Online Healthcare System Using Cloud Computing and Artificial Intelligence

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Abstract: *A system to have your health check-ups done and access your reports anywhere anytime. Tracking the nearby labs, doctors and able to get blood based on your need through this system. Consulting your doctors online through chat or video and getting prescriptions based on your health. Keeping a track of your daily body health parameters using health devices connected to your phone and transferring this data on the cloud for the doctors to access it directly. Making use of an expert system in this application to get preventive measures and advices through the use of artificial intelligence. Since, cloud computing and artificial intelligence are the emerging technologies, they can be integrated with traditional health management to provide better health care services.*

Keywords: *Artificial Intelligence, Cloud Computing, Expert System, Healthcare, Health Management.*

I. Introduction

A system for complete health monitoring and to have your health check-ups done efficiently and quickly, to access your reports anytime anywhere. Get details of nearest pathology labs, if you need blood it is just a tap away. The application will broadcast your need to the people having same blood group in your locality. Based on your symptoms get preventive measures on your phone through an expert system and advices from your doctor over live chat. The devices that calculate the health parameters of your body are connected to your phone, this data can be transferred to the cloud server from where the doctors can directly access the patient's data.

In this fast-moving world, it is essential to focus on your health and do regular health check-ups. Hence there is a need to have an online system to efficiently manage all the above aspects. This system includes three components: Services [Cloud Computing and Expert System], Web application and Client Portal.

Cloud computing is an emerging technology proving to be a boon in businesses and various other fields. It is also making advances in the medical industry, becoming a significant tool for healthcare professionals everywhere. The cloud is used to store the data and reports of all the patients and also will consist of the knowledge base of the expert system.These reports stored on the cloud will be accessed by the patient and their doctors and will be secured as it will be accessed using proper authentication mechanism.The expert system will give the patient precautionary measures and other health information based on the algorithms and rules stored in the knowledge base. The system makes use of artificial intelligence to give preventive measures so that the patient can avoid any further problems or complications.[1]

This system makes it possible to get high quality care without even stepping into a hospital. Since the reports are stored on the cloud and can be accessed anytime anywhere, you can consult a doctor and get advices, even in situations when it is unable for you to get to a hospital.

II. Objective

- To provide an easy health check-up done and access your reports anywhere anytime.
- To track the nearby labs, doctors and able to get blood based on your need through this system.
- To consult doctors online through chat or video and getting prescriptions based on your health.
- To store real time health parameters on the cloud through devices which is accessed by the doctor.

III. Literature Review

Cloud computing has made new ways in various fields, and there are many experts and researchers who believe that it can benefit in improving the healthcare services, research and can bring a change in the health information technology. Though cloud services are available at minimum cost, effective use of resources and are highly available it is essential that the data is secured. Patient data is highly confidential. The data should be secured and its integrity should be highly maintained. Using cloud computing, data is available on the cloud and therefore the patients can log on to the system and can have access to their data. Also, this data that is

stored on the cloud is available for clinical research. Cloud computing services have lesser costs, reduced man power and reduced paper work.[4]

Mobile Cloud Computing [MCC] is a way of integrating the mobile devices and cloud computing. There are new advances in the mobile technology and cloud computing technology. Using a cloud system, the health care data can be transmitted to the health professionals and they can respond to the patients using the web service network. MCC has brought innovation technology in the health care field tremendously. Electronic journals were the first application developed for mobile devices. This made recording of health data easy and convenient. [5, 6]

However, Cloud Computing faces many challenges in the healthcare sector. Electronic Medical Records [EMRs] are exposed to various threats, the data is susceptible to unauthorized access and attacks. Since the data is stored in a centralized cloud server the sensitive data of the patients is exposed to high risk. Because of this exposure of data, the data is at higher risk of disclosure to unwanted parties. There may be spoofing attacks, tampering with the data and leaking of information from the system. Hence the confidentiality and integrity of the data is highly essential. A secure protection scheme needs to be implemented to protect the sensitive information of the medical records. [7]

There are many advantages of cloud computing in the health industry. Also, it increases the quality of management and speed of transfer of information. Thus, data management, appointments, tracking the best doctors and nearby health institutions becomes more easier and faster. Cloud facilitates instant access to all the patient data from various departments in various locations by different health professionals. [8]

Artificial intelligence is a conceptwhere computer systems are able to perform tasks which normally requires human intelligence. Clinical decision support system [CDSS] was the first successful applications of artificial intelligence. It focused on diagnosis of patient's condition based on the given symptoms and other demographic data. Mycin was one of the expert system developed which identifies bacteria causing severe infections and necessary antibiotics to treat those infections. It is a rule based expert system. AI is not only used in detecting the probabilistic infections or diseases but also is useful in computer-aided detection of complex structures in medical images. An AI based system is capable of learning from the data and then forming conclusions from it. For example, the system is capable of predicting from the data, that certain patients with high sugar level experience fewer complications if they are given drug X one hour before the surgery instead of 30 minutes.[9]

There is a subset of a population suffering from the same disease. This is because of the same genetic makeup and other factors like lifestyle, age etc. Each patient's illness is unique and should be treated differently based on the patient's history and biology. This phenomenon is called as Personalized Medicine. Thus, the main of Personalized Medicine is to predict the possibility of a person developing a disease, get the accurate diagnosis, and then achieve the best treatment available. This can be accomplished using genetic information and AI techniques. Suitable algorithm for this should be chosen based on the system being developed. [10]

Artificial Intelligence when used in medical field helps in producing new tools to support medical decision making, training and medical research. However, the system is equipped with human knowledge, it can never replace human expertise since humans are required to monitor and update the knowledge of the system. Thus, to ensure the validity of the system doctors and medical specialists are important. The mobile based health care system using the artificial intelligence is efficient and easy to carry with us giving us suggestions using the expert system. The use of artificial intelligence in the system helps the patient in diagnosing the disease without contacting the concerned doctor. Basically, this component is added in the system so that the patient can be given precautions and advices to avoid any problems in future or be saved from increasing the level of severity of the illness when the doctor is not available to prescribe the patient. [11, 12]

There is a huge scope of AI in medicine. The integration of intelligent AI tools in the everyday health applications can improve the treatment efficiency and minimize costs by avoiding false diagnosis of diseases. The AI concept is not only used for predicting the diseases but there are robots that perform semi-automated surgical tasks thus increasing efficiency. By including AI, the system can formulate plans on the therapy to be undertaken thereby adding value to the doctors as well as patients. Through the use of expert systems, the process of scientific and medical research is accelerated. [13]

There are various applications in healthcare developed using cloud computing and developed using artificial intelligence. However, combining these two concepts to developed an integrated system is healthcare will bring about a huge change and benefits to the patient, doctors and other health professionals.

IV. Existing Systems

4.1 Doctor On Demand: This application lets you see your doctor through a video consultation, have your questions answered and get a prescription.[2]

4.2 Heatlh Tap: It is an application and website that lets you have virtual medical appointment with a doctor and get your questions answered. It lets you access doctors around the world through messages, text and video chat.[2]

4.3 Hello MD: This system specializes in finding specialists but not getting you immediate care. It helps you connect with the right certified surgeon or doctor and get your appointment placed.[2]

4.4 E-Wireless Health Care System: This system is designed to provide information about only a particular hospital. By using this application, it is possible to maintain information of doctors and patients for a specific hospital.[3]

Drawbacks of the existing systems:

There are various applications available in the healthcare sector. These systems are capable of providing information about drugs and medicines to the doctors, patients and other users. Also there are applications which are capable of only storing the reports of patients and providing consultation with doctors. However, the systems are not capable of giving preventive measures to the patients, information about blood donors, pathology labs and storing the real-time data of the patient using the portable health monitoring devices.

V. Proposed System

Online health care system using the concept of cloud computing and expert system has been proposed. This system will be useful in dealing with all health-related problems. It is an integrated system to have your health check-ups done quickly by locating the nearest pathology labs and to access your reports anytime anywhere.Using this system, you can consult a doctor and through text chat or video chat get advices and prescriptions from your doctor. Also, if you have any skin problems you can upload a picture of your problem for which the doctor will give the required medications. The patient can find out details about the nearby pathology labs, surgeons, doctors and medicines using this system. According to the patient's symptoms and problems the system will find out the best doctor in your locality. Further it is possible to book appointments with the doctors online. If you need blood, the application will broadcast your need to all the people with same blood group in your locality. This functionality saves your time of going to the blood banks. However, you will also get details of the blood banks where your need of blood will be available.The fitness band that you use is connected to phones using Bluetooth. The data calculated by such devices like pulse rate, heart rate, calories burntetc. is accessible in your phone or tablet. Using this system all the data can be stored on the cloud from where the doctor can have direct access to all the information about the patient and can give necessary advices.Also, this data is used by the expert system to give advices to the patients like exercises, diet etc. Patients with diabetes can synchronize a glucometer attachment with their phone to track their blood glucose level and share this data on the application.You can give details about your symptoms to the system and based on the rules in the knowledge base the expert system will give you necessary preventive measures you need to take in order to avoid any problems. This helps until the patient can receive necessary advices and prescriptions from the doctor.
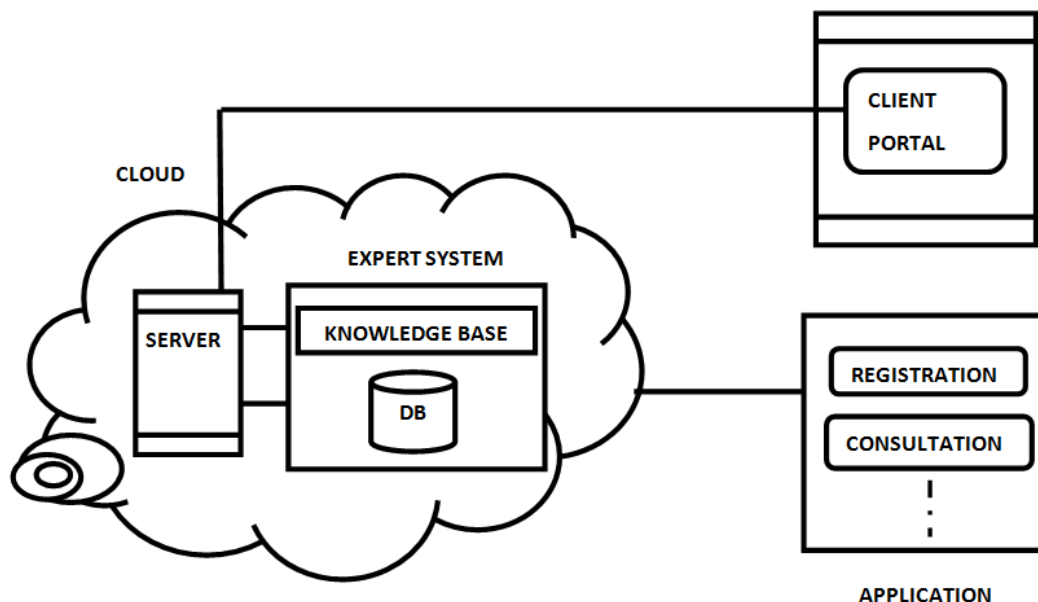

Figure 1: System Model

Application: Using this component of the system the user is able to access all the data related to labs, preventive measures, hospitals, doctors etc. This component maintains feasibility of the user. Electronic Health Records [EHR] and other information of the patients can be accessed. It provides the user interface and increases portability of the user. The patient can consult with the doctor to get advices and necessary prescriptions. The patient can send pictures of the problems faced like skin rashes and other symptoms to give better knowledge to the doctors so that they can prescribe efficiently. The doctors also communicate with their patients through the application component.

Client portal: The client portal enables the user to register themselves with the system. It is essential that proper authenticationmechanisms are used since the patient's personal medical history has to be secured. For this every patient is assigned a unique ID through which the patient can access their data and query the system. Also, the doctors can access their patient data using this ID.

Cloud: This component includes the Server and the Expert System.Server plays an important role since it manages the authentication. The requests of the patients are mapped to the server. All the patient history is stored on the cloud.The rules of the knowledge base which give preventive measures to the patient is a part of the expert system. The values transferred from the health devices to your phone are stored on the cloud which will help the doctor to giveadvices.

VI. Securing The Cloud Data

Shifting the traditional healthcare systems to clouds removes the geographical barriers between the health providers and the patients. Patient data is very sensitive and should be secured properly.Though there are unique ID and password associated with every user it is necessary to implement strict security mechanisms so that the data is not lost, misused or manipulated by any one. Thus, this system makes use of the AES [Advanced Encryption Standard] to secure the data on the cloud. The EHRs of all the patients are encrypted using AES. It is a symmetric key algorithm that means it uses one key for encryption and decryption. The number of rounds in AES is variable and depends on the length of the key. It is one of the most popular and widely used algorithms to secure the data and hence can be efficiently used to protect the personal data of the patients.

VII. Conclusion

In this proposed online health care system will be efficient for providing information about labs, doctors, to get preventive measures, proper medications, booking an appointment online and get expert knowledge. It helps in portability of reports since this system is a central online repository for the patient's data and health records thus reducing paper work. Using the concept of artificial intelligence, the expert system will give general health tips and preventive measures according to the symptoms so that the patient can maintain a healthy lifestyle. Hence, the proposed system can be used for effective health care management and is a complete system for all health-related data and queries.

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