

**IMPLEMENTATION OF AN EXPERT SYSTEM FOR LUNG DISEASE
DIAGNOSIS**Lamesgin. A ^{#1} and Dr.M.Mohamed Sirajudeen ^{#2}^{#1} Post Graduate Student, Department of Information Technology, CNCS, University of Gondar^{#2} Lecturer, Department of Information Technology, University of Gondar

ABSTRACT : Artificial intelligence is a branch of computer science that deals with intelligent machines and software. It mainly concerns with deep study and development phases of intelligent machines. Some authors also define Artificial Intelligence as “The study and design of intelligent agents, where intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success”. An expert system is also called knowledge based system. It is a computer program that contains some of the subject specific knowledge of one or more human experts. The main components of expert system are knowledge base and inference engine. Knowledge base contains the domain knowledge needed to solve the problems in the form of rules. The rules are a popular paradigm for representing knowledge. Inference engine is the code at the core of the system which derives conclusions from knowledge base through inference or reasoning. The major features of expert system are user interface, data representation, inference, explanations, coping with uncertainty and advantages of expert system are fast response, increased reliability, reduced cost, reducing errors, multiple expertise, intelligent database, reduced danger. In this paper, focus on the implementation of an expert system for Lung Disease Diagnosis.

Key words: Lung, Artificial Intelligence, Expert system and Diagnosis.

I. INTRODUCTION

Artificial intelligence systems are used in economics, medicines and military. These systems also have many software applications like video games, computer chess etc. The goals of artificial intelligence research are reasoning, knowledge, planning, learning, communication, perception and ability to manipulate objects.

Expert System is one of the most common applications of artificial intelligence. It is a set of programs that manipulate knowledge to solve problems in a specialized domain that requires human expertise. An expert system represents information and searches for patterns in that information. They are known as expert systems because they model how a human expert analyzes a particular situation by applying rules to the facts (or compares the current case with similar cases) in order to reach a conclusion [4]. There are many applications of expert systems such as diagnosis, design, planning, financial decision making etc. Most applications of expert systems in medicine involve predicting, diagnosing and treating a particular disease [3].

A large number of expert systems are medical. The main aim of any medical expert system is diagnosis and treatment of diseases. A medical expert system is built up of programs and medical knowledge base. The information obtained from medical expert system is similar to the information given by doctor or expert in that particular area [1]. Medical Knowledge of specialized doctor is vital for the growth of medical expert system. This knowledge is composed in two phases. In the first phase, the medical conditions of diseases are recorded during the formation of personal meeting with doctors and patients. In the second phase, a deposit of rules is formed where each rule contains IF part that has the symptoms and THEN part that has the disease that should be realized [4, cited on 12].

Lungs are among the most important organs of the body, since they are vital for the process of breathing and respiration. Here, it is important to define and distinguish between breathing and respiration. Compact Oxford Dictionary defines respiration as: “(Biology) a process in living organisms involving the production of energy, typically with the intake of oxygen and the release of carbon dioxide from the oxidation of complex organic substances.”

The definition of breathing, as given by Compact Oxford dictionary is: “air taken into or expelled from the lungs.” Lung diseases basically hinder with the proper functioning of the mechanism of breathing. They might cause the person to become breathless in cases when the lungs get obstructed by mucus or other obstructive material and the person has to exert extra force in order to breathe. In some cases, the alveoli (air sacs) in the lungs get collapsed causing the patient to wheeze. Patients who need to be treated by medical experts for the disease related to lung need to be physically present on the medical center and contact the doctor, and checked by physicians.

But there are few numbers of specialist and medical centers along the globe, especially in developing country, Ethiopia. It is better to develop an intermediary tool that avoid/ trace the gap between shortage of experts and large number of patients who need expertise advise and treatment, beside wide spread establishment of medical center in the country. Here, Medical expert system that can treat lung disease of patients. Based on symptoms of different types of disease of lung can be treated by this expert system.

II. RELATED WORK

The main objective of this phase was to identify, characterize, and define the problems the system will be expected to solve. The main problems identified include: Shortage of specialist obstetricians; the other medical staff in the Division needed expert knowledge and guidance, from the specialist obstetricians, on diagnosis and treatment of Lung patients. The users needed a system that could: Automate the medical protocols for diagnosis and treatment of lung patients; Offer training facility on the diagnosis and treatment for lung patients.

The following system hardware, software, and human (end user) skills requirements are recommended so as to get the fastest, most reliable and upgradeable computer system that can diagnose lung patients efficiently and reliably[3][4]. This was categorized as: Hardware requirements (a computer); Software requirements (Operating and application); what is expected of the user to have in order to use the system (such as medical skills and knowledge and basic computer skills).

The system architecture diagram enables us to model the applications of a system graphically. It shows the interaction of users and system response, including the system development, development of knowledge question [2][5].

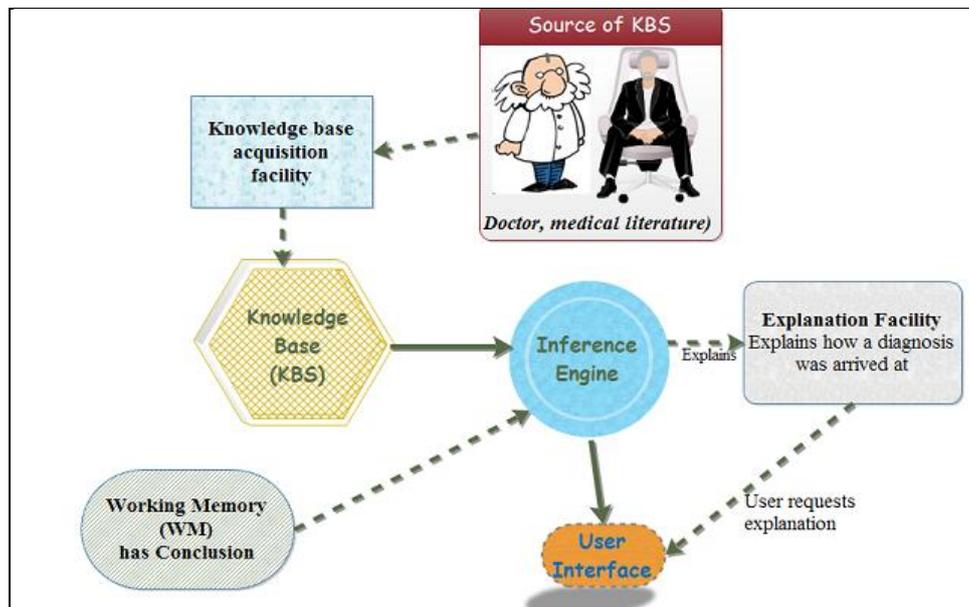


Figure 1.1 System Architecture

III. PROPOSED SYSTEM

The proposed rule based expert system has the following components- contains information about thirty-two lung diseases which are represented as a set of if-then production rules. It is analogue to the long term human memory. The total ordering of production rules is done in the knowledge base. In order to easily understand let us see an examples:

I. Tuberculosis is a lung disease whose persistent cough, constant fatigue, weight loss, loss of appetite, fever, coughing up blood, night sweats. So it will be stored in knowledge base in the form of a rule which is as follow:-

Disease (Patient, tuberculosis):- Symptom (Patient, persistant_cough), Symptom (Patient, constant_fatigue), Symptom (Patient, weight_loss), Symptom (Patient, loss_of_appetite), Symptom (Patient, fever), Symptom (Patient, coughing_up_blood), Symptom (Patient, night_sweats).

II. Pneumonia is a disease whose symptoms are cough, fever, shaking chills, shortness of breath. So it will be stored in knowledge base as follow:-

Disease (Patient, pneumonia):-Symptom (Patient, cough), Symptom (Patient, fever), Symptom (Patient, shaking_chills), Symptom (Patient, shortness_of_breath).

III. Byssinosis is a disease whose symptoms are chest tightness, cough, wheezing. So it will be stored in knowledge base as follow:-

Disease (Patient, byssinosis):- Symptom (Patient, chest_tightness), Symptom (Patient, cough), Symptom (Patient, wheezing)

The **working memory** has conclusions reached before they are displayed to the user. The Fact Base contains facts which are used to match against the antecedent part of rules stored in the knowledge base. The fact base is analogue to the short term human memory.

The Inference Engine as for the inference Engine, the user provides information about the problem to be solved and the system then attempts to provide insights derived (or inferred) from the knowledge base by examining the facts in the knowledge base.

The system uses the forward chaining inference method (the process of starting with the facts and working forward to the conclusions [2, cited on 10]).

The main task of Inference Engine is to carry out the reasoning by linking the rules with facts and deducing new facts. The **User Interface** is used to communicate between user and expert system. It runs on a Windows platform, running Visual Prolog, Swipl-w64-723 prolog.

The Explanation facility allows a user to understand how the expert system arrived at certain results . This module enables the user to ask the expert system how a particular conclusion is reached and why a specific fact is needed.

The Developer Interface is used to modify the knowledge.

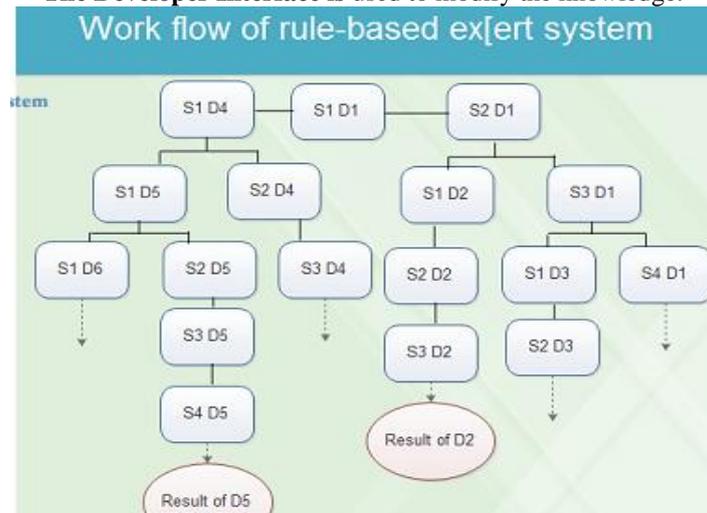


Figure 1.2 Workflow for rule based system

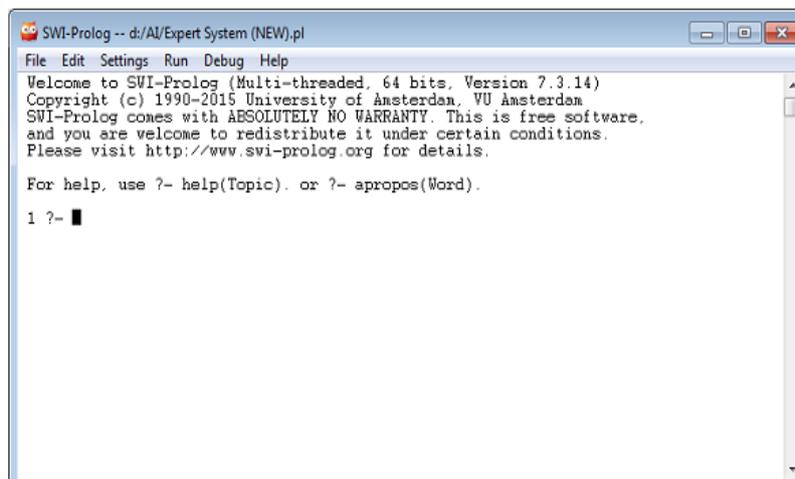


Figure 1.3 Initial Interface

IV. CONCLUSION

This project designed and implemented on the basis of medical expert system, Artificial intelligence. It diagnoses diseases related to lung. The project implemented (knowledge acquired) by visual prolog, SWI-Prolog (Multi-threaded, 64 bits, Version 7.3.14). As a recommendation, it is better to review further literatures related to disease of different type, and expert system (Medical Expert System), and incorporate their symptom in the knowledge acquisition and make it more general. And it is advisable and my recommendation to integrate the system with more user friendly front-end applications, like Java or C#.

References

- [1]. Jimmy Singla, "The Diagnosis of Some Lung Diseases in a Prolog Expert System", North West Institute of Engg. & Tech. Dhudike.
- [2]. J. Gudu, "Development of a Medical Expert System as an Expert Knowledge Sharing Tool on Diagnosis and Treatment of Hypertension in Pregnancy", International Journal of Bioscience, Biochemistry and Bioinformatics, Vol. 2, No. 5, September 2012.
- [3]. R.A. Soltan1, "Diagnosis of Some Diseases in Medicine via computerized Experts System", International Journal of Computer Science & Information Technology (IJCSIT) Vol 5, No 5, October 2013 DOI : 10.5121/ijcsit.2013.5505 79.
- [4]. Jimmy Singla, "Medical Expert Systems for Diagnosis of Various Diseases", International Journal of Computer Applications (0975 – 8887) Volume 93 – No.7, May 2014.
- [5]. Atif Imran Toor, "Decision Support System for Lung Diseases (DSS)", Department of Computer Science and Electronic, Malardalen University, Sweden (MDH).