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Diagnosis of Diseases of the Nose Using the Certainty Factor Method

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Abstract

The nose is the human respiratory organ and is a very important sense of smell for patients. Nasal polyps and sinus infections are several diseases that can affect the health of the nose. The nasal cavity reduces inflammation and protects the nasal passages. Many people think these symptoms are flu symptoms and do not immediately seek medical help. So many people find out too late that they have a nasal disease. Public understanding of nasal diseases is still lacking, so many people do not know clearly what disease they suffer from. The certainty factor is to measure something certain and uncertain when making a decision.

Keywords: *Expert System, Certainty Factor, Nose*

1. Introduction

Humans can feel the smells and aromas around them. The nose is the human respiratory organ and is a very important sense of smell for humans, so it is very important for humans to always maintain their health. However, nasal polyps and sinus infections are some of the diseases that can affect nasal health [1], [2].
Nasal congestion is a serious problem for some patients. This disease often recurs and requires long-term treatment for years. Nasal polyp treatment aims to reduce the size of the polyp or remove the polyp to relieve symptoms, especially nasal congestion. The goal of sinusitis treatment is to reduce inflammation, keep the nasal passages dry, and relieve sinus inflammation [3].
Various theories have often been put forward regarding the causes of nasal disease, but no theory has been accepted with certainty. Sinusitis or nasal polyps have almost the same symptoms so mistakes often occur. Public understanding of nasal diseases is still lacking, so many people do not know clearly what disease they suffer from and how to treat it. Many people think these symptoms are flu symptoms and do not immediately seek medical help. So many people find out too late that they have a nose disease [4].

2. Research Methodology

2.1. Expert System

According to [5] in his book entitled Expert Systems Textbook, he states that in general an expert system is a system that tries to adopt human knowledge or intelligence to computers, so that computers can solve problems as usual. done by humans. The brain of the expert system is the Inference Engine, also known as the rule interpreter [6], [7].

2.2. Certainty Factor Method

According to [10] Certainty Factor theory was proposed by Shortliffe and Buchanan in 1975 to adopt uncertainty problems by an expert. The Certainty Factor method is chosen when facing an uncertain problem or event. There are 2 ways to get the confidence value (CF) from a fact, namely [11], [12], [13], [14]:

1. The Net Belief method proposed by E.H. Shortliffe and B.G. Buchanan

CF(*Rule*) = MB(H,E)-MD(H,E)

$$MB(H,E) = \begin{cases} \dfrac{\text{Max}\,[P(H \mid E),P(H)]-P(H)}{\text{Max}[1,0]-P(H)} & P(H) = 1 \end{cases}$$

$$MD(H,E) = \begin{cases} \dfrac{\text{Min}\,[P(H \mid E),P(H)]-P(H)}{\text{Min}[1,0]-P(H)} & P(H) = 0 \end{cases} \quad (1)$$

Information :
CF (Rule) = Certainty factor
MB(H,E) = Measure of Belief (measure of confidence) in hypothesis H, if given evidence E (between 0 and 1)
MD(H,E) = Measure of Disbelief (measure of distrust) towards evidence H, if given evidence E (between 0 and 1)
P(H) = Probability of truth of hypothesis H
P(H|E) = Probability that H is true given the fact E

Sample case :
A data states that the probability of someone suffering from Eczema is 0.2, then the data shows that out of 100 people who suffer from Eczema, 70 people experience symptoms of itching, calculate the CF value of itching symptoms for Eczema.
Answer :
H = Eczema
E = Itching
P(H|E) = 70/100 = 0.7

$$MB(H,E) = \frac{}{1 - 0.2} = \frac{}{0.8} = 0.63$$

$$MD(H,E) = \frac{Min[0.7,0.2]-0.2}{0 - 0.2} = \frac{0.2 - 0.2}{-0.8} = 0 \quad (2)$$

Nilai CF = MB – MD = 0.63-0 = 0.63

2. By interviewing an expert
   The CF (Rule) value is obtained from the interpretation of the "item" from the expert, which is converted into a certain CF value according to the following certainty table.
   CF Certainty Value

Table 1: Certainty Values of Certainty Factors

Uncertain Term	CF
Definitely not (Tidak Pasti)	-1.0
Almost certainly not (Hampir pasti tidak)	-0.8
Probably not (Kemungkinan besar tidak)	-0.6
Maybe not (Mungkin tidak)	-0.4
Unknown (Tidak tahu)	-0.2 to 0.2
Maybe (Mungkin)	0.4
Probably (Kemungkinan besar)	0.6
Almost certainly (Hampir pasti)	0.8
Definitely (Pasti)	1.0

3. Results and Discussion

3.1. Calculation of Certainty Factor

Table 1: Disease Type Data

No	Disease Code	Type Of Disease
1	P01	Nasal Polyps
2	P02	Sinusitis

Table 2: Symptoms Data

No	Disease Code	Type Of Disease
1	G01	Nasal congestion
2	G02	Thick yellow liquid
3	G03	Pain in the head
4	G04	The fluid feels like it is being swallowed
5	G05	Cough
6	G06	Runny nose
7	G07	Pain in the face
8	G08	Smelly breath
9	G09	There is a lump on the left side of the nose

Next is CF user weight data as in the table below:

Table 3: Expert Certainty Factor Value

Uncertainty Trem	CF
No	0
Don’t Know	0,2
Slightly sure	0,4
Sure enough	0,6

Sure	0,8
Very Sure	1

3.2. Case Study

A patient states that he has symptoms currently experienced, the symptoms experienced by the patient with the User's weight value, for example the User chooses the following answer:
1. G01 = Nasal congestion (Pretty sure = 0.6)
2. G02 = There is a thick yellow liquid (Pretty sure = 0.6)
3. G03 = Pain in the head (Pretty sure = 0.6)
4. G04 = Liquid feels like swallowing (Confident = 0.8)
5. G05 = Cough (Slightly confident = 0.4)
6. G06 = Runny nose (Pretty sure = 0.6)
7. G07 = Pain in the face (Confident = 0.8)
8. G08 = Smelly breath (A little sure = 0.4)

Table 4: Expert and User Trust Value

No	Symptoms Data	Expert CF	User CF
G1	Nasal congestion	0,8	0,6
G2	There is a thick yellow	0,6	0,6
G3	Pain in the head	0,8	0,6
G4	Liquid feels like swallowing	0,6	0,8
G5	Cough	0,6	0,4
G6	Runny nose	0,6	0,6
G7	Pain in the face	0,6	0,8
G8	Smelly breath	0,4	0,4

From the symptoms described above, the system will carry out the process according to the Certainty Factor method. Calculate the CF value by claiming CFPakar with CFUser to calculate the CF value for the disease the patient is suffering from:

$CF[H,E]_1 = CF_{pakar} * CF_{user}$
$= 0,8 * 0,6$
$= 0,48$

$CF[H,E]_2 = CF_{pakar} * CF_{user}$
$= 0,6 * 0,6$
$= 0,36$

$CF[H,E]_3 = CF_{pakar} * CF_{user}$
$= 0,8 * 0,6$
$= 0,48$

$CF[H,E]_4 = CF_{pakar} * CF_{user}$
$= 0,6 * 0,8$
$= 0,48$

$CF[H,E]_5 = CF_{pakar} * CF_{user}$
$= 0,6 * 0,4$
$= 0,24$

$CF[H,E]_6 = CF_{pakar} * CF_{user}$
$= 0,6 * 0,6$
$= 0,36$

$CF[H,E]_7 = CF_{pakar} * CF_{user}$
$= 0,6 * 0,8$
$= 0,48$

$CF[H,E]_8 = CF_{pakar} * CF_{user}$
$= 0,4 * 0,4$
$= 0,16$

Combining the CF values of the disease in the patient.
For calculations CF[H,E]1,2:

$CF[H,E]_{1,2} = CF[H,E]_1 + CF[H,E]_2 * (1-CF[H,E]_1)$
$= 0,48 + 0,36 * (1-0,48)$

= 0,6672

$CF[H,E]_3$ = $CF[H,E]_2 + CF[H,E]_3 * (1-CF[H,E]_2)$

= 0,6672 + 0,48 * (1-0,6672)

= 0,8269

$CF[H,E]_4$ = $CF[H,E]_3 + CF[H,E]_4 * (1-CF[H,E]_3)$

= 0,8269 + 0,48 * (1-0,8269)

= 0,91

$CF[H,E]_5$ = $CF[H,E]_4 + CF[H,E]_5 * (1-CF[H,E]_4)$

= 0,91 + 0,24 * (1-0,91)

= 0,9316

$CF[H,E]_6$ = $CF[H,E]_5 + CF[H,E]_6 * (1-CF[H,E]_5)$

= 0,9316 + 0,36 * (1-0,9316)

= 0,9562

$CF[H,E]_7$ = $CF[H,E]_6 + CF[H,E]_7 * (1-CF[H,E]_6)$

= 0,9562 + 0,48 * (1-0,9562)

= 0,9772

$CF[H,E]_8$ = $CF[H,E]_7 + CF[H,E]_8 * (1-CF[H,E]_7)$

= 0,9772 + 0,16 * (1-0,9772)

= 0,9808

So, the CF belief value of the disease suffered by the patient is:

Presentase = CF * 100%

= 0,9808 * 100%

= 98,08%

Based on the CF calculation, the highest value is for the type of sinusitis with a value of 0.9808 or 98.08%. From the results obtained, the system diagnoses that the patient is suffering from sinusitis.

4. Program Discussion

The following is the design for making an expert system for diagnosing diseases of the nose using the Certainty Factor method:

Fig. 1: Home Page

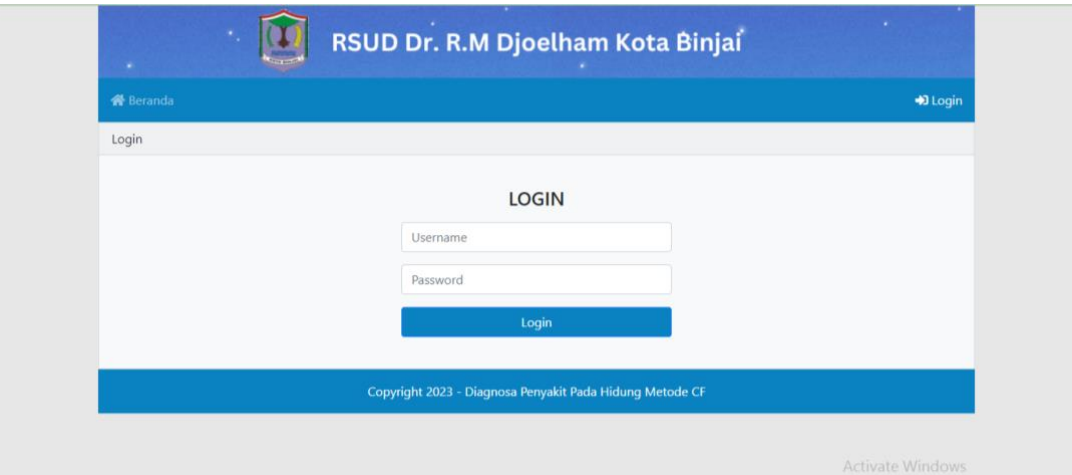

Fig. 2: Login Page

Fig. 3: Admin Page

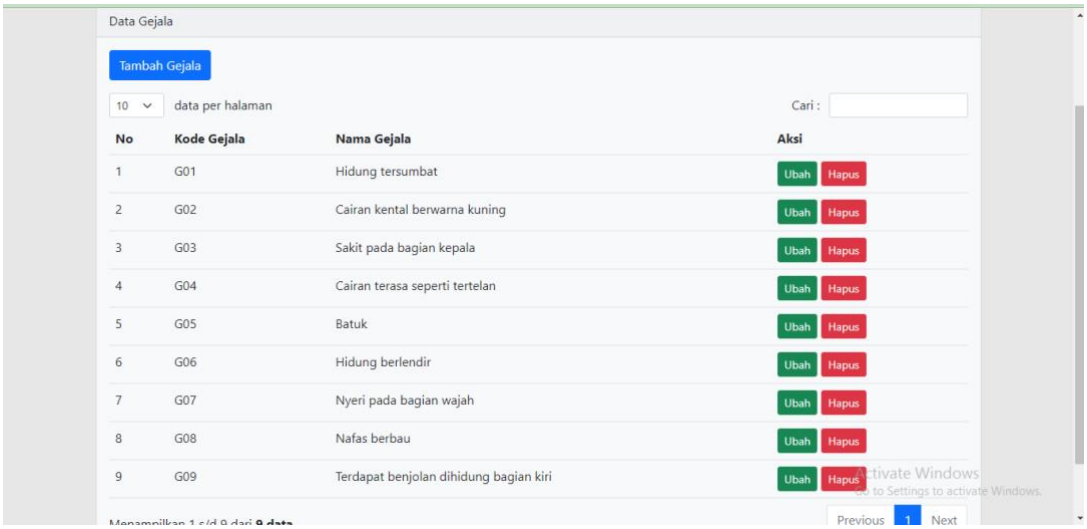

Fig. 4: Symptoms Page

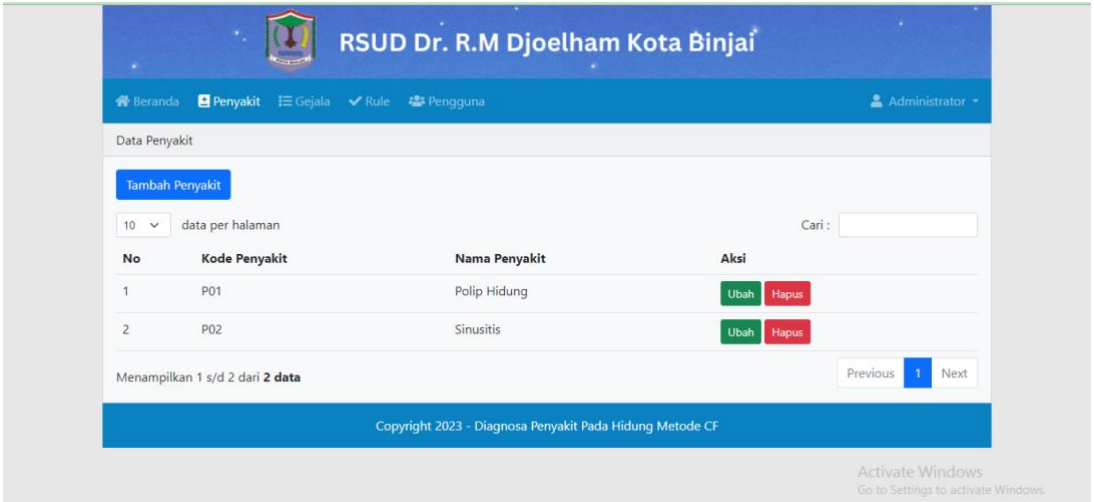

Fig. 5: Disease Page

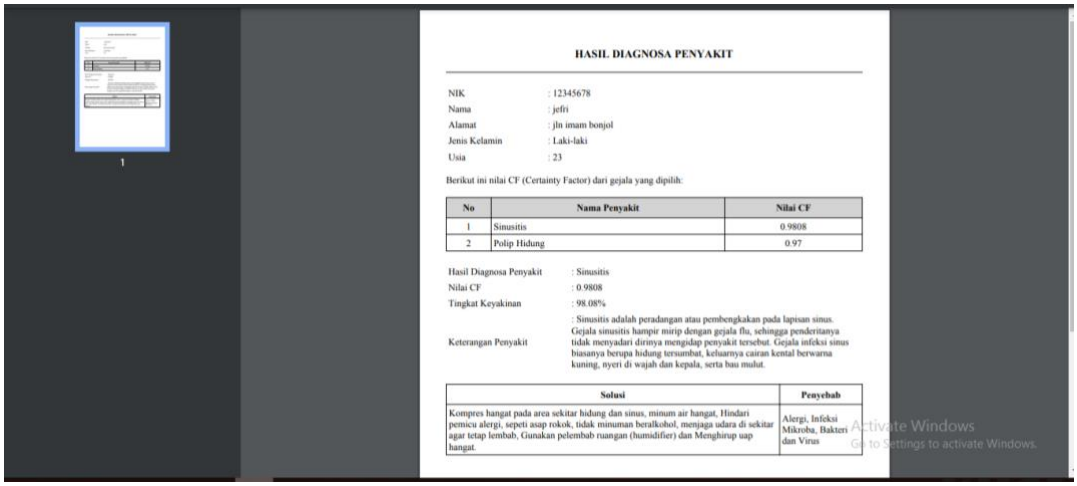

Fig. 6: Diagnostic Print Page

5. Conclusion

The conclusions of the design results from expert system users for diagnosing diseases of the nose are as follows:

1. This expert system application can help people who want to know whether they have been diagnosed with a nose disease or not.
2. Using the certainty factor method, the current expert system makes it easier for patients to carry out the consultation process, where the final result is in the form of treatment and solutions.
3. Using the certainty factor method can make it easier for users to provide answers related to the level of confidence in the symptoms experienced so that they can more accurately determine the type of nose disease they are suffering from.

6. Suggestion

Suggestions that can be given for developing this expert system so that it can be more useful and effective in diagnosing nasal diseases are as follows:

1. This expert system for diagnosing nasal diseases can develop into wider applications such as adding types of nasal diseases.
2. It is hoped that this application can be further developed with other methods as a comparison with the methods currently used.
3. The design of an expert system for diagnosing diseases of the nose using the certainty factor method that was built requires several improvements both in terms of appearance and content.

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