EXPERT SYSTEM FOR DIAGNOSIS OF BLOOD FEVER DISEASE

DENGUE USING THE CHAINING AND BACKWARD METHOD

CERTAINTY FACTOR

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ABSTRACT

Dengue Hemorrhagic Fever is a disease that is quite popular in Indonesia. Judging from the large number of patients infected with the disease and not a small number of patients died due to not being helped immediately. Lack of public sensitivity to the symptoms of dengue hemorrhagic fever is what ultimately causes many casualties, due to late getting medical treatment. Thus, accurate analytical skills are needed in assisting the patient diagnosis process. The Backward Chaining method is a chain that is traversed from a hypothesis back to the facts that support the hypothesis, and the Certainty Factor is a method to prove whether a fact is certain. The system can be run if the user enters the symptoms experienced and provides a confidence value for the symptoms they are experiencing and then gets a diagnosis and a solution.

Keywords: Disease Diagnosis, Expert System, Backward Chaining, Certainty Factor

1. INTRODUCTION

Dengue Hemorrhagic Fever is a disease that is quite popular in Indonesia. Judging from the large number of patients experiencing the disease and not a few casualties due to helplessness. Dengue Hemorrhagic Fever is an infection caused by the Dengue virus. Dengue virus is transmitted by mosquitoes, especially Aedes aegypti mosquitoes.

The outbreak of Dengue virus was caused by a lack of attention to the environment around the residence so that many Aedes aegypti mosquitoes breed. When a person is infected with the Dengue virus, the patient will not immediately show the symptoms, but after an incubation period of approximately 3 days after being infected, the patient will show symptoms such as fever, dizziness and so on. Lack of sensitivity to the symptoms of Dengue fever is what ultimately causes many casualties due to late getting medical treatment. Because of these problems, an Expert System was compiled using the Backward Chaining and Certainty Factor methods.

The Backward Chaining method is a chain that is traversed from a hypothesis back to the facts that support the hypothesis. Another way of describing Backward Chaining is in terms of objectives that can be fulfilled by fulfilling sub objectives. Backward Chaining can also be interpreted as reasoning starting from the highest level to build a hypothesis, down to the lowest level facts that can support the hypothesis called top-down reasoning. Arhami (2005: 115). Backward Chaining is one a branch of artificial intelligence or artificial intelligence, as well as methods that can be used in an expert system to determine the point of trouble like an expert. Certainty Factor is a method to prove whether a fact is certain or uncertain in the form of metric 2

usually used in expert systems. This method is perfect for expert systems that diagnose something that is uncertain. (Joseph Giarratano, 2004).

Based on the above background, a computer application is needed that can make it easier for users to diagnose symptoms of the disease being experienced, so with a consideration the authors conducted a diagnostic research for Dengue Hemorrhagic Fever with the title "Expert System for Diagnosing Dengue Hemorrhagic Fever (DHF) Using the Backward Chaining Method. and Certainty Factor ".

2. BASIS OF THEORY

2.1 EXPERT SYSTEM

An expert system is a system that adopts knowledge from humans (experts) into computers, so that computers can solve problems like an expert (Sri Kusumadewi, 2003).

2.2 BACKWARD CHAINING

Backward chaining is a search strategy in the opposite direction of forward chaining (Forward Chaning). The search process starts from the goal, namely the conclusion that becomes the solution to the problems at hand. The inference engine looks for the rule rules in the knowledge base whose conclusion is the solution to be achieved, then from the rules obtained, each conclusion is traced back the path that leads to that conclusion. If the information or the value of the attributes that lead to this conclusion is in accordance with the data provided, then the conclusion is the solution that is being sought, if it is not appropriate then the conclusion is not the solution being sought. Traceability starts the search process with a goal so this strategy is also called goal-driven.

2.3 CERTAINTY FACTOR

Certainty Factor (CF) is to accommodate the uncertainty of thought (inexact reasoning) of an expert proposed by Shortliffe and Buchanan in 1975. An expert (for example a doctor) often analyzes existing information with expressions with uncertainty, to accommodate this we use certainty factor (CF) to describe the level of confidence. (T. Sutojo, 2011)

In the implementation of certainty factors to assume the degree of certainty of an expert on a data. This concept is then formulated in the basic formula as follows:

$$CF[H,E] = MB[H,E] - MD[H,E]$$

Information :

CF = Certainty factor (certainty factor) in hypothesis H which is influenced by facts E

MB(H,E) = measure of belief (measure of confidence) towards hypothesis H, if E evidence is provided (between 0 and 1)

MD(H,E) = measure of disbelief (measure of confidence) on evidence H, if evidence E is provided (between 0 and 1)

Hipotesa = Hipotesa

E = Evidence (event or fact)

$$CF[H,E]1 = CF[H] * CF[E]$$

Information :

CF(E) = certainty factor evidence E being influenced by evidence E

CF(H) = certainty factor hipotesa assuming evidence is known with certainty, namely when CF(E,e) = 1

CF(H,E) = certainty factor hipotesa which is influenced by evidence e is known with certainty.

Certainty Factor for a rule with a similar conclusion (similarly concluded rules) :

CFcombine CF[H,E]1,2 = CF[H,E]1 + CF[H,E]2 * [1-CF[H,E]1]

CFcombine CF[H,E]old,3 = CF[H,E] old + CF[H,E] 3 * (1-CF[H,E] old]

To calculate the percentage to disease, the equation is used: CFpersentase= CFcombane* 100%

3. RESEARCH METHODOLOGY

3.1 Problem Analysis

Lack of sensitivity to the symptoms of Dengue fever is what ultimately causes many casualties due to late getting medical treatment.

3.2 Data Analysis

The data used in this system is data from Dengue Hemorrhagic Fever symptoms and disease which consists of 23 symptoms and 3 disease diagnoses.

3.3 Main Function of the System

The main functions of this system are:

1 Can determine the diagnosis of Dengue Fever.

2. Can provide information to users about solutions to Dengue Fever.

3.4 Flowchart System

The system flowchart is a depiction of the steps and sequence of procedures from a program. Flowcharts help analysis and programmers to solve problems in program operation, in other words, flowcharts are a description of the process flow of a system. The following is an overview of the system flowchart used.
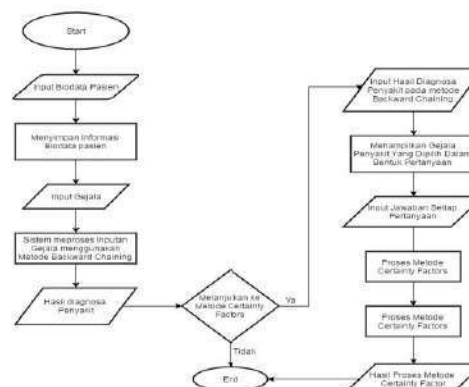

Figure 1. Flowchart System

3.5 Entity Relationship Diagram (ERD)

Entity Relationship Diagram or ERD is a diagram that describes the arrangement of tables and their attributes and determines the relationships between tables. ERD also explains the relationship between attributes and tables, where attributes have a function to describe the characteristics of the table. The following is an image of the ERD used in this system.
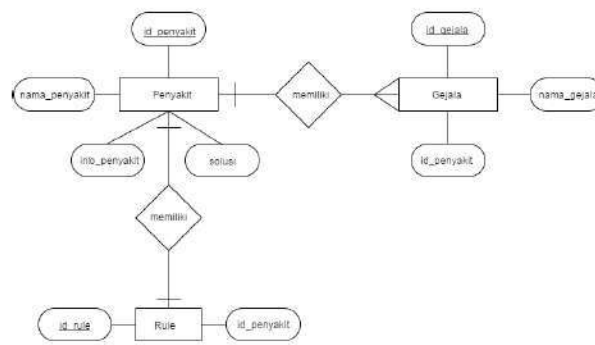
Figure 2. ERD System

3.6 Data Flow Diagram (DFD)

Data flow diagram abbreviated as DFD or data flow diagram is a diagram that describes the flow of data in a system. In this system, there are several DFD levels which are described below.

3.6.1 Data Flow Diagram Level 0 (DFD 0)

DFD Level 0 is describing a diagram that can represent all processes contained in a system. DFD level 0 of the system used in this final project is described as follows:

Figure 3. DFD Level 0

In the diagram above, it consists of 2 traffic or system users. The admin entity enters data such as disease data, disease symptom data, disease rule data, and solution data. While the user entity selects the disease data, then the system provides the results of the disease solution.
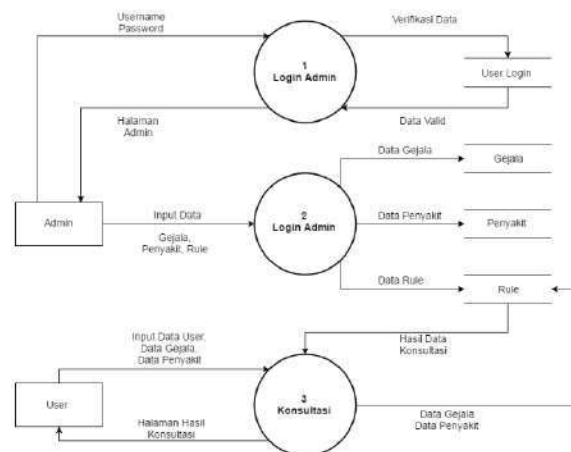
3.6.2 Data Flow Diagram Level 1 (DFD 1)

Figure 4. DFD Level 1

In Figure 4, the data flow through DFD Level 1 explains the data flow from the admin and from the user. From the diagram, it can be understood that the admin logs in by filling in the username and password, if the username and password are valid it will display the admin page. On the admin page, you can input symptom data, disease data, and rule data.

Users can consult through the system by inputting user data, symptom data and disease data. The data will be processed by the system by matching the user input data with the rule data formed from the symptom and disease data inputted by the admin. During the consultation process, a diagnosis of dengue hemorrhagic fever was produced.

4. INTERFACE IMPLEMENTATION

User Interface (User Interface) is a communication mechanism between the user (user) and the system. The user interface (User Interface) can receive information from the user (user) and provide information to the user (user) to help direct the path of tracking problems until a solution is found. Here are some examples of how the User Interface form looks on this system :

4.1 Main admin page

This page serves to display all access rights to the program including masters and consultations. And can add, change and delete diseases, symptoms, solutions and rules. The display can be seen in Figure 5.

Figure 5. Admin Main Page View

4.2 Main Page

In Figure 6. is a display of the main page which functions to display all information and general features related to the system.

Figure 6. Main Page View

On the main page there are buttons that are used to access other pages as described below*:*

A. Admin Login

Serves to access the admin page..

B. Main page

Serves to return to the main page, and displays general information.

C. Consultation

Serves to access the consultation page.

5. Risults and Discussion

5.1 System Testing

The purpose of testing this system is to determine whether the diagnosis of Dengue Fever has determined an accurate result.

5.2 Testing

In table 1, testing was carried out by inputting the symptoms of the tea plant and the patient's suspected disease, testing was carried out using the Backward Chaining method. In table 2 the test is carried out by inputting the user's belief value about the symptoms experienced based on the results of the previous method's diagnosis, testing is carried out using the Certainty Factor method.

Table 1 Testing Backward Chaining

Testing *Backwad Chaining*			
No	Symptoms that Occur	Suspected existing Disease	Test Results *Backward*
1	Headache Whole body pain(mialgia) Nausea There are dengue sufferers inside radius 200 meters from your location	(P01) Dengue fever (P02) Dengue Hemorrhagic Fever	Dengue Fever (P01) with a percentage of 33% Dengue Hemorrhagic Fever (P02) with a percentage of 29%

Table 2 Testing Certainty Factor

Pengujian Ke *Certainty Factor*						
Demam Dengue		CF Pakar	Jawaban User/ CF User		CF = CF_pakar* CF_User	CFcombine CF[H,E]1,2 =CF1 +CF2 *(1-CF1)
if	Demam tinggi 2-7 hari	1	0,0	Tidak	0	0,240
and	Sakit kepala	0,4	0,6	cukup_yakin	0,24	0,240
and	Nyeri retro-orbital (di belakang bola mata)	0,6	0,0	Tidak	0	0,696
and	Nyeri seluruh badan (*Mialgia*)	1	0,6	cukup_yakin	0,6	0,696
and	Nyeri sendi	1	0,0	Tidak	0	0,769
and	Mual atau/dan muntah	0,4	0,6	cukup_yakin	0,24	0,769
and	Ruam kulit/bitnik merah pada kulit	0,4	0,0	Tidak	0	0,769
and	Rasa lemah badan	0,6	0,0	Tidak	0	0,769
and	Pendarahan ringan (dari gusi, hidung, dll	0,8	0,0	Tidak	0	0,815
and	Terdapat penderita dengue di daerah yang sama	0,6	1,0	sangat_yakin	0,2	0,815
and	Tenggorokan sakit	0,6	0,0	tidak	0	0,815
and	*Konjungtiva* Merah (Mata Merah)	0,6	0,0	tidak	0	0,815
Then	Demam Dengue					
Hasil Akhir (CFoldterakhir* 100%)						81,5%

In testing using the backward chaining method, there are several symptoms that occur and the suspected disease that is experienced is headache, whole body pain (myalgia), nausea, there are dengue sufferers within a radius of 200 meters from your location, and Dengue Fever, Dengue Hemorrhagic Fever. , the results of the test revealed Dengue Fever with a percentage (33%), Dengue Hemorrhagic Fever with a percentage (29%).

In testing using the Certainty Factor method is a continuation of the previous method where all the symptoms of the disease that has the highest diagnosis will be displayed, then the user enters the confidence value of each of the existing symptoms, the results of the test issue a certainty value from the diagnosis of dengue fever with a percentage (81.5%). The following is the output of the program shown in Figure 7 and Figure 8.

Figure 7 Consultation Results Backward Chaining

Figure 8 Consultation Results Certainty Factor

5.3 Test Analysis

This test analysis aims to measure the suitability level of the system by manual calculation testing that has been done.

5.3.1 Backward Chainig

Analysis of the backward chaining test results, there are several symptoms that occur and the suspected disease that is experienced, namely headaches, body pain (myalgia), nausea, there are dengue patients within a radius of 200 meters from your location, and Dengue Fever, Dengue Hemorrhagic Fever, the rule rule 1, rule 2, the results of the test issued Dengue Fever with a percentage (33%), Dengue Hemorrhagic Fever with a percentage (29%), with a level of conformity, namely.

Table 3 Test Analysis Backward Chainin

Pengujian	Input Gejala & Penyakit	Diagnosa Rule	Diagnosa *Backward*	Kesesuaian
1	Gejala : - Sakit kepala - Nyeri seluruh badan (mialgia) - Mual - Terdapat penderita DBD dalam radius 200 meter dari lokasi anda Penyakit : - Demam Dengue - Demam Berdarah Dengue	Rule 1 Rule 2	- Penyakit Demam Dengue (P01) dengan persentase 33% - Penyakit Demam Berdarah Dengue (P02) dengan persentase 29%	Sesuai Sesuai

5.3.2 Certainty Factor

Based on Table 2 and Figure 8, it is found that the system output and manual calculations have the same result, namely 81.5%, so it can be concluded that the suitability value of the test is appropriate.

6. CONCLUSION AND SUGGESTION

6.1 Conclusion

From the results of the research in the previous chapters on the Expert System for Diagnosis of Dengue Fever By using the Backward Chaining Method and Certainty Factor, several conclusions can be drawn as follows:

[1] Based on the system testing that has been carried out, it shows results in accordance with manual calculations.
[2] The implementation of the backward chaining method can help the user to get facts about the symptoms of the disease based on the inputted symptoms and suspected diseases, and the use of the Certainty Factor method can support and strengthen the diagnostic results of the previous method.
[3] From the tests carried out on the user, it is found that the dengue diagnosis system can be applied and accepted by the user / patient with an average value of the Easy Use Testing result of 97%.

6.2 Suggestion

With the completion of this final project, it is hoped that it can be further developed with the following development suggestions:

[1] It is recommended to develop this system more broadly for disease coverage. Given that there are also diseases that often appear together with dengue fever and have similar symptoms.
[2] Need to be assessed by an expert if adding a diagnosis of disease and symptoms. It needs to be updated regularly by experts so that the application is always updated about the latest diseases and symptoms.

7. REFERENCE

[1]. Arhami, Muhammad. (2005), Konsep Dasar Sistem Pakar, Yogyakarta: ANDI.
[2]. Dr Yekti Mumpuni, widayati Lestari. (2015). Cekal (Cegah dan tangkal sampai tuntas) Demam Berdarah. Yogyakarta: Rapha Publiser.
[3]. Giarratano, J., and Riley, G. (1994). Expert System Principles and Programming, PWS Publishing Company, Boston.
[4]. Hasibuan, Nelly Astuti. Sunandar, Hery. Alas, Senanti. dan Suginam.(2017), Sistem Pakar Mendiagnosa Penyakit Kaki Gajah Menggunakan Metode Certainty Factor, Jurnal Riset Sistem Informasi Dan Teknik Informatika (JURASIK), Volume 2 No. 1.
[5]. Joseph Giarratano, dan Gary Riley (2004). Expert Systems: Principles and Programming, Fourth Edition.
[6]. Kusumadewi, Sri. (2003). Artificial Intelegence (Teknik dan Aplikasinya), Yogyakarta: Graha Ilmu.
[7]. Lestari D. (2012). "Definisi sistem pakar". Arsip Teknik Informatika UMMI.
[8]. Mujilahwati, Siti. (2014), Diagnosa Penyakit Tanaman Hias Menggunakan Metode Certainty Factor Berbasis Web, Jurnal Teknik A, Vol. 6. No. 2.
[9]. Mukhtar, Nurmala. dan Samsudin. (2014), Sistem Pakar Diagnosa Dampak Penggunaan Softlens Menggunakan Metode Backward Chaining, Jurnal Buana Informatika, Volume 6, Nomor 1.
[10]. Mulyani, Evi Dewi Sri. Uryani, Neneng Sri. dan Putri, Fia Vauziah. (2017), Aplikasi Pakar Diagnosa Anak Berkebutuhan Khusus Dengan Metode Backward Chaining (Study Kasus : TK Plus As-Salam Kec. Kawalu KotaTasikmalaya), Techno.COM, Vol. 16, No. 3.
[11]. Oetomo, Budi Sutedjo Dharma. (2006). Perencanaan dan Pembangunan Sistem Informasi, Yogyakarta.
[12]. S. Suparman. (1991), Mengenal Artificial Intelligence, Yogyakarta: Andi Offset.
[13]. Santoso. Julianti, M. Ramaddan. dan Winarto, Abdul Haris. (2018), Sistem Pakar Penyakit Padi Menggunakan Metode Certainty Factor Di Desa Giling, Pati Jawa Tengah, JURNAL SISFOTEK GLOBAL, Vol. 8 No. 2.
[14]. Saputra, Angga Sulchan. Jati, Bayu Kuncoro. Utomo, dan Sumdoro Fajar. (2016), Aplikasi Analisa Masalah Mesin Motor Bebek Menggunakan Metode Backward Chaining, Seminar Nasional Teknologi Informasi dan Multimedia.
[15]. Setiawan, Sandi. 1993. Artificial Intelligence. Yogyakarta: Andi Offset.
[16]. Sibagariang, Swono. (2015), Sistem Pakar Diagnosa Penyakit Sapi Dengan Metode Certainty Factor Berbasis Android, Jurnal TIMES, Vol. IV No 2.
[17]. Sidik, Betha. (2012), Pemrograman Web dengan PHP, Informatika, Bandung.
[18]. Soedarto. 2012. Demam Berdarah Dengue Dengue Haemoohagic fever. Jakarta: Sagung Seto.

[19]. Sutojo,T.S.Si.,M.Kom,MulyantoEdy ,S.Si.,M.Kom dan Dr.Suhartono Vincent. (2011), Kecerdasan Buatan . Andi Yogyakarta:Unidus.

[20]. Tarigan, Feriani A. (2014), Sistem Pakar Untuk Mendiagnosa Penyakit Ginjal dengan Metode Backward Chaining, Jurnal TIMES, Vol III No 2.

[21]. Turban, E, 1995, Decision Support System and Expert System. Prentice Hall

[22]. Turnip, Mardi. (2015), Sistem Pakar Diagnosa Penyakit THT Menggunakan Metode Backward Chaining, Riau Journal Of Computer Science, Vol.1/No.1.

[23]. Turban, E, 1995, Decision Support System and Expert System. Prentice Hall

[24]. Wulandari, Fitri. dan Yuliandri, Ihsan. (2014), Diagnosa Gangguan Gizi Menggunakan Metode Certainty Factor, Jurnal Sains, Teknologi dan Industri, Vol. 11, No. 2.