Design of Sore-Throat Medical Diagnosis System

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Abstract:- **Diseases should be treated well and on time. If they are not treated on time, they can lead to many health problems which may result in loss of life. These problems are becoming worse due to the scarcity of specialists, practitioners, health facilities and lack of convenience means to health facilities. In an effort to address such problems, studies made attempts to design and develop expert systems which can provide advice for physicians and patients to facilitate the diagnosis and recommend treatment of patients. This study presents the design of a medical diagnosis system for patient to diagnose some of the most common diseases that plague human, the diseases that causes sore throat.**

The study provides a brief overview of medical diagnosis systems, analysis of already existing studies and presents the proposed system for diagnosing diseases that causes sore throat. The system will be a desktop app developed using the Java programming language and the use of a database to store records in.

The methodology adopted for this system is the Verification and Validation model because it allows for testing at the various stages of development. The focus of the system is on the diseases that causes sore throat and it will be manned by an admin who will be an expert in the area of sore throat causing diseases in order for the information provided to be accurate and reliable.

In conclusion, the system developed assist patient to diagnose symptoms in order to obtain the actual diseases causing the symptoms and then provide remedies for the diseases

Keywords: Sore-throat, medical diagnosis system, diseases, symptoms.

1.0 INTRODUCTION

Health is essential for everyone and people are now very much aware of this fact. This knowledge has led to an increase in the need for health information and changes in the information seeking behavior. According to recent studies, 81% of U.S. adults use the Internet and 59% of them have used the internet to search for health information regarding diseases, diagnoses and their treatments [1].

Unfortunately, not everyone suffering from some diseases or illness has access to medical experts due to various circumstances and the increase in health awareness by the people has resulted in doctors being in high demand increasing the doctor patient ratio thereby increasing the workload on doctors. This increase in health awareness has also lead to an increase in the self-diagnosis tools such as websites, application and the likes. Also the doctor's consultation fee is increasing which burdens patients with low income [2]. Advances in the field of medicine as well as areas of IT has brought about telemedicine which is a way of providing health information at a distance and at low cost making it easier for financially disadvantaged people to have access to medical information as well as helping to reduce the workload on medical experts. This is possible in the form of a diagnosis system to help user diagnose and treat common diseases and illness as this study intends. These systems collect and deliver knowledge that cannot be easily represented using traditional form of computing. The main advantage of these system is that they can be used to disseminate expertise knowledge immediately, around the clock, anywhere in the world and by lots of people at the same time. It also provides accurate information on recorded disorders thereby solving the issue of information overload. The systems also help to make early diagnosis possible and this is relevant because a more accurate diagnosis is possible when a full history can be gotten early in the disease process, while the person can still answer questions and recall how and when the symptoms first appeared. Early diagnosis of a disorder allows individuals with the disorder take advantage of early-stage support groups and learn tips and strategies to better manage the disorder.

The medical diagnosis system for the diagnosis of common sore throat diseases is a desktop application that efficiently diagnose symptoms, determine the cause and recommend appropriate remedies and prevention methods. The system will allow users input their symptoms and

present the users with the probable disorder that exhibits the symptoms. It then provides the users with therapies for treating the disorder as well as prevention methods.

The increase in health consciousness of people has led to people visiting hospitals for medical checkup and diagnosis of even the negligible symptoms. However, not everyone can access health care facilities at their convenience and hence most people turn to self-diagnosis tools such as the internet for help. The problem with the internet however is the issue of information overload. On the internet there can be too much of irrelevant information mixed with the relevant ones which requires the user to sort through which can be time wasting and the user might still not get the relevant information for the disorder [1]. Advances in the field of medicine, particularly in the field of computer aided methods has led to the design of expert systems to assist in medical diagnosis. However, most expert systems have been designed solely to serve as an assistant to medical experts during the process of diagnosis and very few have been designed to aid users in self - diagnosing diseases and illness, as many denizens who lack convenient access to proper traditional medical care mostly take to the internet to search for information on symptoms experienced. However, this approach is time consuming and is hindered by the excess of irrelevant and at times misleading information on the internet. Advent of medical diagnosis systems and developments in telecommunication, has now made it possible to access precise medical information at very low cost and this is beneficial to disadvantaged people having little or no access to medical care. This study proposes a system for the diagnosis and treatment of common diseases that causes sore throat.

The objectives of this study is to design a diagnosis and recommendation system to help users diagnose and recommend treatment for common diseases that causes sore throat by providing accurate information provided by experts to users, thereby, solving the problem of distance to healthcare centers, lack of access to healthcare centers, to provide accurate information to the patients thereby, solving the problem of information overload or misinformation and to solve the problem of long queues and time wastage experienced in hospitals

The research project is targeted towards people living far from hospitals or healthcare centers, thereby finding it difficult to visit the hospitals and people who lack access to the proper medical channels. The proposed system is applicable only to circumstances that are medically related in terms of diagnosis and treatment of common sore throat diseases

The purpose of this study is to develop a medical diagnosis system that helps user with diagnosing sore throat and other associated symptoms and giving the resultant disease. The system will also recommend remedies for the treatment of these diseases and provide methods or techniques for preventing a reoccurrence.

2.0 LITERARATURE REVIEW

Starting with the evolution of medical diagnosis and recommender systems and their utilization in the health sector. Several studies have been carried out on medical diagnosis in the health sector over the last decades and their utilization by medical experts for support during diagnosis. However, few studies have been carried out on medical diagnosis system for utilization by patients rather than medical experts and as a means of total self-diagnosis rather than as support for diagnosis.

Medical Diagnosis

In medicine, diagnosis refers to both the process of attempting to determine or identify a possible disease or disorder to the opinion reached by this process. It refers to the process of identifying the condition, disease or problem that explain a person's symptoms through thorough systematic analysis of the background of the symptoms, evaluation of the research or test results, and investigation of the probable causes. Diagnosis is done by analyzing the information gotten from the history or examination of the person seeking medical care. Diagnosis is often challenging because many signs and symptoms are not specific, therefore diagnosis where several possible explanations are compared and contrasted must be performed and this procedure is known as differential diagnosis. Differential diagnosis involves finding as many disease or condition as possible that can possibly cause the signs or symptoms experienced by an individual and the eliminating the diseases by further medical test until only one disease or condition remains probable. It involves the correlation of various pieces of information followed by pattern recognition and differentiation until a final result is reached.

Medical Diagnosis Systems

Medical diagnosis systems are expert systems that arose as a result of the advances in the computer-based methods for improving the qualities of diagnosis. People in remote areas are mostly deprived of the facilities of having experts to diagnose disease, so there is the need to store the expertise of specialists in computers through the use of expert systems technology. These expert systems are computer programs that simulate the chain of reasoning of an expert in a specific domain, or clarify uncertainties where normally one or more human experts would be consulted [3]. The medical diagnosis expert systems are developed for the diagnosis of diseases and are of two types;

- Rule based expert systems
- Knowledge based expert systems

The rule-based expert systems are systems that store and manipulate knowledge to interpret information in a useful way. They include both conventional techniques such as database management systems (DBMSs), and artificial intelligence (AI) techniques such as knowledge-based systems or expert systems. These types of systems are usually domain-specific and uses rules to make decisions. The knowledge-based system on the other hand is a system that uses a knowledge base to solve problems and represent knowledge explicitly.

The proposed research study uses a combination of the rule-based system techniques and knowledge-based system techniques to develop a system for performing diagnosis based on user symptoms and the study uses a database for storing, retrieving and generally manipulating records. For the study, human expertise is stored is stored in the system in suitable form for users to easily access when needed. The system can then make inferences based on the stored knowledge with the user input and then arrive at a specific conclusion.

Common Diseases That Causes Sore Throat

Sore throat is a pain, irritation or scratchiness of the throat that causes difficulty in swallowing. It is one of the most common reason many patients visit primary healthcare physician. Sore throats are caused by viruses that causes common cold and flu such as coronavirus and respiratory syncytial virus and bacterial such as group A. streptococcus which causes strep throat There are different diseases that causes sore throat as one of their symptoms and such diseases can be confusing for people with no medical knowledge. The study proposes the design of a diagnosis system for the diagnosis and treatment of common diseases that causes sore throat for use by the patients or would-be patients.

The common sore throat causing diseases that the system aims to diagnose include strep throat, pharyngitis and common cold.

Strep Throat, Causes, symptoms and treatment

A strep throat is a bacterial infection that causes inflammation and pain in the throat. It is a common condition caused by group A Streptococcus bacterial and it affects children and adults of all ages [4]. However, it is mostly common in children between the ages of 5 and 15. Common and frequents symptoms of strep throat include sore throat especially when swallowing, sudden fever (101F or higher), chills, headache, fatigue, loss of appetite, swollen lymph nodes in the neck, small read or purple spots on the roof of the throat, redness around the back of the throat and white patches at the back of the throat [5]. Several other less frequent symptoms of strep throat might also be experienced and these rare symptoms include nausea or vomiting, rash on the neck and chest, muscle ache, abdominal pain, stiff joints and painful lymph nodes. Strep throat can be spread through sneezing and coughing. There are some home remedies for patients with strep throat which help relieve their discomfort temporarily such as gargling with salt water which however cannot cure the disease. The treatment of strep throat is done through the use of antibiotics which inhibits the spread of the bacterial and infection. Antibiotics such as penicillin and amoxicillin are the common over the counter medications for a strep throat infection. The treatment is done until the infection is gone completely to avoid a relapse and if done properly, the symptoms should improve within a week [4].

Pharyngitis, Causes, Symptoms and Treatment

Pharyngitis is a sore throat caused by inflammation of the back throat which is called pharynx. This inflammation can be caused by bacteria such as Group A streptococcus, bordetella pertussis which causes whooping cough and diphtheria. It can also be caused by viruses such as adenovirus which is one of the causes of common cold [6]. Pharyngitis can result from an untreated strep throat. The most common symptom of pharyngitis is sore throat, other symptoms include fever, skin rashes, swollen lymph glands in the neck, joint pain, muscle ache, headache. Pharyngitis is an infectious disease that can be spread through mucus, nasal discharge or saliva that contains the virus or bacteria. Remedies for pharyngitis include over the counter treatments like acetaminophen such as Tylenol, ibuprofen, gargling with saltwater and apple cider vinegar, eating raw garlic, chewing licorice root or drinking licorice tea, using throat spray that contain benzocaine and phenol and cough drops to keep the throat moist [7].

Common Cold, Causes, Symptoms and Throat.

The common cold is a viral disease of the nose and throat caused by lots of viruses the common being rhinovirus. Other viruses that causes common cold include coronavirus, respiratory syncytial virus, influenza and para influenza. Common cold can be contracted through direct physical contact with someone who has a cold or by touching contaminated surface. It can also be gotten from infected droplets in the air from a cough or a sneeze. A cold start when a virus attaches to the lining of the nose or throat which causes the immune system to send out white blood cells to attack the virus. This attack against the virus is what causes the throat to get inflamed [8]. The symptoms of common cold include sore throat, runny nose, cough, congestion, mild headache, sneezing, low grade fever and general un-wellness. The remedies for common cold include staying hydrated this can be done by drinking lemon water with honey to help loosen congestion and prevent dehydration, resting, gargling with saltwater to soothe sore throat, using nasal drops or sprays to soothe stuffiness, using over the counter drugs like acetaminophen, ibuprofen or aspirin to help relieve pain.

Overview of the Medical Diagnosis and Recommendation System for Common Diseases That Causes Sore Throat

The medical diagnosis and recommendation system for the diagnosis of common disorders that causes sore throat is designed towards gathering input from the user in the form of symptoms analyze these input and compare them in the records in the database. It then displays the disorder that best fits the symptoms from the list of disorder recorded in the database. The system will then recommend possible treatments for the disorder and recommend a visit to a specialist in the case of a more serious condition. The user will use the system when experiencing sore throat to know the cause of their and how to remedy it.

The system is overseen by a medical specialist in the area of throat diseases. In order to ensure the accurate diagnosis of symptoms and recommendations, the admin of the system will be a licensed medical practitioner whose area of specialization lies in the treatment of throat diseases as

such practitioner will be the most reliable source of information for the system. The system itself cannot operate on its own without the aid of the admin and the system itself cannot make diagnosis on its own, it depends on the information supplied by the admin in the database to make an accurate diagnosis of the users' inputted symptoms.

Overview of Existing Systems Similar to the Proposed Medical Diagnosis System

There are several systems developed for the diagnosis of various illnesses similar to the proposed system. An example of such systems is the diagnosis system for the diagnosis of malaria, an expert system for diagnosing eye disease using clips, web based medical diagnosis system (WOMEDS).

The Web Based Medical Assistant System for Malaria Diagnosis and Therapy

The web based assistant system for malaria diagnosis and therapy was developed to diagnose malaria and recommend therapies based on a classification model. The system was built in form of a web site developed using HTML, PHP and MySQL. The system has two interfaces, the first being the user interface where the user can create an account and login to the second interface which is the diagnosis interface. The diagnosis interface contains the patients recorded details as well as selected symptoms table that contains 19 symptoms from which the patient can select depending on their feelings. The patient also has the chance to input other perceived symptoms not identified in the symptoms table. Once all the perceived symptoms are selected and submitted via a check button, the patient is taken to the next phase where the diagnosis of the symptoms and recommended therapies are provided. The patients have to provide their login details to view the results. According to WHO, the web based medical assistant system for malaria diagnosis and therapy has high detection rate and aids in reducing the number of patients waiting for a consultation by doctors, however, the system requires internet access and a GPRS enabled mobile phone for accessibility and while most people own a GPRS enabled phone, not all can access the internet at all time.

An Expert System for Diagnosing Eye Disease Using Clips

This system is developed to provide the user with background information for the diagnosis of some eye disease. The system was developed using CLIPS which is an abbreviation for C Language Integrated Production System and is a programming tool designed for the development of software to model human knowledge or expertise for medical treatments [9]. The developed expert system was developed to diagnose eye disease based on the user answers to specified questions provided by the system. The answers the user provide helps the expert system to diagnose the disease using inference engine, it then stores the facts and conclusion of the inference in the database which it processes to extract rules that completes the knowledge base. The expert system has the user interface, the explanation interface and the inference engine. The user interface serves the point of communication for the user and the system, once the system is loaded, a menu is displayed which allows the user to select disease suffered and then the system ask the user to input symptoms experienced, after which the system diagnoses the user

Although, the expert system for the diagnosis of ear disease using CLIPS help doctors and patients in providing decision support system, expert advice and interactive training tool, the system does not provide treatments options for the eye disease diagnosed.

The Web Based Medical Diagnosis System (WOMEDS)

The web based online medical diagnosis system is a system designed for users to perform diagnosis for health problems and it has monitoring feature and provides health tips for the user. The system can also be used by doctors to perform further diagnostics and provide database references for patient's health information. The main objective of the web based online medical diagnosis system (WOMEDS) is to provide convenience to doctors, hospital administration and patients, increase accuracy of the patient's illness diagnosis by doctors. The system focuses on management of 3 main parts;

- The patient registration and administration
- Patient diagnosing and treatment
- Health Monitoring and tips

In the first part, there are two users; the person registering in and the hospital staff to attend to the patient. In the second part, there is the patient and the doctor and in the third part there is only the patients. Each patient has a username and a password. So whenever the patient enters their username, the system gets their information from the patient's database and give appropriate diagnosing and health tips according to their medical records. Each patient also has their own different database including the doctor. The doctor can access the patient's database to go through the patient's updated health record. At the same time, the database can be used by doctors to diagnose the patient's illness [10].

This web based system uses three-tier architecture system and focuses on portal hypertension disease which is high blood pressure of the portal vein. The 3-tier architecture system plays a very important role in the Web Based Online Medical Diagnosis System (WOMEDS) because it supports flexibility in the implementation and open migration path, improved reusability, improved data access flexibility, supports data driven business logic and supports dynamic changes to system function and structure [10]. The Web Based Online Medical Diagnosis System (WOMEDS) has a special feature that can alert the patients about portal hypertension disease and upcoming appointments. If the system detects severe portal hypertension, it will display a message which states that the WOMEDS cannot cure the disease and the particular patient need to consult the doctor. However, if the portal hypertension disease is still in the early stage, the Web Based Online Medical Diagnosis System (WOMEDS) ask the user a series of question and link to the medical websites where the patients can gain information. The system then displays the results and also the prescriptions. The patients can then get the medicines in authorized pharmacies.

The advantage of the system is that it helps the user get appropriate information needed on portal hypertension, overall health conditions and in developing a better lifestyle especially in the hospitals [10]. Also the patient's information in the WOMEDS system will be protected by privacy procedures that offer strong protection. However, the system is an application that is hosted on a server and can be accessed through the use of a web browser only and therefore requires the use of the internet which may not be readily available.

HEPAR: An Expert System for the Diagnosis of Disorders for the Liver and Biliary Tract

Medical Expert systems render assistance in diagnosis procedures thereby reducing the role of clinical experience in medical diagnosis. One of such diagnostic expert system is the HEPAR system for diagnosing liver and biliary tract disorders. Development of the HEPAR system began in 1984 and it was designed as supportive tool for diagnoses of liver and biliary tract disorders. The aim of the system is to improve the analysis of patients with disorders of the liver or biliary tract by reducing the amount of diagnostic test to be applied and to make clinical knowledge available to other people in the medical field [11]. The HEPAR system operates as pattern recognition system consisting of a knowledge base containing specific diagnostic knowledge and a computer program which applies the represented knowledge to new patient data to draw diagnostic conclusions. All the information used to differentiate between different disorders of the liver and biliary tract, such as the signs and symptoms, and also the derived information, such as diagnostic categories, is represented in a domain description where clinical entities are specified as part of the definition of a particular object, amongst others by listing the appropriate data which may be observed in patients suffering from a disorder of the liver or biliary tract. However, the system only serves as a support for diagnosis and is accessible by medical expert rather than the patient. The system also diagnoses only liver and biliary tract disorders.

3.0 SYSTEM IMPLEMENTATION

The system was developed using the Java programming language, NetBeans IDE and a database. The application was built based on the modern trend of programming by modern day programmers with front-end and back-end. The front-end part is what the users see and interact with and it includes the design of the user interface which is done in a way to make user experience friendly and easy to use. The back-end is where the functionality of the system is stored and is where the system can be changed and updated. It includes the database and server.

3.1 Java Programming Language

Java is an object oriented programming language developed by a team of developers led by James Gosling at Sun Microsystems. It is a simple object oriented, distributed, secure, interpreted, architecture neutral, portable, multithreaded, and dynamic language. It is a full-featured, general-purpose programming language is useful for developing robust applications. Java is being used today not only for web programming but also for developing standalone applications across platforms on servers, desktop computers, and mobile devices.

Database

The medical diagnosis system will not be complete without a database to store, retrieve and manipulate the necessary information. The system is built using MySQL database packaged in XAMPP which contains a combination of free open source software which helps you to build a local server for testing applications.

The Disease Table

This is the table that contains all the disease that is diagnosed by the system. Once a user enters a request, a filtering operation takes place where all the diseases not matching the user requests are filtered out and only those matching the user input will be left behind. The user can to see the results

XAMPP Server

The XAMPP stands for Cross-Platform (X) Apache (A), Maria DB (M) PHP (P) and Perl (P). XAMPP is a lightweight Apache distribution that makes it easy for developers to create a local web server for testing and deploying their software. It has all the necessary things needed to set up a web server such as server application which is the Apache, database and scripting language. It is cross platform which means it works well on different operating systems such as Linux, Windows and [12].

The medical diagnosis system has the user interface and the output from the backend. The interface of the system is what the user of the system sees and interact with when using the medical diagnosis system for sore throat causing diseases. It consists of a set of icons, menus, graphical display and commands that are provided by the software to its users to communicate and interact with the system thereby making it user-friendly and easy to use. It has the following pages;

Login Page

This is the page that the user sees once the system is opened. It allows the user to access the system provided that login details are accurate. If the user has no account with the system, the user can click on the register button to register. The admin is also required to login before access can be granted to the system.

Registration Page

The registration page is for unregistered users to register in order to be given access to the user. Once the user has successfully registered, the user will be directed to the sign in page to sign in to gain access to the system

The Main Dash

Once registration and login is successful. The user is taken to the main dashboard of system where the user can access the functionalities of the system. The dashboard enables the make use of the system as it is intended. The dashboard contains the tabs for functionalities such as health tips, specialists, and Feedback as well as the tab to logout of the

system. The dashboard is sectioned into 4 parts containing different functionalities.

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The Result Section

This section shows the result of the users' query. Once a user input is searched, every disease with symptoms matching the request will be displayed for the user. On clicking on it, the results show in the result section for the user to see clearly. The user also has the opportunity to print out the result if need be.

The Feedback Section

This section allows user to send a feedback to the admin on the functionality of the system as well as on the effectiveness of the diagnosis provided by the system. Feedback is a very important component that helps reveal areas that need improvement. This helps to better modify the system to meet the users' needs.

The Specialist Page

This page allows user to find specialist for a particular disease within the scope of the system if available. The contact details of the specialists such as email and mobile number are also included to enable user have access to them if need be. The sharing of such personal information will be done with the permission of the specialist themselves

The Admin Dashboard

This is where the admin adds, update and delete records for the system. The admin can also view messages sent by the users as feedback and members details.

The Logout Section

Logging out means to end access the system. It informs the system that the current user wishes to end the login session.

Testing the Application

The system was tested using an apache web server alongside a web browser. Testing is done to ensure that the system is working as it should. Ensuring that the system meets its requirement is one of the important aspect of building a system. Testing the system involves starting the application from the login page and following every link and entering all necessary data. Also testing helps to check the stability of the system, wrong data that was inputted and the result.

Data Security of the System

When building a system that requires storage of data and the use of the client-server paradigm, data security must be ensured. To ensure data security i.e. integrity, availability, and confidentiality of the data, the following measures were taken:

a) The use of usernames and passwords to prevent unauthorized access into the application.

b) The use of password encryption

3.2 The Proposed System

A formal model of the system was created using Unified Modeling Language (UML) which consists of mainly graphical language to represent the concept that is required in the development of the Medical Diagnosis and Recommendation System. The proposed system is a diagnosis system for diagnosing the different diseases that causes sore throat. The system will be in form of an application that users can access on their devices. A user experiencing sore throat along with other symptoms can use the system to find the exact disease that matches the symptoms being experienced and also to get remedies for the diseases. The system will have an admin who will be a medical expert to add and update records on sore throat diseases, their symptoms and remedies as new data become available. The system will require users to register and login in order to protect their data and the system may be updated whenever the user connects to the internet. In the development of the system, the technologies of the java programming language were used to develop the system. When used the system has the capabilities to diagnose a user based on symptoms and recommend possible treatment once the result of the diagnosis is known. The system aims to reduce the need to visit an actual healthcare center before treating common diseases that causes sore throat. The system also recommends a visit to the doctor in the case of a serious and life threatening disease. The system also provides the information of a specialist if necessary that the user can communicate with for a serious disease.

3.3 System Development Life Cycle (SDLC)

System development life cycle (SDLC) is a term used is in software engineering to describe the well-defined structured sequence of stages in the development of a software product. Each software product goes through the fundamental phases of the SDLC and these phases include planning, analysis, design and implementation, [13]. Once the system has been implemented, testing and maintenance is done. The phases are explained in details below. The SDLC phases are implemented in the development of a system through the use of various models. The model chosen for this project is the verification and validation model.

The Verification and Validation Model (V-Model)

The Verification and Validation Model V-model is an SDLC model where the execution of processes happens in a sequential manner in a V-shape. The model is based on the association of a testing phase for each corresponding development stage. Under the V-model, the corresponding test stage of the development stages is planned in parallel which means that the development stage is on one side of the V is the verification phases and on the other side is the validation phases and both sides are joined by the coding. There are several phases of the verification phase of the v-model and the phases are explained below

- The Requirement Analysis Phase: This is the first phase of the development cycle where the requirements for the system are collected by analyzing the needs of the users. This phase is concerned with determining what the proposed will

do and requires detailed understanding of the user requirements.

- System Design Phase: Once a clear understanding of the user requirement is understood, the system developer can then design the system. The system design will involve understanding and detailing the complete hardware and communication setup for the system being developed. The system test plan is developed based on the system design.

- Architectural Design Phase: The architectural specifications of the system are understood and designed in this phase. In this phase, the technical approach to the system development is selected and the system is divided into modules with different functionality. This phase is also referred to as the High Level Design (HLD). The transfer of data between the internal module and the outside world is also understood in this phase and with this information, integration tests can be designed and documented during this stage.

- Module Design Phase: This phase is referred to as the Low Level Design (LLD) and it specifies the internal design for all system module. It is necessary to ensure that the design is compatible with the other modules in the system architecture as well as with external systems. The unit tests can be designed at this stage based on the internal module designs.

The V-Model Validation Phases
There are several phases of the V-model validation phases and they include

- Unit Testing Phase: This validation phase involves testing at the code level in order to eliminate bugs at an early stage.

- Integration Testing Phase: This phase is associated with the architectural phase of the verification phase and at this phase, Integration tests are performed to test the coexistence and communication of the internal modules within the system.

- System Testing Phase: This phase is directly associated with the system design phase and it involves checking the entire system functionality and the communication of the system under development with external systems. Most software and hardware compatibility issues can be discovered during this system test execution.

- Acceptance Testing Phase: This phase is associated with the requirement analysis phase and it involved testing the system in the user environment. Acceptance test uncovers the non-functional issues such as load and performs defect in the user environment as well as compatibility issues with other systems in the user environment.
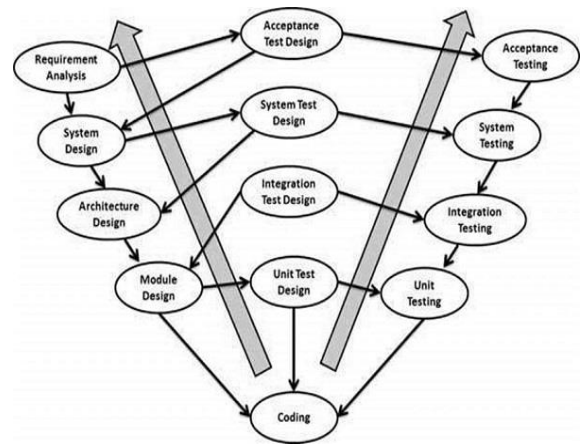

Figure 1. The SDLC V-Model

Requirement Specifications
The requirement specification of the system is a complete description of the behavior of the system to be developed and includes the set of use cases that describes the interaction between the user and the software. Requirement specification is of 2 types;

3.4 Functional requirements
The functional requirement of the system defines the specific functions that are performed by the system together by the data operated on by the functions of the system. The functional requirements are presented in scenarios that depict an operational system from the perspective of its end users. Some features of the system include;

I. The system shall incorporate a mechanism to authenticate users
II. The system will then verify and validate the user input
III. In the case of an error, the system will display an error message
IV. The system shall allow user to input their symptoms and then based on the symptoms filter out the unrelated diseases to finally display the disease that matches
V. The system allows the admin to insert, update and delete records
- Non-functional requirements

The non-functional requirements address the different aspects of the system other than the specific function the system performs. These aspects include system performance, costs and system characteristics such reliability and portability. The non-functional requirements of the system also include the system development process such as;

- The system will be designed to be user friendly
- The system design will consist of an aesthetic graphical user interface for the user to interact with the system
- The system will be developed to prevent unauthorized access to the system
- The system will also provide an easy to use interface for easy of navigation.

3.5 Hardware and Software Requirement

The hardware and software requirements of the system are the requirement needed for designing, structuring and ensuring that the system is designed smoothly and it operates properly. Both requirements of the system are presented in the tables below;

After a proper review of existing system, a model of the proposed system was built using the Unified Modelling Language (UML) structure and behavioral diagrams. A use case diagram is a Unified Modelling Language (UML) behavioral diagram that is the primary form of a software requirements for a software under development. It is used to describe the set expected behavior of a system by specifying the set of actions that the system can perform in collaboration with one or more external users of the system. The users are referred to actors of the use case. The use case is an effective technique for communicating the behavior of a system in user's term by specifying all the externally visible system behavior.
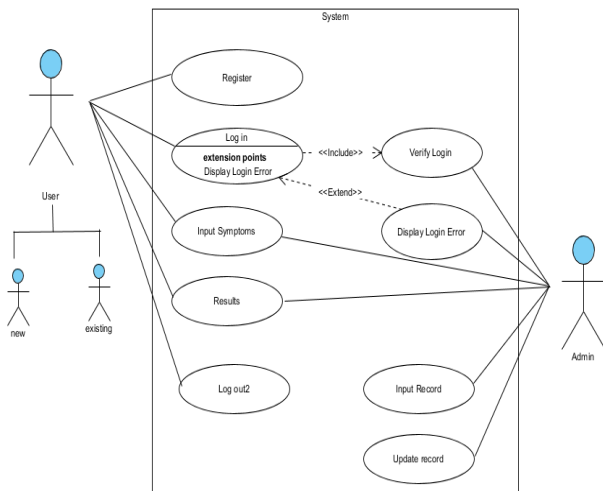

Figure 2. System's Use Case Diagram

Use Case Narratives

Use case narratives describes the process step inside each use case and the narratives helps to understand the meaning of the processes. The above use case is described in the use case narratives below

Table 1. Place Request Table

Brief description	User inputs symptoms at system request and waits for system's response
Actors	User Admin
Flow of event	1. User logons to the software 2. User input symptoms 3. System displays diseases that matches symptoms 4. User selects the disease that best fits 5. User checks for treatments of the best fit
Special requirements	System requires user specific input to function appropriately
Pre-condition	Actor has to be logged on to the software
Post-condition	System provides response based on user input

3.5.3 Activity Diagram

An activity diagram is a unified modelling language behavioral diagram that visually presents a series of actions or flow of control in a manner similar to a dataflow diagram. Activity diagram describes the flow from one activity to another and these activities are the operations of the system.
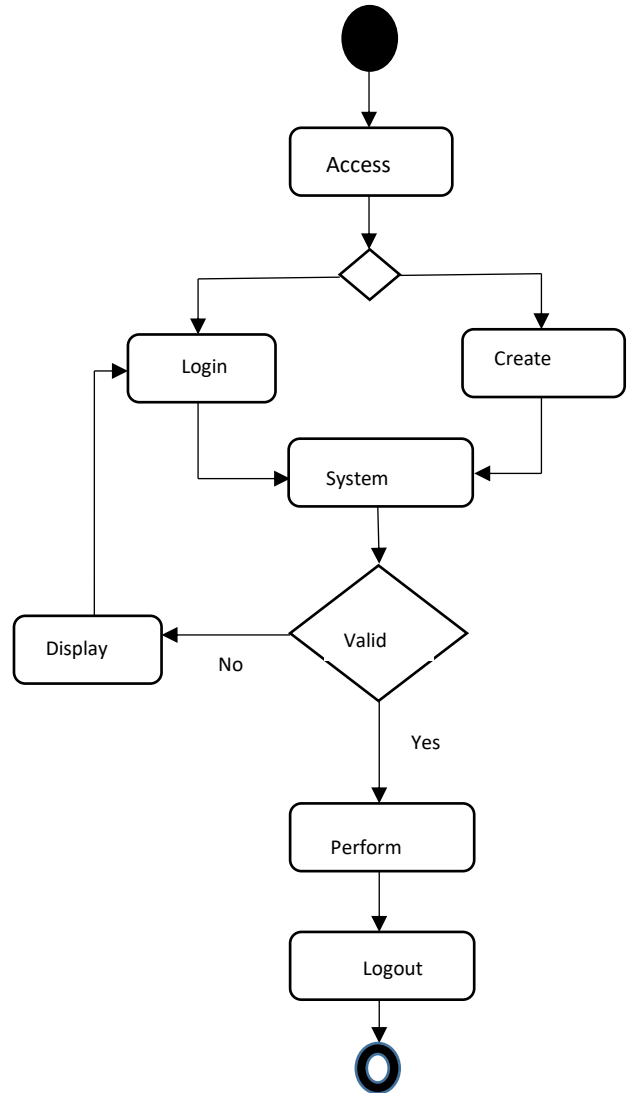

Figure 3. Activity Diagram of the System

4.0 SUMMARY, CONCLUSION AND RECOMMENDATION

4.1 Summary

This system helps users to diagnose sore throat causing diseases based on symptoms being experienced. It is a desktop application that is easily accessible to the user for use whenever required. Through this study, we have been able to study literature on existing diagnosis systems, their specific uses, users and limitations. Also modeling the different operations of the diagnosis system using unified modelling language diagrams such as use case diagram, activity diagram and sequence diagram was done to aid the development of the diagnosis system for sore throat causing

diseases and evaluation of the system for its functionalities and usability using controlled testing was carried out as well.

4.2Conclusion

The medical diagnosis system for the diagnosis of sore throat causing diseases was developed to help users diagnose sore throat and the symptoms that comes with it to know the disease from those symptoms. The system helps to reduce the need to visit the hospital to treat minor sore throat illnesses. The person experiencing such symptoms can just access the system to know the cause and remedies for their sore throat. This helps to reduce the number of people visiting the hospital daily and also saves the time of the user in visiting the hospital. The system also helps to prevent information overload that the user would have encountered when using the internet to source for information on their experienced symptoms. It does so by providing the appropriate information that the user requires.

The system is a medical diagnosis system for diseases that causes sore throat, with focus on 3 of the common diseases that causes sore throat: Strep Throat, Pharyngitis and Common Cold.

These diseases are among the most common reason people visit the hospital but are however treatable at home if detected on time. The system provides a way for user to quickly detect the disease and provide remedies for treating the diseases at home. This remedies are however not random but are provided by a skilled medical practitioner, that is, the admin.

A review of other existing diagnosis system was carried out in order to understand how a diagnosis system should be structured and designed as well as the limitations of the current diagnosis system. The system was then developed with the information gotten from the reviews in mind.

4.3 Scope for Future Works

1. The system developed is based on the diagnosis of the common diseases that causes sore throat, the system can however be extended to diagnoses other common diseases that causes sore throat
2. The system can also be further developed to diagnose other disease apart from the ones that causes sore throat.
3. The system can also be further extended to take into consideration children and pregnant women.

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