

Early Detection of Nervous Disease Using Expert System and Multimedia

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Abstract - Central nervous system has the main function to detect, analyze, and deliver information. The information collected by the sensory system is integrated in the brain, the signal is passed to the motor system, the autonomic pathways to control movement, visceral activity, and endocrine functions. The nervous system has immune function and support modulate neural activity. Neurological disease commonly found due to the lack of information and knowledge about the disease. So, this study made by using forward and backward chaining reasoning with healing therapies and the treatment. The system is made so that the patient can see, understand the type of central nervous diseases, their healing therapies and the treatment. This system provides multiple solutions for the prevention of disease according to the type of illness. The methodology for developing the system is using waterfall method. The application software used to create this application program is Dreamweaver MX, XAMPP, Adobe Photoshop, MySQL, Opera / Mozilla Firefox. The results of this research is in the form of an application program that can help user to determine the type of central nervous diseases, provide extensive information about central nervous diseases, the treatment and healing therapy.

Keywords: *Expert System, Nervous Diseases, Waterfall.*

I. INTRODUCTION

Central nervous system consists of the brain and spinal cord. The brain has three functions that is receives sensory input from the spinal cord and of the nerves themselves, processing a variety of sensory input that is a function of cognition that includes integration, and data stored associations as well as the emotional component, initialize and coordinate motor output. To carry out those functions required neural networks that contain thousands of nerve cells that will deliver information from the brain and from the brain to various parts of the body. Generally nerve cells consists of several parts: the cell body, axons, dendrites and synaptic ends. Most of the multipolar nerve cells means to have several dendrites with one axon, but some are bipolar means only one dendrite and an axon. The number of dendrites allows a single nerve cell receives a lot of input. Each axon will end up in a synaptic end. Most synapses form between axons to dendrites, but also can occur between axon to the cell body, or between two axons or two dendrites (Ikawati, 2011).

At this time many kinds of inventions in neurological disease, with advances in computer technology can help people in a variety of fields one of them is an expert system. Expert

systems are computer programs designed to model problem solving skills as an expert. With the development of expert systems could be created pharmacotherapy application of expert systems that can diagnose central nervous disease based on symptoms and treatment as well as a way of healing therapy.

These systems diagnose diseases of the central nervous based on the symptoms experienced. The types of diseases of the central nervous contained in this system are: Pain, Headache, Epilepsy, Parkinson's, Alzheimer's, Stroke, Depression, Bipolar disorder, Schizophrenia. Treatment is based on the identification of disease experienced by patients who have been previously examined by experts, there are suggestion, recommendation, appeal. The methodology used in the development of expert systems is the waterfall method comprising: system engineering, analysis, design, coding, testing and maintenance (Pressman, 2002). Making this system until the testing stage and the program is successfully executed in accordance with its function.

II. LITERATURE

A. Expert System

Expert System is a computer-based system that uses knowledge, facts and reasoning techniques in solving problems that normally can only be solved by an expert in the field (Kusrini, 2006).

B. Advantages and Disadvantages of Expert System Expert System

The advantages of expert systems (Kusumadewi, 2003), namely: storing knowledge and expertise of an expert, improve output and productivity, able to take and preserve the expertise of specialists, capable of accessing the knowledge, able to work with incomplete information and uncertainty, saving time in decision making. The weakness of expert systems (Arhami, 2005), namely: knowledge is not always easily obtained, the limitations of experts and sometimes their approaches are varied, the difficulties in making an expert system that is high quality and require enormous costs in the development and maintenance, need to be tested carefully before used.

C. Structure of Expert System.

An expert system consists of two main parts, namely: the development environment and consultation environment (Kusumadewi, 2003).

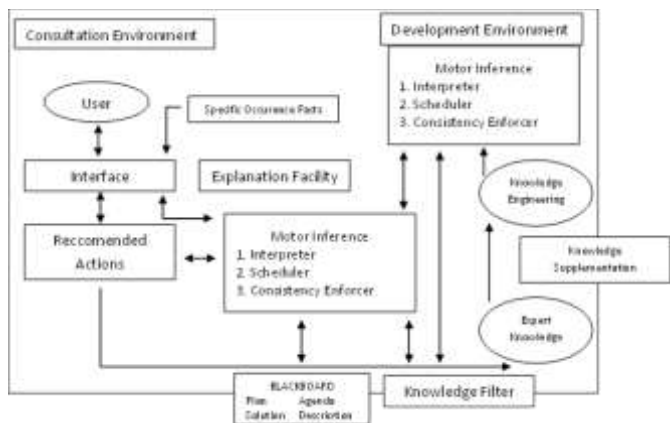


Figure 1. Structure of Expert System.

D. Knowledge Base

The knowledge base used in this expert system using *Rule-Based Reasoning* that knowledge represented using the form IF-THEN rules.

E. Inference Engine

There are two approaches to control inference in rule-based expert system (Arhami, 2005), namely: *Forward Chaining*, reasoning starts from the facts first to test the truth of the hypothesis. Tracking forward the fact in accordance with the section IF from *IF-THEN* rules. And *Backward Chaining*, reasoning starts from the first hypothesis and to test the truth of this hypothesis should be sought from existing facts. Tracking backward looking facts in accordance with the section IF-AND from *IF-AND-THEN* rules.

Both methods of inference are influenced by three kinds of tracking, namely *Depth-first Search*, tracking rules in depth of the root node to move down to the level in the sequence. *Breadth-first Search*, moving from the root node, nodes of each level are tested before moving to the next level. *Best-first search*, work by a combination of *Depth-first search* and *Breadth-first search* by taking advantages of both methods.

F. Nerve Disease

The equations are an exception to the prescribed Below are the types of central nervous diseases and symptoms as well as the cure (Ikawati, 2011):

- Pain is divided into two that is *Acute pain*, the cause may be known or unknown. Symptoms: The time of pain last for hours, days, up to one week and can be associated with tissue injury, inflammation, a procedure relating to surgery, the birth of a baby, could be followed a short illness disorders and emotional anxiety. *Chronic pain*, symptoms: longer time pain could be months or years for example, arthritic pain, spinal pain, post-herpes neuralgia pain, multiple sclerosis. Non-

- opiate analgesic medications are paracetamol, aspirin, ibuprofen, diclofenac, piroxicam etc.
- **Headache: *migraine*.** Migraine is divided into two. Migraine without aura is a clinical syndrome characterized by specific signs of headache and associated symptoms. Migraine with aura is characterized by focal neurological symptoms usually precede or sometimes accompany the headache. The reason: eating and drinking that contain alcohol, caffeine, chocolate, fermentation, monosodium glutamate, nitrates, saccharin, tyramine. Glare, noise, offensive odor, cigarette smoke, changes in weather, terrain elevation. Physiological behavior such as excessive sleep or lack of sleep, fatigue, menstruation, not eating, intense exercise, stress. Symptoms: fatigue, muscle tension, headaches accompanied by vomiting, light-sensitive and voice-sensitive. Medication: acetaminophen, aspirin, isometeptan, ibuprofen, naproxen sodium etc.
- ***Epilepsy*.** Symptoms: pain for weeks, recurrent seizures caused by the release of repetitive synchronous, abnormal and excessive of brain neurons. Medication: Fenotin, carbamazepine, lamotrigine, okskarbazepin, valproic acid, benzodiazepines, barbiturates, vigabatrin, tagabin, gababetin etc.
- ***Parkinson*.** Symptoms: pain for weeks, shaking, stiffness, reduced movement speed, blank facial expression, speaking difficulty, swallowing difficulty, foot cannot step, slow swing arm, depression, anxiety. Medication: bengtropine, carbidopa, apomorphine, entacapone etc.
- ***Alzheimer's*.** Symptoms: pain for weeks, memory loss, cognitive abilities of patients are progressively slower, cannot count, it's difficult to remember the name of the object or person. Medication: risperidone, ziprasidon, escitalopram, fluoxetine, citalopram etc.
- ***Stroke*.** Symptoms: neurological damage there are total or partial blockage in 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. Medication: alteplase, aspirin, clopidogrel, dipyridamole, cardioembolism etc.
- ***Depression*.** Symptoms: modunipolar disorders, epidemiology, etiology, prognosis. Symptoms: patients are depressed, sadness, decreased interest, weight loss, insomnia, fatigue, etc. Medication: citalopram, escitalopram, paroxetine, sentralin, fluvoksamin etc.
- ***Bipolar*.** Symptoms: severe depression, prolonged, deep, alternating with periods of excessive (mania), decreased need for sleep, talkative, increased libido, haughty, severe thought disorder. Medication: lithium carbonate, valproic acid, sodium valproate, carbamazepine, lamotrigine etc.

- *Schizophrenia*. Symptoms: severe brain disorders, abnormal, thought disorder combined of hallucinations, delusions, disorganized thinking and behavior decreased over time, impaired thinking and emotional balance. Symptoms: delusions, hallucinations, disorganized speech, uncontrolled behavior, negative symptoms. Medication: chlorpromazine, flufenazin, loksapin, molindom, mezoridasin, ferfenazin, thloridazin etc.

G. World Wide Web

World Wide Web (WWW) is a network of thousands of computers that are categorized into two: the client and the server by using special software to form a network called client-server networks (Sutarman, 2007). By using hypertext technology, web users are led to find information by following the links provided in the web document displayed in a web browser.

H. How WWW Works

In web designing one should know first how the web works. Works on the web includes two important things, namely: web browser software and web server software (Nugroho, 2004). Both of these software work as client-server. Web browser that acts as a client allows interpreting and viewing information on the web, while the web server that acts as a server allows receiving the information requested by the browser. If a request for information comes, the web server will look for the requested file and then sends it to the browser that requested it. Of course the way the web works is not as simple as this, there are many things to know the workings of the web. As for how the web works in brief is:

- a. Web information is stored in documents called web pages.
- b. Web pages are files stored on computers called web servers.
- c. Computers reading the web pages are called as a web client.
- d. Web client displays the page by using a program called a web browser.
- e. A popular web browsers are Internet Explorer and Netscape Navigator.

I. Web Browser

The browser is a program designed to retrieve information from a computer server on the Internet network (Sutarman, 2007). To access the web need a program that is commonly called the Web Browser or Browser.

J. Hypertext Transfer Protocol (HTTP)

HTTP is a protocol that specifies rules that need to be followed by the web browser in soliciting or taking a document, and by a web server to provide the requested documents from web browser (Sutarman, 2007). This protocol is a standard protocol used for accessing the HTML document.

There are several studies related to expert systems in this study:

1. *Web-Based Expert System For Identifying Type And Disease in Roses*. In this study the object is related to roses plant (Yuwono et al, 2008).
2. *Expert System Diagnosis of Chickens Disease Using Voice Commands*. In this study expert system is equipped with a voice command (Yuwono, 2011).
3. *Expert System Using Fuzzy Inference Engine for Determining Pests and Diseases in Red Onion Plant*. In this study using fuzzy inference engine to determine pests and diseases red onion plant (Kaswidjanti, 2006).

The studies mentioned above is different from the research that will be made in the development of pharmacotherapy application of expert systems for diagnosing diseases of the central nervous. But in general many aspects obtained from earlier researchers support the necessary information in the study.

III. RESEARCH METHODS

A. System Requirements Analysis

The subject of this system is to make the application of web-based pharmacotherapy expert system to diagnose diseases of the central nervous accompanied with the remedies and healing therapies. This system aims to help the user to be aware of diseases that affects the central nervous and healing therapies with information of what medications is used. Data recommendations that resulted in this system is equipped with a type of the disease, symptoms, remedies and therapeutic remedies, so that the user can know the suffered neurological disease and how to treatment with healing therapy. The system will analyze the answers to each question that given in order to obtain answers on the basis of the knowledge contained in this expert system. Before analyzing the answers, the system first provides a number of questions to the user through the interface of the symptoms of the illness. The system will analyze the answers of the user to perform the tracking process to the knowledge base.

B. Process Design

Designing DFD is used to describe a hierarchy of existing processes and data flow between processes in this system. DFD level 0 present all elements of the system with a single process with input and output data indicated by arrows in and out sequentially. The system built has two outside entities namely admin and user. Admin has the authority to update the data, while the user can only use this system and are not authorized to update the data. User simply enter the data into the system, then the system will provide the output of the user.

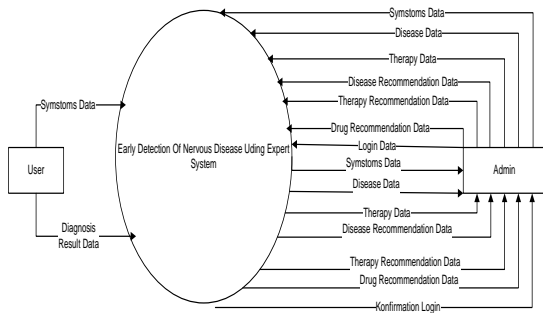


Figure 2. DFD Level 0

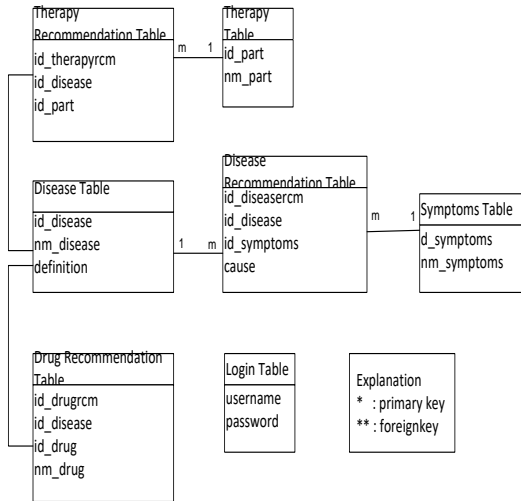


Figure 3. Relationship Table

C. Knowledge Acquisition

The process of acquisition of knowledge is by compiling knowledge about the type of central nervous disease accompanied by symptoms, causes and treatment and healing therapies. Knowledge that should be acquisitioned are the suffered symptoms.

D. System Design

Application of the expert system is designed to retrieve and identify the overall data regarding the definition of the disease, the cause of the disease, treatment, symptoms of the disease. The design phase of this expert system consists of five design that is knowledge representation, inference engine, DFD, database and interface design.

E. Knowledge Representation Design

Knowledge representation that being made to build this application is using a rule-based production rules. The structure of rules has two parts, namely antesendent and consequents. The conclusions stated in the THEN are justified, if the IF part of that system also correctly or according to certain rules.

Rule of production in this system uses two searches that is forward chaining for rules of the production of disease and backward chaining for rules

of the production of disease therapies. Rule of production for implementation are:

Production Rule Disease

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

The following rules in accordance with the production of disease symptoms:

1. Rule production of Epilepsy disease
if pain for weeks
and recurrent seizures
and release of asynchronous
and abnormal
and an excess of brain neurons
then disease Epilepsy
2. Rule for Alzheimer disease
if pain for weeks
and memory loss
and slowly progressive cognitive abilities
and cannot compute
and cannot remember names and things
then Alzheimer's disease

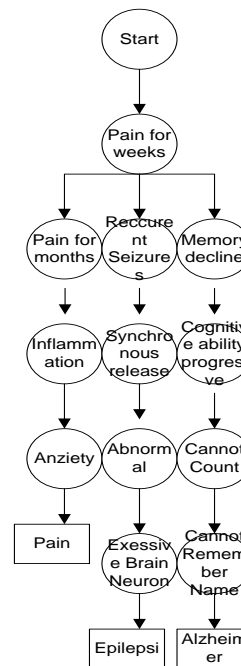


Figure 4. Forward Chaining.

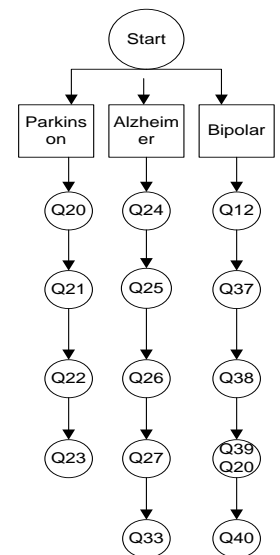


Figure 5. Backward Chaining

The following will be displayed Table 1 that indicates the acquisition of knowledge of the relationship of symptoms with central nervous disease. For symptoms Id is given code G. The medicine of diseases of the central nervous is stated according the illness. In table 1 there are 51 kinds of symptoms of central nervous diseases. While there are 9 types of the disease of the central nervous disease. In Table 2 is shown the acquisition of knowledge of drug relationship with diseases of the central nervous

indicated in the table below. Drugs Id is given code O. While the central nervous disease remains to be mentioned by name the disease. In Table 2 there are 47 types of central nervous disease drugs. The number of diseases and the types are same as shown in Table 1.

Table 1. Central Nervous System Relationships and Disease Symptoms

N	Sy	Symptoms	P	H	E	P	Al	St	D	Bi	S
o	mp		ai	e	pi	ar	z	ro	e	p	c
	to		n	a	le	ki	h	k	pr	ol	h
	ms		d	p	n	ei	e	e	e	ar	z
1	G1	Pain for weeks	*		*	*	*				
2	G2	Pain for months	*								
3	G3	Inflamation	*								
4	G4	Anxious	*								
5	G5	Fatigue		*							
6	G6	Muscles tense		*							
7	G7	Headache		*							
8	G8	Vomiting		*							
9	G9	Light/voice sensitive		*							
10	G1	Recurrent seizures			*						
11	G1	Synchronous release			*						
12	G1	Abnormal			*						
13	G1	Excessive neurons			*						
14	G1	Trembling				*					
15	G1	Stiffness				*					
16	G1	Less speed				*					
17	G1	Blank expression				*					
18	G1	Talking difficulty				*					
19	G1	Swallowing difficulty				*					
20	G2	Legs cannot move				*					
21	G2	Depression				*					
22	G2	Anxiety				*					
23	G2	Slow swing arm				*					
24	G2	Memory decline					*				
25	G2	Cognitive ability pr					*				
26	G2	Cannot count					*				
27	G2	Hard to remember					*				
28	G2	Clogged blood vessel						*			
29	G2	Damaged brain tissue						*			
30	G3	Less oxygen						*			
31	G3	Less nutrients						*			
32	G3	Severe depression							*		
33	G3	Decrease bedtime								*	
34	G3	Increased libido								*	
35	G3	Talkative								*	
36	G3	Mind disturbed								*	
37	G3	Severe brain disorder									*
38	G3	Abnormal									*
39	G3	Thought disorder									*
40	G4	Often hallucinations									*
41	G4	Delusions									*
42	G4	Irregular thinking									*
43	G4	Decreased behavior									*
44	G4	Impaired balance									*
45	G4	Emotional disturbs									*
46	G4	Patients depressed						*			
47	G4	Sad						*			
48	G4	Decline in interest						*			
49	G4	Weight loss						*			
50	G5	Insomnia						*			
51	G5	Exhaustion						*			

Table 2. Central Nervous System Drug and Disease Relationship

N	Symptom	Symptoms	P	H	E	P	A	S	D	B	S
o	s Id		ai	e	pi	ar	lz	tro	e	p	ch
			n	a	le	ki	h	o	p	p	h
			d	p	n	ei	e	k	e	ar	z
1	O1	Paracetamol	*								
2	O2	Asetosal	*								
3	O3	Ibuprofen	*								
4	O4	Diklofenak	*								
5	O5	Piroksikam	*								
6	O6	Asetaminofen		*							
7	O7	Aspirin		*							
8	O8	Isometeptan		*							
9	O9	Ibuprofen		*							
10	O10	Naprosken		*							
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	Benzotropin				*					
21	O21	Karbidopa				*					
22	O22	Apomorfin				*					
23	O23	Entacapone				*					
24	O24	Risperidon				*					
25	O25	Ziprasidon				*					
26	O26	Citalopram				*			*		
27	O27	Fluoksetin				*					
28	O28	Alteplase						*			
29	O29	Aspirin						*			
30	O30	Klopidogrel						*			
31	O31	Dipridamol						*			
32	O32	Kardioemboli						*			
33	O33	Escitalopram					*		*		
34	O34	Paroksetin							*		
35	O35	Sentralin							*		
36	O36	Fluvoksamin							*		
37	O37	Litium Karbonat								*	
38	O38	Asam valproat								*	
39	O39	Natriumvalproa								*	
40	O40	Lamotrigin								*	
41	O41	Klorpromazin									*
42	O42	Flufenazin									*
43	O43	Loksapin									*
44	O44	Molindom									*
45	O45	Mezoridasin									*
46	O46	Thloridazin									*
47	O47	Ferfenazin									*

IV. RESULTS AND DISCUSSION

After conducting the analysis and design phases the next stage is:

A. Implementation of Hardware and Software

In the implementation phase is computer hardware with the following specifications: processor *Inter (R) Atom (TM) CPU N280 @ 1.66GHz, 1 GB RAM, 160 GB Hard Drive, Intel (R) GMA 950*. And the software used is *Microsoft Windows Operating System XP Home Edition Version 2002 Service Pack 3*, some of the support software are: *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, 2008, Adobe Photoshop CS3*, Installing Apache web server, PHP,

MySQL and phpMyAdmin on this implementation using the program package XAMPP v. 1.5.3.

B. Implementation of Application Development

Software used is Macromedia Dreamweaver 2008. The consultation page contains a diagnosis by asking a few questions to be answered by the user. The following Figure 6 is a consultation page views.

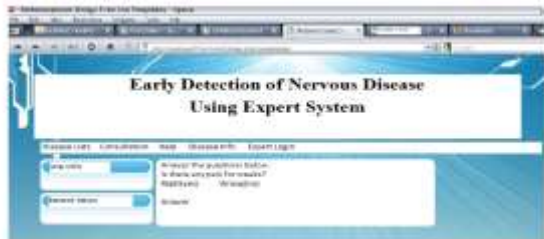


Figure 6. Display page consultation.

List of diseases page includes different types of central nervous diseases. Figure 7 below display the page of the list of diseases of the central nervous.



Figure 7. Display page of the list of diseases.

Disease symptoms page loads the symptoms of a disease of the central nervous types that have chosen. The following figure 8 is a display of symptoms of the disease of the central nervous pages.

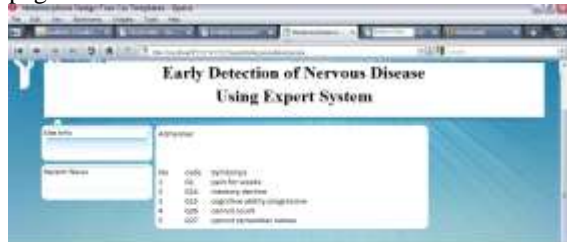


Figure 8. Display page of disease symptoms.

Patient data page contain the patient's name, sex, address and name of the owner or the patient's family name. The following figure 9 is a view of patient data page.



Figure 9. Display page of patient data.

Analysis of the results page is in the form of conclusions drawn by an expert system based on the symptoms that have been mentioned by the user. Here is a picture 10 that displays analysis results of the central nervous disease page.



Figure 10. The analysis results page view.

The login page is a page that can only be accessed by administrators, for the purposes of updating the data, add data or delete data.

V. CONCLUSION

Based on these results it can be concluded as follows:

- a. Provide information to the user about the disease that affects the central nervous, early diagnosis based on the symptoms given.
- b. Helps the user to understand and obtain information about the kinds of diseases of the central nervous.
- c. Assist the user in identifying the disease of the central nervous early, through data processing symptoms, making further treatment of the disease can be done quickly.
- d. Provide information to the user about how the treatment can be done and healing therapies.
- e. The data contained in the system can be updated or supplemented as needed.

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