Diagnose Expert System Computer Malfunction Certainty Factor Method

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Abstract—An expert system is a knowledge base system that solves problems using an expert's knowledge that is entered into a computer, thereby increasing productivity. Because an expert can work faster than a human lay works like an expert. Expert systems also solve problems by imitating the ways in which an expert expert offers solutions with problems in his field, one of which is in the field of computer repair, the problem of computer damage becomes a fairly complicated problem, this problem is generally experienced by individuals and institutions. One of them is in school institutions that have computer laboratories. To diagnose computer use can damage the certainty factor method that helps identify damage to the computer and find the cause of damage to the computer based on the symptoms that occur and the solution to repair it. Certainty Factor is one of the techniques used to deal with uncertainty in decision making. In dealing with a problem, answers are often found that do not have full certainty. This uncertainty is influenced by two factors, namely the uncertain rules and user uncertain answers. Uncertain rules are rules of symptoms that are determined for a damage.

Keyword: Expert System, Computer, Certainty Factor

1. Introduction

Current technological advances in the computer field is very fast, a lot of advantages in the can be accessed easily and quickly evolving technologies must be supported by an appropriate device, there are times when a computer that is used may not work in accordance with function, this is normal because the computer can also be worn when continuously used, and without proper maintenance. In this problem can be solved by experts who can be simplified into expert systems (expert systems). Computer malfunction problem becomes a particularly complex issue, these issues are commonly experienced by individuals and institutions. One of them in school establishments that have computer labs.

2. Theory

2.1 Expert System

Artificial Intelligence is one area of computer science which utilizes intelligent computer so that it can behave like the computer manusia. Ilmu develop software and hardware to mimic human actions. Simulated human activities such as reasoning, vision, learning, problem solving, natural language understanding and so on. In accordance with the definition, then the artificial intelligence technology learned in areas such as: Robotics (Robotics), Computer Vision (Computer Vision), Language Processing Natural (Natural Language Processing), Pattern Recognition (Pattern Recognition), Nerve System Artificial (Artificial Neural System), Voice Recognition (Speech Recognition), and Expert System (Expert System). Artificial Intelligence to solve the problems by utilizing a computer to a complex problem by following a process of human reasoning. One of the techniques of artificial intelligence that mimics human reasoning process is Expert System.

2.2 Expert System Elements

Expert systems can not be separated from the human element related thereto. Personnel associated with the existing expert system 4, namely:

a. Expert (Expert)

b. Builders knowledge (Knowledge Engineer)

c. Builder system (System Engineer)

d. User (User)

2.3 Certainty Factor

Factors certainty (Certainty Factor) is one method used to deal with uncertainty in expert systems. Shortliffe certainty factor introduced by Buchanan in the manufacture MYCIN. MYCIN, expert systems to
diagnose bacterial infections in the blood, using a certainty factor method for overcoming the lack pastian. CF 
(H, E) = MB (H, E) - MD (H, E)

CF (H, E): certainty factor hypothesis H is affected by the evidence (symptoms) E.
MB (H, E): measure of confidence (measure of Increased belief) against hypothesis H which is influenced by 
evidence E.
MD (H, E): the size of unbelief (measure of Increased disbelief) against hypothesis H which is influenced by 
evidence E. The basic form formula certainty factor of a rule in the form of IF E THEN H is as follows:

CF (H, e) = CF (E, E) * CF (H, E)

Where :
e : Evidence or observation time.
E : Evidence or new observation.

CF (E, E) : Certainty Factor evidence E is influenced by evidence e.
CF (H, E): Certainty Factor hypothesis H assuming the evidence known with certainty when the CF (E, e) = 1
CF (H, e) : Certainty Factor hypotheses influenced by evidence e.

In the method required certainty factor hypothesis certainty factor value given by an expert and also the value of 
evidence obtained from event / events. In a study to determine the value hypothesis CF (H) hypotheses obtained 
from consultations to experts. As for the value of CF (E) evidence in getting from the most prominent symptoms 
are visible from some of the symptoms experienced in the computer lab, so it can produce value CF (H) and the 
value of CF (E) symptoms of damage to the computer as in the following table:

<table>
<thead>
<tr>
<th>uncertainTerm</th>
<th>CF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not sure</td>
<td>0.4</td>
</tr>
<tr>
<td>Certainly</td>
<td>0.8</td>
</tr>
<tr>
<td>very definitely</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Table 2.
Table Percentage Confidence

<table>
<thead>
<tr>
<th>No.</th>
<th>Percentage Rate</th>
<th>Values Beliefs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40% - 60%</td>
<td>Not sure</td>
</tr>
<tr>
<td>2</td>
<td>61% - 80%</td>
<td>Certainly</td>
</tr>
<tr>
<td>3</td>
<td>81% - 100%</td>
<td>very definitely</td>
</tr>
</tbody>
</table>

3. Analysis

<table>
<thead>
<tr>
<th>Code</th>
<th>Damage</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| H01  | Monitor / LCD Damaged | - The first solution able to turn off the computer with the hard off to die and press a few seconds to remove the charge capacity and then turn on. If they still show symptoms of damage, then there could be a hardware malfunction, check the connectors.  
- LCD opaque solutions to overcome them can be done simply by replacing the cathode ray tube monitors.  
- As for the incomplete color can replace the mainboard or replace the VGA cable. |
| H02  | RAM Broken | - Try clearing the RAM using the eraser by brushing brass in RAM.  
- Check the RAM you are using if it is a kind of computer you use. |
| H03  | HDD Damaged | - Check the hard drive relationship with the socket  
- Check whether the hard disk sound if so it is possible that there are bad sectors, immediately back up your data before the total dead hard drive, and prepare a new hard drive. |
| H04  | VGA Damaged | - Turn off the computer and unplug the VGA card, and then reinsert it carefully and make sure it is properly installed.  
- If you use a VGA card VGA On Board clashed with the motherboard, you should disable the function of On Board VGA BIOS.  
- If it is not able to be repaired manually, you should immediately bring it to the nearest service center or by replacing the motherboard. |
| H05  | Sound Card Damaged | - Reinstall the sound card driver and make sure the sound card is installed correctly in the slot.  
- Make sure the cable connector is plugged in correctly  
- If there is a broken cable then immediately replace connecting cable is |
<table>
<thead>
<tr>
<th>Code</th>
<th>Damage</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| H06  | OS Troubled | - Check the hard drive cable is already installed  
- Whether the computer is clean of viruses, if not please clean viruses or reinstall  
- Check the bios settings at the boot menu, if it is appropriate to boot from the hard drive |
| H07  | Damaged applications | - Forced close the application. If the program becomes unresponsive, you can press (and hold) Ctrl and Alt and Delete keys (Control, Alt, and Delete) on your keyboard to open the Task Manager. You can then choose the unresponsive application and click End Task to forcibly shut down.  
- Reinstall the faulty application  
- Turn off the anti-virus protected if the application is useful as debug |
| H08  | Power Supply Damaged | - Check whether the cable is properly connected and installed the plug into the socket.  
- Also check the on / off button behind exactly behind the Power Supply is in the On position.  
- If you are sure installed correctly but still no respond. the possibility of cable / power supply itself is damaged. replace with a new cable or a new power supply. |
| H09  | processor | - Open the processor from its slot, clean the processor with tissue and let the pasta to keep them cool.  
- Check the pin slot on the motherboard if there is no reply defects, if defective please trim  
- Processor and motherboard must match, if not match it must be replaced. |
| H10  | memory less (Need to Upgrade RAM) | - Unplug long RAM  
- Replace with new RAM, make sure its capacity is greater than the old |
| H11  | memory VGA less (Need to Upgrade Memory) | - Unplug VGA long  
- Replace with new VGA, ensure greater capacity than the old |
| H12  | Clock less high processor (Need to upgrade Processor) | - Processor Clock Unplug long  
- Replace with a new processor clock, make sure the capacity is greater than the old |
| H13  | Front Panel Error | - Check the preparation and cabling  
- See the installation instructions on the motherboard |
| H14  | Less Power On Power Supply | - It is recommended that a new switch, as if on hold will result in the other components |
| H15  | Damaged USB devices | - Check the drivers in device manager is already installed, if not there will be an exclamation point. If it has not been installed in order to install it first  
- When it is installed but not detected, check cabling usb. |
| H16  | broken keyboard | - Turn off the computer and check whether the keyboard cable is plugged in correctly to the CPU.  
- If you need a keyboard can be cleaned using a vacuum cleaner sucked or clean it with a brush.  
- Cleaning is done when the computer is off and separated from the keyboard port. |
| H17  | Mouse broken | - The first solution to the mouse pointer does not move try to restore order task manager, the way of the keyboard press ctrl + alt + delete together, then if it appears the windows task manager, you can turn off programs that do not resonding.  
- The second solution to the mouse does not work at all you first need to check the physical connection of the mouse. In the worst case, your mouse may have been damaged and you need to buy a third baru.Solusi try to issue double click lalukan Kontol Panel> Hardware and Sound> Devices and printers> mouse. From here you double-click a data set keceatan as your order |
<p>| H18  | Motherboard | - Check around the motherboard whether there is a capacitor that is swollen, if |</p>
<table>
<thead>
<tr>
<th>Code</th>
<th>Damage</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| H19  | Power cable broken | - Remove the cable and reinstall it. Make sure the power cord is plugged in correctly  
- Check if there are scratches on the cable, the cable dressing to cover cable slot if who drop out  
- We recommend that new change |
| H20  | Cable Sata / Ide Damaged | - Make sure the cable is properly installed.  
- Replace the cable if damaged |
| H21  | CD / DVD / ROM / RW Damaged | - Try to replace defective motors tray with a new one on the CD / DVD Rom.  
- Furthermore, if the CDs / DVDs can not be read then intervenes to clean the optical CD / DVD Rom, and then perform a calibration trimpot (a type of potentiometer) which exist in around the optic. The trimpot slightly rotate clockwise using any device, be it with a pointed pliers and screwdriver mini.  
Be sure and see if the trimpot on the CD / DVD you've really twisted.  
- 43 Another way is to fix part of the regulator CD / DVD Rom. The solution is to replace the total board IC and replace the CD / DVD Rom new.  
- Turn off the PC, wait for approximately 5 minutes, then On right back.  
- When booting, press suggested that (Del, Esc, F1, F2, F10, etc.) to enter the BIOS Setup menu, please read the article.  
- Select the BIOS settings on Default_settings. And change the time and date settings in the BIOS.  
- Press F10 or Save & Exit the BIOS.  
- The computer will restart, and see if the boot able to walk normally mean all finished.  
- If the error message still appears and turns BIOS can not keep setting the date (step 3), replace the CMOS battery with a new one, On-kan pc, do no.2  
- 4. Hopefully here can walk normally. |
| H22  | bios Error | - Turn off the PC, wait for approximately 5 minutes, then On right back.  
- When booting, press suggested that (Del, Esc, F1, F2, F10, etc.) to enter the BIOS Setup menu, please read the article.  
- Select the BIOS settings on Default_settings. And change the time and date settings in the BIOS.  
- Press F10 or Save & Exit the BIOS.  
- The computer will restart, and see if the boot able to walk normally mean all finished.  
- If the error message still appears and turns BIOS can not keep setting the date (step 3), replace the CMOS battery with a new one, On-kan pc, do no.2  
- 4. Hopefully here can walk normally. |

<table>
<thead>
<tr>
<th>Symptoms code</th>
<th>Symptoms name</th>
<th>CF Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>E01</td>
<td>Tombol life but there is no image displayed monitored</td>
<td>0.8</td>
</tr>
<tr>
<td>E02</td>
<td>Terdapat horizontal / vertical middle of the monitor</td>
<td>0.8</td>
</tr>
<tr>
<td>E03</td>
<td>Tidak no initial appearance bios</td>
<td>0.8</td>
</tr>
<tr>
<td>E04</td>
<td>Muncul Error messages on the bios (message is always different depending on certain conditions)</td>
<td>0.4</td>
</tr>
<tr>
<td>E05</td>
<td>Bios alarm goes off</td>
<td>0.4</td>
</tr>
<tr>
<td>E06</td>
<td>Terdengar strange sound on the HDD</td>
<td>0.8</td>
</tr>
<tr>
<td>E07</td>
<td>Frequent hangs / crashes while running the application</td>
<td>0.8</td>
</tr>
<tr>
<td>E08</td>
<td>Always scan the disk when booting</td>
<td>0.8</td>
</tr>
<tr>
<td>E09</td>
<td>Muncul error message when running the application</td>
<td>0.4</td>
</tr>
<tr>
<td>E10</td>
<td>Device driver information is not detected in the device manager, even if the driver has been installed</td>
<td>0.4</td>
</tr>
<tr>
<td>E11</td>
<td>suddenlyarrived OS automatic restart</td>
<td>0.4</td>
</tr>
<tr>
<td>E12</td>
<td>The exit of the blue screen on OS (message is always different depending on certain conditions)</td>
<td>0.8</td>
</tr>
<tr>
<td>E13</td>
<td>Sounds remain out although device drivers and settings have been done according to the instructions</td>
<td>0.8</td>
</tr>
<tr>
<td>E14</td>
<td>Muncul error message while running audio applications</td>
<td>1.0</td>
</tr>
<tr>
<td>E15</td>
<td>Muncul error message the first time the OS loaded from the HDD</td>
<td>0.8</td>
</tr>
<tr>
<td>E16</td>
<td>Tidak no signs of sebagain / whole device works (all of the cooling fan is not spinning)</td>
<td>0.4</td>
</tr>
<tr>
<td>E17</td>
<td>Often sudden death without cause</td>
<td>0.8</td>
</tr>
<tr>
<td>E18</td>
<td>Muncul messages on the windows, that the windows virtual memory shortage</td>
<td>0.8</td>
</tr>
<tr>
<td>E19</td>
<td>Applications run with a slow, slow response to input</td>
<td>0.8</td>
</tr>
<tr>
<td>E20</td>
<td>Graphics performance is very heavy (usually in the open internet and manipulation of images)</td>
<td>1.0</td>
</tr>
<tr>
<td>E21</td>
<td>Device not detected in the bios</td>
<td>0.8</td>
</tr>
<tr>
<td>E22</td>
<td>Information detection wrong in the bios</td>
<td>0.4</td>
</tr>
<tr>
<td>Symptoms code</td>
<td>Symptoms name</td>
<td>CF</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>E23</td>
<td>Part of his devices work</td>
<td>1.0</td>
</tr>
<tr>
<td>E24</td>
<td>Sebagain / whole character input dead</td>
<td>1.0</td>
</tr>
<tr>
<td>E25</td>
<td>The mouse pointer does not respond to mouse movement</td>
<td>1.0</td>
</tr>
<tr>
<td>E26</td>
<td>TaMPAK black block, and the image is not symmetric / random</td>
<td>1.0</td>
</tr>
<tr>
<td>E27</td>
<td>Exit long beep when the laptop is turned on</td>
<td>0.4</td>
</tr>
<tr>
<td>E28</td>
<td>Dihidupkan somewhat difficult</td>
<td>0.4</td>
</tr>
<tr>
<td>E29</td>
<td>The power cable suffered scratches</td>
<td>0.4</td>
</tr>
<tr>
<td>E30</td>
<td>Tidak no indication of incoming power</td>
<td>0.8</td>
</tr>
<tr>
<td>E31</td>
<td>Mati total</td>
<td>0.8</td>
</tr>
<tr>
<td>E32</td>
<td>Computer life position and then suddenly die screen</td>
<td>0.8</td>
</tr>
<tr>
<td>E33</td>
<td>Exit beeps repeatedly</td>
<td>0.4</td>
</tr>
<tr>
<td>E34</td>
<td>Bforgetting until the operating system has been restarted again</td>
<td>0.4</td>
</tr>
<tr>
<td>E35</td>
<td>Power supply fan is not spinning</td>
<td>1.0</td>
</tr>
<tr>
<td>E36</td>
<td>The power supply fan and processor fan spins</td>
<td>0.4</td>
</tr>
<tr>
<td>E37</td>
<td>CD / DVD / ROM / RW undetected in OS</td>
<td>1.0</td>
</tr>
<tr>
<td>E38</td>
<td>CD / DVD / ROM / RW drive that can not go out CD</td>
<td>0.4</td>
</tr>
<tr>
<td>E39</td>
<td>The message &quot;BIOS ROM checksum error - System halted&quot;</td>
<td>1.0</td>
</tr>
<tr>
<td>E40</td>
<td>Operating System Not Appear</td>
<td>1.0</td>
</tr>
<tr>
<td>E41</td>
<td>When in the press the power button is not lit</td>
<td>1.0</td>
</tr>
</tbody>
</table>

In establishing this expert system would apply Certainty Factor Method (Certainty Factor) to resolve the problems encountered. The knowledge base is taken from the relationship of symptoms and damage to the computer that is then compiled in the form of rules (rule). Rule (rule) can be seen in the following table:

**Table 5. Rule (Rule)**

<table>
<thead>
<tr>
<th>Rule Production (AND)</th>
<th>IF</th>
</tr>
</thead>
<tbody>
<tr>
<td>R01</td>
<td>E01</td>
</tr>
<tr>
<td>R01</td>
<td>E02</td>
</tr>
<tr>
<td>R01</td>
<td>E26</td>
</tr>
<tr>
<td>THEN</td>
<td>H01</td>
</tr>
<tr>
<td>R01</td>
<td>E04</td>
</tr>
<tr>
<td>R01</td>
<td>E05</td>
</tr>
<tr>
<td>R02</td>
<td>E11</td>
</tr>
<tr>
<td>R02</td>
<td>E12</td>
</tr>
<tr>
<td>R02</td>
<td>E33</td>
</tr>
<tr>
<td>THEN</td>
<td>H02</td>
</tr>
<tr>
<td>R02</td>
<td>E07</td>
</tr>
<tr>
<td>R02</td>
<td>E08</td>
</tr>
<tr>
<td>R03</td>
<td>E10</td>
</tr>
<tr>
<td>R03</td>
<td>E21</td>
</tr>
<tr>
<td>R03</td>
<td>E22</td>
</tr>
<tr>
<td>R03</td>
<td>E34</td>
</tr>
<tr>
<td>THEN</td>
<td>H03</td>
</tr>
<tr>
<td>R03</td>
<td>E03</td>
</tr>
<tr>
<td>R04</td>
<td>E09</td>
</tr>
<tr>
<td>R04</td>
<td>E12</td>
</tr>
<tr>
<td>THEN</td>
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</tr>
<tr>
<td>R05</td>
<td>E11</td>
</tr>
<tr>
<td>R06</td>
<td>E15</td>
</tr>
<tr>
<td>R06</td>
<td>E40</td>
</tr>
<tr>
<td>THEN</td>
<td>H06</td>
</tr>
<tr>
<td>R07</td>
<td>IF</td>
</tr>
<tr>
<td>R07</td>
<td>E07</td>
</tr>
</tbody>
</table>
Here is an example of a computer malfunction factordiagnosa certainty calculation below:

<table>
<thead>
<tr>
<th>Rule 1 MONITOR / LCDRUSAK:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IF</strong> Tombol hiduptapitidakada image tertampil dimonitor <strong>AND</strong> Terdapatgaris horizontal / vertikalditengahmonitor <strong>THEN</strong> Tampakblok black, dangambar asymmetric / random</td>
</tr>
</tbody>
</table>

Specialists determine the value of CF experts for each of the following symptoms:
- CF (expert) Power on but no image displayed on the monitor = 0.8
- CF (expert) are horizontal / vertical amid the monitor = 0.8
- CF (expert) looks black block, and the image is not symmetric / random = 0.1

Users determine the value of CF user for each of the following symptoms:
- CF (user) Power on but no image displayed on the monitor = 0.4
- CF (user) are horizontal / vertical amid the monitor = 0.4
CF (user) looks black block, and the image is not symmetric / random = 0.8

Rules which have been determined are then calculated the value of CF CF expert with the user using the equation:

\[
CF (H, E) = CF (E) \times CF (\text{rule}) = CF (\text{expert}) \times CF (\text{user})
\]

Rule 1.1 = 0.8 * 0.4 = 0.32
Rule 1.2 = 0.8 * 0.4 = 0.32
Rule 1.3 = 1.0 * 0.8 = 0.8

Because there is more than one symptom, then subsequently used to determine damage to the equation:

\[
CF_{\text{combine}} (CF_{\text{gejala1}}, CF_{\text{gejala2}}) = CF_{\text{f1}} + CF_{\text{f2}} \times (1 - CF_{\text{f1}})
\]

\[
CF_{\text{combine1}} (CF_{\text{gejala1}}, CF_{\text{gejala2}}) = 0.32 + 0.32 \times (1 - 0.32) = 0.32 + 0.21
\]

\[
CF = 0.53 \text{ old1}
\]

\[
CF_{\text{combine2}} (CF_{\text{old1}}, CF_{\text{gejala3}}) = 0.53 + 0.8 \times (1 - 0.53) = 0.53 + 0.37
\]

\[
CF = 0.9 \text{ old2}
\]

Hence the conclusion: the last old CF CF damage, based on a calculation of the percentage calculated CF subsequent conviction damage to the equation

\[
\text{Percentage} = \frac{CF_{\text{disease}} \times 100}{0.9 \times 100} = 90\%
\]

Based on the calculation, then the damage monitor / LCD has a confidence level of 90% and the system has a percentage value of confidence "SANGATPASTI".

4. Design

Designing a system for diagnosing expert system computer damage is to use Diagram usecase diagram, This diagram is used to describe the application and user behavior to application. In this system, the user Consist general application and general admin. User as users of the system while the admin as the manager of the system. As do the common user and admin in this system is more visible in this Figure:
5. Conclusion

Based on the description and discussion of the analysis of testing has been done, it can be concluded against damage Diagnosing Computer Expert System with Certainty Factor method as below:

a. An expert system to diagnose damage to the computer with certainty factor method can be implemented properly and efficiently and can provide solutions to overcome them.

b. Diagnosing damage to the computer with certainty factor method, performed in a way to diagnose based on symptoms and produce a confidence percentage value against damage.

c. This expert system can accelerate the performance of a technician to repair damage to computers in the computer lab.

6. Reference