

Original Research Paper

Expert System for Diagnosis Coronavirus Disease

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Article History

Received:
27.03.2023

Revised:
21.04.2023

Accepted:
01.05.2023

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Abstract: The latest issue of the disease called COVID-19 has become famous all over the world. Hence, through this problem, it found that this disease have the same symptom with other diseases such as Influenza and also normal flu. Detecting diseases at early stage can enable to overcome and treat them appropriately. This is because many of peoples does not know and does not aware of the symptom of this various diseases. In an effort to address those problems, an Expert System for Corona Earlier Detection has been proposed to help the doctors to detect those various diseases in human body. Through this research, the researcher will held an interview with the doctors to collect data and information about those diseases' symptoms and also search for the related articles to make sure this research going successfully. The method that will be used in this research is Certainty Factor. To conclude, this system will be useful to the healthcare department as it will give earlier detection when the patient are positively exposed to the disease that is known by Corona.

Keywords: Certainty Factor, Corona Virus, Expert System.



1. Introduction

Coronavirus is one of disease that is also known as COVID-19. It is one of virus that was found in Wuhan during December in year 2019. This disease getting worse and was spread through the whole world. According to World Health Organization (WHO) in 2020, this COVID-19 is state as a pandemic condition. Until now the ranking of Coronavirus disease getting increase in every country and the number of patients who diagnosed Coronavirus are about millions. In addition, the Coronavirus disease are spread via airborne droplets of fluid that was produced by the infected individuals. For instance, the Coronavirus disease can attack peoples within all ages.

There are few symptoms that can be seen in those people who are infected to Coronavirus disease such as high fever with the body temperature (37.5°C and above), dry coughing, flu and sometimes they are having breathing difficulties. Based on the symptoms that have been shown by the people who are infected in Coronavirus disease, this symptom are same as with MERS and SARS. According to Harmon et al [1], there are few categories of the patient statuses which includes Patient Under Supervision (PUS) that refer to patient who are having serious symptoms, Insider Oversight Status (IOS) which refer to the patient that have milder symptoms and Non Suspect (NON) which refer to the person having outsider of the main symptoms.

For sure, our focus now is to make earlier detection on this Coronavirus disease and to stop the total infections of the Coronavirus disease and also to implement the appropriate management in order to overcome the transmission of the Coronavirus disease. Method that have been used for this expert system is Certainty Factor. This method is suitable to prove the condition in certainty or uncertainty factor. Hence, this expert system can help to assist the medical workers to detect the Coronavirus disease without waiting for a long process of the laboratory results.

The main problem that occur is this Coronavirus disease has a few symptoms shown in other diseases. For an example, the symptom shown in Coronavirus disease such as flu and fever can be shown in influenza disease too. When it shows the same symptoms, it will make people will be less concern and getting confused whether they are diagnosed as Coronavirus patient or just an ordinary flu.

To know someone are positive or negative Covid-19, they need to know the symptoms of the Coronavirus disease and they are needed to do the swab test to diagnose whether they are having positive or negative of the Coronavirus disease. For sure, to know the result, the process took is so long because they need to wait for the result from the laboratory.

2. Literature Review

2.1. Coronavirus

Coronavirus is one of the disease that was found in Wuhan, China during the year of 2019. It rapidly spread, resulting in an epidemic throughout China, followed by an increasing number of cases in other countries throughout the world. In February 2020, the World Health Organization (WHO) designated the disease COVID-19, which stands for coronavirus disease 2019. The virus that causes COVID-19 is designated severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2); previously, it was referred to as 2019-nCoV.

According to World Health Organization [2], COVID-19 is an infectious disease caused by a newly discovered strain of coronavirus, a type of virus known to cause respiratory infections in humans. Coronaviruses are a large family of viruses that are known to cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). According to Zue-Zu [3], the data on 1,099 patients with laboratory-confirmed Covid-19 from 552 hospitals in 31 provinces/provincial municipalities was extracted through January 29th, 2020. From the result, the median age was 47.0 years, and 41.90% were females. Only 1.18% of patients had a direct contact with wildlife, whereas 31.30% had been to Wuhan and 71.80% had contacted with people from Wuhan. Fever (87.9%) and cough (67.7%) were the most common symptoms. The median incubation period was 3.0 days (range, 0 to 24.0 days). On admission, ground-glass opacity was the typical radiological finding on chest computed tomography (50.00%). Significantly more severe cases were diagnosed by symptoms plus reverse-transcriptase polymerase-chain-reaction without abnormal radiological findings than non-severe cases.

According to Geng Li [4], Coronaviruses are enveloped, nonsegmented, positive-sense single-stranded RNA virus genomes in the size ranging from 26 to 32 kilobases, the largest known viral RNA genome. The virion has a nucleocapsid composed of genomic RNA and phosphorylated nucleocapsid (N) protein, which is buried inside phospholipid bilayers and covered by two different

types of spike proteins: the spike glycoprotein trimmer (S) that can be found in all Coronavirus, and the hemagglutinin-esterase (HE) that exists in some Coronavirus. The membrane (M) protein (a type III transmembrane glycoprotein) and the envelope (E) protein are located among the S proteins in the virus envelope. Coronavirus were given their name based on the characteristic crown-like appearance.

According to Chathappady et al, [5] Coronaviruses are enveloped positive-sense RNA viruses belonging to the family Coronaviridae and the order Nidovirales spread among humans and animals.

2.2. Expert system

An expert system refer to the computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if-then rules rather than through conventional procedural code. According to Viral Nagori [6], Expert system is a very special branch of Artificial intelligence that makes extensive use of specialised knowledge to solve problem at the level of human expert. There are different types of expert systems. They are rule based expert system, fuzzy expert system, frame based expert system, and hybrid expert systems. Hybrid expert system is the combination of two or more types of intelligent systems. Prominently, there are two types in hybrid expert systems. The first one is neural expert systems and the second one is neuro-fuzzy systems. Neural expert system combines the features of rule based expert system along with neural network features. While neuro-fuzzy expert system combines the features of fuzzy logic along with the features of neural network.

Expert possesses deep knowledge and practical experience over the years which results into expertise. Expert has an ability to code the knowledge in form of rules. Any rule consists of two parts: The IF part, called and antecedent (premise or condition) and THEN part, called the consequent (conclusion or action). A rule can have multiple antecedents joined by the keywords AND, OR, or combination of both. The antecedent of a rule consists of two parts. They are object and its value. Object and value are linked by an operator. The operator can be mathematical or may be logical.

There are few advantages of using an expert system such as there are providing consistent solutions. It can provide consistent answers for repetitive decisions, processes, and tasks. As long as the rule base in the system remains the same, regardless of how many times similar problems are being tested, the conclusions drawn will remain the same. Besides that it also can provides reasonable explanations. It can clarify the reasons why the conclusion was drawn and be why it considers as the most logical choice among other alternatives. If there are any doubts in concluding a certain problem; it will prompt some questions for users to answer to process the logical conclusion. Not only can overcome the human limitation but the expert system also easy to adapt to the new conditions. Users will be able to frequently use it in seeking solutions. The knowledge of experts is an invaluable asset for the company. It can store the knowledge and use it as long as the organization needs it [7].

2.3. Diagnosis

Diagnosis refers to the identification of the nature of an illness or other problem by examination of the symptoms. To make it clear, diagnosis is the process of finding out what is causing symptoms, a disease or injury in someone that called patient and the opinion reached based on the process. According to Fehr, [8] when a diagnosis is accurate and made in a timely manner, a patient has the best opportunity for a positive health outcome because clinical decision making will be tailored to a correct understanding of the patient's health problem.

According to Tess bright et al [9], there are few types of diagnostic testing and one of it is diagnosis of clinical. This diagnosis is made on the basis of medical signs and patient reported symptoms, rather than diagnostic test. Laboratory diagnosis is a diagnosis based on significantly on laboratory reports or test results, rather than the physical examination of the patient.

The diagnostic process proceeds as follows: First, a patient experiences a health problem. The patient is likely the first person to consider his or her symptoms and may choose at this point to engage with the health care system. Once a patient seeks health care, there is an iterative process of information gathering, information integration and interpretation, and determining a working diagnosis. Performing a clinical history and interview, conducting a physical exam, performing diagnostic testing, and referring or consulting with other clinicians are all ways of accumulating information that may be relevant to understanding a patient's health problem [10].

2.4. Certainty Factor

Certainty Factor (CF) is a device used in rule-based systems to assign weight to facts or pieces of knowledge. The weights express the perceived certainty of a fact being true: usually -1 indicates certainly false, +1 indicates definitely true, and intermediate values represent varying degrees of certainty, with 0 meaning unknown [11]. The medical expert system MYCIN used certainty factors, with conjunctions of rules taking the minimum value. The use of certainty factors is similar to probabilistic reasoning but is less formally related to probability theory [12]. This approach was first employed in Mycin. Mycin was a pioneering rule-based Expert System designed to assist physicians in the antimicrobial treatment of patients [13].

In terms of knowledge elicitation, unlike studies of elicitation of probabilities, there are no studies in which CFs have been elicited from subjects. Consistent with the axioms of the CF formalism, however, some experimental studies concerned with mapping probabilities to verbal uncertainty expressions have suggested that the quantitative meanings given to terms such as "likely" may be dependent upon the subjective prior probability [14].

Certainty Factor is a method to prove whether a fact is definite or uncertain in the form of a metric usually used in expert system. This method is perfect for expert systems that diagnose something that is not certain [15].

3. Methodology

In this research development methodology, we will discuss on the methodology that can be used to develop the system. At the end of the discussion, the researcher will choose one of the best methodology that can be used to develop the expert system. The methodology that can be used in developing the software is Evolutionary Prototyping Model.

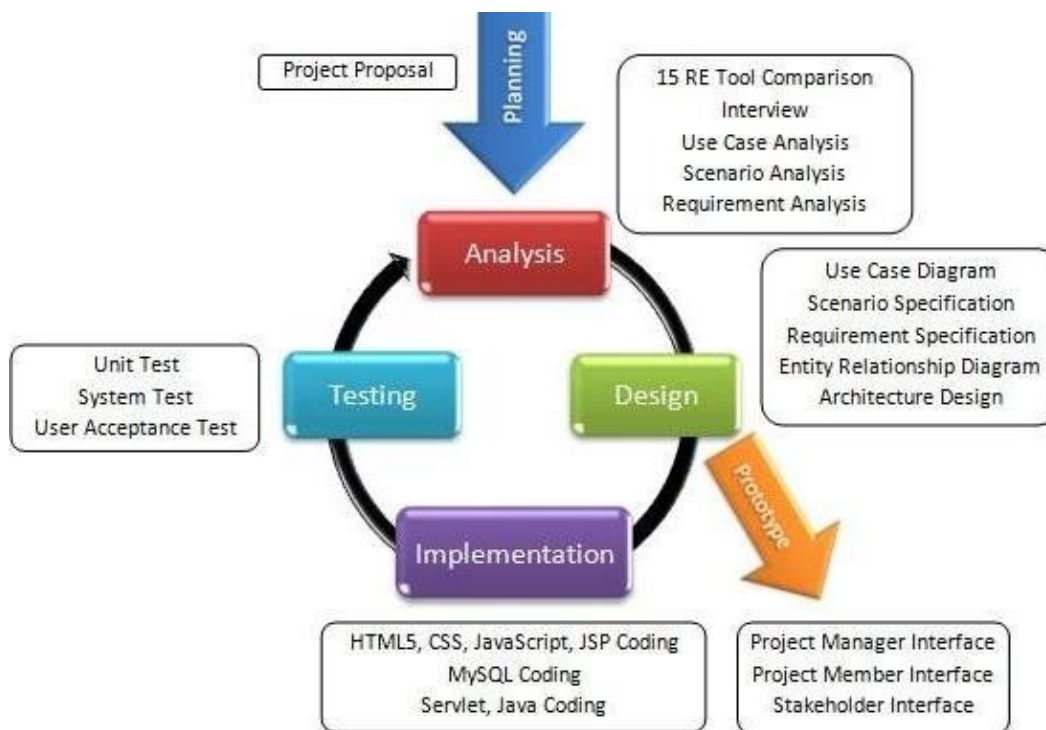


Figure 1. Evolutionary Prototyping Model

Evolutionary prototyping model is one of the software development model that been used to develop the system. Evolutionary prototyping is a software development method where the developer or development team first constructs a prototype. After receiving initial feedback from the customer, subsequent prototypes are produced, each with additional functionality or improvements, until the

final product emerges. This prototyping scheme differs from the rapid or throwaway prototyping, in that the developer begins with the best understood requirements; whereas in rapid prototyping, the developer implements the least understood requirements. Furthermore, the first prototype need not be built quickly. Evolutionary prototyping is similar to incremental development in that parts of the system may be inspected or delivered to the customer throughout the software life cycle model.

4. Finding and Discussion

List of interview question that has been asked to the experts

- 1) Can you tell generally about the coronavirus disease?
- 2) What are the symptoms shown by the people who are exposed to Coronavirus disease?
- 3) As we can see, there are few symptoms of other diseases such as influenza A having the same symptoms of Covid-19. How we can identify the accurate symptoms for the people who diagnosed the disease called Coronavirus?
- 4) How to clinically identify cases of COVID-19?
- 5) How we can detect the person who have the positive case of Covid-19 but by the time he/she does not show any symptoms of Covid-19 disease?
- 6) What are the suitable method that can be used to identify the disease of coronavirus?

Based on the analysis that have been done to diagnose coronavirus disease using certainty factor method, it is the most accurate way to identify whether we are affected to coronavirus disease. By the certainty factor method, we just only know that if the value of $CF(e)$ is more than 1.0 it will have a high chance to have the coronavirus disease.

Figure 2 shows the view symptoms page.

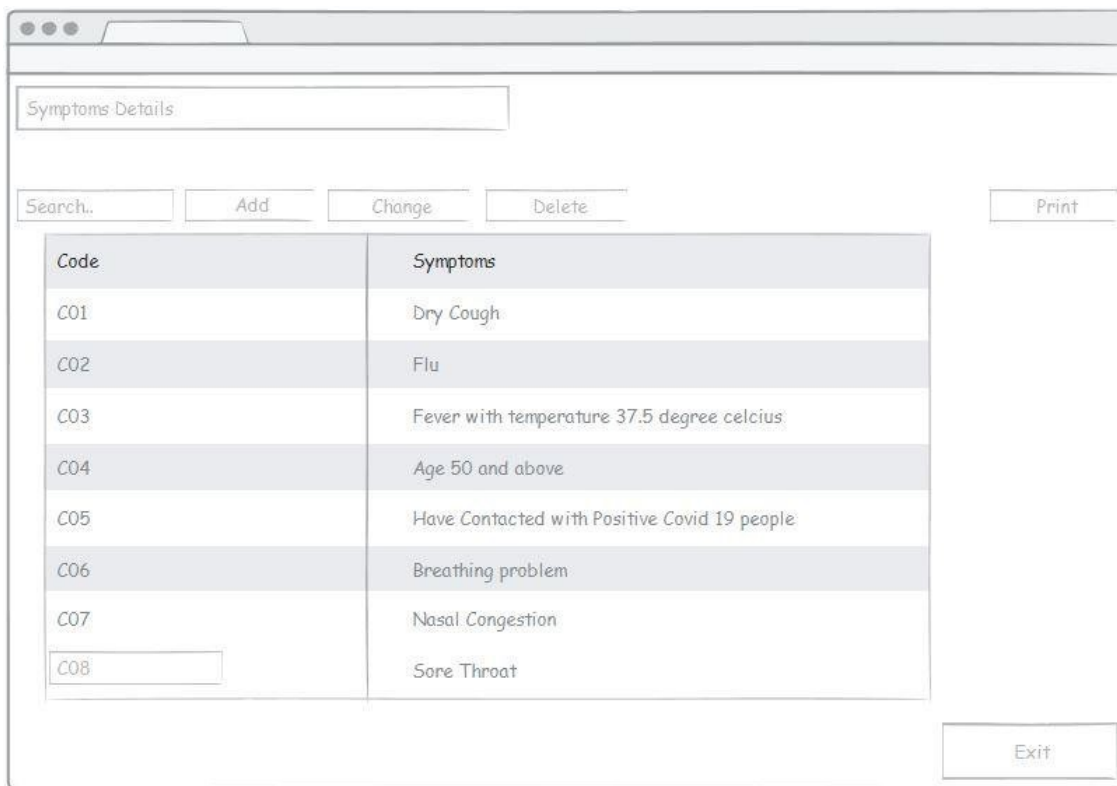


Figure 2. View Symptoms Page

5. Conclusion

This system much help people who are infected to the coronavirus disease as it have an accurate system and calculation to diagnose this disease. We hope that more system will be develop especially

an expert system as this is the best way to diagnose any of diseases and problems occurred in our daily life.

In ensuring to increase the quality of the system, improvement in the term of interface design have to be made in order to make the application user-friendly. One of the improvements that can be made is changing the colour used in the system. Other than that, improvement can be made by adding tooltips and help button in the user interface. This can increase the level of user-friendliness of this web application.

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