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Early Diagnosis of Sinusitis Using Expert System Methods

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ABSTRACT

Sinusitis is a disease of the nose, which occurs due to inflammation of the sinuses due to allergies or infection with viruses, bacteria or fungi. Sinusitis can occur in any of the four sinuses (maxillary, etmoidalis, frontalis, sphenoidalis). The most common causes of sinusitis are due to viral infections. Often times it is caused by a cold or flu virus that is spread by the sinuses from the upper respiratory tract. After a cold or flu, secondary bacterial infection can occur. This will cause the walls of the sins to become inflamed or inflamed. An infected tooth can also make the sinuses infected. A doctor can diagnose sinusitis by looking at the symptoms that occur. For example, nasal congestion or runny nose with facial pain. If the sinusitis is severe or recurs, You are advised to see an ENT specialist (ear, nose, throat). These specialists will try to find the main cause of sinusitis that occurs. CT scans can also be used to find out the cause of sinusitis. Therefore, an expert system application was made using the forward chainy method to diagnose sinusitis. This system application is a system that helps doctors (experts) and the public in diagnosing sinusitis with symptoms felt by users. an expert system application was made using the forward chainy method to diagnose sinusitis. This system application is a system that helps doctors (experts) and the public in diagnosing sinusitis with symptoms felt by users. an expert system application was made using the forward chainy method to diagnose sinusitis. This system application is a system that helps doctors (experts) and the public in diagnosing sinusitis with symptoms felt by users.

1. Introduction

Generally expert systemis a system that seeks to adopt human knowledge to computers designed to model problem-solving abilities like an expert. With this expert system, even ordinary people can solve their problems or just look for quality information that can only be obtained with the help of experts in their fields. Expert systems will also be able to assist the activities of experts as experienced assistants and have assistants who are experienced and have the required knowledge. In its preparation, an expert system combines inference rules with a specific knowledge base provided by one or more experts in a particular field. The combination of these two things is stored on the computer,

Expert system is a computer system that matches the decision-making abilities of an expert. The word equals means that an expert system is expected to work in all respects like an expert. Expert systems are one of the branches of Artificial Intelligent that make extensive use of specific knowledge for solving human-level problems who are experts in certain fields (Al Ajlan, 2015).

2. Literature review

Fauzi (2018), "This research was conducted based on the need for a tool for the user community in diagnosing ENT (Ear Nose Throat) in humans. The tool is an expert system using Visual Basic 6.0., This expert system is a tool to diagnose and also provides advice on treatment.

Nurdiyanto, 2016) "This study aims to determine the description of social adjustment in adolescents with sinusitis. Sinusits can be one of the obstacles for adolescents in making social adjustments.

Saputro (2018) "Ear, Nose and Throat Disease has become a disease that is suffered by quite a lot of people in the world. The increase in ENT disease is getting higher, not accompanied by the number of experts. In this case, an analysis is needed to speed up the diagnostic process. Therefore it is necessary to use an expert

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system application, namely a computer application that behaves like an expert. Expert systems are able to solve problems that usually can only be solved by an expert using a knowledge base, facts and reasoning techniques. In this analysis using the forward chaining method as an inference engine .

3. Research methods

3.1 System analysis

To build an application requires an information in accordance with the formulation of the problem, the main idea of solving the problem and the system model to be built. In this study, a problem was found, namely the lack of public knowledge about sinusitis. So we need a system that can socialize the knowledge of experts and help the performance of a doctor in diagnosing sinusitis. So an expert system was built to diagnose sinusitis by using the forward chaining methodPHP as programming and MYSQL as the database.

3.2 Expert System Design

In designing an expert system, rules are needed that can provide the right solution in completing case studies. The following is a diagnostic table that shows the details of the disease.

Table 1.
Diagnosis Table

No.	Types of Sinusitis	Symptoms
1.	Frontal Sinusitis	Pain / heaviness / pressure on the face, heat, headaches, tooth pain
2.	Maxillary sinusitis	Nasal congestion, yellowish or greenish mucus / runny nose, smell / smell disorders, headache, cough, Pain / heaviness / pressure in the ear
3.	Ethmoid sinusitis	Pain / heaviness / pressure on the face, heat, tooth pain, pain / heaviness / pressure in the ears
4.	Sphenoid sinusitis	Nasal congestion / nasal congestion, yellowish or greenish mucus / runny nose, smell / smell disorders, headaches, cough, dizziness.

3.3 Sinusitis

The function of the sinus cavity itself is to maintain nasal moisture and maintain air exchange in the nasal area. The sinus cavity itself consists of 4 types, namely:

a. Frontal Sinus, located above the eye in the middle of each eyebrow
b. Maxillary sinus, located between the cheekbones, just beside the nose
c. Ethmooid sinus, located between the eyes, just behind the nasal bone
d. Sphenoid sinus, located behind the ethmoid sinus and behind the eye

A typical symptom of abnormalities in the sinuses is a headache that is felt when the patient wakes up in the morning. Sinusitis has symptoms, namely tenderness and swelling of the affected sinuses, but there are certain symptoms that arise based on the sinus affected:

a. Maxillary sinusitis causes cheek pain just below the eyes, toothaches and headaches and coughs
b. Frontal sinusitis causes headache on the forehead, heat, headache and pain in the teeth.
c. Ethmoid sinusitis causes pain behind and between the eyes as well as a headache on the forehead. Inflammation of the etmoidal sinuses can also cause pain when the edges of the nose are pressed, reduced sense of smell and nasal congestion.
d. Sphenoid sinusitis causes pain that is uncertain and can be felt on the top of the head or at the back, or sometimes it causes earaches and neck pain.
e. Other symptoms are:
   - not feeling well, dizzy
   - fever)
   - tired, lethargic
   - cough, which may get worse at night
   - runny nose or stuffy nose.

3.4 Forward Chaining

Forward Chaining is a forward tracking method, which begins with the facts given by the user, then looks for the knowledge base and then looks for the rules that match the facts. After that, a hypothesis is held to get a conclusion. Matching facts or statements starts from the left. In other words, reasoning starts with the facts first, then a rule is sought according to the facts given to test the truth of the hypothesis.

3.5 Use Case Diagram

Use case This diagram is made to describe the functional model of a system that uses actors and use cases. The following is a Use case diagram for an expert system used to diagnose sinusitis.

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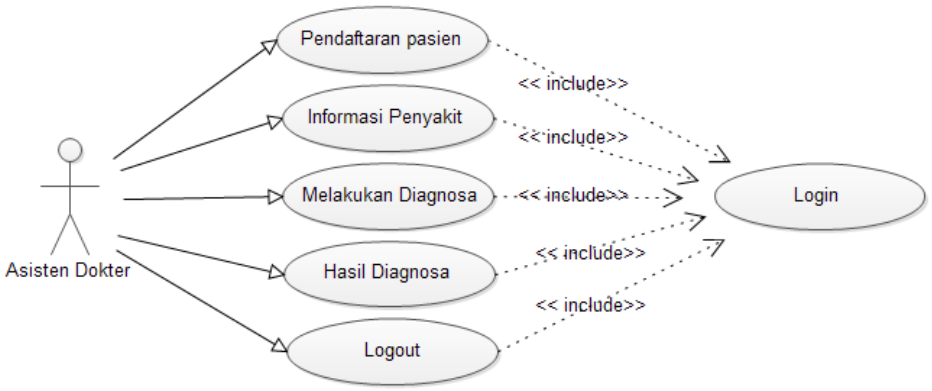

Figure 1. Use Case diagram

4. Results and Discussion

4.1. Data collection

a. Symptom Data

The following describes the symptom data that has been obtained with the information G as a symptom, namely:

Table 2.
Symptom Data

Code	Symptoms
G1	Pain / heaviness / pressure on the face
G2	Nasal congestion, mucus / mucus that is yellowish or greenish, smell / smell disorders
G3	Hot
G4	Headache
G5	Tooth Pain
G6	Cough
G7	Pain / heaviness / pressure in the ear
G8	Dizzy

b. Disease Data

The following has described the disease data that has been obtained with the information P as disease, namely:

Table 3.
Disease Data

Code	Types of diseases
P1	Frontal Sinusitis
P2	Maxillary sinusitis
P3	Ethmoid sinusitis
P4	Sphenoid sinusitis

c. Patient Data

The following is data on patients who experienced sinusitis from May to November.

Table 4.
Patient Data

No.	Types of Sinusitis	Month / Patient						
		May	Jun	Jul	Aug	Sep	Oct	Nov
1.	Frontal Sinusitis	5	4	5		7	3	3
2.	Maxillary sinusitis	7	-	5	2	-	4	5
3.	Ethmoid sinusitis	3	6	5	4	5	-	5
4.	Sphenoid sinusitis	3	5	7	-	2	-	3

4.2 Matrix Table

In making an expert system, a disease systematic in the form of a table is needed to facilitate the design. From the rule base table, a matrix table can be created as follows:

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Table 5.
Matrix Table

Symptoms	Disease			
	P1	**P2**	**P3**	**P4**
G1	v		v	
G2		v		v
G3	v		v	
G4	v	v		v
G5	v		v	
G6		v		v
G7		v	v	
G8				v

4.3 Rule Basis

Here is the expert system rule base:

Table 6.
Rule Basis

No.	Rules
1.	IF G1 AND G3 AND G4 AND G5 THEN P1
2.	IF G2 AND G4 AND G6 AND G7 THEN P2
3.	IF G1 AND G3 AND G5 AND G7 THEN P3
4.	IF G2 AND G4 AND G6 AND G8 THEN P4

4.4. Decision Tree

A process of the knowledge base or information obtained from experts is first converted into a decision tree, so that in solving problems it is easier to search for the best final conclusion. The decision tree diagram in this system is:

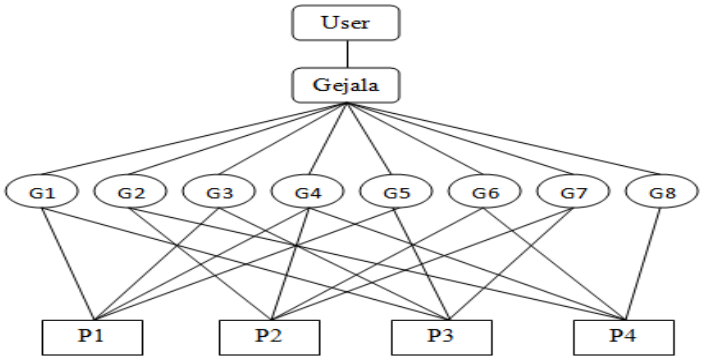

Fig 2. Decision Tree

4.5 Results / System Implementation

Results and discussion of trials of the system that was built and designed is planned to be implemented at the Krakatau Medika Hospital, namely by using the PHP programming language and database using MySQL.

4.6. Running Applications

The admin view is the page used for admins in managing a running system. To open the admin view by opening Mozilla Firefox and entering the addresshttp: //localhost/spk.php

1. Login Page Views

The login view is a display used for admins to enter the expert system application to diagnose sinusitis. There are two login pages.

a. Username and Password

Username is the admin name that has been registered in the system while the password is the security used in verification to enter the system.

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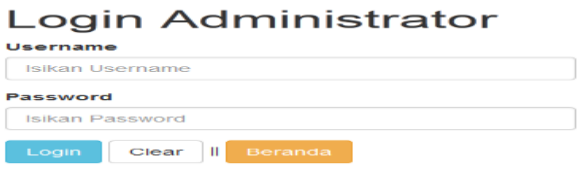

Fig 3. Login Display

b. Home Menu Display

Fig 4. Home Menu Display

c. Patient Registration Menu Display

Fig 5. Display Patient Registration Menu

d. Diagnostics Menu Display, which consists of several questions.

Fig 6. Display Diagnostic Menu

e. Display of Diagnostic Results

Fig 7. Display of Diagnostic Results

5. Conclusion

Based on the results of the discussion of an expert system to diagnose sinusitis, the conclusions that can be drawn are as follows:

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1. With the existence of an expert system to diagnose sinusitis, it can make it easier to make diagnoses that will be used by patients by collecting symptom data, then making the existing rules.
2. Making an expert system application for diagnosing sinusitis using the PHP application and using the MySQL database. The application is designed to display disease management in order to provide information and solutions to patients suffering from sinusitis.

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