Android Application for Diagnosing General Symptoms of Disease Using Forward Chaining Method

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Abstract – Sometimes people feel doubtful about things that happened to their physical health. Especially when there is no place to ask about the pain they feel or experiencing. So usually and are more often they ignoring and underestimate the symptoms they are experiencing. Generally someone knows that minor illnesses such as colds or diarrhea, do not require special examination or complex treatment. The problem is, minor illness could be an indicator of a serious disease. Therefore one must know the symptoms of disease they feel with diagnose the symptoms. To facilitate someone to diagnose the symptoms they experienced, we develop an Android based application that can provide solutions for what they should do when they are experiencing these symptoms, whether they could do their own treatment at home, or should be immediately checked by a doctor. This application using inference forward chaining method. By using this application, diagnostic results of disease can be detected through the consultation process or answering the questions provided by the system quickly and effectively with an Android smartphone as the media.

Keywords: Applications, General Symptoms, Disease, Forward Chaining, Android

I. INTRODUCTION

An early symptom of the disease is a disease that can threaten one's health, but in fact symptoms of the disease are sometimes taken for granted by most people [1]. The problem of the results of questionnaires distributed to the general public the data found that 78.7% of 61 respondents sometimes do not recognize the type of disease they are feeling or experience, and 85.2% of respondents only recognize the symptoms, without knowing the type of disease that is causing the symptoms.

Sometimes people feel doubtful about things that happened to their physical health. Especially when there is no place to ask about the pain they feel or experiencing. So usually and are more often they ignoring and underestimate the symptoms they are experiencing. Someone needs to know what exactly are they suffering, what causes it, how long the recovery period, and could the healing be accelerated [2].

From the results of a questionnaire distributed to 61 respondents, the general public, about 60.7% know when a mild illness can be an indication of a more serious disease, but there are also respondents who do not know which is about 39.3%. Generally someone knows that minor illnesses such as colds or diarrhea, do not require special examination or complex treatment [2]. Therefore one must know the symptoms of disease they feel with diagnose the symptoms.

To diagnose the symptoms can be done by connecting a problem with a solution that is by using Inference engine. There are two ways that can be done in making inference engine that is forward chaining and backward chaining [3]. Forward chaining is a multiplication inference that connects a problem with a solution called a chain (chain). A chain is sought or bypassed/traversed of a problem to obtain the solution [4]. Backward Chaining is using goal-driven approach, starting from the expectation of what will happen (hypothesis) and then look for the supporting evidence (or the opposite) to our expectations [5]. So that it can be seen that the forward chaining more emphasis on diagnosis of symptoms with breadth-first search, and backward chaining emphasizes diagnosis of the symptoms with depth first search [6]. By doing inference engine will make it easier to diagnose the symptoms of general disease. Because when someone does a diagnosis of the symptoms that they experienced then they will quickly and precisely determine how to cope with the disease.

Based on the existing problems then an application that can diagnose the general symptoms was created, which later the result from the diagnosis of the general symptoms that may provide a solution of what to do if they are experiencing these symptoms, whether they could do their own treatment at home, or should be immediately checked by a doctor.

II. THEORETICAL BASIS

A. Artificial Intelligence

Artificial intelligence is a part of a computer science that make the machine (computer) can do the job as good as done by humans. At the beginning of the creation, the computer is only used for counting tool only. However, as the times goes on, the role of a computer dominates the life of mankind. The Computer is no longer used as a counting tool, more than that the computer is expected to be empowered to do all the things done by humans [3]. To make a computer that can act as good as human, people should put the knowledge and the ability to think to a computer.

More details, the meaning of artificial intelligence can be viewed from various perspectives, among others [3]:

1. Intelligence's Viewpoint
   Artificial intelligence will make the machine becomes 'intelligent' (able to do what humans do).
2. Research's Viewpoint
   Artificial intelligence is a study of how to make the computer to do something as good as humans. Domain that frequently discussed by Researchers include:
   a. Mundane Task
   b. Formal Task
   c. Expert Task
3. Business' Perspective
   Artificial intelligence is a very powerful set of tools and methodological to solves business problems.
4. Programming's Perspective
   Artificial intelligence includes the study of symbolic programming, problem solving and searching. To perform artificial intelligence applications there are two parts that needed, they are:
   a. Knowledge Base
      Contains the facts of theoretical thinking and the relationship between each other.
   b. Inference Engine
      Is the ability to draw conclusions based on experience.

B. Forward Chaining Methods

A multiplication inference that connects a problem with a solution called the chain (chain). A chain that looked for or passed / crossed by a problem to obtain a solution called a forward chaining. Another way to describe this forward chaining is by thinking to the fact that lead to the conclusion that the fact exists[6].

Forward chaining is also called reasoning from the bottom to the top because of reasoning from the lower level to the top level of a fact lead to conclusion which based on facts. Reasoning from the bottom to the top in an expert system can be likened to conventional programming from the ground up. The fact is the basis of a knowledge-based paradigm because they cannot be parsed into the smallest units that have meaning [6]. Good uses for forward chaining occurs if the tree is wide and not deep. This is because the forward chaining make the search of breadth-first easier. Forward chaining is good if the search for a conclusion proceed level by level. In contrast to the backward chaining that facilitate the search depth first, a good tree for depth first search is narrowed and deep [6].

Forward chaining inference can be regarded as a strategy that stems from a number of known facts. Search is performed by using rules that premise fits the known facts is to acquire new facts and continue the process until the goal is achieved or until it no longer rules the premise is more compatible with the known facts and the facts obtained [7].

There are several ways that can be done in performing inference, including the Forward Chaining. Forward Chaining is matching facts or statements starting from the left (first IF). Here's an example of inference by using forward chaining, namely [8]:

> **IF high fever and red spots THEN patients affected by dengue fever**

Forward chaining method has some characteristics which are as follows [6]:

1. Planning, monitoring and control
2. Presented for the future
3. antecedent to consequent
4. Data guides, reasoning from the bottom up
5. Look Forward to get what solutions that follow the facts
6. Breadth first search easier
7. antecedent determines search
8. Explanatiom is not facilitated

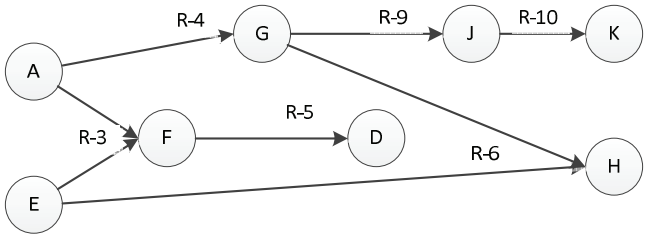

Figure 1 Process Flow Forward Chaining

C. Diagnosis

Diagnosis in the Indonesian Dictionary (February 25, 2016) is the determination of the type of the disease by researching or checking symptoms. In the medical's term diagnosis is also known as the determination of the disease based on signs and symptoms by using ways and tools such as labs, photos, and clinics. Therefore we can conclude that the diagnosis is to identify the characteristics of diseases or conditions or that distinguish one disease or condition to the other. Assessment can be done through physical examination, laboratory tests, and could be assisted by a computer program designed to improve decision making.

D. Symptoms

Symptoms according to the dictionary is every indication of the disease seen or felt by the patient. According to the Indonesian dictionary (25 February 2016) the symptoms are concerning (circumstances, events, etc.) that is unusual and noteworthy (sometimes signifies something will happen) and the situation became signs of (occurrence, outbreak) something,

Meanwhile, according to Wikipedia (25 February 2016) Symptomp is indicated of diseases or the disturbance of health, shaped by signs or characteristics of the disease and can be felt, such as nausea or dizziness. However, there

are things that are not covered within the meaning of terms such as hallucinations or delusions, because the way to do this indicated piled on the actors themselves often unknowingly, and not the result of observations made by the medical examination.

III. RESULTS AND DISCUSSION

In the application that will be built, diagnostic flow application process of the general symptoms of the disease of men and women, when diagnosing the symptoms using forward chaining method can be described in the general with a flowchart as follows:

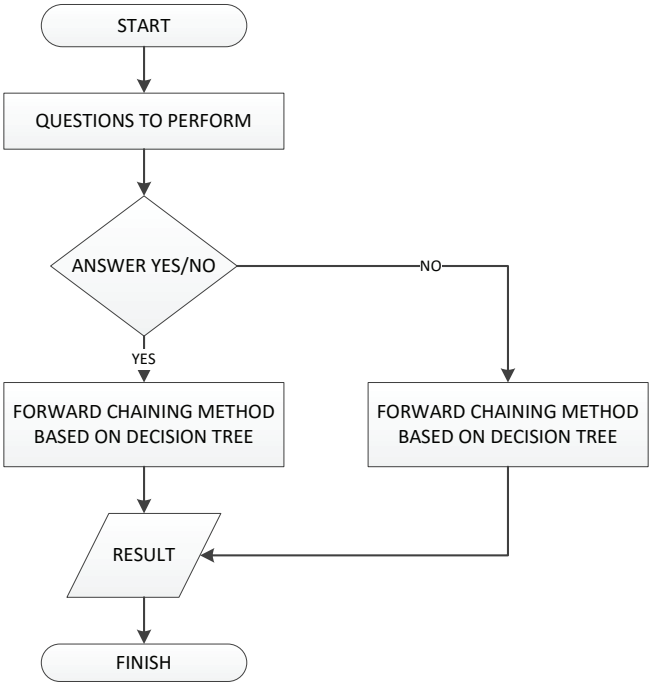

Figure 2 Application Process Flow Diagnosis

A. Forward Chaining Method Design

Forward chaining method that will be used for the completion of the diagnosis of the general symptoms are as follows (the example case of symptoms of abdominal pain). Following the design phase forward chaining method in this study are as follows:

1. Symptoms Data

Determining the general symptoms found in a book by dr. Tony Smith, entitled "Doctor in Your Home" which the truth has been validated by a Doctor during an interview, then reprocessed into some of the symptoms that are interconnected.

Table 1 Data Symptoms

Symptom Code	Name Symptom
G091	Sakit Perut
G092	Diare
G093	Terdapat Darah Merah Pada Kotoran
G094	Sakit Perut Berawal Dari Punggung
	Menjalar Ke Lipat Paha
G109	Sakit Perut Berlangsung Selama Lebih Dari Satu Jam
G006	Muntah Saat Menahan Sakit Perut Yang Terasa Membengkak Dan Lunak, Yang Tidak Mereda

2. Disease Data

Identifying the diseases related to the general symptoms that can be found on the tables of symptoms, in men and women disease which contained in the book by dr. Tony Smith, entitled "Doctor in Your Home" which the truth has been validated by a doctor during an interview.

Table 2 Data Disease

Code Of Disease	Name Of The Disease
P041	Gastroenteritis
P042	Ulceratif Colitis
P043	Kelainan Pada Saluran Kemih
P044	Gangguan Perut Yang Serius
P055	Perikasakan Ke Dokter
P056	Sakit Perut Yang Hebat

3. Decision Tree

From Table 1 and Table 2, and then a decision tree or flow inference was made, which explains the flow of general symptoms which later will generate the disease data. This decision tree was made based on the diagnosis result from a book by dr. Tony Smith, entitled "Doctor in Your Home" which the truth has been validated by a doctor during an interview.

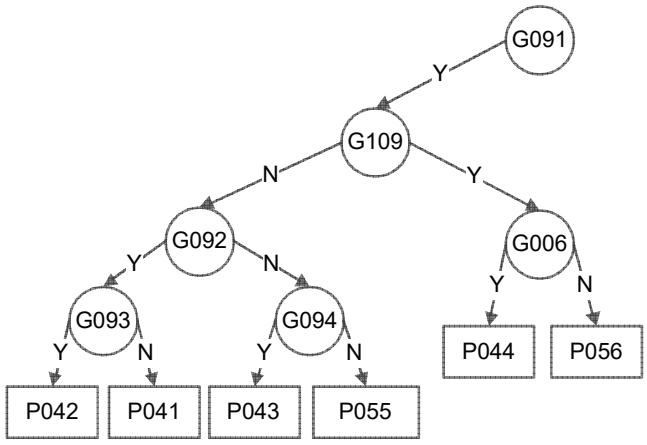

Figure 3 Decision Trees Forward Chaining

4. Inference Engine

In this stage, the reasoning conducted by using the contents from a list of the rules based on the order or a certain pattern. The mechanism which author created is using forward chaining method. The search was performed by selecting the symptoms first and then matched with the existing rules. Table 3 below is the relationship between symptoms and diseases.

Table 3 Relationships Symptoms and Disease

No	Symptom	Symptom Code	Disease					
			P041	P042	P043	P044	P055	P056
1	Sakit Perut	G091	X	X	X	X	X	X
2	Diare	G092	X	X				
3	Terdapat Darah Merah Pada Kotoran	G093		X				
4	Sakit Perut Berawal Dari Punggung Menjalar Ke Lipat Paha	G094			X			
5	Sakit Perut Berlangsung Selama Lebih Dari Satu Jam	G109				X		X
6	Muntah Saat Menahan Sakit Perut Yang Terasa Membengkak Dan Lunak, Yang Tidak Mereda	G006				X		

The cross sign (x) indicates that patients experiencing these symptoms. Here is a basic knowledge that contains rules of the relationship between the symptoms with the disease in Table 4:

Table 4 Rule-Rule Relationship to Disease Symptoms

NO.	RULE
R1	IF G091 AND G092 THEN P041
R2	IF G091 AND G092 AND G093 THEN P042
R3	IF G091 AND G094 THEN P043
R4	IF G091 AND G109 AND G006 THEN P044
R5	IF G091 THEN P055
R6	IF G091 AND G109 THEN P056

Description of production rules above table are as follows:

R1 **IF** Sakit Perut **AND** Diare **THEN** Gastroenteritis
R2 **IF** Sakit Perut **AND** Diare **AND** Terdapat Darah Merah Pada Kotoran **THEN** Ulceratif Colitis
R3 **IF** Sakit Perut **AND** Sakit Perut Berawal Dari Punggung Menjalar Ke Lipat Paha **THEN** Kelainan Pada Saluran Kemih
R4 **IF** Sakit Perut **AND** Sakit Perut Berlangsung Selama Lebih Dari Satu Jam **AND** Muntah Saat Menahan Sakit Perut Yang Terasa Membengkak Dan Lunak, Yang Tidak Mereda **THEN** Gangguan Perut Yang Serius
R5 **IF** Sakit Perut **THEN** Perikasakan Ke Dokter
R6 **IF** Sakit Perut **AND** Sakit Perut Berlangsung Selama Lebih Dari Satu Jam **THEN** Sakit Perut Yang Hebat

B. Use Case Diagram

Use Case describes the interaction of the actors in the diagnosis application of the general symptoms disease in men and women. The use case in diagnosis application of the general symptoms disease in men and women have only one actor namely user. User on the application of the general symptoms disease in men and women can diagnose the symptoms which they feel, viewed health information, and viewed about the application. As illustrated in Figure 4 below:

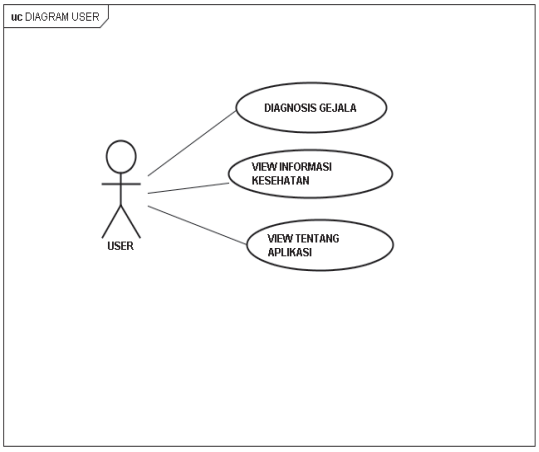

Figure 4 Use Case Diagram Application Diagnosis General Symptoms

In accordance with the design steps forward chaining method, it will discuss the steps to start diagnosing the symptoms are felt by the user.

1. Home page

The home page is the starting time of diagnosis applications general symptoms of the disease these men and women executed. On the home page there is a button start. The button serves to open the main menu page. Home page can be seen in Figure 5.

Figure 5 Home Page

After performing the home page then select a menu ranging diagnosis contained in bar menu. Having started the diagnosis is selected, it will look to start the diagnosis. As seen in Figure 6.

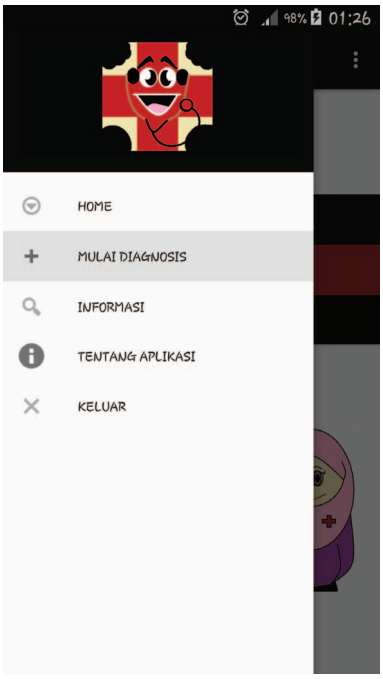

Figure 6 Select Start Diagnosis

2. Diagnosis Page

Diagnosis page is a page where users can diagnose general symptoms they feel. In the diagnosis page will appear question in accordance with the decision tree and forward chaining inference engine. On this page the user can only answer yes or no. After that the application will ask questions back and forth in accordance with the groove rule / regulation in the process of diagnosis. On this page the user can also diagnose reset by pressing the reset button diagnosis. Weather diagnosis can be seen in Figure 7 and Figure 8. For diagnostic results can be seen in Figure 9.

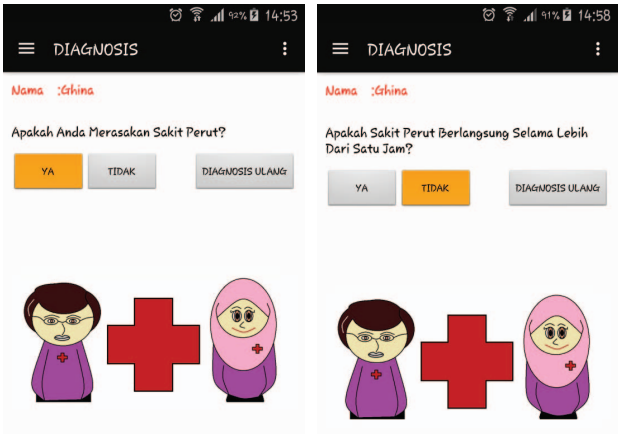

Figure 7 Step 1 Diagnosis Symptoms

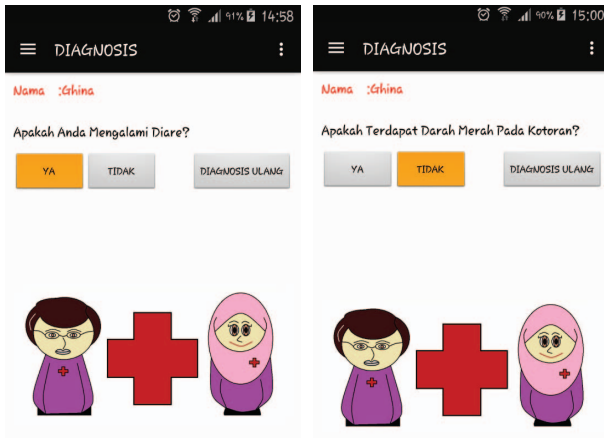

Figure 8 Step 2 Diagnosis Symptoms

Figure 9 General Symptoms Diagnosis Results

Based on this line of questioning that is displayed on the application of the general symptoms of diagnosis Figure 7 and Figure 8, it can be concluded that if the user feel the symptoms of abdominal pain with diarrhea, the results of the diagnosis was gastroenteritis. The conclusions generated by the application in Figure 9 together with the conclusions generated by the decision tree in Figure 10 and a forward chaining rules of production method.

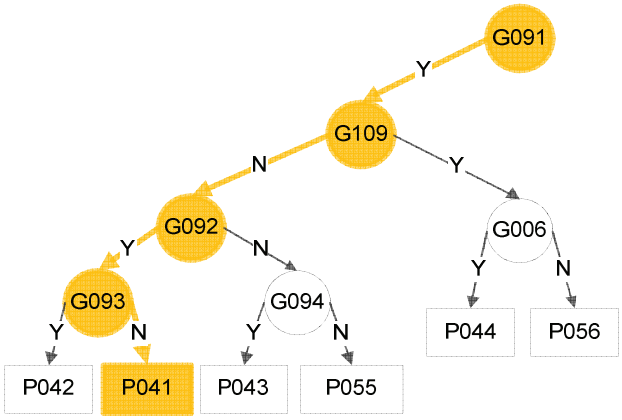

Figure 10 Decision Trees Forward Chaining R1

R1 IF G091 **AND** G092 **THEN** P041
R1 IF Sakit Perut **AND** Diare **THEN** Gastroenteritis

Based on comparative analysis has been done by adjusting the diagnostic yield of the decision tree and forward chaining inference engine with a diagnosis using the Application. The results of diagnosis using the same application with the result of the diagnosis by a decision tree and forward chaining inference engine, both in the symptom data, as well as from the results of the diagnosis of the disease that is data. This proved the application has successfully resulted in the diagnosis of the general symptoms that correspond with decision tree and forward chaining inference engine.

C. Application Comparison Table

Here is a comparison table between common symptom diagnosis applications with other applications / systems that are already in a kind of literary study.

(1) Expert System In Identifying Cancer In Children Early And How Abatement [9]
(2) Disease Diagnosis Expert System with Forward Chaining Dogs [10]
(3) Detection Expert System Cancer in Women Using Method Chaining Forward [11]
(4) The Diagnosis Application of General Symptoms Disease In Men and Women Android-Based Using Forward Chaining Method

Table 5 Comparison Of Similar Literature

No.	Comparison	(1)	(2)	(3)	(4)
1	User Friendly		√		√
2	Fast performance				√
3	Offline Capabilities	√		√	√
4	Accessible Anywhere		√		√
5	Requires Login	√	√	√	
6	Search By Decision Trees		√		√
7	Effective in Providing Question		√	√	√
8	Not Require Configuration Database				√
9	Not Have Database Server	√		√	√
10	Single-File Database				√

IV. CONCLUSION

Based on the results, it can be concluded of which is as follows:

1. The searching Methods with forward chaining can help diagnose general symptoms of the disease on men and women, could generate output into the diagnosis of disease, according to the results of the expert and first aid guide the worked of dr. Smith.
2. By using the inference of forward chining method, could be easier when searching general symptoms, because the forward chaining method emphasizes the breadth-first search, which is the searching on decision trees will start from the root node continues to level 1, then move on to the next level until the discovery results diagnosis.
3. On the application of the general symptoms of the diagnosis disease on men and women, the user only answer the question in accordance with the needs and symptoms felt by the user. Without having to answer all the questions contained in the application.
4. The results of the diagnosis will always obtained fixed and unchanging, which can be mean consistent. Because the result of the application of the general symptoms diagnosis has been tested by experts, resulting in accurate diagnosis.

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