

Website-Based Expert System for Diagnosing Epilepsy in Children Using the Forward Chaining Method

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Article Info

Article history:

Received October 10, 2024

Revised October 16, 2024

Accepted November 1, 2024

Keywords:

Epilepsy

Expert System

Forward Chaining

Website

ABSTRACT

Information technology has been used in various sectors of life, including the health sector. One of them is the use of expert systems in diagnosing disease. Disease diagnosis carried out by an expert has weaknesses along with the expert's biological weaknesses. One technology that can be a solution is an expert system. This research aims to build a web-based expert system for diagnosing epilepsy in children, along with things that parents can do when treating epilepsy patients. The method used in this research is forward chaining, and system testing is carried out using the Black Box method. From the system design that has been created and tested, a web-based expert system application for diagnosing epilepsy in children has been produced. The black-box testing results show that all menus function well and as expected. The results of expert testing and user testing results obtained a final score of 3.8, which means the assessment is in the very suitable category. Apart from that, it will provide information and education to the public, in this case, the parents of epilepsy patients, regarding the type of epilepsy the child suffers from and how to treat it, which can be accessed anywhere and at any time.

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How to Cite:R. Nasser, S. Subhan, and iin putri, "Website-Based Expert System for Diagnosing Epilepsy in Children Using the Forward Chaining Method", International Journal of Engineering and Computer Science Applications (IJECSA), vol. 3, no. 2, pp. 71-80, Sep. 2024. doi: [10.30812/ijecsa.v3i2.4524](https://doi.org/10.30812/ijecsa.v3i2.4524).

1. INTRODUCTION

Expert systems, or what is known as expert systems in information systems, have become one of the successful trends in modern times like today. Expert systems aim to develop information systems that facilitate the work or activities of every human being. The expert in question is someone who has special expertise in their respective fields, for example, a doctor, psychologist, mechanic, technician, and so on [1]. The knowledge of experts in the system is used to answer various questions or for consultation. The implementation of expert systems is widely used in various fields, one of which is the health sector, because expert systems are seen as a way of storing expert knowledge in a particular field in a computer program so that decisions can be made in carrying out intelligent reasoning [2]. One of the implementations of expert systems is by applying the forward chaining method in an application that can diagnose diseases. 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 [3]. One of the implementations of expert systems with the forward chaining method in the health sector is an expert system for diagnosing diseases, which is included in the group of epilepsy diseases, especially epilepsy in children. Previously, there have been many studies related to expert systems, so this study refers to previous expert system research. This study refers to research conducted by [4] entitled "Creation of a Web-Based Expert System Application for Diagnosing Infectious Diseases Caused by Bacteria and Viruses." This study aims to produce a website-based expert system application using Hypertext Preprocessor (PHP) and My Structured Query Language (MySQL) that can provide information on solutions to types of diseases caused by bacteria and viruses using the forward chaining tracking technique. This application will display a selection of symptoms that can be selected by the user until the final result or conclusion of the analysis results from the previous questions is obtained. The final result of this expert system will display the name of the infectious disease caused by bacteria and viruses experienced by the patient [4]. Another study was conducted by [5], entitled "Web-Based Expert System for Diagnosing ISPA Diseases with the Forward Chaining Method." This study aims to help people suffering from ISPA be helped and treated quickly and accurately. This expert system was created using the PHP and MySQL programming languages as databases and the forward chaining method [5].

In a study conducted by [6] entitled "Web-Based Expert Application for Diagnosing Skin Diseases in Children Using the Certainty Factor Method". This study aims to design a web-based expert application for diagnosing skin diseases in children using the certainty factor method, the analysis method, and system development using an object-oriented analysis model and a prototyping development model. This system was built using PHP, Javascript programming languages, and the MySQL Database. The results of the trial of this system include calculating the solution to the certainty factor using 15 symptom rules and 4 diseases. This system can help determine skin diseases in children aged 0-5 years [6]. Research conducted by [7] entitled "Application of Certainty Factor Method in Web-Based Diphtheria Disease Diagnosis Expert System." This study aims to design and build an expert system capable of diagnosing diphtheria early through the Expert System Development Life Cycle (ESDLC) application. The results of this study are a web-based expert system application for diagnosing diphtheria with a knowledge base consisting of 12 symptoms of the disease. This diphtheria disease diagnosis expert system has gone through a trial process using the black box testing method, and the results all show that the application's features can operate properly [7]. Another study was conducted by [8] titled "Web-Based Cattle Disease Diagnosis Expert System Using the Forward Chaining Method." The results of this study, namely the development that has been carried out by the author during the design process to the implementation of the cattle disease diagnosis expert system using the forward chaining method, concluded that the cattle disease diagnosis expert system can provide consultation between users and the system and provide diagnostic results in the form of solutions and treatment of previously diagnosed diseases [8].

Some of the results of relevant studies conducted by several authors related to expert systems do not show or provide services or menus related to handling and treatment that families of sufferers of the disease can do in their expert systems. In this study, the expert system that will be created and what will be new in this study is that this expert system can contribute to the community who are still ignorant about epilepsy and also contribute to the health sector that can diagnose epilepsy in children and also the treatment that families of sufferers can do. Epilepsy, commonly known as Ayan by the Indonesian people, is considered an infectious disease that cannot be cured and is caused by supernatural powers or mental disorders [9]. However, in reality, epilepsy is a disorder of the central nervous system or the activity of nerve cells in the brain. So, epilepsy is not an infectious disease, mental disorder, or supernatural disorder. Epilepsy is also a disease that requires quite a long treatment, even for life, but with the right therapy, sufferers can be freed from epilepsy [10]. However, pediatricians who specifically handle epilepsy and act as experts are not always consistent in making diagnoses, so they find inappropriate therapy [11]. Human expertise also does not last long; it can be lost due to death, retirement, or changing jobs. So, this research aims to create an expert system application to diagnose epilepsy in children and its treatment. This can make it easier for sufferers and their families or companions when handling children with epilepsy.

2. RESEARCH METHOD

This type of research is Research and Development (R&D), a process or steps in developing a new product or perfecting an existing product [12]. The application development method used is using the waterfall model. The waterfall method works on a system carried out sequentially or linearly [13]. So if step 1 has not been done, then step 2 cannot be done, so you must follow the steps to be able to proceed to the next step [14]. The stages of the waterfall model can be seen in the chart (Figure 1), namely: (1) Data Collection stage is data will be collected regarding epilepsy in children along with its types and all symptoms related to the type of epilepsy, both from books, journals, theses, and interview results with pediatricians; (2) System analysis stage is the running system and the proposed system are analyzed in relation to the expert system for diagnosing epilepsy in children; (3) Design stage is the interface display of the system to be created will be designed where the epilepsy diagnosis system in children is website-based; (4) After designing the system interface, the next stage is the system creation stage, in this case, a website-based expert system using several supporting applications or software such as the PHP programming language, Sublime Text, Xampp; (5) Testing the system that has been created whether it is feasible or valid and ready to use. Testing is a technique that is often used to verify and validate the quality of an application. Testing is a procedure for executing a program or system to find errors. This study uses the Blackbox Testing method; (6) Website system maintenance ensures that the website remains optimal and relevant and its goals are achieved. Website maintenance can include several tasks, such as Monitoring web traffic, Updating content, Ensuring the website is secure, Backing up the website, and Checking the domain's validity [15].

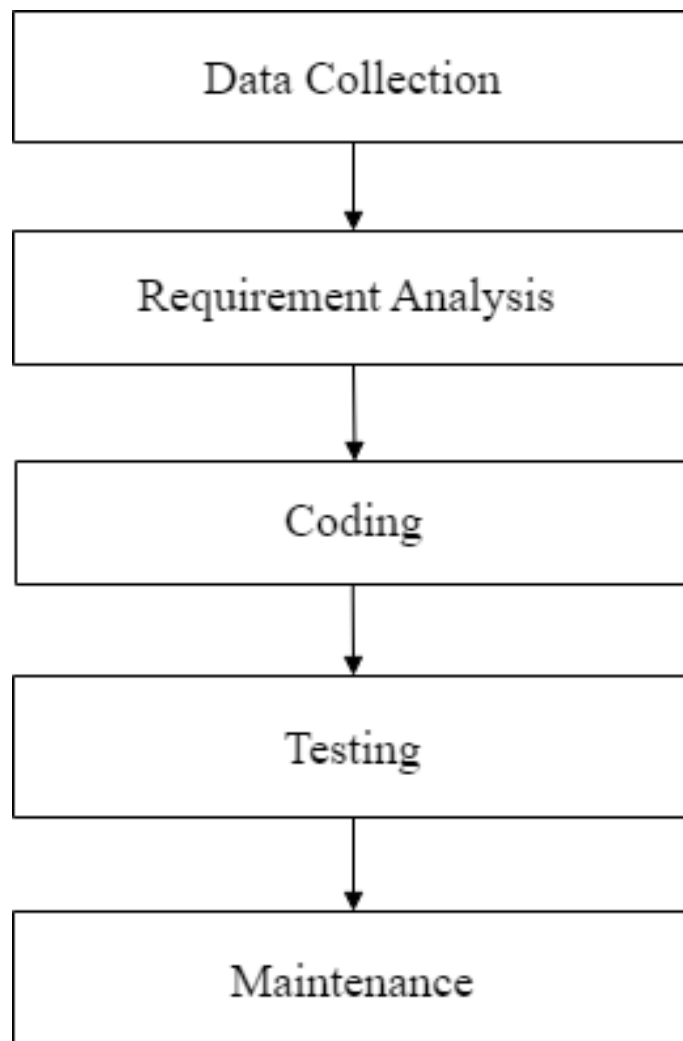


Figure 1. Waterfall Model Stages

2.1. Flow of the forward chaining method

In an expert system, an inference engine is needed that contains the thought patterns and mechanisms of an expert's reasoning to solve a problem. The inference engine technique used in this research is forward chaining. The forward chaining flow can be seen in Figure 2, namey: (1) Ask symptom questions in patients; (2) Collect input of symptoms experienced by the patient; (3) Use the forward chain method to check the rules based on existing premises; (4) If the rule is found, then conclusion rules will be added to the database; if any new premise is found, then steps one to four are repeated. rule when not found, then given default output; (5) Provide information and solutions.

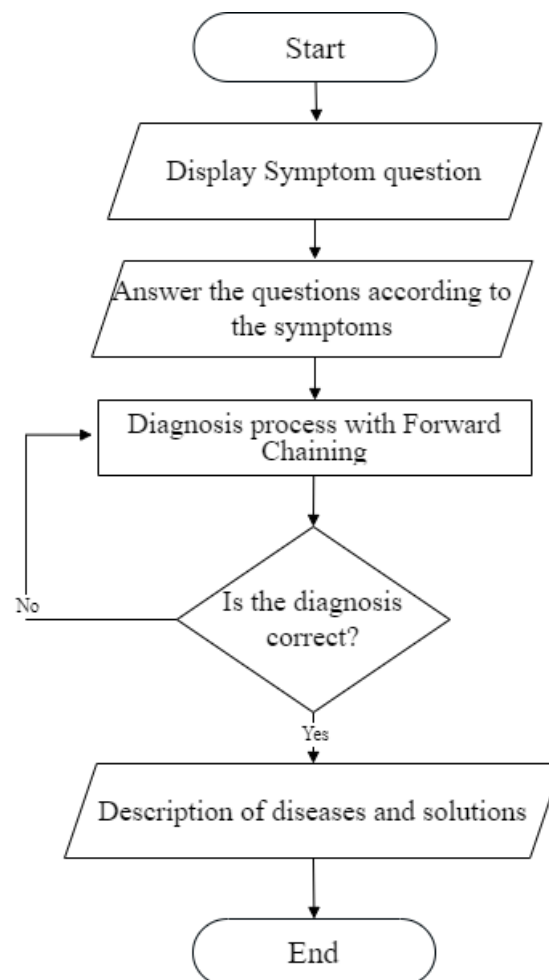


Figure 2. Forward Chaining Flow Chart

3. RESULT AND ANALYSIS

1. Data collection

At this stage, data collection has been carried out on epilepsy in children along with its types and all symptoms related to the type of epilepsy from books, journals, theses, and interview results with pediatricians.

2. System analysis

At this stage, an analysis of the current system and an analysis of the proposed system related to the expert system for diagnosing epilepsy in children is carried out. The system running at the Public Health Center is shown in Figure 3. Figure 3 explains

that when a patient comes to a health center, the service process is carried out conventionally by registering the patient with a health worker then after the administrative completeness is complete, the patient will meet a doctor for the diagnosis process and get the results of the diagnosis of the type of disease. Meanwhile, the proposed system can be seen in Figure 4. Figure 4 explains that the proposed system allows patients to see the results of their disease diagnosis and treatment without meeting directly with experts, in this case doctors or health workers.

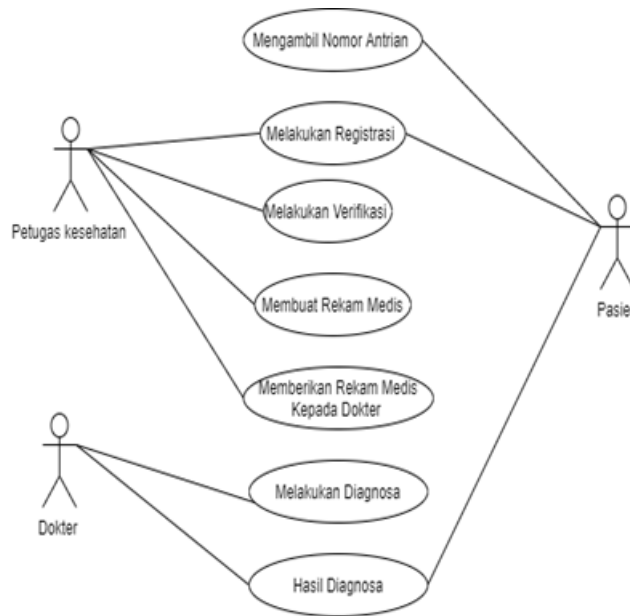


Figure 3. Forward Chaining Flow Chart

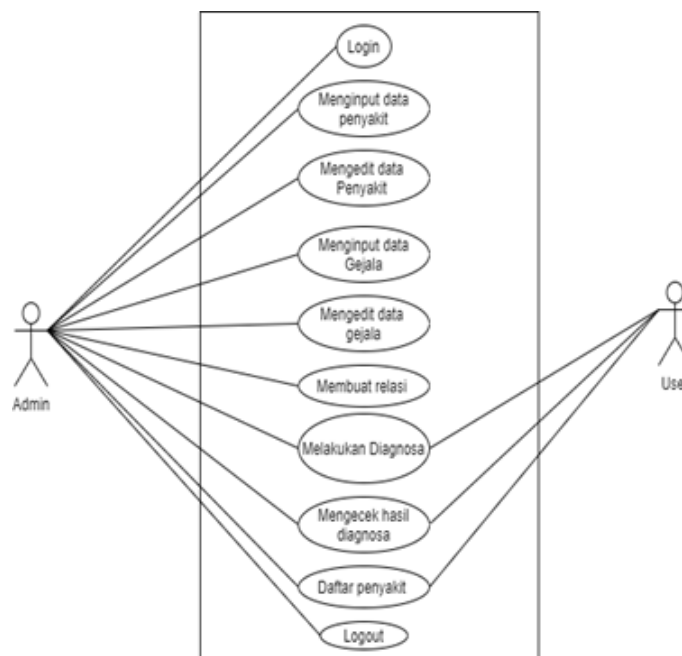


Figure 4. Proposed system

3. Design and Creation

Implementation is the stage where the system is ready to be operated in real conditions to determine whether the system created can produce the desired goals. This expert system for diagnosing epilepsy is implemented using a web-based programming language. In this expert system, the application will present several questions where general users (patients) can answer the questions with yes or no options if the question is following the search flow in the system, the type of epileptic attack, and the therapy that is suitable for the type of attack are displayed. Knowledge is stored in a database using a MySQL database. The following is a design of the interface of the system that has been created. The system is the main page that is first used when the application is run. The initial display of the system is shown in Figure 5. Figure 5 shows the system's initial display when it is first run. The display contains a welcome greeting and a general explanation of epilepsy. Figure 6 shows the diagnosis menu contains a series of symptoms of epilepsy that may be experienced by epilepsy sufferers and can be selected by ticking the symptoms experienced by the patient.



Figure 5. Initial System Display

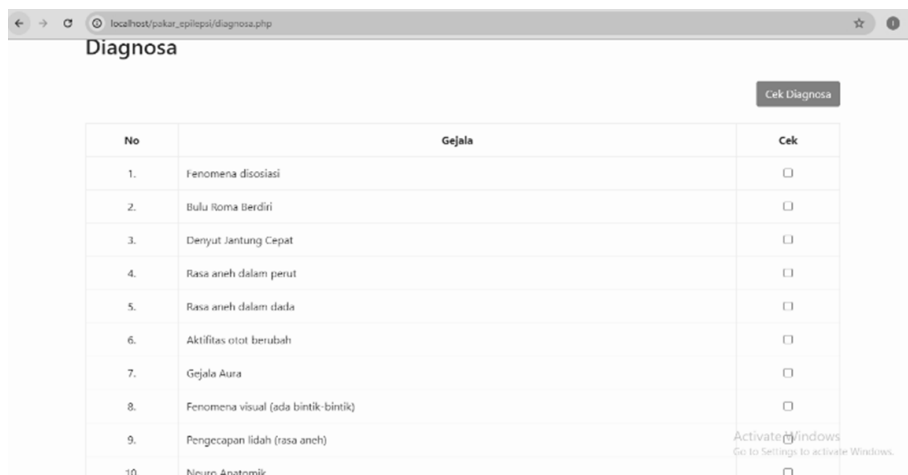


Figure 6. Diagnosis Menu

Figure 7 shows the disease list menu contains information about the types and types of epilepsy the patient suffers. There are 4 types of epilepsy and also 12 symptoms of epilepsy. Figure 8 shows the admin menu page contains the admin profile that can manage this system. In this menu, the admin can add rules, in this case, regarding the type of disease, diagnosis, and treatment of the disease. Figure 9 shows the diagnosis results menu is a page that contains the results of the diagnosis of epilepsy based on a series of symptoms selected by the patient. In this menu, you will also see the treatments that can be done, such as types of drugs, solutions, and even the causes of the disease.



Figure 7. Disease List Menu

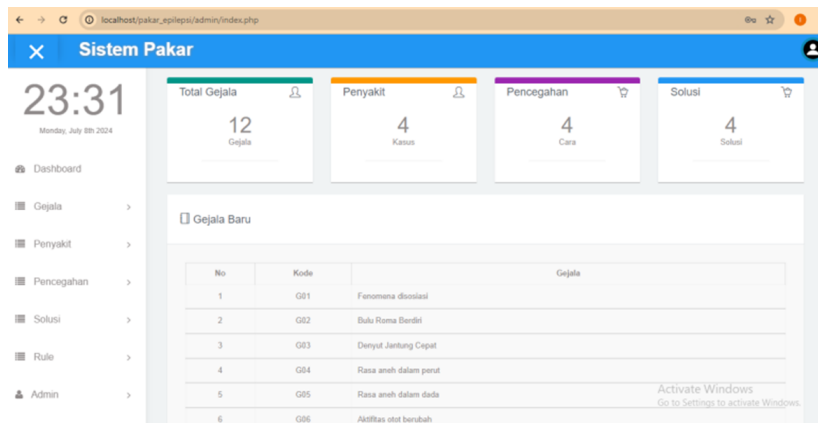


Figure 8. Admin Page

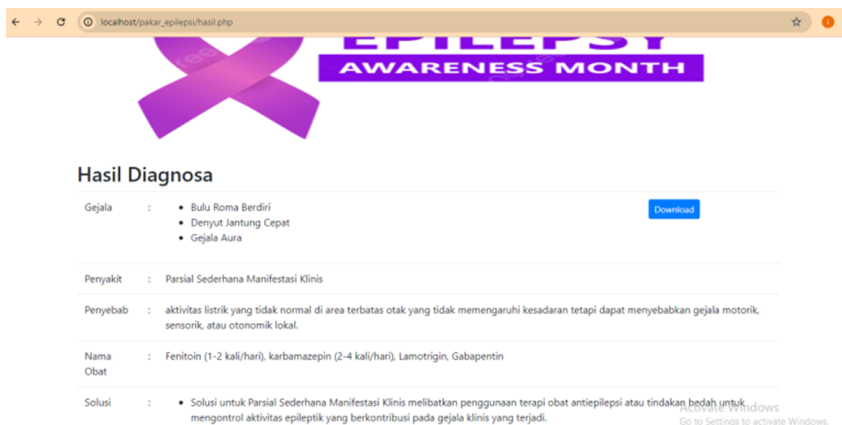


Figure 9. Diagnosis Results

System testing is done using the BlackBox method where, which method is a method of testing tools or buttons from the system that has been created. From the test results, each button or tool in the system runs according to its function. The results of expert

testing and user testing obtained a final value of 3.8, which means that the assessment is in the very appropriate category. Website system maintenance ensures that the website remains optimal and relevant and achieves its goals. Website maintenance can include several tasks, such as Monitoring web traffic, updating content, Ensuring the website is secure, backing up the website, and checking the domain's validity.

3.1. Discussion

Based on the test results, it can be seen that the system that has been created can run well according to its functional objectives. Five main menus are presented from the expert system application that has been created. Like the home menu that shows the initial display of this expert system application when it is first run. Then, the diagnosis menu shows a series of symptoms of epilepsy, and this page can select any diagnosis or symptoms suffered by the patient. The next menu is the disease list menu, namely a menu with a list page and types of epilepsy along with the types of attacks or symptoms and the right treatment for patients and families and patient companions. Finally, the account menu, menu is the admin menu to log in to edit or change the diagnosis, list of diseases, and the appearance of the expert system for diagnosing epilepsy.

4. CONCLUSION

Based on the expert system application that has been created during the design process for the implementation of a web-based expert system in diagnosing epilepsy using the forward chaining method, it can be concluded that the expert system can diagnose the type of epilepsy early by answering questions given by the expert system according to the symptoms experienced by the patient. Users can see the types of epilepsy and the symptoms of each epilepsy. In addition, users can print the results of the diagnosis by pressing the print button at the bottom of the website at the end of the diagnosis session. This expert system can facilitate users, in this case, health workers and patients, in carrying out the consultation process because only by using the application can patients receive the results of the diagnosis of the type of epilepsy from the symptoms given and get the right treatment for prevention and treatment. In addition, this expert system has an attractive and easy-to-use interface so that the community can easily use this application to find out the type of epilepsy attack they are suffering from. For further research, it is better to add types of epilepsy attacks or other symptoms or even create an expert system for other types of diseases needed by the community.

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