Computer Malfunction Early Detection System Design

Lisa Melvi Ginting[1], Ressy Dwitias Sari[2], Azmi Rizki Lubis[3], Vivi Ramayanti Harahap[4], Mhd. Dominique Mendoza[5], Irma Permata Sari[6]

{lisamelvi99@gmail.com[1], ressydwitiassari@unj.ac.id[2], azmirizkilubis@unimed.ac.id[3], viviramayanti@gmail.com[4], aenaen@unimed.ac.id[5], irmapermatasari@unj.ac.id[6]}

Mechanical Engineering Education Department Of Faculty Of Engineering of Universitas Negeri Medan, Indonesia[1],
Informatics And Computer Engineering Education Of Faculty Of Engineering of Universitas Negeri Jakarta, Indonesia[2],
Electrical Engineering Of Faculty Of Engineering Of Universitas Negeri Medan, Indonesia[3],
Educational Development And Quality Assurance Institute Of Universitas Negeri Medan, Indonesia[4],
Information Technology And Computer Education Of Faculty Of Engineering Of Universitas Negeri Medan, Indonesia[5],
Information Technology Systems Of Faculty Of Engineering Of Universitas Negeri Medan, Indonesia[6]

Abstract. System detection is part of the expert system. An expert system is an application in a computer that aims to help make decisions or aims to solve problems in a specific field. Diagnosing computer failure is a time-consuming and expensive task to do manually. Intelligent systems called expert systems were introduced to develop hardware failure diagnoses for any computer system. Problems with PC components can be detected by the sound coming out of the spiker when the BIOS performs a POST (Power On Self-Test). It sounds different depending on the problem. The purpose of this work is to use the five planes method, namely strategic, scope, structure, skeleton, and surface planes, to the design of a computer damage early detection system based on user experience. This article leads to the construction of an interface for a computer damage early detection system based on beep.

Keywords: Computer Malfunction, Expert System, Five Planes Method, User Experience

1 Introduction

The rapid development of technology has led to many changes in various fields. The impact of technological advances can bring comfort to society, because once human work was done manually, now with the help of computer systems. In everyday life, people often use computers or the Internet as a tool to facilitate public work.

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Computer systems are based on interconnected devices produced by different vendors. Therefore, it is not possible to solve all system errors (for example due to interoperability problems) based only on one product information. Instead, problem-solving practically requires the identification, identification and consolidation of relevant information from various sources. If done manually, the process can be time-consuming and error-prone [1]

Artificial intelligence is one of the fields of information technology that resembles human nature [2]. With the help of artificial intelligence, we can create solutions to problems that arise, act or make decisions, as well as simplify human work in everyday work. One part of Artificial Intelligence is an expert system [3]. Expert systems are an application on computers designed to help make decisions or solve problems in a particular field. According to expert systems, computer systems must mimic all expert decision-making skills [4]. Expert Systems are one branch of computer science that uses computers to make them behave intelligently like humans [5]. Expert system tries to insert human knowledge into computers so that computers can solve issues like experts do.

Problems with computer components can be detected from sounds coming out of speakers when the BIOS performs POST (Power On Self-Test) [6]. The sound varies depending on the problem. Detecting damage through voice makes it easy for computer users to identify them. Several methods, such as trust factor, forward series, and case-based reasoning, have been studied to make rules for diagnosing computer errors in specialized systems. The Dempster Shafer method is part of the non-monotonic inference method to calculate inconsistencies resulting from the addition or reduction of new facts that alter existing rules, so that with the Dempter Shaffer method can also be sought the chance or percentage of symptoms of damage [7].

Because user experience design has a significant influence on a product's success or failure, it has grown in importance within the software development process. A product or service's user experience, which includes the human-machine interface, is defined as the portion that the user may interact with. The range of user experience includes product knowledge, searches, classifications, installs, sales, installations, services, expansions, enhancements, and a variety of other elements of life [9].

The purpose of this research will ensure system success by designing the system according to the experiences of educational institution users [10]. The ISO standard states that user experience includes all of the responses a user has while using a system, product, or service [11]. As the method focuses on human-computer interaction to be able to analyze the designed website, the User Experience method is applied to facilitate identifying problems in the website design process and finding solutions according to the user's wishes [12]. In addition, the method can also offer convenience to website visitors.

This article presents a design which meets user needs through appropriate techniques and guidelines. The five planes approach was used in the system's development. A reference framework that explains how user experiences might be built is the five planes framework [13].

2 Methods

2.1 Data Collection

Primary data for this study was collected directly from computer service users and a computing specialist, such as a lecturer in electrical engineering. Interviews with users of computer services to find out the actions of people in the face of damage that occurs to their computers. In addition, interviews to the electrical engineering lecturer to know the ways that can be done before the computer is decided to be repaired by his experts. The knowledge, requirements, and functionality that potential system users want are also obtained through primary data collecting the samples.

2.2 Design Method

The author applied the five plane method to the construction of a computer detection system. The Five Plane method offers guidelines on how to design the detection system's user interface, which will be developed for this project. This approach facilitates the description of the information system's user experiences in conceptual models, both about the problem and its resolution [14]. Surface, framework, structure, scope, and strategy are the five areas that make up the five-level technique. There is more tangible at the top level and more abstraction at the lower level [15]. Fig.1 shows the five planes method.

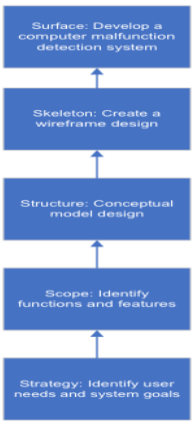

Fig. 1. Five Planes Method

Each level of the five planes method depends on the level below it, so its application must start from the lowest level. The description of each level in the five planes method, namely [16]:

a. Strategy Plane: This level is to find out the needs of users as the purpose of building a system. This stage will provide the results of the functions and resources of the system to be built.

b. Scope Plane: This level is to translate the results of user requirements that have been obtained in the previous level into functional specifications with complete descriptions such as features in the system.

c. Structure Plane: This level is to determine the interaction of how the system behaves and responds to users. Basically, this phase offers a structure for the information that makes sense to humans.
d. Skeleton Plane: The purpose of this level is to provide a framework that enables users to engage with system operations. This comprises the interface design or the organization of interface elements. In addition, a collection of screen elements and the system's navigation design are provided at this stage to help users navigate the system.
e. Surface Plane: This level's objective is to offer a framework that lets users interact with the capabilities of the system. This includes the way that interface elements are arranged or designed. The stage also provides the collection of screen elements and the navigational layout of the system, allowing users to navigate about it.

3. Result and Discussion

This section uses the five planes method to discuss the research results. This technique is used to obtain an understanding of how a computer crash detect system's user experience should be designed. This method makes it easier to conceptually represent the user experience of the computer crash detection system in terms of the problem being solved and the technology required.

3.1 Strategy Plane

This phase's goals are to define the demands of the user and develop the product. Interviews with customers of computer repair services and a computer repair specialist were conducted for this. Numerous user needs were discovered as a result of the observations and interviews, including:

1. Users are able to identify symptoms of computer damage through the system..

2. The system can provide the results of diagnosing computer damage based on the symptoms felt by the user.

3. The system can provide solutions to computer damage experienced by users.

3.2 Scope Plane

From the user needs that have been compiled in the strategy plane, this stage provides results in the form of the main features and functions of the computer damage detection system. The results of this stage are illustrated with a use case diagram which can be seen in Fig. 2.

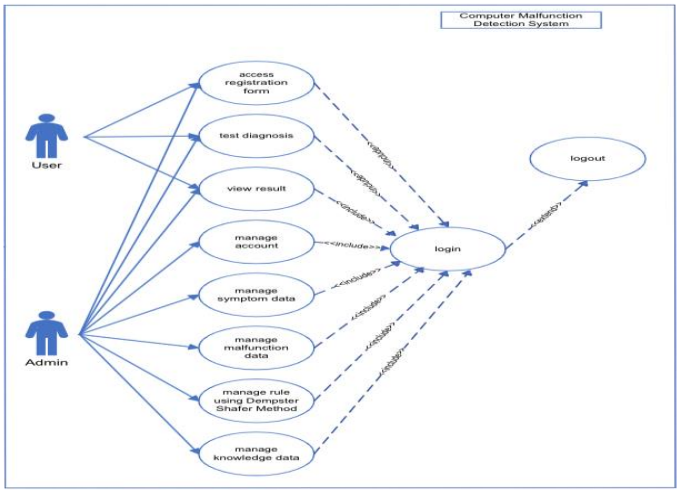

Fig. 2. Use Case Diagram

The computer damage detection system has 2 types of users, namely users who will detect computer damage (users) and admins. The results of the scope plane obtained several features that will be built in the system, namely:

1. User, can:
   a. Access registration form, This feature is to register so that the system can recognize users who use the computer damage detection system.
   b. Test diagnosis, This feature is for testing the symptoms of computer malfunctions experienced by users.
   c. View result, This feature is to view the diagnosis results provided by the system. This feature also provides computer repair suggestions to system users.
2. Admin, can:
   a. Can act like a general user, this feature is given so that the admin can help users directly in detecting computer damage.
   b. Manage accounts, this feature helps the admin in managing the accounts of all users of the computer damage detection system.
   c. Manage symptom data, this feature is to add, change and delete computer damage symptoms data.
   d. Manage malfunction data, this feature is to add, change and delete types of computer damage. This feature makes the computer damage detection system dynamic.
   e. Manage rule using Demspter Shafer Method, this feature relates to the application of one of the methods of the expert system. This method requires the admin to create a relationship between the symptoms of damage and the type of computer damage. Thus, this feature is useful for adding, changing and deleting relationships between symptoms of damage and types of computer damage if there are changes in the future.
   f. Manage knowledge data, this feature is to provide the plausibility value of each symptom. Thus, this feature is useful for adding, changing and deleting rules or plausibility values if there are changes in the future.

3.3 Structure Plane

In the previous stage, the results of the users of the system were divided into two, namely users who detect computer damage (users) and admins. Next, determine the interaction of the system with the user. This interaction is depicted in the activity diagram. Activity diagrams are divided based on the needs of system interactions on users and admins. This stage produces three activity diagrams, which can be seen in Fig. 3 below.

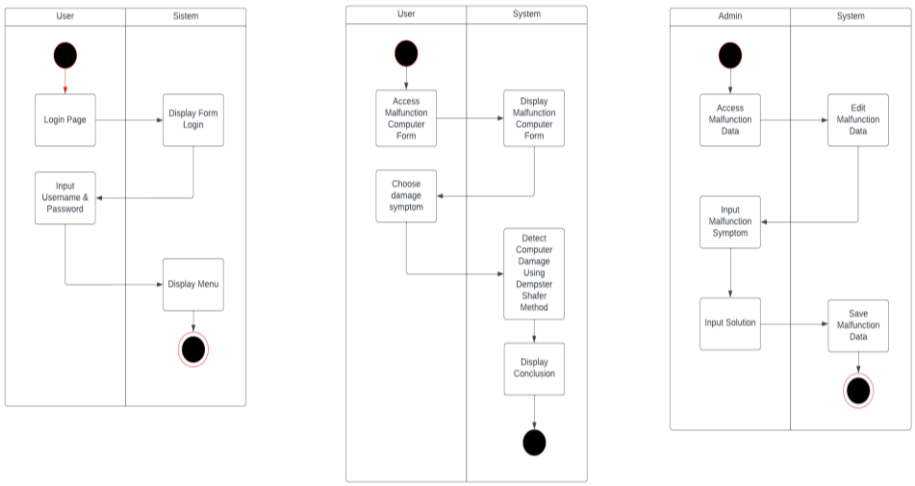

Fig. 3. Computer Malfunction Detection System Activity Diagram

The first activity diagram describes the activity flow system for logging in to the system. The login process is done by entering the username and password of the user who has previously registered on the registration page. If the username and password are correct, the system will display the computer damage detection menu.
The second activity diagram is a system activity for users who will detect computer damage. The activity starts from the user opening the damage form page, then the user makes input based on the symptoms of computer damage experienced by the user. After the user makes an input, the system will process the results of the type of computer damage based on the Dempster Shafer method and the system provides a solution for handling computer damage.
The third activity diagram is a system activity for the admin in managing the computer damage detection system to be dynamic. Admin input data on computer damage and symptoms. In this activity, the admin inputs handling solutions based on symptoms and computer damage.

3.4 Skeleton Plane

After obtaining system features and activities from the previous stage, the author is then in the skeleton plane stage, which presents a framework that includes interface design or arrangement of interface elements of the computer damage detection system. A low fidelity prototype design, which is a representation of the website interface design and includes the

layout of items like buttons, control elements, images, and text blocks, is what this stage outputs. The results of the low fidelity prototype can be seen in Fig. 4 below.

Fig. 4. Low Fidelity Prototype Computer Malfunction Detection System

The result of this stage is that the first page is an interface design of the initial display page of the computer damage detection system. The second page is the interface design of the user registration page. Before using the system, users first create an account on this page. The third page is the interface design of the computer damage diagnosis process page. This page serves to select the symptoms of computer damage experienced by the user. The fourth page is the

interface design of the diagnosis results given by the system to the user. This page has information on the type of computer damage and computer damage handling solutions. The fifth page is the design of the computer damage list interface. This page provides information to the user in the form of types of computer damage owned by the system.

3.5 Surface Plane

The last stage of the five planes method is to convert low fidelity prototypes into PHP, HTML and CSS code. The author completes this step by mapping the outcomes of the previous steps. In order enhance the user experience along with easy use, the computer damage detection system is designed in line with user needs.

The result of the surface plane is a computer damage detection system consisting of several pages, namely:

1. Home page, this page provides explanatory information about the meaning of expert systems, the meaning of PC/computer which aims to increase user understanding of computer damage detection systems. This page can be seen in Fig. 5.

Fig. 5. Home Page

2. User registration page, this page serves to accommodate user data so that all inputted data can be recorded by the database. The results of this page can be seen in Fig. 6.

Fig. 6 User Registration Page

3. Diagnosis Page, this page can be used if the user has successfully registered then the next step is for the user to diagnose computer damage by selecting the symptoms experienced by the user. The results of this page are shown in Fig. 7.

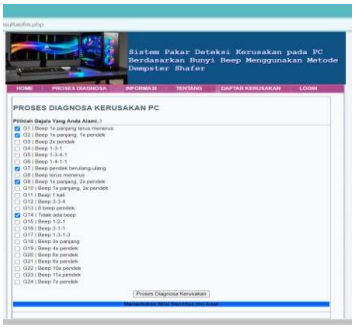

Fig. 7. Damage Diagnosis Process Page

4. Diagnostic results page, this page functions to provide the results of diagnosing computer damage by providing information on calculations from the Dempster Shafer method with a combination formula. Information in the form of initial pleusability values and new pleusability values. This page can be seen in Fig. 8.

Fig. 8. Diagnostic Result Page

5. Computer Damage Types page, this page contains information for a list of types of computer damage and their handling solutions. This data can be accessed by the admin to view, add, change or delete data from the type and solution of handling computer damage. This page can be seen from Fig. 9.

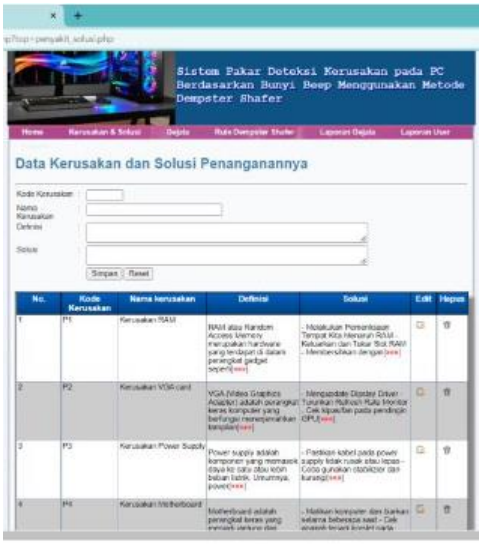

Fig. 9. Computer Malfunction List

4. Conclusion

The paper uses the five planes method to the design of a computer fault detection system. The primary goal for developing this interface was to get features and a design based on user experience, according to by the results. An essential component of the computer crash detection system's interface design is found in each of the five planes of the method. As can be noticed that the five planes method's base level results in an abstract concept, and the upper levels create the concept visible as a system design. This research produces two types of users of the computer damage detection system, namely users who will detect computer damage (users) and admins. This system has several features based on the type of user, namely testing symptoms of computer damage, providing results and solutions to computer damage, and managing symptoms of computer damage which makes this system dynamic if there are changes in the future.

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