Expert System In Predicting COVID-19 Using Certainty Factor Method

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ABSTRACT

During this pandemic, the people of Mukomuko Regency, Bengkulu Province are having problems knowing whether they have the common cold or COVID-19 because the symptoms of COVID-19 are similar to the common cold. Meanwhile, visiting the hospital requires a fee which causes some people to be unable to carry out further examinations. With these conditions, it is difficult to make early predictions of COVID-19. Therefore, the researcher made a system that can predict the possibility of contracting someone with an artificial intelligence concept by using the certainty factor method. The design of this application is quite simple so that it is easy for users to use. The users simply click the "consultation" button and select the symptoms they are experiencing and their conditions. Then the system will calculate what percentage of the user is likely to be exposed to COVID-19.

Keywords: COVID-19, Expert System, Certainty Factor.

INTRODUCTION

In December 2019, there was a mysterious case of pneumonia in Wuhan, Hubei Province which is suspected to be caused by the Huanan market in Wuhan which sells various animal meats, including animal meat that is rarely consumed such as bats, rats, snakes, scorpions which are consumed by the public. In less than 1 month, this case increased rapidly and spread in various provinces in Japan, Korea, China and Thailand. Initially, this disease was given the name Novel Corona Virus (2019-nCoV), then it was changed by WHO on February 11, 2019 to Corona Virus Disease (COVID-19). This disease is caused by the Serve Acute Respiratory Syndrome Coronavirus-2 (SARS-Cov-2) (World Health Organization , 2019).

Because the symptoms of COVID-19 are similar to the common cold, the people of Mukomuko are having problems knowing whether they have the common cold or COVID-19. Meanwhile, visiting the hospital/puskesmas/practice requires a fee which makes some people unable to carry out further examinations. These conditions make it difficult to make early detection of COVID-19. Thus, a prediction system is needed that can detect a person's infection by using an artificial intelligence concept. Therefore, the author decided to conduct a research on "Expert System In Predicting COVID-19 Using the Certainty Factor Method". This research is expected to contribute to minimizing the transmission or spread of the corona virus in the hope of helping the public in predicting COVID-19.

Literatur Review

A. Expert System

Wijayana (2019) "expert systems are computer-based systems that use knowledge, facts and reasoning techniques in solving problems that usually can only be solved by an expert in a particular field".

In general, an expert system is a computer system that can match or imitate the ability of an expert. Experts in question are people who have special skills who can solve problems that cannot be solved by ordinary people. For example doctors, mechanics, psychologists and others. Expert systems help users in the world use their own knowledge in solving problems at the same level as an expert.

B. Website

Website or site can be defined as a collection of pages that display text data information, still or motion image data, animation data, sound, video or a combination of all of them, both static and dynamic which

form a series of interrelated buildings where each is linked. with page networks (hyperlinks) (Hendra, 2007). Broadly speaking, websites can be classified into 3 parts, namely (Aziz, 2013):

1. Static Website

A static website is a website that has pages that cannot be changed, meaning that changes to a page are done manually by editing the code that is the structure of the website.

2. Dynamic Website

Dynamic websites are websites that are structurally designed to be updated as often as possible. Usually in addition to the main ones that can be accessed by users in general, a backend page is also provided for editing content from the website. Usually a dynamic website is linked to the database so in an organized and structured way.

3. Interactive Website

An interactive website is a web that is currently popular. One example of interactive websites are blogs and forums. On this website, users can interact and argue about their thoughts. Usually websites like this have a moderator to arrange so that the topics discussed don't get off track.

C. COVID-19

According to the World Health Organization (2019), Covid-19 or Corona Virus Disease is “an infectious disease caused by a newly discovered type of coronavirus. Coronaviruses are a group of viruses that can cause disease in animals or humans.” Corona virus is the latest type of virus that affects humans. This virus works by infecting humans to other humans. Corona viruses are commonly found in animals such as snakes, cats, bats and farm animals.

The symptoms of COVID-19 are generally very similar to those of the common cold. Symptoms of COVID-19 include fever, dizziness, sore throat, dry cough, sneezing, chest pain, nausea, fatigue, loss of taste in the tongue, loss of smell, body aches and diarrhea. Symptoms of COVID-19 can get worse quickly and cause respiratory failure and even death. According to Centers for Disease Control and Prevention (2020) symptoms of COVID-19 infection can appear from 2 to 14 days. Although everyone can be infected with COVID-19, it is the elderly. Having a chronic disease and having a low immune system are more susceptible to this infection and its complications.

D. Certainty Factor

According to Sutojo (2011: 194) Certainty Factor is "a method to prove the uncertainty of an expert's thinking, where to accommodate this one usually uses Certainty Factor to describe the level of confidence of an expert on the problem at hand". There are two kinds of CF used, namely the CF given by the expert and the CF value given by the user.

In the calculation of Certainty Factor, there are several antecedents (in different rules) with the same consequence. In the overall concept of Certainty Factor, it is also often known as belief and disbelief. Belief is belief, while disbelief is disbelief. The model that is often used in calculating the level of confidence (certainty factor) of a rule, as follows:

The 'Net Belief' method proposed by E.H Shortliffe and B.G Buchanan in 1984:

CF (Rule) = MB(H,E)-MD(H,E)……(1)

Where:

CF Rule (H,E) = Certainty Factor

MB(H,E) = Measure of belief (measure of belief) on the hypothesis, if given evidence E (between 0 and 1)

MD(H,E) = Measure of disbelief (measure of disbelief) against hypothesis H, if given evidence E (between 0 and 1)

P(H) = Probability of the truth of the hypothesis H

P(H|E) = Event or deed (Evidence) that H is true because of the fact E

RESEARCH METHODS

A. System Design Method

Waterfall method is used as development method in designing system. This method is often referred to as the "classic life style".

The stages of the Waterfall method according to Pressman (2015:42):

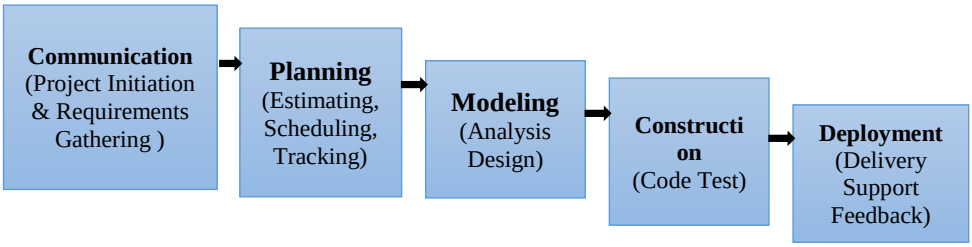

Figure 1. Stages of Waterfall Method

1. Communication (Project Initiation & Requirements Gathering)

Communication is needed between customer and developer in order to get the goals to be achieved, especially with work that is technical in nature. From it, project initialization is generated, such as collection of required data and analysis of the problems encountered

2. Planning (Estimating, Scheduling, Tracking)

This stage explains what tasks need to be carried out, the risks that might be happen at any time, the product to be made, the things needed in the manufacture of the product and the schedule of activities to be carried out as well as the tracking of the system cultivation process.

3. Modeling (Analysis & Design)

In this stage the system architecture begins to be designed starting from designing data structures, interface displays and program algorithms that aim to make it easier for developers to understand the core point of what will be done.

4. Construction (Code & Test)

In this stage, the implementation of the design that was previously made is carried out. Furthermore, the system that has been created will be tested whether the system is running well or there are errors so that it can be repaired immediately.

5. Deployment (Delivery, Support, Feedback)

This stage is the last stage, that is the delivery of software to customers, periodic software checks, repairs, customer assessments and software development according to user feedback.

B. Certainty Factor Calculation

Table 1. Interpretation Range

Uncertaint Term	CF
Definitly	1
Almost certaintly	0.8
Probably	0.6
Maybe	0.4
Definitely not	0

After going through the interview process with the expert, the CF value given by the expert on each symptom is obtained. Expert CF results are obtained with the following formula:

CF[h,e] = MB[h,e] – MD[h,e]

Table 2. Expert CF Value

No	Syimptoms	MB	MD	Expert CF
1	Headache	0.4	0.2	0.2
2	Sneeze	0.4	0.3	0.1
3	Fever	0.6	0.3	0.3
4	Dry Cough	0.4	0.2	0.2
5	Sore Throat	0.4	0.2	0.2
6	Sore Body	0.4	0.3	0.1
7	Fatigue	0.4	0.2	0.2
8	Anosmia	0.8	0.3	0.5

9	Chest Pain	0.6	0.2	0.4
10	Nauseous	0.4	0.2	0.2
11	Loss Of Taste	0.8	0.2	0.6
12	Diarrhea	0.4	0.3	0.1
13	Limp	0.4	0.1	0.3

In the table below it is assumed that the value taken is the value inputted by the user into the expert system. The user will then provide an answer in the form of a selected value for each symptom.

Table 3. User CF Value

No	Syimptoms	User CF	Description
1	Headache	0.8	Almost certaintly
2	Sneeze	1	Definitly
3	Fever	1	Definitly
4	Dry Cough	0.6	Probably
5	Sore Throat	0.8	Almost certaintly
6	Sore Body	0.8	Almost certaintly
7	Fatigue	0.6	Probably
8	Anosmia	0	Definitely not
9	Chest Pain	0	Definitely not
10	Nauseous	0	Definitely not
11	Loss Of Taste	0	Definitely not
12	Diarrhea	0	Definitely not
13	Limp	0	Definitely not

To find out further analysis of the Certainty Factor method, then calculations are carried out between expert CF and user CF for each symptom.

Table 4. Multiplication Result

No	Symptoms	Expert CF	User CF	Expert CF* User CF
1	Headache	0.2	0.8	0.16
2	Sneeze	0.1	1	0.1
3	Fever	0.3	1	0.3
4	Dry Cough	0.2	0.6	0.12
5	Sore Throat	0.2	0.8	0.16
6	Sore Body	0.1	0.8	0.08
7	Fatigue	0.2	0.6	0.12
8	Anosmia	0.5	0	0
9	Chest Pain	0.4	0	0
10	Nauseous	0.2	0	0.
11	Loss Of Taste	0.6	0	0
12.	Diarrhea	0.1	0	0.
13	Limp	0.3	0	0

The next step is to calculate the combination of the results of the multiplication of each symptom. The following are the results of the CF combination for each COVID-19 symptom:

CF1 + CF2 - (CF1 * CF2) = CF(old)
0.16 + 0.1 - (0.16 * 0.1) = 0.26 - 0.016 = 0.244
0.244 + 0.3 - (0.244 * 0.3) = 0.544 - 0.0732 = 0.47
0.47 + 0.12 - (0.47 *0.12) = 0.59 - 0.564 = 0.53
0.53 + 0.16 - (0.53 * 0.16) = 0.69 - 0.0848 = 0.61
0.61 + 0.08 -(0.61 * 0.08) = 0.69 – 0.0488 = 0,64
0. 64 + 0.12 - (0,76 * 0.12) = 0.79 – 0.1024 = 0.68(CFold)
Avarage : CF(old) * 100 = Result
0.68 * 100 = 68%

So, based on the results of the calculations above, it can be concluded that there is a 68% chance that users will get COVID-19. The higher the percentage, the higher the possibility of the user being exposed to COVID-19. For definite results, a swab must still be done.

RESULTS AND DISCUSSION

A. Admin Interface

1. Login Page

This page is the starting page when the admin accesses the expert system to manage the data on the expert system. The admin must fill in the username and password to enter the expert system administrator.

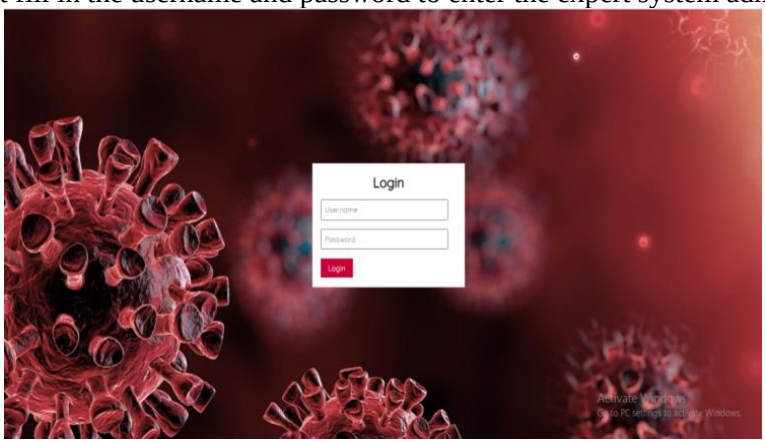

Figure 2. Login Page

2. Dashboard

The dashboard page contains the amount of symptoms, diseases, knowledge and rules.

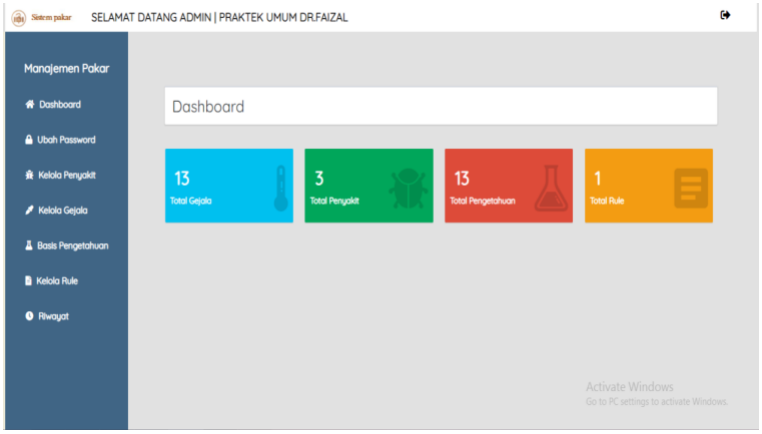

Figure 3. Dashboard

3. Change Password

This page is a page to change the admin password. This page contains fields, namely the new password and confirmation of the new password, there is also a “Change Password” button.

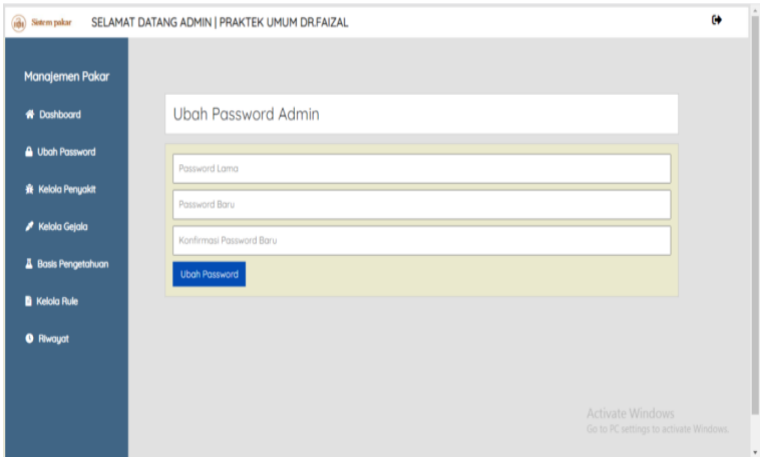

Figure 4. Change Password

4. Manage Symptoms

This page is a page to display all the symptoms of the disease. Admin can add, change and delete symptoms.

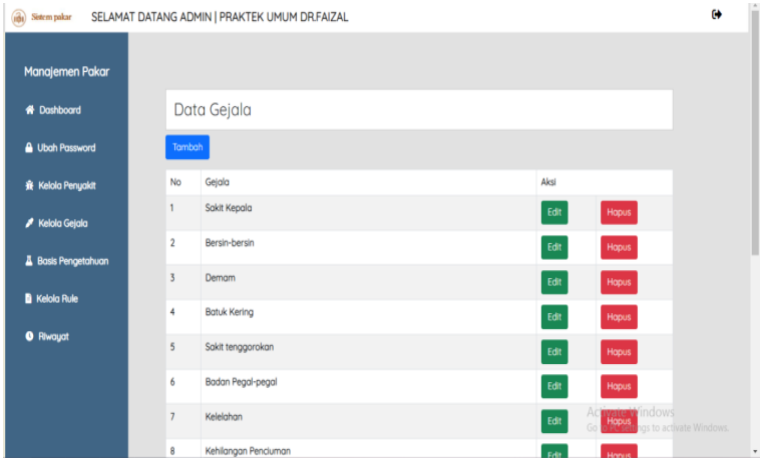

Figure 5. Manage Symptoms

5. Knowledge Base

This page contains the relationship of the disease to the symptoms and the value of the expert certainty factor for each symptom.

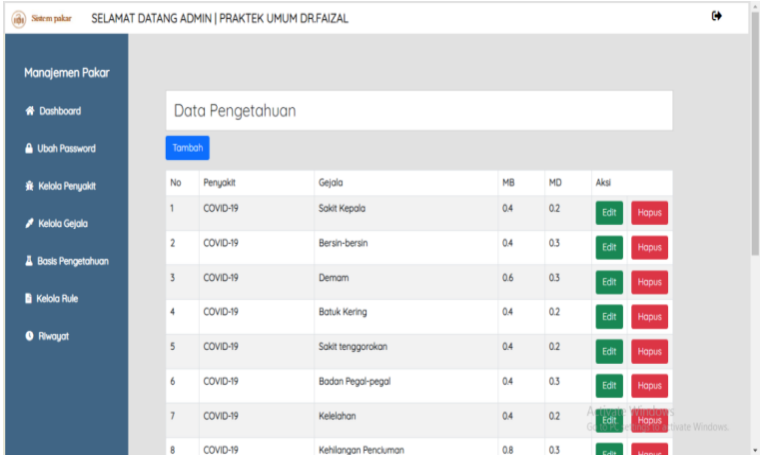

Figure 6. Knowledge Base

B. User Interface

1. Homepage

This page is the initial screen when the user opens the expert system. In the header section there is a Home menu, Disease Info, Doctor Profile, About and Admin Login and in the content section there is a consultation button.

Figure 7. Homepage

2. COVID-19 Info

This page contains information about COVID-19 ranging from understanding, symptoms to the healing period of COVID-19. This is how the disease info page looks like:

Figure 8. COVID-19 Info

3. Consultation Page

a. Simptom Selection Page

Consultation page is a page used by the user to perform a diagnosis. The user selects the symptoms according to the user condition. Each condition has a different value. After that, the answer will be calculated to get the value of certainty factor

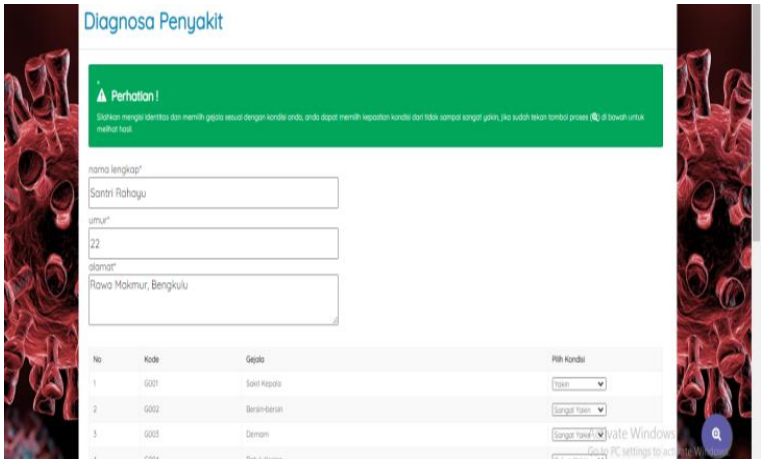

Figure 9. Simptom Selection Page

b. Diagnosis Result

After user clicks the process button, the results of the consultation in the form of selected symptoms will be displayed, calculating the certainty factor for how likely it is to get COVID-19, disease details and solutions.

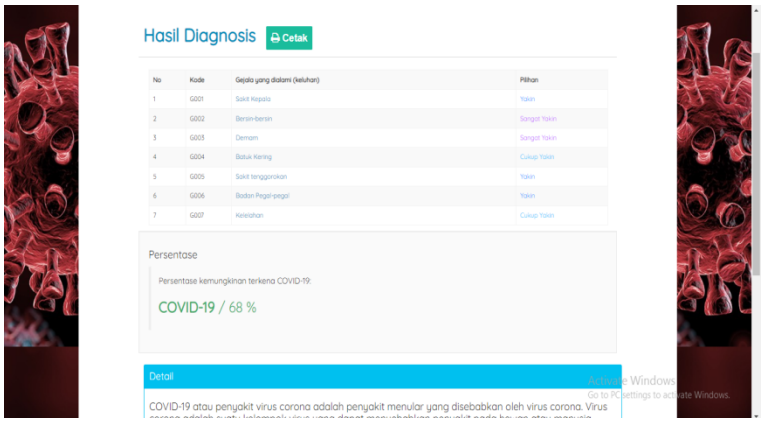

Figure 10. Diagnosis Result

c. Print Result Page

This page is a page to print the result of the consultation. When user clicks the "print" button on the diagnosis page, a print page will appear which can be seen in the picture below:

Figure 11. Print Result Page

4. Doctor Profile

This page contains information in the form of short profile of doctor who have contributed to the creation of this expert system.

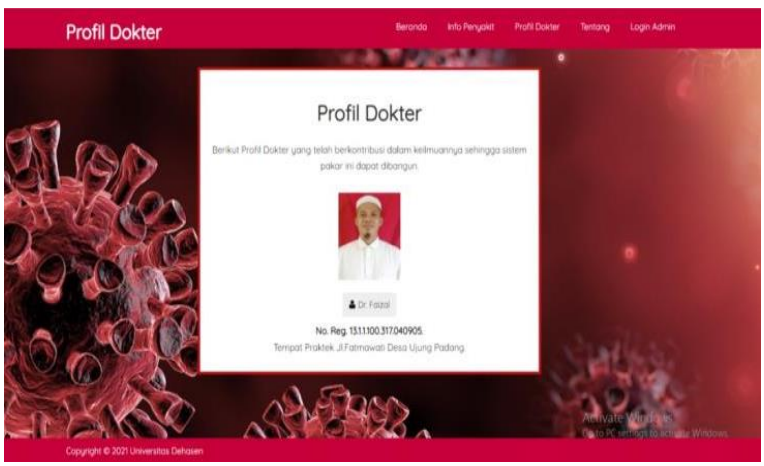

Figure 12. Doctor Profile

CONCLUSIONS

Based on the research results and explanations above it can be concluded that:

1. This expert system application can be used by users as a reference for predicting COVID-19 disease
2. The certainty factor method in this expert system shows the value of the possibility of contracting COVID-19.
3. The results of the diagnosis of this expert system refer to the symptom reference of the disease under study and are correct based on the application of the Certainty Factor method.
4. This expert system can only predict COVID-19 disease.
5. In addition to predicting the possibility of contracting the disease, this expert system application can also provide information about COVID-19.

REFERENCES

Aziz, Scholecul. (2013). *Gampang dan Gratis Membuat Website Untuk Pemula dan Orang Awam.* Jakarta: Kunsi Komunikasi.

Buchanan, B. G., & Shortliffe, E. H. (1984). *Rule-Based Expert Systems:The MYCIN Experiments of the Stanford Heuristic Programming Project*. London: Addison Wesley.

Center For Diades Control and Prevention (CDC). (2020*). Coronavirus Disease 2019 (COVID-19)*

Hendra, W.S (2007) *Pengertian* Website *dan Unsur-unsurnya.*

Pressman, R.S (2015). *Rekayasa Perangkat Lunak: Pendekatan Praktisi Buku I.* Yogyakarta: Andi

Sutojo, T., dkk. (2011). *Kecerdasan Buatan.* Yogyakarta: Andi Offset.

Wijayana, Yenita. (2019). *Sistem PakarKerusakan Hardware Komputer Dengan Metode Backward Chaining Berbasis Web.*

World Health Organization. (2019). *Coronavirus Disease (COVID-19)*

World Health Organization. (2019). *Pertanyaan Jawaban Terkait COVID-19, HIV dan Antiretoviral di Indonesia.*