIM Sei Bamban Having a computer lab that is used as a proposition for Teaching and Learning Activities (KBM). The use of computers in the lab are also very solid in accordance with the schedule of teaching, so the risk of damage to the Personal Computer (PC) becomes larger. Diagnosing damage to personal computer (PC) using the method of Certainty Factor can help identify damage to the PC based on the symptoms that arise and provide solutions for damage tersebut. The symptoms of damage to the Personal Computer will then be changed in the form of applications. To create an application the author uses Microsoft Visual Studio 2010. This thesis will explain the damage report and solutions for Personal Computer.

2. Theory

A. Certainty Factor Method

Certainty factor method is a method used to resolve cases of uncertainty, where the size is based on a fact or rule. Certainty Factor is a numerical value of an evidence received as a conclusion. Certainty Factor (CF) is a clinical parameter values given MYCIN to show how much confidence. CF indicates the size of the certainty of the fact or rule. CF uses an assumed value for the degree of belief in an expert to the data. Certainty factor introduces the concept of confidence and uncertainty are then formulated in the basic formula. There are two ways to get the level of confidence (CF) of a rule, the method of "Belief Net" proposed by EH Shortliffe and Buchanan BG and interview an expert.

As for the formula of certainty factor method is as follows:

\[
\text{CF (Rule)} = \frac{\text{MB} (H, E) - \text{MD} (H, E)}{1}
\]

\[
\text{MB}(H, E) = \begin{cases} 
1 & \frac{P(H)}{\text{lainnya}} \\
\frac{\max [P(H|E), P(H)] - P(H)}{\max [1,0]} & \text{lainnya}
\end{cases}
\]

\[
\text{MD}(H, E) = \begin{cases} 
1 & \frac{P(H)}{\text{lainnya}} \\
\frac{\min [P(H|E), P(H)] - P(H)}{\max [1,0]} & \text{lainnya}
\end{cases}
\]

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Information:

CF : certainty Factor
MB (H, E): Measure of Belief (ukurana trust) against hypothesis H, if given evidence E (between 0 and 1)
MD (H, E): Measure of Disbelief (a measure of distrust) towards evidence H, if given evidence E (between 0 and 1)
P (H) : probability (The probability of the truth of the hypothesis H)
P (H | E): The probability that H is really due to the fact E.

3. Results and Discussion

A. Problem analysis

Analysis is very bergepengaruh terhadap stage next process, where the goal is for systems that already exist today that will be developed later. The process for diagnosing damage to personal computer (PC) dibahas in the application of expert systems using certainty factor.

B. Discussion

In the operation of a personal computer, of course, we often encounter the problem of damage in use or operate a personal computer, as often happens very long loading, keyboard / mouse dead ataublank error monitor, and so on. This can be caused by a lack of care on a personal computer or the components of the personal computer has begun to weak or damaged, then it needs to do analysis on a personal computer proficiency level if necessary dilakukan maintenance and repair. Personal computers in the damage analysis method used is the certainty factor method. The stages were carried out to analyze the damage to personal computer are as follows:

a) Data analysis

The data analysis consists of three, namely, as following:

1) Research Sites

In a research settlement expert system for diagnosing damage to the personal computer (PC) is done in private vocational YAPIM Sei Bamban.

As for the things which the authors observed in this study are as following:

- symptoms of Damage
- type of Damage
- Damage Solutions

b) System Requirements Analysis

In systems engineering and software engineering system needs analysis include the determination of the needs of the jobs or conditions to be fulfilled in a new product or product changes, which take into consideration the various needs that intersect between the various stakeholders. The need of the results of this analysis should be carried out, measured, tested related to the needs identified and defined to the level of detail sufficient for system design. As for the necessity of the system is as follows:

a. Functional Requirements

Functional requirements is a description of the activities and services that must be provided by the system. Things become functional requirements are as following:

- input

Data inputs are used in expert systems of a predicament is the symptom data damage the personal computer.

- Process

To produce output, the expert system will process the data with certainty factor method.

- output

Processes performed by the expert system to diagnose damage to personal computer (PC) will produce output in the form of damage along with damage solutions.

![Fig 1. Functional Requirements.](https://iocscience.org/ejournal/index.php/CNAPC)
Non-functional requirements are requirements by sistem yang aims to support the functional requirements that have been determined.

- **Performance**
  - A system built to provide accurate results.
- **Easy to use**
  - The system is built easily used by anyone, without having to go through an expert.
- **Economical**
  - With this system, can reduce the cost of care as well as improvements on the personal computer.

c) **Built Systems Analysis**

Analysis carried out by the system built several steps:
- Identifying the symptoms of damage to the personal computer.
- Diagnose or determine the type of personal computer damage.
- Providing solutions or advice against such damage.

To build this system, the author uses the method certainty factor in the decision. This system can make the diagnosis of damage to the symptoms of damage to the personal computer. This uncertainty can be a probability that depends on the results of a symptom. Mengmasukkan dalah fault symptom will result in the kind of damage that is not certain.

C. **Certainty Factor Analysis Method**

In this study, to build an expert system application authors use the programming algorithm Visual Basic application using Microsoft Visual Studio 2010 for the design of the system and Microsoft Office Access 2007 as the medium used to build a database, which will be used as a medium for data storage of symptoms -gejala damage, type of damage and damage diagnostics solutions for personal computers, as well as input and output media on the design of the system.

The technique used to do diagnosis of damage to the personal computer is using a technique or method for menggunakan metode certainty factor is very appropriate to look for a certainty, and this technique can also be used for other research such as diagnosing heart diseases, diseases of animals / livestock, and so forth. Here is the algorithm of the system at the completion of the expert system to diagnose damage to personal computers, namely:

1. Inserting a PC damage symptoms.
2. Enter the type of damage to the PC.
3. Including the value of MB (measure of Increased belief) the size of the increase kepercayaan dan MD (measure of Increased disbelief) the size of the increase in distrust.
4. Determining the production rule (rule).
5. Calculation methods certainty factor (CF).
6. The calculation result and diagnosis of damage.

d) **Inserting a PC Damage Symptoms**

Here are the symptoms of damage to the PC:

| Symptoms code | Symptoms name                                           |
|---------------|---------------------------------------------------------|
| G01           | Lamp power die                                         |
| G02           | Alarms do not live                                     |
| G03           | CPU fan occasionally spinning / sometimes not           |
| G04           | There is no display on the monitor / no signal          |
| G05           | Dirty RAM / loose                                      |
| G06           | Reading system motherboard RAM installed                |
| G07           | processor heat                                         |
| G08           | Bad sectors on the disk                                |
| G09           | There is a faulty electronic components on the motherboard |
| G10           | Power supply is not stable                             |
| G11           | VGA gross / loose                                      |
| G12           | Operating system damaged                               |
| G13           | Over load in the operation of computer                  |
| G14           | Chipset motherboard or VGA too hot (over)               |
| G15           | Processor heatsink fan death                           |
| G16           | Lock heatsink loose or broken                           |
### Symptoms

| Symptoms code | Symptoms name                                      |
|---------------|---------------------------------------------------|
| G17           | Unstable electricity voltage (up and down)        |
| G18           | Hard drive is hot                                 |
| G19           | USB connector loose / loose                       |
| G20           | Cables are damaged or broken                      |
| G21           | Yet BIOS setting for USB keyboard                 |
| G22           | The mouse movement fractures                      |
| G23           | The mouse movement is slow                        |
| G24           | Mouse sometimes moves sometimes not               |
| G25           | Mouse does not move at all                        |
| G26           | Error installing jumper sound when assembling     |
| G27           | Sound driver installation errors                  |
| G28           | Sound card loose / loose                          |
| G29           | Beeps twice                                       |
| G30           | Sound one long beep                               |

### Insert type PC Damage

The following types of damage to the PC:

| Damage Codes | Damage name | Solutions |
|--------------|-------------|-----------|
| K01 Dead computer | - Replace the power cable from the power supply is normal. |
|               | - If it does not work, check the wiring panel mounted on the motherboard. |
|               | - If it does not work, replace the power supply which is nice. |
| K02 Computer Alarm and Not Shown | - If that does not work, the last step is to replace the motherboard with a new one that corresponds to the processor. |
|                | - Remove the VGA card / PCI card from the motherboard. |
|                | - Remove the RAM and make sure the RAM slots are clean from dust or dirt. |
| K03 Computer Blue Screen | - Clean the pin RAM using a pencil eraser or wipes, try pin is not touched by hand because it can cause corrosion or rust. |
|                | - After the RAM and the slot is cleaned, replace the RAM in its slot. |
| K04 Computer Hang | - If it does not work, turn off the computer first move keslot other RAM RAM. |
|                | - If it still does not work, then replace it with a new RAM. |
|                | - If it does not work, replace the motherboard with a new one in accordance with the processor. |
|                | - Reinstall the operating system. |
| K05 Computer Shutdown | - Replace the hard drive. |
|                | - Clean the processor from dust. |
|                | - Check that the fan spins at 2200 rpm and above. |
| K06 Restart the computer Alone | - Add thermal paste on the top of the processor. |
|                | - Reinstall the operating system. |
|                | - Replace the hard drive. |
| K07 keyboard Error | - Check the power supply. |
|                | - Check whether the driver has been installed or not. |
| K08 mouse Error | - Check the power supply. |
|                 | - Check whether the driver has been installed or not. |
| K09 Sound / Audio Not Beep | - Install driver sound / audio. |
|                | - Plug the USB Sound. |
f) **basis Rules**

The rule base between the type of damage and the symptoms would be explained in the following table:

| Table 3 |
| Rule Base. |
| Basis Aturan |
| K01 | K02 | K03 | K04 | K05 | K06 | K07 | K08 | K09 |
| G01 | √ |
| G02 | √ |
| G03 | √ |
| G04 | √ | √ |
| G05 | √ | √ | √ |
| G06 | √ | √ |
| G07 | √ |
| G08 | √ | √ |
| G09 | √ |
| G10 | √ | √ | √ | √ | √ |
| G11 | √ |
| G12 | √ | √ | √ |
| G13 | √ |
| G14 | √ |
| G15 | √ |
| G16 | √ |
| G17 | √ |
| G18 | √ |
| G19 | √ |
| G20 | √ |
| G21 | √ |
| G22 | √ |
| G23 | √ |
| G24 | √ |
| G25 | √ |
| G26 | √ |
| G27 | √ |
| G28 | √ |
| G29 | √ |
| G30 | √ |

g) **Entering Values MB and MD**

The following MB and MD values of each symptom in each of damage, namely:

| Table 4 |
| Values MB and MD On Each symptom. |
| name Damage | Symptoms name | MB | MD |
| Dead computer | Lamp power die | 0.8 | 0.1 |
| Alarms do not live | 0.8 | 0.05 |
| CPU fan occasionally spinning / sometimes not | 0.8 | 0.1 |
| There is no display on the monitor / no signal | 0.8 | 0.1 |
| Power supply is not stable | 0.8 | 0.1 |
| Beeps twice | 0.6 | 0.05 |
| Computer Alarm Sound and Not Shown | Sound one long beep | 0.6 | 0.05 |
| There is no display on the monitor / no signal | 0.8 | 0.02 |
| Dirty RAM / loose | 0.8 | 0.1 |
| Reading system motherboard RAM installed | 0.5 | 0.05 |
| processor heat | 0.4 | 0.2 |
| computer bluescreen | Bad sectors on the disk | 0.5 | 0.2 |
| There is a faulty electronic components on the motherboard | 0.6 | 0.2 |
| Power supply is not stable | 0.8 | 0.1 |
| VGA gross / loose | 0.7 | 0.05 |
### Table 5: Value Certainty Factor.

| Uncertain Term               | CF  |
|------------------------------|-----|
| definitely not               | -1.0|
| Almost certainly not         | -0.8|
| Unlikely                     | -0.6|
| Probably not                 | -0.4|
| Do not know                  | -0.2 to 0.2|
| Maybe                        | 0.4 |
| Most likely                  | 0.6 |
| almost certainly             | 0.8 |
| Certainly                    | 1.0 |

#### h) Determining the Production Rule (Rule)

From the table above, the rule that can be taken as follows:

**rule 1**: IF Alarm power light does not live dead AND AND Fans CPU sometimes spinning / sometimes not AND There is no display on the monitor / no signal AND Power supply unstable THEN Dead Computer.

**rule 2**: IF Beeps twice AND sound one long beep AND There is no display on the monitor / no signal THEN Alarm Sound Computers and Not Shown.

**rule 3**: IF Dirty RAM / loose AND Reading system RAM on the motherboard AND Dirty RAM / loose AND Bad sectors on the disk AND Operating system damaged AND Power supply is not stable THEN Operating System Computer did not appear bluescreen.

**rule 4**: IF Over load in computer operation AND AND Operating System does not appear dirty RAM / longar AND Bad sector on the hard drive or the motherboard chipset AND VGA too hot (over) THEN computer hangs.

**rule 5**: IF Power supply Unstable AND Fan die processor heatsink heatsink AND Lockout loose or broken THEN Computer Shutdown.

**rule 6**: IF Unstable electricity voltage (up and down) AND Power supply is not stable AND RAM dirty / loose hard drive is hot AND THEN corrupted Operating System Restart Your Own Computer.
rule 7 : IF Power supply Unstable AND Konektor loose / baggy AND Cables are damaged or broken AND Yet BIOS setting for USB keyboard THEN Keyboard Error.

rule 8 : IF Power supply Unstable fractures AND Pergerakan mouse mouse movement slow AND AND Mouse sometimes moves sometimes not AND Mouse does not move at all THEN Mouse Error.

rule 9 : IF Error installing jumper sound when assembling the installation error AND AND sound card drivers sound off / loose THEN Sound / Audio No sound.

i) Calculation Method of CF

| Table 6 | Symptom Alternatives to-1. |
|---------|---------------------------|
| Alternative |   | Diagnosis |
| A-01 | G01 | ✓ |
|      | G02 | ✓ |
|      | G03 | ✓ |
|      | G04 | ✓ |
|      | G10 | ✓ |

Initial formula:

CF [H, E] = MB [H, E] - MD [H, E]

MB (h, e1 ^ e2) = MB [h, e1] + MB [h, e2] * (1 - MB [h, e1])

MD (h, e1 ^ e2) = MD [h, e1] + MD [h, e2] * (1 - MD [h, e1])

MB (G01) = Lamp power die = 0.8, MB (G02) = Alarm is not life = 0.8

MD (G01) = Lamp power die = 0.1, MB (G02) = Alarm is not life = 0:05

Then the calculation of the manual:

MB (Dead Computer, ^ G01 G02) = 0.8 + 0.8 * (1 - 0.8)

= 0.8 + (0.8 * 0.2)

= 0.8 + 0.16

= 0.96

MD (Dead Computer, ^ G01 G02) = 0.1 + 0.05 * (1 - 0.1)

= 0.1 + (0.05 * 0.9)

= 0.1 + 0.045

= 0.145

CF [H, E] 1 = 0.96 - 0.145

= 0.815

MB (Dead Computer, ^ G01 G02, G03) = 0.96 + 0.8 * (1 - 0.96)

= 0.96 + (0.8 * 0.04)

= 0.96 + 0.032

= 0.992

MD (Dead Computer, ^ G01 G02, G03) = 0.145 + 0.1 * (1 - 0.145)

= 0.145 + (0.1 * 0.855)

= 0.145 + 0.0855

= 0.2305

CF [H, E] 2 = 0.992 - 0.2305

= 0.7615

MB (Dead Computer, G01 G02 ^ ^ G03, G04) = 0.992 + 0.8 * (1 - 0.992)

= 0.992 + (0.8 * 0.008)

= 0.992 + 0.0064

= 0.9984

MD (Dead Computer, G01 G02 ^ ^ G03, G04) = 0.2305 + 0.1 * (1 - 0.2305)

= 0.2305 + (0.1 * 0.7695)

= 0.2305 + 0.07695

= 0.30745

CF [H, E] = 0.9984 - 0.30745

= 0.69095

MB (Dead Computer, G01 G03 ^ ^ G02 G04, G10) = 0.9984 + 0.8 * (1 - 0.9984)

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\[
= 0.9984 + (0.8 \times 0.0016) \\
= 0.9984 + 0.00128 \\
= 0.99968
\]
MD (Dead Computer, G01 G03 \^\^ G02 G04, G10) = 0.30745 + 0.1 \times (1-0.30745) \\
= 0.30745 + (0.1 \times 0.69255) \\
= 0.30745 + 0.069255 \\
= 0.376705
CF [H, E] = 0.99968 - 0.376705 \\
= 0.622975
Percentage = 0.622975 \times 100\% \\
= 62.2975\%

j) Calculation Results and Diagnosis
So, based on calculations that have been done it can be concluded Alternative 1 to 5 symptoms would get a diagnosis of computer damage dead with 62.2975% percentage that is almost certain. Solutions of diagnosis such damage is replace power cable from the power supply are normal, if it does not work, check the wiring panel mounted on the motherboard, if it does not work, replace the power supply with a nice, if not managed well, the final step replace the motherboard with a new one in accordance with the processor.

4. Conclusion

Based on the description and discussion of the analysis of the tests, it can be concluded on the Expert System for Diagnosing Damage to Personal Computer Using Certainty Factor method is as follows:

a) Designing applications expert system for diagnosing damage to the personal computer.

b) Applying the method of certainty factor in the application of expert system to diagnose the symptoms of damage to the personal computer.

c) Build a system to diagnose damage to the PC with the symptoms that occur with certainty factor method.

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