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Design and Develop of Expert System to Diagnose Common Diseases Based Initial Assessment, Physical and Laboratory Checkup

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Abstract: Common diseases in Belu district such as diarrhea, TBC (tuberculosis), HIV-AIDS, malaria, anemia, hypertension, upper respiratory tract infection, acute pneumonia, acute bronchitis, dyspepsia, appendix and urinary tract infections are the types of the disease is most commonly found in Atambua's people. The number of medical personnel who handle the number of patients is not comparable because the medical staff in this area is still very little. Therefore the current expert system is needed to help medical personnel and doctors in diagnosing common diseases based on initial assessment, physical and laboratory checkup. The method used is a forward chaining method to get the output of the results of pre assessment based on the symptoms entered. Each symptom is entered will be supported also by using the certainty factor in order to provide confidence in the value of each symptom with a range of values from 0 to 1. Initial assessment needs to be supported by physical and laboratory checkup in order to obtain the output of the diagnosis of illnesses suffered by patients.

Keywords: initial assessement, physical and laboratory checkup, common diseases, certainty factor, Atambua- East Nusa Tenggara

I. INTRODUCTION

The health sector is one area using computer technology. With the development of information technology that so fast, it can be used to provide solutions to problems in the health sector that still manual. One use of information technology is help in diagnose diseases by based on initial assessment, physical and laboratory checkup.

Based on data from inpatient care and outpatient care at the General Hospital Atambua in 2012, the most common diseases suffered by the patient are the category of in disease, surgery and child health that reaches each number 5.190 of 8.067 inpatients and 5.739 of 12.694 outpatients. The diseases of category above namely: diarrhea, TBC (tuberculosis), HIV-AIDS, malaria, anemia, hypertension, upper respiratory tract infection, acute pneumonia, bronchitis acute dyspepsia, appendix and urinary tract infection.

In addition, there are other issues that the number of medical personnel in Belu district is lacking. Based on the number of health workers in Belu district in 2013 was 16 common doctors, 3 specialist, 2 dentist and 154 other health personnel namely: nurses, midwifes, anesthesia staff and dental nurses. So that the current expert system is needed to help medical personnel in diagnosing common diseases to make patients service be faster.

Expert system is part of artificial intelligence which try to adopt a system of human knowledge into a computer so that the computer can resolve the issue as was done by experts. With the expert system, the user can interact with the computer to solve a particular problem. This is because the system can provide the expert knowledge base [1].

An expert system would require valid information from the user to be able to show both the correct result. It is inevitable that there will be found the answers of the user who does not have the full assurance that the results of diagnose less than the maximum. Data uncertainty can be caused due to the incompleteness of the data or information errors [2]. To solving the issue of data uncertainty is then used methods certainty factor (CF) and using forward chaining method to show the possibility of initial assessment of the disease symptoms entered. The initial assessment needs to be supported by physical and laboratory checkup in order to obtain the output of the diagnose of illnesses suffered by patients.

II. LITERATURE REVIEW

Currently, the human need for better medical care is urgent. This means that support modern instrumentation and medical informatics become indispensable including methods to analysis to produce a more optimal diagnosis so that an expert system can be one of the appropriate solution [3]. Expert systems can be applied to diagnose diseases based on knowledge of symptoms or complaints that patients feel. Application of expert system for diagnosing common diseases at the General Hospital Atambua made with web-based applications, so that can be accessed by the public at large. The use of the internet database, effectively storing the facts and data in large quantities to perform inference. Also through the internet also obtained feedback from the user so that the evaluation of the expert system becomes easier [4]. Internet particularly the world wide web (www) has become a platform that is present everywhere in the dissemination of data, information, knowledge and expertise. The rapid growth of the web, the evolution of appropriate technology and the way people tend to rely on web-based services, resulted in web be a project that challenges and multidimensional [5]. Some studies related to web-based expert system that has been successfully developed [6-9].

III. ANALYSIS AND DESIGN

A. Architecture of Expert System:

Common Diseases Expert System is a software developed to help diagnose diseases based on knowledge of symptoms or complaints that patients perceived online on General Hospital Atambua, Belu, East Nusa Tenggara. The system also handles the management of data associated with data management of disease, symptoms, causes and solutions. In addition the system also handles display rule base, managing the relationship between disease symptoms, disease-causing and disease-solutions. Users of this system are the expert and the medical.

This expert system created using programming languages Hypertext Pre-Processor (PHP). For managers of Database Management System (DBMS) used Relational DBMS MySQL.Users will interact with the system through a GUI (Graphical User Interface). In this system, the architecture of the software used in the form of client-server, where all data is stored on the server. Users can access data on the server is online with calling a web service on the web site are available on the web server.

Input data entered will be stored in the database server, so if there is a data search, the desired data will be sought to the database server which then is sent to the requesting client via the web server. For more details can be seen in Figure 1.

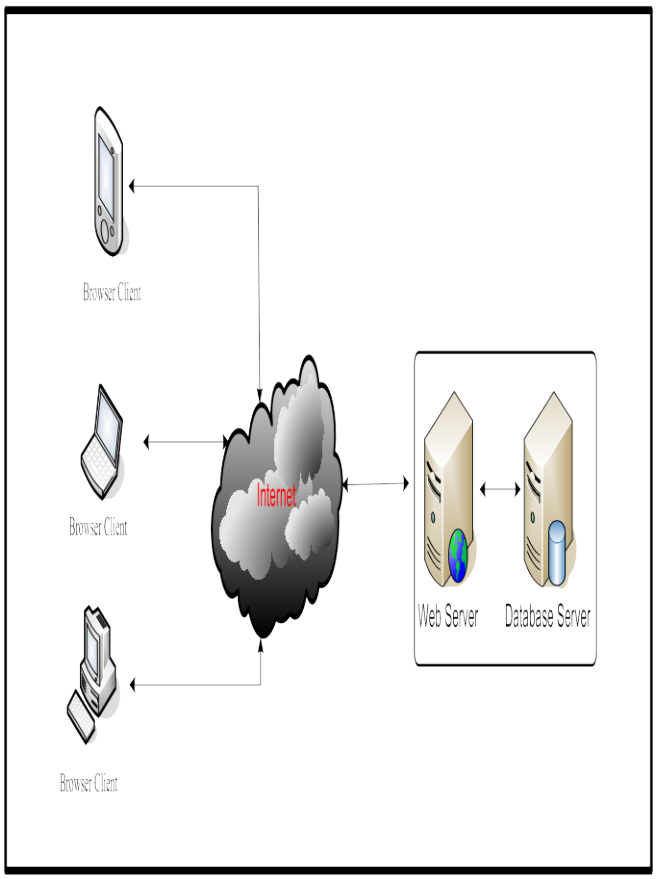

Figure: 1 Common Diseases Expert System Architecture.

B. Software Functionality Requirements:

Use case description of the system developed can be seen in Figure 2

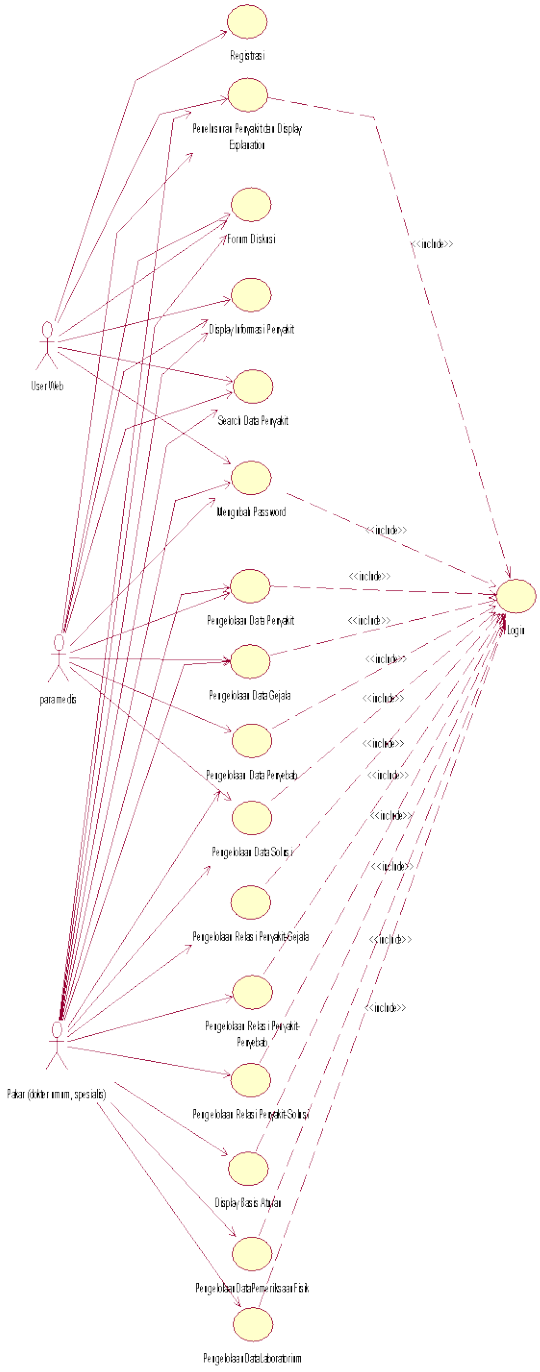

Figure: 2 Use Case Diagram.

C. Expert System Components:

Users interact with the system through a user interface. After that it will be continued in the inference engine with the task of determining the exact solution of a number of solutions available. Inference engine will match a number of facts in the database and the number of rules in the knowledge base (rule base) and then perform inference or reasoning for the conclusion. Then from the inference engine will be heading to the explanation section for explanation of data retrieved and displayed to the user via the user interface.

D. Uncertainty With Certainty Factor (CF):

Certainty factor describing the level of confidence in the problems being faced. The value given in the range between zero (very unsure) to one (very confident). CF equation used in this study is a multiple premise rule (the rule that has a lot of the premise) for Disjunctive Rule (OR):
IF E1 OR E2 OR ... THEN H CF (RULE)
CF(H,E1 OR E2 OR..)=Max{CF (Ei)} * CF(RULE) (1)

IV. SYSTEM IMPLEMENTATION

In Figure 3 displays common symptoms to be selected by the user. Users also have to input the value of confidence in selected symptoms. The system will ask the user to continue or not. If users choose to continue, the system will return the data show symptoms of the disease as in Figure 3. If the user choose not to continue the inquiry, the system will display the results of the diagnosis as Figure 4. The concept of forward chaining in this system lies in the use of some of the symptoms that selected by the user to get a trace of possible types of advanced disease. The results are refined by using the certainty factor that although symptoms are not fulfilled all the input, but the system can display the proper diagnosis.

The diagnosis of a web-based expert system with forward chaining inference method will be able to show the possibility of diseases with information such as the name of the disease, the symptoms of the disease are suitable for, the definition of the disease, the disease causes and solutions. Figure 5 displays an explanation (explanation) and the calculation of confidence factor based on symptoms and the degree of confidence that the previous user input.

The expert system also provide menu to save and display physical and laboratory checkup of patients. The display of physical and laboratory ckeckup can be seen at figure 6 and 7.

Figure: 3 Display of common disease symptoms.

Figure: 4 Results of Disease Diagnosis.

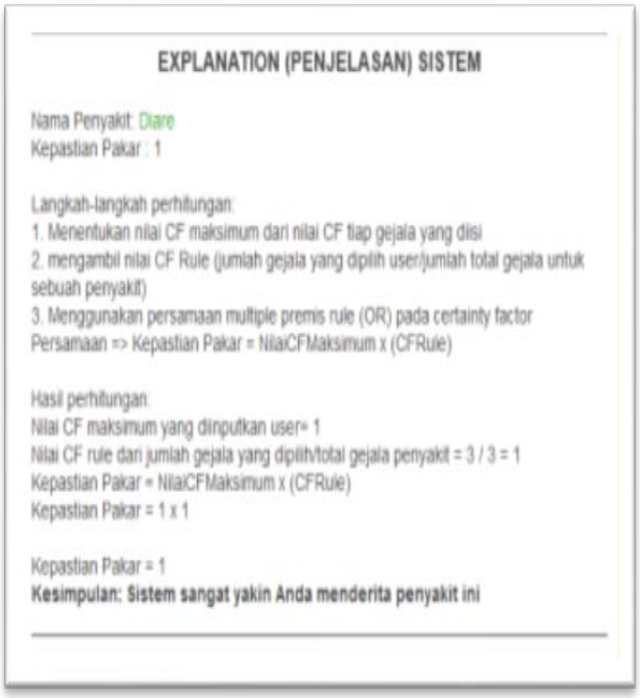

Figure: 5 Display explanation of certainty expert.

A. Example of Analysis Result Diagnosis:

The results of analysis of the sample disease diarrhea chosen by the user is: fever, nausea and vomiting, decreased appetite. Each symptom given each value of confidence. The system will find the type of disease that has symptoms similar to the symptoms selected in accordance with the rules in the knowledge base. Then the system will calculate the number of symptoms which are met by the selected symptoms in the knowledge base and find the number of symptoms that must be met. Eventually the system will calculate the degree of confidence of the result disease diagnosis and then displays to the user via the user interface as shown in Figure 4 and 5. In short it can be shown in the form of Table 1.

Table I. The results of disease diagnosis

Disease name	Number of symptoms that must be met (x)	Number of symptoms that met (y)	CF Rule Value
Diarrhea	3	3	3/3 = 1

Note: CF Rule Value=x/y

B. Analysis of Confidence Degree for Disease (Explanation):

Based on the diseases analysis above, can be translated calculation of confidence factor that is part of a system called explanation. Confidence factor values of each selected symptoms can be seen in Table 2.

Table II. Degree of confidence for symptoms

No	*Symptoms selected*	*Confidence factor of user for symptoms*
1	Fever	1
2	Nausea, vomiting	0.9
3	Decreased appetite	1

a. Calculation results:

The CF maximum value of user input: Max (1, 0.9, 1) = 1

The CF rule value of the number of symptoms selected / total of symptoms=3/3=1.

Experts Certainty = The CF maximum value x (The CF rule value)

Experts certainty=1 x 1=1

The conclusion id system sure that the user suffers diarrhea.

The expert system also provide menu to save and display physical and laboratory checkup of patients as shown in Figure 6 and 7.

Figure: 6 Display physics checkup.

Figure: 7 Display laboratory checkup.

V. CONCLUSION

Common disease diagnosis expert system using forward chaining and certainty factor method successfully designed and developed. The system is able to diagnose common disease by user enter input perceived symptoms with the degree of confidence in symptoms that range from 0 to 1. Based on input from the user, the system will display the results of expert diagnosis, along with the value of certainty and displaying information related to a disease, disease symptoms and solutions. In addition the system is also able to provide an explanation to the patient regarding the diagnosis is delivered to the user. To get better appropriate diagnose result, the expert system also provide menu to save and display physics and laboratory ckeckup of patients.

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