Haemotology Expert System Using Rule Based Mechanism

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***Abstract*- Expert systems are popular knowledge based systems developed using the techniques of 'Artificial Intelligence'. They exhibit the behavior of human expert in a specified field, which involves the problem solving and decision making procedures. Here both the knowledge and the logics are collected from the experience of a specialist in that area. Hematology refers to human blood & its disorders. The present paper deals with the design and development of 'Expert System on Haemotology Using Rule Based Mechanism'. The knowledge base consists of information, collected from doctors (domain experts), about human blood and its disorders. This system mainly contains two modules 'Information system for Haemotology' and 'Expert system for Haemotology'. The Haemotology information system helps the people to know about the information about the different aspects of Haemotology. The Haemotology Advisory system helps the patients to get the required advices about the different diseases attacked to them due to their blood disorders. They submit the symptoms, they observe, in the form of queries. The system is developed using Java Server Pages (JSP) as front-end and MYSQL database as Back-end in such a way that all the activities are carried out in a use friendly manner.**

Keywords: Expert System – Haemotology-Blood and its Disorders-Rule Based Mechanism-Backward Chaining-JSP – Rule Based –MYSQL

1. INTRODUCTION

1.1 Artificial Intelligence:

Artificial Intelligence [1, 2] is defined as the branch of computer science that is concerned with the automation of intelligent behavior. AI is a broad topic including several fields from machine vision to expert systems. The element that the fields of AI have in common is the creation of machines that can "think". Their potential ability for exploiting meaningful relationship with in a data set can be used in the diagnosis, treatment and predicting outcome in many clinical scenarios. Research in Artificial Intelligence and Expert Systems [3] is simply the transfer of intelligence to a machine. High level advanced computer languages, as well as computer interfaces and word-processors owe their existence in a big way to the research into artificial intelligence. The theory and insights brought by AI researchers [4],[5].[6][14] will set a new trend in future computing and prove that it will be in the pioneering end of Computer Science. This paper introduces a novel integrated approach taking the advantages of current technological trends in World Wide Web, rule based expert systems [7], [11], [12],[13] JSP, MYSQL, object oriented paradigm and medical haemotology. The approach adopted here is a client server architecture where the client is a simple PC with graphical user interface and server is JSP & MYSQL data base application. In recent years, number of web portals, providing the online information and advices in agriculture, medicine and other areas [8], [9], are appearing in the internet.

1.2 Expert System:

Expert knowledge is often scarce and valuable. Expert systems [3] are computer programs that capture some of the knowledge from knowledge base and allow its dissemination to others. It is a problem solving and decision making system based on knowledge of its task and logical rules or procedures for using knowledge. Both the knowledge and the logic is obtained from the experience of a specialist in the area.

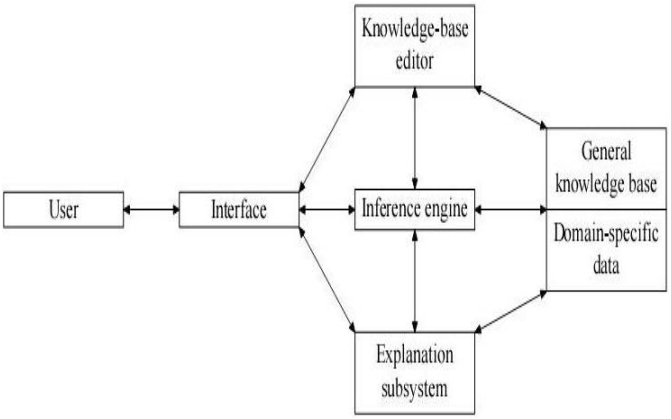

Fig1.1: Knowledge acquisition process of an expert system

The basic components of the Expert System are:

i). Expert:

Experts are hematologists and researchers in the field of Haemotology. Expert supply knowledge, both in the form of factual information and in relation to analytical methods they use to solve problems.

ii). Knowledge Engineer:

The role of the Knowledge engineer is to collect expert advice from several experts and to convert them into rules and facts. The Knowledge Engineer is responsible for updating the changes made by the experts according to their research findings.

The Knowledge Engineer has to perform the following tasks:

1) Select Expert
2) Extract Knowledge Base
3) Develop the Knowledge Base
4) Plan the Expert System

iii). Knowledge Base:

Knowledge Base consists of facts and rules as text files. User may be hematologists, patients and rural people.

iv). User Interface:

The user interface is exchanging information between the user and the inference engine. It involves graphical user controls such as buttons, labels, and list boxes etc. This makes the system user friendly.

v). Inference Engine:

The inference engine design for the expert advisory system uses backward chaining strategy. The main objective of the inference engine is inferring the data from the knowledge base by using different rules of symbolic logic like modus ponens, resolution methods and interacts with the problem-solving unit.

1.3. About Haemotology Expert System:

Haemotology is a branch of internal medicine and dealing with the study of the growth and diseases of the children. This Haemotology Expert System mainly deals with identifying common diseases, common symptoms appear to people and commonly used drugs for haemotology related diseases. It contains two modules namely 'Haemotology Information System' and 'Haemotology Expert System' provide access to the rural people in their villages through internet. Haemotology information system contains static pages in html providing information about different Common Diseases, Common Symptoms, Investigations, Drugs, Services and Preventive Measures collected from the domain experts in Haemotology. Haemotology Expert System contains Haemotology Knowledge Base and provides JSP based dynamic pages. These web pages contain simulated expert advice on the subject, to the end users when they interact with the expert system online and submit answers to queries asked by the system.

2. PROBLEM ANALYSIS

2.1 Domain Analysis for H E S:

The domain is. The motivation for the development of 'Haemotology Expert System' is to develop a new system which can give the entire information about the diseases, symptoms, preventions, self help and definitions etc… in the field of Haemotology.

2.2 Proposed System

The functionality behind the 'Haemotology Expert System' is answering to the questions asked by the user and experts using a data base connectivity between user and the expert system. The proposed system is divided into two parts: Static Part and Dynamic part. In Static part, the user can get all the static information about the different common diseases, common symptoms, preventions to be taken, and some frequently asked questions (FAQ's) about different diseases in Haemotology. In Dynamic part, the user is having an online interaction with the expert system, the user has to answer the questions asked by the Expert System in Self –Help option in the menu. Depends on the response by the user the expert system decides the disease and displays the disease and control of disease.

2.3 Functional Requirements:

i). Inputs: The system needs the information about the symptoms from the user to produce the output.

ii). Outputs: The outputs of the system will be:

1) Information about the diseases

2) Small description about the disease

3) Prevention measures

iii). Store: The information collected through experts is stored as a database (Knowledge Base) that serves as a repository for quick processing and future retrieval. The system stores the information in the following html files: About Haemotology, Structure and Function, Common Symptoms, Common Diseases, Investigations and Preventions. The System Stores the information related to expert design in knowledge base in the following ways.

iv). Rules: A set of rules, which constitute the program, stored in a rule memory of production memory and on an inference engine required to execute the rules.

v). Dataset: The monitoring data is in the MySQL database. It can be used as any other data stored in a database. This greatly increases the opportunity with which you can conduct post-analysis of the monitoring data**.**

3. SYSTEM DESIGN

3.1 Haemotology System Architecture

Here first the patients are asked to provide the information about symptoms they observe through Questionnaire, then the expert system process these symptoms with the help of rule based backward chaining mechanism and diagnose the probable disease. Then the system will present the precautions to that disease.

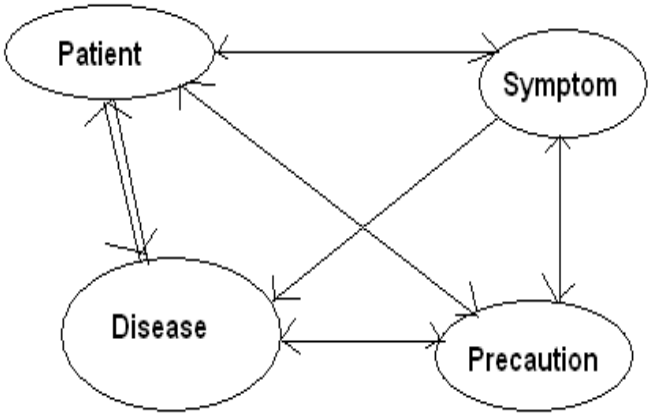

Fig.3.1: Haemotology System Architecture

3.2. Rule-Based Expert System using Backward Chaining Mechanism:

The tasks or steps to be followed for developing better backward-chaining systems are as follows.

Step 1: Defining the Problem Precisely

A precise problem is defined by looking or finding information about the problem by looking into reports, documents, books and conducting the interviews and brain storming sessions with specialists in haemotology.

Step 2: Defining the Goals

The second step is to define the goals for the system. Every backward-chaining system needs at least one goal to get started. Defining the goals help us to start from the right track

and end on the expected track and avoids from being mislead from the real problem. And also by defining the goals in making the backward-chaining system, it is possible to dedicate our time and focus on the part that greatly needs consideration.

Step 3: Designing the Goal Rules

The third step is designing the Goal Rules: for each goal in our system must have at least one rule or goal rule that can conclude it. Goal rules are designed in the same way as any other type of rule i.e. by looking for necessary preconditions to satisfy the rule's conclusions. The general form of the rules is: IF precondition1 AND precondition2 THEN protfolio1. With the goal portfolio1 is attained but undergo first the two preconditions. The goal rules also have decision table to make and help the decision making with this rules and testing for goal rules are also made.

Step 4: Expanding the System

The fourth step is expanding the system: At this point the system already has set of goals and rules. It is totally functioning but not very intelligent. There are two most common ways to expand the knowledge of the system and these expansion techniques are - broadening or deepening the systems knowledge which teaches the system about additional issues and the other one is giving a deeper understanding about the problem which concerns the system more about the issues it already know about.

Step 5: Refining the System

The fifth step is refining the system: Hear at this point, the system is fully functional for the needs of the initial objectives. However several additional features are also added to the system that will enhance both its performance and maintenance.

Step 6: Design the Interface

The sixth step is designing the interface: This step is also very important because the users view the expert system through the system's interface. To a large extent, the acceptance of the system will depend on how well this interface accommodates the needs of the user. And also if the interface is not easy and not pleasing as expected then the user may not be willing to choose even though the expert system is very good.

Step 7: System Evaluation

The final step is system evaluation: At this point the prototype system is complete. All of the rules are coded in the system and the interface is designed according to the recommendations given on the previous sections. So now it is ready for the evaluation of the system, and this is done by making some questions to the expert and tests the system with sample inputs and sees if the system is really running properly by consulting the haemotology expert. By following the steps mentioned above, the Haemotology expert system finds the appropriate disease affected and displays the user with final disease affected with proper cure to that particular disease.

4. RESULTS

Fig 4.1: Screen shot of Information System

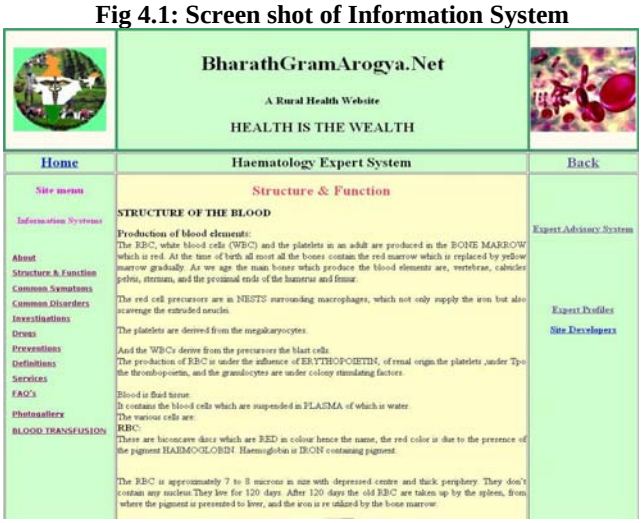

Fig 4.2: Screen shot of Information System

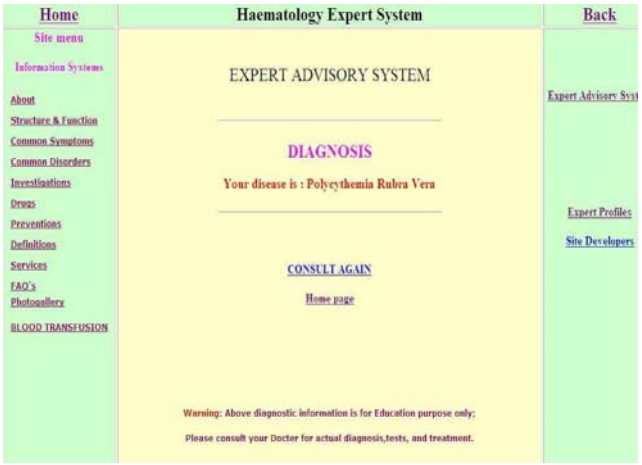

Fig.4. 3: Screen shot of Expert System

Fig 4.4: Screen shot of Disease Display

5. CONCLUSION & FUTURE WORK

The work in this paper has revealed and emphasized the effectiveness and importance of expert system as a decision support tool for the patients and diagnosis services. The data analysis reveals that some disorders, which have not been identified and treated by doctors, can also be managed by expert systems. It is also very clear that there is difference in the advice quality and consistency given by the expert system almost near to the human experts. In Future there is a proposal that implementing this expert system in all rural & regional languages for better understanding of the users.

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