Expert System For Early Detection and Diagnosis of Central Nervous Diseases in Humans With Forward Chaining And Backward Chaining Methods Using Interactive Multimedia

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Abstract

The tasks of the nervous system contained in the human body include diagnosing, analyzing and conveying information. This information that has been obtained will be combined with the sensory system, and will then be integrated in the brain and signals, then transmitted again to the motor system and autonomic pathways to control movement, visceral activity, and endocrine function. All actions are controlled by nerves which are interconnected to form a signaling network consisting of the sensory system and the motor system. The nervous system has several functions, including immunity and supporting function and modulating the activity of the nervous system. There are many types of neurological diseases found in the medical world, but due to a lack of information and knowledge about the disease. So the researchers made this study using forward and backward chaining reasoning methods, along with neurological disease therapy, ways of healing, and methods of treatment. This system is made so that sufferers can easily understand about neurological diseases, and understand the types of central nervous diseases, along with their healing therapies, and how to treat them. This system provides several solutions to prevent neurological diseases according to the type of disease. The system development methodology uses the waterfall method. Application software used to create this application program is Dreamweaver MX, Adobe Flash CS3, XAMPP, Adobe Photoshop, MySQL, Opera, Mozilla Firefox. The result of this research is an application program that can help users to find out the types of central nervous disease and provide extensive information about central nervous disease and find out how to treat and cure them.

Keywords : Backward Chaining, Fordward Chaining, Expert Systems, Multimedia, Neurological Diseases.

Preliminaries

Chapter 2 Summary

The nervous system in the human body has a duty to diagnose, analyze, and convey information. This information will be combined by the sensory system, and will then be integrated in the brain and signals, then will be passed on to the motor system and autonomic pathways to control movement, visceral activity, and endocrine functions. All actions are controlled by interconnected nerves to form a signaling network consisting of sensory and motor systems. The nervous system has an immune function and supports functions and modulates nerve activity. Many types of nervous diseases are found due to lack of information and knowledge about the disease. So the researchers made this study using forward and backward chaining reasoning methods along with healing therapy and treatment methods. This system is made so that sufferers can understand and understand the types of central nervous disease along with healing therapies and ways of treatment. This system provides several disease prevention solutions according to the type of disease. The system development methodology uses the waterfall method. Application software used to create this application program is Dreamweaver MX, Adobe Flash CS3, XAMPP, Adobe Photoshop, MySQL, Opera, Mozilla Firefox. The result of this research is an application program that can help users find out the types of central nervous disease and provide extensive information about central nervous disease and find out how to treat and cure therapy.

1. Introduction

The central nervous system consists of the brain and spinal cord. The brain has three functions, namely receiving sensory input from the spinal cord and from its own nerves, processing various sensory inputs, namely cognitive functions which include integration and association of stored data and emotional components, initializing and coordinating motor output. To carry out these functions, a neural network is needed which contains thousands of nerve cells that will deliver information from the brain and to the brain from various parts of the body. In general, nerve cells consist of several parts, namely the cell body, axons, dendrites and synaptic ends. Most of the nerve cells are multipolar, meaning they have several dendrites with one axon, but some are bipolar, meaning they only have one dendrite and one axon. The number of dendrites allows one nerve cell to receive many inputs. Each axon ends at a synaptic end. Most of the synapses are formed between axons and dendrites but can also occur between axons and cell bodies, or between two axons or two dendrites (Ikawati, 2011).

At this time there are many types of neurological disease discoveries, so with advances in computer technology can help humans in various fields, one of which is expert systems. An expert system is a computer program designed to model problem-solving abilities like an expert. With the development of an expert system, an expert system pharmacotherapy application can be made that can diagnose central nervous disease based on symptoms and how to treat it and its healing therapy.

This system diagnoses the type of central nervous disease based on the symptoms experienced. The types of central nervous disease contained in this system are: Pain, Headache, Epilepsy, Parkinson's, Alzheimer's, Stroke, Depression, Bipolar, Schizophrenia. Treatment is carried out based on the identification of diseases experienced by patients who have been previously researched by experts, some in the form of suggestions, recommendations, appeals. The methodology used in developing this expert

system is the waterfall method consisting of: systems engineering, analysis, design, coding, testing and maintenance (Pressman, 2012). The making of this system is up to the testing stage and the program is successfully executed according to its function.

2. Literature Review

2.1 Expert System

Expert System is a computer-based system that uses knowledge, facts and reasoning techniques to solve problems that usually only an expert can solve in the field (Kusrini, 2016).

2.2 Advantages of Expert Systems and Disadvantages of Expert Systems

The advantages of an expert system (Kusumadewi, 2013) are: storing the knowledge and expertise of an expert, increasing output and productivity, being able to retrieve and preserve the expertise of experts, being able to access knowledge, being able to work with information that is incomplete and contains uncertainty, saving time in decision making . Weaknesses of expert systems (Arhami, 2015), namely: knowledge cannot always be obtained easily, expert limitations and sometimes the approaches that experts have are different, difficulties in making expert systems of high quality and requiring enormous costs in development and maintenance, it is necessary tested carefully before use.

2.3 Expert System Structure

The expert system consists of two main parts, namely: the development environment and the consultation environment (Kusumadewi, 2013).

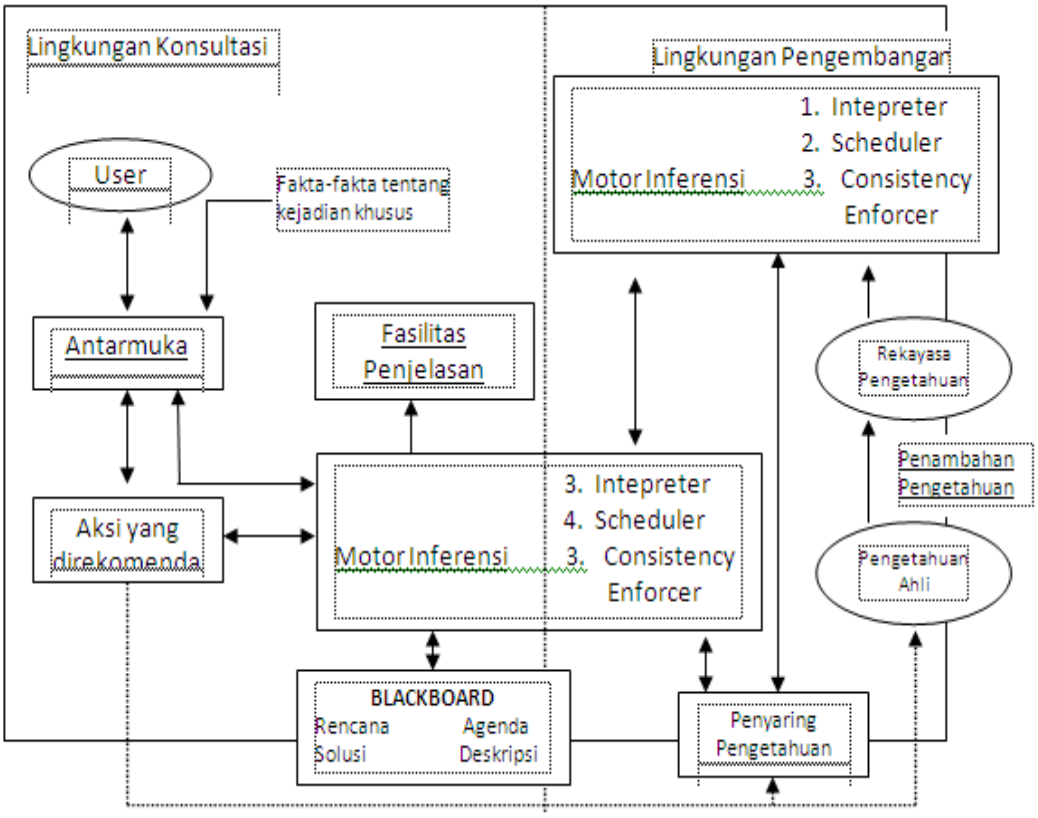


Figure 1. Expert System Structure.

2.4 Knowledge Base

The knowledge base used in this expert system uses Rule-Based Reasoning, where knowledge is represented using IF-THEN-shaped rules.

2.5 Inference Engine

There are two approaches to controlling inference in a rule-based expert system (Arhami, 2015), namely: Forward Chaining, reasoning starts from facts first to test the truth of the hypothesis. Forward tracking looks for facts that comply with the IF portion of the IF-THEN rule. And Backward Chaining, reasoning starts from the hypothesis first and to test the truth of the hypothesis, the facts must be sought. Backtracking looks for facts that comply with the IF-AND part of the IF-AND-THEN rule.
The two inference methods are influenced by three kinds of tracing, namely Depth-first Search, which performs in-depth tracing of the rules from the root node moving down to the deep sequential level. Breadth-first Search, moving from the root node, the nodes that exist at each level are tested before moving to the next level. Best-first search, works based on a combination of depth-first search and breadth-first search by taking the advantages of the two methods.

2.6 Central Nervous Disease

Below are the types of central nervous disease and their symptoms and remedies (Ikawati, 2011):
a. Pain can be divided into two, namely acute pain, the cause may be known or not. Symptoms: pain time lasts hours, days, up to a week and can be associated with tissue injury, inflammation, a procedure related to surgery, childbirth, brief illness can be followed by anxiety and emotionality. Chronic pain symptoms of a longer pain time can be months or years for example rheumatic pain, back pain, post herpes neuralgia pain, multiple sclerosis. Non-opiate analgesic drugs are paracetamol, acetosal, ibuprofen, diclofenac, piroxicam etc.
b. Headache: migraine. Migraine is divided into two, namely migraine without aura is a clinical syndrome characterized by headaches with specific signs and related symptoms. Migraine with aura characterized by focal neurological symptoms usually precedes or sometimes accompanies the headache. The cause: eating and drinking containing alcohol, caffeine, chocolate, fermentation, monosodium glutamate, nitrates, saccharin, tyramine. Glare, noise, offensive odors, cigarette smoke, changes in weather, altitude. Physiological behavior such as sleeping more or less sleep, fatigue, menstruation, not eating, strenuous exercise, stress. Symptoms: fatigue, muscle tension, headache accompanied by vomiting, light sensitivity and sound sensitivity. Medicines: acetaminophen, aspirin, isometeptan, ibuprofen, naproxen sodium etc.
a. pilepsy. Symptoms: pain for weeks, recurrent seizures caused by repeated, abnormal and excessive synchronous release of brain neurons. Medicines: Phenotine, carbamazepine, lamotrigine, oxcarbazepine, valproic acid, benzodiazepines, barbiturates, vigabatrin, tagabine, gababetin etc.
b. Parkinson's. Symptoms: pain for weeks, trembling, stiffness, reduced speed of movement, blank facial expression, difficulty speaking, difficulty swallowing, unable to move legs, sluggish arm swing, depression, anxiety. Drugs: benztropine, carbidopa, apomorphine, entacapone etc.
c. Alzheimer's. Symptoms: pain for weeks, memory decline, slow progressive cognitive abilities of the patient, unable to count, difficulty remembering the names of objects or people. Drugs: risperidone, ziprasidone, escitalopram, fluoxetine, citalopram etc.
d. Stroke. Symptoms: neurological damage, complete or partial blockage of one or more blood vessels, causing damage to brain tissue due to reduced supply of oxygen and nutrients, decreased function,

paralysis of half the body, vertigo, dysarthria, aphasia etc. Medicines: alteplase, aspirin, clopidogrel, dipiridamol, cardioembolism etc.
e. Depression. Symptoms: modunipolar disorders, epidemiology, etiology, prognosis. Symptoms: the sufferer is depressed, sad, decreased interest, weight loss, insomnia, fatigue, etc. Drugs: citalopram, escitalopram, paroxetine, centroid, fluvoxamine etc.
f. Bipolar. Symptoms: severe depression, prolonged, profound, alternating with excessive periods (mania), decreased need for sleep, a lot of talk, increased libido, heightened mood, severe mental disorders. Drugs: lithium carbonate, valproic acid, sodium valproate, carbamazepine, lamotrigine etc.
g. Schizophrenia. Symptoms: severe brain disorder, abnormal, thought disorder combination of hallucinations, delusions, irregular thinking and decreased behavior over time, disturbance of thinking and emotional balance. Symptoms: delusions, hallucinations, irregular speech, uncontrolled behavior, negative symptoms. Drugs: chlorpromazine, flufenazine, loksapine, molindom, mezoridacin, ferphenazine, thloridazine etc.

2.7 World Wide Web

The World Wide Web (WWW) is a network of thousands of computers which are categorized into two, namely client and server by using special software to form a network called a client-server network (Sutarman, 2017). By using hypertext technology, web users are led to find information by following the links provided in web documents that are displayed in a web browser.

2.8 How the WWW Works

In designing the web, you must first know how the web works. Working on the web includes two important things, namely: web browser software and web server software (Nugroho, 2014). Both of these software work like client-server. The web browser that acts as a client allows you to interpret and view information on the web, while the web server that acts as a server allows you to receive the information requested by the browser. When a request for information arrives, the web server will search for the requested file and then send it to the browser requesting it. Of course the way the web works is not that simple, there are many things you need to know to get to know how the web works. The way the web works briefly is as follows:
a. Web information is stored in documents called web pages (web pages).
b. Web pages are files that are stored on computers called web servers.
c. Computers reading web pages are called web clients.
d. Web clients display pages using a program called a web browser.
e. Popular web browsers are Internet Explorer and Netscape Navigator.

2.9 Web browser

The browser is a program designed to retrieve information from a computer server on the internet network (Sutarman, 2017). To access the web, we need a program, namely a Web browser or commonly called a browser.

2.10 Hypertext Transfer Protocol (HTTP)

HTTP is a protocol that determines the rules that need to be followed by a web browser in requesting or retrieving a document, and by a web server in providing the document requested by a web browser (Sutarman, 2017). This protocol is a standard protocol used to access HTML documents.

3. Analysis and Design

3.1 System Requirements Analysis

The topic of this system is to create a web-based expert system pharmacotherapy application to diagnose central nervous disease along with its treatment and healing therapy. This system aims to help users find out the types of central nervous disease suffered and their healing therapy and information on the drugs used. The recommendation data generated in this system is equipped with the type of disease, the symptoms of the disease, the method of treatment and healing therapy, so that the user can find out what neurological disease is suffered and how to treat it as well as its healing therapy. The system will analyze the answers to each question given in order to obtain answers based on the knowledge base contained in this expert system. Before analyzing the answers, the system first gives a number of questions to the user through the interface about the symptoms of the illness. The system will analyze the answers from the user by tracking the knowledge base.

3.2 Process Design

DFD design is used to describe the hierarchy of existing processes and data flow between processes in this system. DFD level 0 presents all system elements with a single process with input and output data indicated by arrows that enter and exit respectively. The system built has two external entities, namely admin and user. Admin has the authority to update data, while users can only use this system and are not authorized to update data. Users only enter data into the system, then the system will provide output to the user.

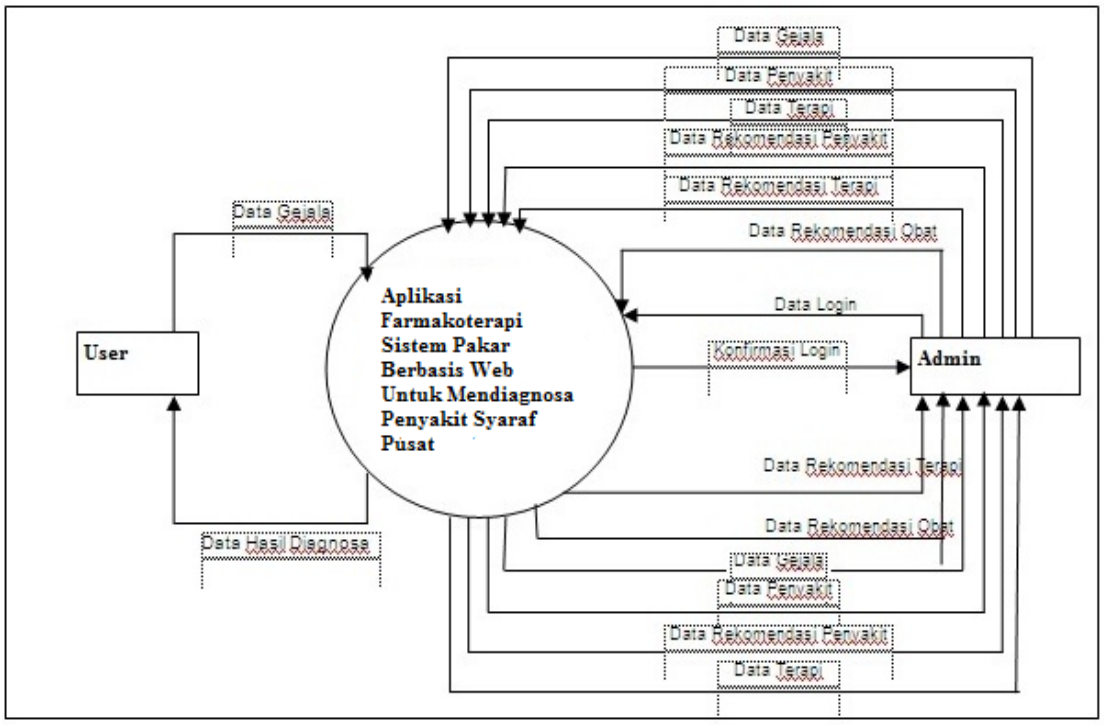


Figure 2. DFD Level 0

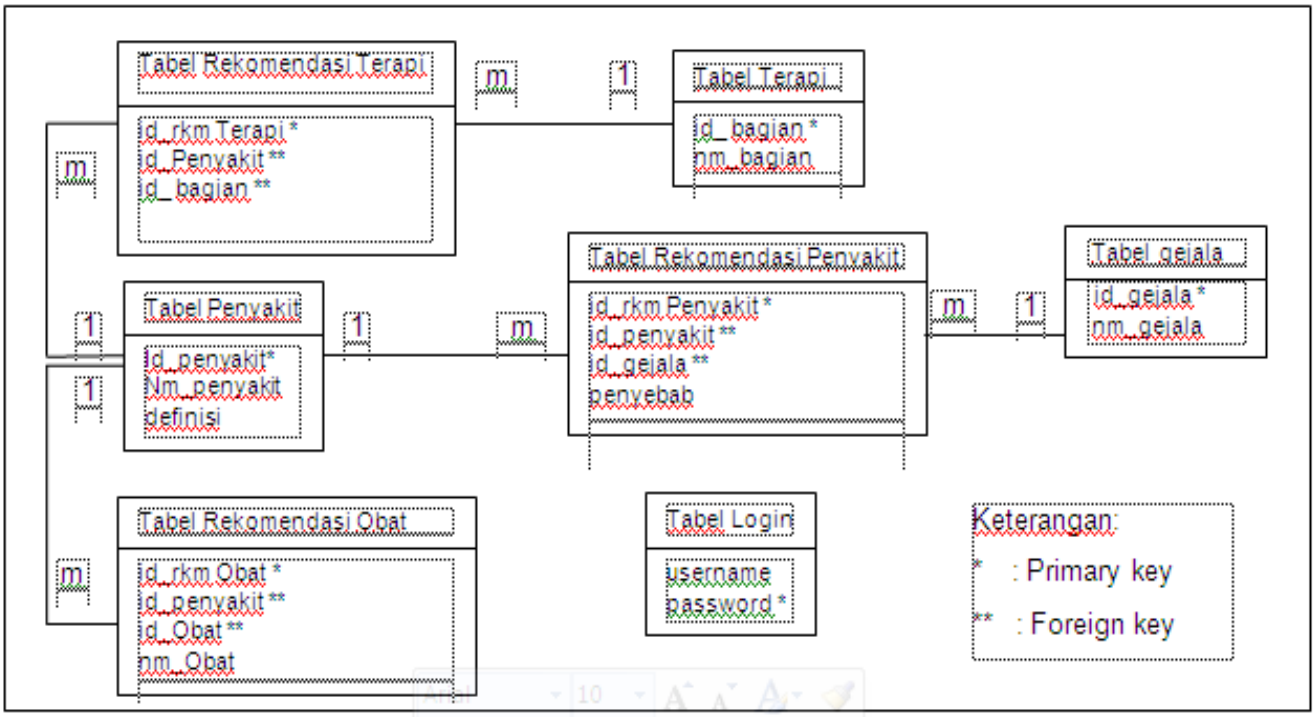


Figure 3. Relationship Between Tables

3.3 Acquisition of Knowledge

The process of acquiring knowledge is carried out by gathering knowledge about the types of central nervous disease accompanied by its symptoms, causes, treatment and healing therapy. Knowledge that must be acquired is a symptom suffered.

3.4 System Design

This expert system application is designed to retrieve and identify overall data regarding the definition of disease, causes of disease, treatment, symptoms of disease. This expert system design stage consists of five designs, namely knowledge representation, inference engine, DFD, database and interface design.

3.5 Knowledge Representation Design

The representation of knowledge that is carried out to build this application uses rule-based production rules. The rule structure has two parts, namely antecedents and consequents. The conclusion stated in the THEN section is stated to be true, if the IF part of the system is also true or in accordance with certain rules.

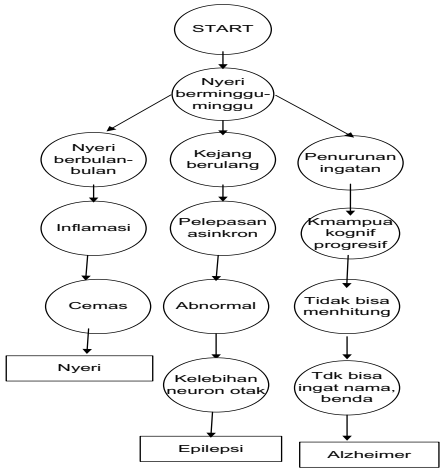
The production principle in this system uses two traces, namely forward chaining for the disease production principle and backward chaining for the disease therapy production rule. The production rules for implementation are:

Disease Production Rules

Diseases discussed in this implementation include Pain, Headache, Epilepsy, Parkinson's, Alzheimer's, Stroke, Depression, Bipolar, Schizophrenia.

Following are the rules of disease production according to the symptoms:

a. Epilepsy production rules
If pain lasts for weeks
and recurrent seizures
and asynchronous discharge
and abnormal
and excess brain neurons
then Epilepsy
b. The rule for Alzheimer's disease
if pain is weeks
and memory impairment
and slow progressive cognitive abilities
and can't count
and can't remember names and things
then Alzheimer's disease



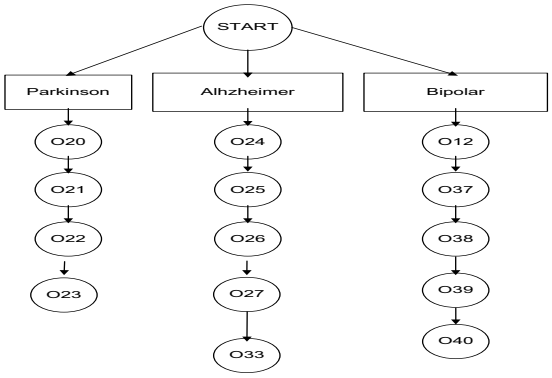


Figure 4. Example of Fordward Chaining Tracking Figure 5. Example of Backward Chaining Tracking.

In the following table 1 shows the knowledge acquisition of the relationship between symptoms and central nervous disease. For symptom ID is given code G. As for drugs from central nervous diseases, the names are mentioned according to the disease. In table 1 there are 51 kinds of symptoms of central nervous disease. Meanwhile, there are 9 types of central nervous disease. Table 2 shows the acquisition of knowledge of the relationship between drugs and central nervous disease, which is shown in the table below. For drug ID code O is given. Meanwhile, central nervous disease is still mentioned according to the name of the disease. In table 2 there are 47 types of drugs for central nervous disease. The number of diseases and types are the same as shown in table 1.

Table 1. Relationship between Symptoms and Central Nervous Disease

No	Id Symptoms	Symptoms	Headache	Pain	Epilepsi	Parkinson	Alzheimer	Stroke	Depresi	Bipolar	Skizoprenia
1	G1	Pain for weeks	*		*	*	*				
2	G2	Pain for months	*								
3	G3	Inflammation	*								
4	G4	Anxious	*								
5	G5	Fatigue		*							
6	G6	Tense muscles		*							
7	G7	Headache		*							
8	G8	Gag		*							
9	G9	Light and sound sensitive		*							
10	G10	Recurrent seizures			*						
11	G11	Repetitive, repeat,			*						
12	G12	Abnormal			*						
13	G13	Excess brain neurons			*						
14	G14	Shaky				*					
15	G15	Stiffness				*					
16	G16	Less movement speed				*					
17	G17	Blank facial expression				*					
18	G18	It's hard to talk				*					
19	G19	Difficulty swallowing				*					
20	G20	Feet can't move				*					
21	G21	Depression				*					
22	G22	Anxiety				*					
23	G23	Sluggish arm swing				*					
24	G24	The patient's memory decline					*				
25	G25	Cognitive abilityprogrsf					*				
26	G26	Can't count					*				
27	G27	It's hard to remember nm,					*				
28	G28	Blocked blood vessels						*			
29	G29	Damaged brain tissue						*			
30	G30	Lack of oxygen						*			
31	G31	Lack of nutrition						*			
32	G32	Long period of severe								*	
33	G33	Decreased sleep time								*	
34	G34	Increased libido								*	
35	G35	Talk too much								*	
36	G36	Distracted mind								*	
37	G37	Severe brain disorders									*
38	G38	Abnormal									*
39	G39	Complex thought disorders									*
40	G40	Frequent hallucinations									*
41	G41	Delusions									*
42	G42	Irregular thinking									*
43	G43	Decreased good behavior									*
44	G44	Balance disorders									*
45	G45	Emotional disturbances									*
46	G46	The sufferer is depressed							*		
47	G47	Sad							*		
48	G48	Decreased interest							*		
49	G49	Weight loss							*		
50	G50	Insomnia							*		
51	G51	Fatigue							*		

Table 2. Relationship between Drugs and Central Nervous Disease.

No	Id Drug	Drug	Headache	Pain	Epilepsi	Parkinson	Alzheimer	Stroke	Depresi	Bipolar	Skizoprenia
1	O1	setamol	*								
2	O2	Asetosal	*								
3	O3	Ibuprofen	*								
4	O4	Diklofenak	*								
5	O5	Piroksikam	*								
6	O6	taminofen		*							
7	O7	Aspirin		*							
8	O8	Isometeptan		*							
9	O9	Ibuprofen		*							
10	O10	roksen natrium		*							
11	O11	Fenotin			*						
12	O12	Karbamazepin			*					*	
13	O13	Okskarbazepin			*						
14	O14	Lamotrigin			*						
15	O15	Asamvalproat			*						
16	O16	Barbiturate			*						
17	O17	Vigabatrin			*						
18	O18	Tagabin			*						
19	O19	Gababetin			*						
20	O20	ztropin				*					
21	O21	Karbidopa				*					
22	O22	Apomorfin				*					
23	O23	ıcapone				*					
24	O24	eridon					*				
25	O25	Ziprasidon					*				
26	O26	Citalopram					*		*		
27	O27	Fluoksetin					*				
28	O28	Alteplase						*			
29	O29	Aspirin						*			
30	O30	Klopidogrel						*			
31	O31	Dipiridamol						*			
32	O32	Kardioemboli						*			
33	O33	talopram					*		*		
34	O34	Paroksetin							*		
35	O35	Sentralin							*		
36	O36	Fluvoksamin							*		
37	O37	ımKarbonat lamotrigin dll.								*	
38	O38	Asam valproate								*	
39	O39	Natrium valproat								*	
40	O40	Lamotrigin								*	
41	O41	Klorpromazin									*
42	O42	Flufenazin									*
43	O43	Loksapin									*
44	O44	Molindom									*
45	O45	Mezoridasin									*
46	O46	Thloridazin									*
47	O47	Ferfenazin									*

4. Results and Discussion

After carrying out the analysis and design stages the next stages are:

4.1 Hardware and Software Implementation

At the computer hardware implementation stage with the following specifications: Inter (R) Atom (TM) CPU N280 @ 1.66GHz, 1 Gb RAM, 160 Gb Harddisk, Intel (R) GMA 950. And the software used is the

Microsoft Windows Operating System. XP Home Edition Version 2012 Service Pack 3, some supporting software, namely: Apache Web Server 2.2.2, MySQL 5.0.21, PHP 5.1.4, PhpMyAdmin 2.8.1, Opera v.10, Web Editor: Macromedia Dreamweaver 2018, Adobe Photshop CS3, Installing the Apache web server, PHP, MySQL and PHPMyADMIN in this implementation using the XAMPP v program package. 1.5.3.

4.2 Implementation of Application Development

The software used is Macromedia Dreamweaver 2018. The consultation page contains disease diagnosis by asking a number of questions that must be answered by the user. The following figure 6 is a view of the consultation page.

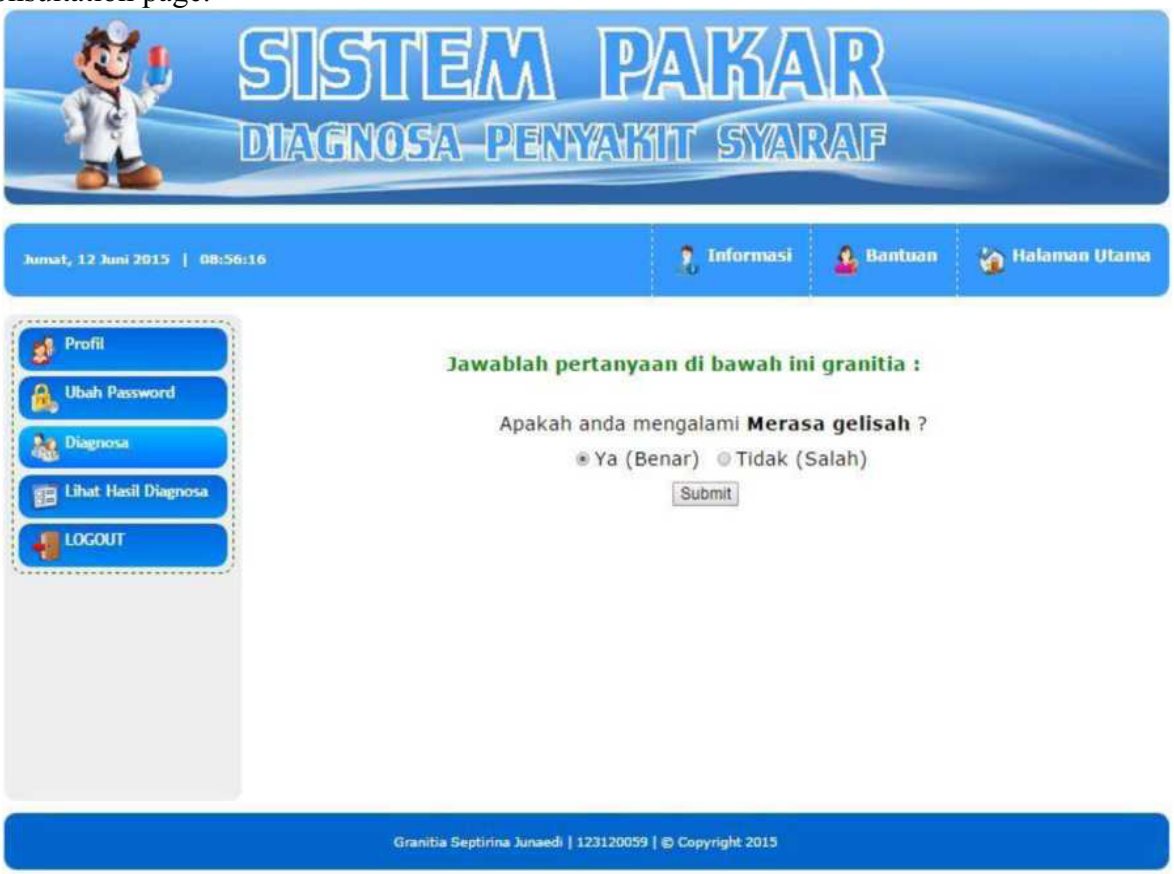


Figure 6. The consultation page view.

The disease list page contains various types of central nervous disease. Figure 7 below is a page display of a list of central nervous diseases.

Figure 7. Diseases list page view.

The symptom page contains the symptoms of a selected type of central nervous disease. The following figure 8 is a display of the symptoms of central nervous disease.

Figure 8. Display of disease symptoms page.

The patient data page contains the patient's name, gender, address and owner's name or the patient's family name. The following figure 9 is a patient data page display.

Figure 9. Display of patient data page.

The results analysis page is in the form of conclusions drawn by the expert system based on the symptoms mentioned by the user. Here is a picture of 10 page views of the analysis of the results of central nervous disease.

Figure 10. Display of the result analysis page.

The login page is a page that only administrators can access. for the purposes of updating data, adding data and deleting data.

5. Conclusion

Based on the results of this study, the following conclusions can be drawn:
a. Provides information to users about central nervous diseases, early diagnosis based on the symptoms given.
b. Helping users understand and obtain information about the types of central nervous disease.
c. Assisting users in early identification of central nervous diseases, through processing symptom data, so that further treatment of these diseases can be done quickly.
d. Provide information to the user about how the treatment can be done and the healing therapy.
e. The data contained in the system can be updated or added as needed.

6. Exercise

1. Explain what you know about the term expert system?
2. Give your explanation about the backward chaining method in an expert system?
3. Describe the method of forward chaining in an expert system?
4. Mention the difference between the two methods above in question number 2 and number 3?
5. Mention the advantages and disadvantages of the two methods above?
6. In your opinion, the expert system is very suitable and suitable for solving any problems?
7. Give examples of solutions and case studies of problems in the expert system?
8. Mention the steps and stages of adjustment using an expert system?
9. Give examples of problems that can be solved using an expert system?
10. State the tracing techniques that you know with the expert system?
11. Dept first search what kind of search techniques do you use for your explanation?

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