**AN EXPERT SYSTEM FOR SEXUALLY TRANSMITTED DISEASE DIAGNOSIS AND TREATMENT.**

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**ABSTRACT**

Over 93 million people get ill with sexually transmitted diseases in sub-Saharan Africa. However, research has shown that people with sexually transmitted diseases, find it difficult to access a physician for diagnosis on time, due to large number of people accessing medical facilities at the same time, resulting from limited human experts in Africa and Nigeria in specific. Due to this problem, I have implemented a medical expert system for diagnosis and treatment of sexually transmitted diseases that efficiently diagnose individuals. The patients diagnose themselves by answering questions provided by the system. This paper presents the design and development of the system. Forward chaining rules were used to implement the knowledge base and the system is easily accessible through the internet (web).

**CHAPTER ONE**

**INTRODUCTION**

* 1. **BACKGROUND OF THE STUDY**

The quality of service delivery all around the world is continuously improved by the use of computer-based applications. These applications are mostly built based on artificial intelligence which is the area of computer science that focuses on the creation of machines that can perform functions considered as intelligent by humans. These functions performed by the machines are highly sensitive and require knowledge in the domain where these machines are designed to act as if originally, they are in control of situations. That is, the system is build to mimic human thoughts and understand human behavior via expert system technology.

An expert system is a computer application that performs a task that would otherwise be performed by a human expert; such tasks include diagnosing human illnesses and several others. Most expert systems are designed to take human place while others are designed to aid humans.

**1.2 PROBLEM STATEMENT**

The continuous increase in human population without a corresponding increase in medical facilities, bias, inconsistency, retirement or even death of human experts, has brought about difficulties in delivering health care services. This has made it necessary that I design an expert system which can assist in health care delivery, in the diagnosis of sexually transmitted diseases (STDs).

**1.3 SIGNIFICANCE OF THE STUDY**

The relevance of this study cannot be overemphasized as the numerous difficulties faced in the medical area of Sexually Transmitted Diseases (STDs), are so obvious that patients find it challenging and time consuming to access medical practitioners for diagnosis. This has made life unbearable for patients suffering from these diseases (STDs) thereby, resulting to further health complications. An expert system for diagnosing STDs is therefore a system with enormous level of significance that cannot be undermined; this system will be of great benefit to not just the patients or individuals, but to the medical practitioners as well as the medical institutions. The obvious challenges faced by the government, health sector and individuals are enough to suggest that the relevance of this system are not limited to but include the following;

**Professionalism:** This system will contain valid and well researched algorithm that will aid in decision making, this decision support system will be written on the basis of manually collected data and enhanced through well designed syntax to take decisions that are seen to be from facts already programmed, by this the system tends to be very professional and reliable. The system is also not prone to mistakes and can be easily updated.

**Reduced time consumption:** One of the major advantages of an expert system is speed; the designed system will reduce time consumption of record handling and enhance efficiency as the workload will be reduced to the minimum level.

**Proper data collection:** The expert system will use a secured database management system to safely store information that can be collected and made reference to when required.

**Confidentiality:** The system will handle the issue of the fear of result; people believe that with the already existing manual system, their results pass through hands they should not. With the computerized system, anonymity and patient’s confidentiality will be maintained.

**1.4 OBJECTIVE OF THE STUDY**

The general aim of this study is to design a knowledge based expert system with medical efficiency for STD diagnosis, whereby individuals or patients access this system at convenience for STD diagnosis. In specifics, the objectives are:

* To provide stress-free access to patients for diagnosis at ease
* To reduce time consumed before a patient access an expert for diagnosis
* To improve consistency in health care services
* To improve efficiency and privacy in medical diagnosis

**1.5 SCOPE OF THE STUDY**

The study covers the design of a knowledge based system in the medical domain of STD diagnosis, the knowledge based system handles symptomatic fields of relatedness where patients are diagnosed through a stepwise procedure using the following;

1. **Sign in or Login:** A patient or an individual logs-in if he/she already has an account to gain access for diagnosis. Whereas, sign in to register an account if he/she is new to the system in order to be diagnosed.
2. **Diagnosis:** First, a patient or an individual sees a displayed number of symptoms telling different reactions possibly felt. These symptoms are displayed with images explaining each symptom likely to be experienced by a patient, for easy identification and understanding. The patient will have to tick or select the symptoms he/she is experiencing and submit, before the system can run diagnosis.
3. **Result:** The system computes the selected symptoms through series of calculated algorithms. This process takes place in the knowledge domain of the expert system, where after a minimum of six symptoms can the system term a disease.
4. **Treatment:** The system then suggests drug prescription to the patient for further treatment and control of the disease.

**1.6 CONCLUSION**

**CHAPTER TWO**

**LITERATURE REVIEW**

**2.0 HISTORY OF ARTICIAL INTELLIGENCE**

To however get a detailed understanding about expert systems, a brief history of Artificial Intelligence is unavoidable necessary. The quest for Artificial Intelligence is as modern as the frontiers of computer science and as old as antiquity. The concept of thinking machine began as early as 2500BC, when the Egyptians looked to talking statues for mystical advice (Haack, 2004). Artificial Intelligence as both a term and a science was coined 120 years later, after the operational digital computer had made debut. In 1956, Allen Newell, J.C Shaw and Herbert Simon introduced the first Artificial Intelligence program, the Logic Theorist to find the basic equations of logic as defined in principia mathematica by Bertrand Russell and Alfred North Whitehead. For one of the equations, the Logic Theorist surpassed its inventor’s expectations by finding a new and better proof. Suddenly a true thinking machine that knew more than its programmers evolved and lead to the development of another system called the General Problem Solver (G.P.S). They were developed to imitate human problem solving protocols regardless of the information contained in the domain, however, as time progressed they were said to be weak a method as they covered weak information about their domain of study which led to weak performance in problem solving involving complex domains (Nilsson, 2009).

The foundation of Artificial Intelligence covers several disciplines including but not restricted to philosophy, mathematics, psychology, computer engineering and linguistics. The connectionist paradigm evolved from a model proposed on artificial neurons that mimics the structure of human brain, the model was proposed in 1943 by McColloh and pitts. The rise of Artificial Intelligence continued as Feigenbaum and others at Stanford began the heuristic programming project (HPP) to investigate other problem domains that could benefit from the expert system technology. By this the next major effort was in the area of medical diagnosis, MYCIN was developed by Bruce Buchanan and Dr Edward Shortliffe to diagnose bacterial infection in the blood using about 450 rules. MYCIN is the most widely known expert system in the era of the growth of Artificial Intelligence because of the two reasons below as coined from (Feigenbaum and Buchanan, 1993).

1. Its design was based on interviews with several doctors that specialized in particular domains; hence, it contains a number of heuristic rules used in identifying certain infections by physicians.
2. It lead to the later development of EMYCIN (Empty MYCIN) which was the first expert/knowledge-based system shell, the development time of EMYCIN was considerably reduced as compared to MYCIN, the researchers developed EMYCIN by taking all the rules out of the system and leaving just an empty shell in which other developers in the domains can just plug in their knowledge base.

From the dark ages also known as the birth of Artificial Intelligence, expert systems have been providing pre-selected rules for decision making within specialized domains of knowledge but are limited by the fixed choice and by the date of the expert opinion embodied in the decision rules. Expert systems have been found to have profound impacts which include reducing time of task from days to hours, minutes and seconds. The benefits of expert system since this time include but are however not limited to improved customer satisfaction, improved quality of products and services, accurate and consistent decision making. They operate in hazardous environments where humans could be exposed to various risks; expert systems have featured and make things easier in various fields such as agriculture, education, manufacturing industries, banking, medicine, and do on. In medicine, diagnosis of patients’ complicated conditions, clinical laboratory identification of bacterial infections diseases and recommendations of treatments, surgery, emergencies, drugs and toxicology and dentistry are some of the domains for expert system development. Expert systems emulate the decision making ability of human experts, they are designed to solve complex problems by reasoning about knowledge like an expert, and not by following the procedure of a developer as in the case in conventional programming (Meech, 2006).

**2.1 INTELLIGENT SYSTEM EVOLUTION**

As the attributes of personal computing hardware (speed, memory, storage capacity, and resolution) have doubled since the 1980s, our society has reached a point where no serious performance limitations exist for “intelligent methods” and the computational complexities are now embedded within or subsumed beneath the Human-Machine Interface. As a result, these approaches can be applied to study and solve extremely complex and intricate problems beyond the ability of the human mind to handle in a time frame appropriate for process control. Process control has traditionally tried to maintain a system at a set-point for as much time as possible in response to upsets or disturbances in load variables. Nowadays, the set-points themselves have become disturbances with updates occurring at increasing frequencies as communications and measurements cycles have sped up to bandwidths previously unimaginable (Meech, 2006).

The definition of intelligent systems is a difficult problem and is subject to a great deal of debate. From the perspective of computation, the intelligence of a system can be characterized by its flexibility, adaptability, memory, learning, temporal dynamics, reasoning, and the ability to manage uncertain and imprecise information.

Expert systems technology was originally invented in the Artificial Intelligence laboratories in an attempt to apply the state-space search, knowledge representation, and inference techniques developed in early research to some “real-world problems.” The hope of the inventors was to demonstrate, especially to those always-fickle funding agencies that Artificial Intelligence was possible and practical and that thinking about thinking machines was scientifically sound. They succeeded beyond their wildest dreams. Expert systems have evolved as a highly marketable offshoot of research in the subfield of computer science called artificial intelligence (Artificial Intelligence). Since its unofficial inception at the Dartmouth Summer Research Project on Artificial Intelligence in 1956 (attended by well known personalities such as Marvin Minsky, Allen Newell, Herbert Simon, Claude Shannon and John McCarthy), Artificial Intelligence has had as one of its primary goals the creation of ‘thinking machines.’ While this ambitious goal has not yet been attained to anyone’s acknowledgement, there have been substantial advances in what we now know about human thinking and learning. Along the way, research in Artificial Intelligence from late 1970s at Stanford, MIT and Carnegie-Mellon Universities provided some very powerful techniques for codifying human experience and knowledge so that computers can store it and apply it to solve practical problems. The mid-1970s saw the emergence of the first expert systems for applications (Avron and Feigenbaum, 1981).

According to Barr and Feigenbaum (1981), the mid-1970s saw the emergence of the first expert systems for applications such as medical diagnosis (Mycin by Shortliffe), chemical data analysis (Dendral by Lindsay and others), and mineral exploration (Prospector, by Duda and others). Furthermore, Turing is seen to have made a significant and characteristic provocative debate in artificial intelligence. Turing (1950) in his Turing test defined intelligent behavior as the ability of human level performance in all cognitive tasks. The issue of acting humans springs up when intelligent systems interact with people. For example, an expert system explaining how it came to a diagnosis or a natural language processing system has a dialogue with a user. He later concluded that, for any complex decision to be made, or problem to be solved, experts in specific areas have particular knowledge, specific alternatives, the chances of success, and also the benefits or costs that may be inquired. Based on these earlier concepts, intelligent systems were developed and have since been very useful to supervisors and managers with situational assessment and long time planning.

**2.2 EXPERT SYSTEM**

Expert systems are computer programs that can perform some tasks which typically require the capabilities of a skilled human. These tasks are usually of a decision-making nature rather than physical actions. Examples of such tasks are managing water levels in a wetland, forecasting weather conditions, assessing environmental impacts, and selecting mitigation measures for environmental hazards. As computer programs that contain human expertise, they are referred to variously by the labels expert systems, knowledge-based systems, inference systems or rule-based systems (Abraham, 2005).

In the late 1960’s to early 1970’s, expert systems began to emerge as a branch of Artificial Intelligence. The intellectual roots of expert systems can be found in the ambitions of Artificial Intelligence to develop “thinking computers”. Domain specific knowledge was used as a basis for the development of the first intelligent systems in various domains. Feigenbaum (1981) published the best single reference for all the early systems. In the 1980’s expert systems emerged from the laboratories and developed commercial applications due to the powerful new software for expert systems development as well as the new possibilities of hardware. Feigenbaum (1982) defined an expert system as an “an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution”. Differences from conventional programs include facts such as: An expert system simulates human reasoning about a problem domain as the main focus is the expert’s problem solving abilities and how to perform relevant tasks, as the expert does. An expert system performs reasoning over representations of human knowledge in addition to doing numerical calculations or data retrieval using the knowledge base and the inference engine separately. An expert system solves problems using heuristic knowledge rather than precisely formulated relationships in forms that reflect more accurately the nature of most human knowledge dealing with symbolic values and procedures.

Shu-Hsien (2004) said that Expert system (ES) is a branch of applied artificial intelligence community in the mid 1960’s. The basic idea behind expert system is simply that expertise, which is the vast body of task-specific knowledge, is transferred from a human to a computer. This knowledge is then stored in the computer and users call upon the computer for specific advice as needed. The computer can make inferences and arrive at a specific conclusion. Then like a human consultant, it gives advice and explains, if necessary, the logic behind the advice. Turban and Aronson (2001) provided powerful and flexible means for obtaining solutions to a variety of problems that often cannot be dealt with by other more traditional and orthodox methods. Thus, their use is proliferating too many sectors of our social and technological life, however, their applications categories are; rule-based systems, knowledge-based systems, neural networks, fuzzy expert system, object oriented methodology, case-based reasoning (CBR), system architecture development, intelligent agent (Artificial Intelligence) systems, modeling, ontology, and database methodology together with their applications for different research and problem domains. The goal of expert systems research is to program into a computer the knowledge and experience of an expert. Expert systems are used in medicine, business management, mining natural resources and much more. An alternative way to present them is functionally, i.e., according to the types of problems that they address. The non-exclusive categories that seem to capture most applications are classification, prediction, interpretation, planning, monitoring and control, and analysis. The categorical approach is advantageous because the user then acquires an appreciation of the broad applicability of expert system methodology without becoming distracted by details that are specific to particular applications (David and Clark, 1989; The surveys in Hushon, 1987, Moninger and Dyer, 1988).

The areas explained below are some of the fields where expert systems are used, according to Alexander and Fairbridge (1999). These fields of applying expert system technologies are however not limited to just the under listed fields as the growth in technology advances day-by-day.

**Classification problems** are the most common type of application. This is due to the impact of our inherent human need to classify objects and events as being members of particular groupings. A salient characteristic of classification problems is that there is a finite (usually small) and enumerable list of possible groups; this make these problems relatively easy to solve. Hence, all problems that fall into a particular solutions group are treated similarly with respect to action. Diagnosis is a very common application problem, where systems are diagnosed in terms of the causes of malfunction. These include biological systems (e.g., trees, crops or fish populations), hydrological and chemical systems (e.g., lakes and streams), mechanical systems (e.g., waste treatment) or physical systems (e.g., hailstorm severity). The cause may be a pathogen, a malfunctioning pump, a parasite, a climate change, and so on. Other non-diagnostic classification systems only seek to place an object or event into a particular category without labeling that category as malfunctional; for example, identification of type of atmospheric inversion, classification of soils, selection of options in insecticides, or identification of species. Another large class of expert systems applications includes those that deal with **prediction**, these estimate some important future characteristic of an environmental system based on current details about it. Some examples of prediction problems are forecasting for weather and other environmental phenomena, qualitative modeling of biological or physical systems (e.g., vegetation change, crop production and wildlife populations), and damage estimation (e.g., following toxic contamination, for insect epidemics or for flooding). When these expert systems select their predictions from a small set of possible future conditions, they can also be categorized as classification expert systems. It should be apparent that there is some overlap between classification and prediction problems. In fact, all these categories are non-exclusive, and hence overlaps exist between most of them. In fact, many systems can be categorized in multiple ways.

**Interpretation** problems are similar to prediction problems except that the characteristic to be estimated is a current one, rather than a future one. Because this characteristic condenses and summarizes the information about an environmental system, it usually carries with it some important management implications. Ways in which expert systems have been applied include hazard and risk ratings (e.g., fire danger ratings, and contamination or toxicity potential estimation), environmental assessment (e.g., impacts of human intervention, cost estimation, and report evaluation or generation), and data interpretation (e.g., model interpretation, site selection or ranking, species selection and equipment selection), and management actions (e.g., fire suppression, and crop production and treatment prescriptions).

Solutions to the above three categories of problems most often consist of a single action or parameter estimate. *Planning* type problems, on the other hand, are resolved by specifying an ordered set of actions to be performed. Because a large number of possible action sequence are possible, planning problems tend to be much more difficult to solve and are more computationally costly. Examples of reported applications in this area are catastrophe mitigation (e.g., hazardous site cleanup, and fire suppression), forest and agriculture production (planning, treatment and harvest), construction (e.g., roads or airport runways), and scheduling and resource planning (e.g., for regional water quality, landscape and land use). Expert systems provide a viable approach to solving planning problems because these problems usually have a fairly well defined goal that is constrained by certain of their attributes. Moreover, they are non-quantitative in nature and require a systematic search through a large number of possible solutions.

In contrast to the off-line decision making that is the problems described above; there are situations in which decisions are made as part of real-time operations, *Monitoring and control problems* are of this type. In many of these instances monitoring and control activities are intertwined in the sense that a process is monitored by an expert system that also takes action when some condition signals its attention. At other times, an expert system only performs monitoring, and a human being performs the control action. Examples of monitoring and control applications are very few in the environmental sciences, and this category is only mentioned here for the sake of completeness.

**2.3 EXPERT SYTEM COMPONENTS**

Most expert systems consist of several distinct components. These are knowledge base, working memory, reasoning engine, explanation subsystem and a user interface. The *knowledge base* contains the scientific knowledge and experience for the particular area of expertise. Imagine that we are designing an expert system to diagnose automobile engine malfunctions. We might want to include knowledge about spark plugs, fuel pump, battery, starter, fuel injectors, etc., and also how these engine components affect engine operation. A component mechanic can usually pinpoint engine problems fairly quickly with only a small amount of information about the functioning of the various parts. Often a specialist, such as a mechanic, possesses intuition that he or she has acquired through years of experience. This intuition is often ratified in rules-of-thumb (or good guesses) that allow the specialist to solve problems quickly and effectively. For this type of expert knowledge to be used by a computer it must be represented in some way that the computer can easily manipulate. There are numerous techniques for *knowledge representation*, but traditionally the most common one is the use of condition-action rules, the expert system operates either in consultation mode or knowledge acquisition mode. The various system components enable it to solve problems for which it has knowledge in the knowledge base, to interact with users, and to explain the rationale for the solutions it reaches. This is further explained in figure 2.1 by Luger and Stubblefield (1989), as a comprehensive review of the techniques of the functions of expert system components (Alexander and Fairbridge, 1999). Condition-action rules are IF-THEN statements where the consequent action(s) are performed if the premise conditions are true. For example, IF battery charged AND battery-cables = clean AND engine-starting = not cranking THEN check starter. This method of knowledge representation is popular because each rule is modular and contains a ‘chunk of domain knowledge, expert system programmers find rules easy to program, and experts are often able to express their heuristic knowledge in the IF-THEN format. *Working memory* is like the short-term memory of the expert system. It contains assertions about the problem currently under investigation. These assertions may be obtained from the user (via queries), from external programs, from a real time process, or from external data files. Assertions may be facts gathered from the above sources, or they may be hypotheses which have been inferred from other facts that are already known. Because the ultimate goal of knowledge system consultation is to infer problem solutions, some of these intermediate hypotheses will eventually be solutions. All facts and hypotheses in the working memory together described the current context, or the current state, of a consultation session. Usually a closed world assumption is assumed, i.e., only those assertions that are present in the working memory are true and all other possible assertions about the state of the world are assumed false. While the knowledge base and working memory are passive entities, the *reasoning engine* navigates through the knowledge base and registers established assertions in the working memory. A reasoning engine operating on a knowledge base and working memory is how an expert system solves problems. Navigation is performed by the particular control strategy that the reasoning engine employs. A control strategy determines the order in which knowledge base elements (such as rules) are examined in order to arrive at the solution to a problem. Assertions are established as true by the particular inference mechanism used. In a rule-based knowledge representation, the inference method is usually used and rules are selected for evaluation either by the content of their premise conditions (data-driven control) or by their consequent actions (goal-driven control). Details of how the reasoning engine operates are determined by the knowledge representation method used, what types of assertions must be made, and the overall problem-solving methods that are applied. The purpose of an explanation subsystem is to enable the expert system to display to users an understandable account of the motivation for all of its actions and conclusions. Explanation is part of the larger issue of human factors engineering, which also includes the user interface –i.e., the how’s and why’s of a computer system’s interaction with users. Explanation systems are not involved with the correct execution of an expert system. Instead, their purpose is to convince the user that the system’s conclusions are reasonable, to explain how it reached those conclusions, and to aid system developers in debugging the knowledge base and the reasoning methods (Alexander and Fairbridge, 1999).

The term user interface refers to the physical and sensory interaction between computer and user. Functionally, this means how the user inputs information to the system and how information is returned to the user. The more natural (i.e., intuitive and understandable) this interface is, the more effective the human computer interaction will be. Traditionally, this interaction has been serial and text based using the conventional, interactive terminal format. Recent advances in computer interfaces enable expert systems to utilize display graphics, hot graphics (graphical objects that perform some action when activated), and point-and-click operations, video, sound and animations. For most software users, the interface is the application, and hence expert systems may fall into disuse if they lack good user-interface capabilities, figure 2.1 shows the basic components of an expert system.

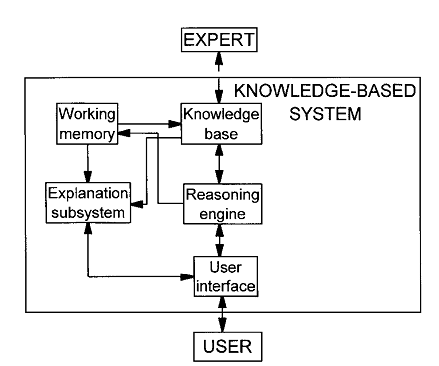


Fig 2.1: Basic components of an expert system Source: Kock, E. D. (2003)

The major components of expert systems that have to be understood are;

**Knowledge engineer:** This refers to the engineer who encodes the expertise in a declarative format of the knowledge base.

**Domain expert:** This refers to the individual or set of individuals who are currently experts, solving the problems in a more manual way which the system is designed to solve.

**System user:** These are individuals who will be consulting with the system to get advice which have already been encoded by the experts.

**System engineer:** The individual, who builds the user interface, designs the declarative formats of the knowledge base and implements the inference engine.

Depending on the size of the system to be designed, the knowledge engineer and the system engineer might be the same person. For a custom built system, the design of the format of the knowledge base and the coding of the domain knowledge are closely related. The format has a significant effect on the coding of the knowledge. The development of an expert systems may enable a major acceleration in several areas of human endeavors, for instance computer programs have important advantages over books as medium for the recording of knowledge, in that they can be updated rapidly and are necessarily more precise and unambiguous. The availability of the expertise of a leading practitioner in a field in a fully precise and directly testable form may well enable other to find improved ways of teaching the underlying skills. A refined form of the knowledge might again be stored in the form of an expert system a valuable benefit of designing an expert system, which has been little exploited so far, is the possibility that it may be directly used as an aid for training or educating or other services. Although the pace of development in the expert system field in recent years is extremely impressive, it is hard to escape the feeling that we are still only scratching the surface of a major new technology with potentials which are yet barely appreciated.

Figure 2.2 shows by Unified Modeling Language (UML), how an expert system interacts with its component

User

Domain

Expert

User Interface

Expertise System

Engineer

Inference

Engine

Knowledge

Engineer

Knowledge

Base

Working

Storage

Encoded

Expertise

Fig 2.2 expert system components and human interface (Source: www.myreaders.info/html/artificial\_intelligence.html)

For a perfect expert system design, all users are put into consideration and their major functions and activities are linked to them, also, those having relatedness are also linked perfectly to each other as demonstrated in the diagram above.

**2.4 EXPERT SYSTEM IN MEDICAL DIAGNOSIS**

Expert systems for medical diagnosis are interactive computer programs, designed to assist health professionals with decision making tasks. The clinicians interact with the system using both the clinician knowledge and the system to make a better analysis of the patient’s data than either humans or software could make on their own. Intelligent systems, particularly expert systems for diagnosis and treatment, have been developed for use in a range of medical contexts:

**MYCIN:** It was the first well known medical expert system developed by Shortliffe at Stanford University (Buchanan and Shortliffe, 1984) used for diagnosis and remedy of bacterial infections. It uses backward chaining inference procedure. It helps doctors, not expert in antimicrobial drugs to prescribe such drugs for blood infections. The limitation of MYCIN is that its knowledge base is incomplete since, it does not cover anything like the full spectrum of infectious diseases. Running it would have required more computing power than most hospitals could afford at that time (1976). Doctors do not relish typing at the terminal and require a much better user interface than that provided.

**PREFIX:** It is a medical expert system that supports solving problems clinicians currently have in evaluating perfusion studies (Ezquerra *et al*., 1992). The heart of the PREFIX system is the knowledge base, containing over 250 rules. They were formulated using the expertise of clinicians and researchers at Emory University Hospital. PREFIX limitation resides in its output. It is mostly numerical.

**INTERNIST-I:** It is a rule-based expert system designed at the University of Pittsburgh in 1974 (Kumar *et al*., 2009) for the diagnosis of complex problems in general internal medicine.

**ONCOCIN:** It is a rule-based medical expert system for oncology protocol management (Wiederhold *et al*., 2001) developed at Stanford University. ONCOCIN was designed to assist physicians with the treatment of cancer patients receiving chemotherapy.

**Dxplain:** It is a decision support system which uses a set of clinical findings (signs, symptoms, laboratory data) to produce a ranked list of diagnosis which might explain (or be associated with) the clinical manifestations (Elhanan *et al*., 1996). The Dxplain provides justification for why each of these diseases might be considered, suggests what further clinical information would be useful to collect for each disease and lists what clinical manifestations, if any, would be unusual or typical for each of the specific diseases.

**PUFF:** It is an expert system for the interpretation of pulmonary function tests for patients with lung disease (Shortliffe *et al*., 1984). PUFF was probably the first Artificial Intelligence system to have been used in clinical practice.

**2.5 MEDICAL DIAGNOSIS SYSTEM**

Medical diagnosis, simply termed often as diagnosis refers both to the process of attempting to determine or identify a possible disorder or disease. The history of medical diagnosis began in earnest in ancient Egypt and the day of Hippocrates (The father medicine) in ancient Greece. In Traditional Chinese Medicine , there are four diagnostic methods namely inspection, auscultation-olfaction (to study sounds arising within organs such as the heart, lung, and stomach prior to treatment), interrogation and palpation (a method of clinical examination using gentle pressure of the fingers to detect growths, change in the size of underlying organs, and unusual tissue reaction to pressure) (Berger, 1999).

Esagil-kin-apli (1069-1046 BC) introduced the use of empiricism, logic and rationality in the diagnosis of an illness or disease, the book made use of logical rules in combining observed symptoms on the body of a patient with its diagnosis and prognosis. There are a number of methods and techniques that can be used in diagnostic procedure including differential diagnosis or following medical algorithms (Berger, 1999).

**Differential Diagnosis:** The method of differential diagnosis is based on finding as many candidate diseases or conditions as possible that can possibly cause the signs and symptoms, followed by a process of elimination or at least rendering the entries more or less probable by further medical test.

**Pattern recognition:** In a pattern recognition method the provider uses experience to recognize a pattern of clinical characteristics. It is mainly based on certain symptoms or signs associated with certain diseases or conditions, not necessarily involving the more cognitive processing involved in a differential diagnosis.

**DIANOSTIC CRITERIA**

The term diagnostic criteria designate the specific combinations of signs, symptoms and test results that the clinician uses to attempt to determine the correct diagnosis (www.patient .co.uk/health/diagnostic\_criteria).

**2.6 STD**

STD stands for Sexually Transmitted Disease.

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