Expert System for Health Care Data Stored On the Cloud

Anvika , Swathy Priya
Student, Assistant Professor
Software Engineering, SRM University,Chennai

***Abstract*— E-Health has gathered great impetus in the recent years felicitating lives of people by providing easy access to doctors, e-health monitoring and also diagnosis of potential health problems that the user may encounter. This sphere can be increased by incorporating medical histories of patients on a cloud that can be accessed by the doctors irrespective of the location. History is a very crucial part of the diagnosis especially incase of emergencies when doctors should be informed about previous allergies or incidents that could be causing the present condition. In this paper we propose a cloud based storage for medical histories of patients, including the medically relevant images. Allocation of a specific ID to the patients as well as hospitals, the system also cross checks the doctors authenticity by a third party authentication mechanism. The system also aims at providing optimized predictions based on the patients symptoms.**

***Index Terms*—E-Health, third party authentication, cloud**

1. INTRODUCTION

Cloud computing is defined as a type of computing technology that relies on sharing computing resources rather than using personal computers or local servers to handle applications. Every domain now exploits the benefits provided by this technology generally aiming at reduced costs and maintained infrastructure as benefits. Health sector is yet another domain that has witnessed a revolution with the use of cloud computing. A few features of this technology are:

- It enables on-demand access to computing resources and provides large storage facilities which are not available in traditional IT environments.
- It supports big data sets that are not only high in volume but have great diversity in terms of the data that is stored and processed.
- It facilitates the sharing of health records among authorized physicians with a timely access irrespective of the location.
- It can act as a central platform to discuss and state the standards for medical procedures.

"Patient centricity" has become the key trend in healthcare provisioning and therefore there is a huge adoption of systems like electronic health records (EHR), electronic medical records (EMR) and others that integrate patient safety with access not constrained by any demographics and a clinical decision support system. The virtual interaction between the patient and the doctor provides data availability which is the key to patient satisfaction .The following domains have witnessed the use of cloud computing in the healthcare domain:

Clinical Research : Data available on the cloud is proving a boon to many pharmacology vendors who can use it for improved research and drug development.

Electronic Medical Records: Physicians and hospitals are moving towards storing the patients records and medically relevant images on the cloud to spare them from the burdensome task of managing this data.

With the success of cloud-based solutions such as virtual physician visits, the technology is expanded to offer an environment for rural healthcare and disaster recovery.

2. MOTIVATION

A. Medical history plays a very crucial role in diagnosis of the patients condition . The patient might have been dropped by a stranger and he may not be aware of the allergies or previous condition of the patient which can hamper immediate treatment.

B. The related documents may be lost during relocation or if there is a natural disaster . This reduces the prospects of having the history or the track record of a patient.

C. Such a system will prevent any forgery introduced in the records, thus maintaining integrit**y.**

3. LITERATURE

E-Health has witnessed a huge interest after the advent of cloud computing as a technology. It basically was based on the objective of being patient centric. As an emerging IT delivery model it can significantly reduce the costs and underlying complexities, improving the workload optimization and delivery of services at the same time. Cloud computing has several features that can be used as a boon in the medical industry.

A. Virtualization: A physical machine is partitioned into several virtual machines that share the resources of the main system in order to create a scalable infrastructure. The virtual machines are created with several APIs or web interfaces. Depending on the application or the type of service required the virtual components can be configured and connected.

B. Computation: Cloud computing is based on technologies such as parallel computing, GRID computing, distributed computing, etc wherein multiple tasks are executed simultaneously.

C. Connectivity : It is connected to the entire Web and information can be accessed anywhere irrespective of the demographics.

D. Architecture: The architecture covers the service oriented architecture (SOA) wherein the application components provide services to other components in the system through a communication protocol.

E. Services: Cloud offers services such as Software (Software as a service: SaaS), Infrastructure (Infrastructure as a service: IaaS), Data (Data as a service: DaaS), hardware (Hardware as a service: HaaS), Platform as a service (PaaS) and Knowledge as a service(KaaS) . With SaaS, the software can reside on the server whereas the enabling part is on the client. This involves benefits such as :

1) Reduced time to benefit: The software's are already installed and thus saves the user the time required in downloading and installing the software.

2) The cost is significantly low along with scalability and integration.

3) The upgrades and patches are also available by default therefore the system always uses the latest version of any software.

Previous work in this domain has reflected how the benefits of cloud computing as a technology ca be utilized and what can be the future enhancements. Few papers suggest several models through which cloud computing can be used either to store a standardized rule for medical practices or as a virtual mode of communication between the doctor and the patient. There are several models that have been discussed previously as to how cloud can be used for maintaining health records.

Central Server Model: It is a centralized repository of the medical data of different hospitals that can be exchanged on demand. The data resides on a central server that is portioned for every participating hospital to maintain data isolation and integrity. The biggest disadvantage that comes on the way is the single point of failure that fails to provide an assurance of continued service availability.

Peer-to-Peer Server Model: In this architecture, hospitals are grouped based on the type of service they provide and are allocated a particular server . The hospitals locally manage the data and whenever there is a referral required the peers communicate and transfer records physically. This system has benefits of lower bandwidth and increased fault tolerance**.**

Hybrid Server Model: This model considers combining two levels of servers to form a hierarchy. The lower levels of servers also known as peripheral servers, are independent of each other, while the higher level is referred to as the main server. Peripheral servers store all the local health records which uploads specific data to the main server when a referral is initiated.

4. PROPOSED SYSTEM

There are several earlier proposed models for storing electronic health data and the proposed solution is an enhancement over them.

The patient's history is maintained as a log and stored on the cloud. The patient maintains a unique ID through which the particular user's data can be accessed. Every doctor is registered on a portal and can gain access to the cloud using a unique ID and password. Only authorized doctors are allowed to access the data of any patient. Whenever the medical data is accessed by any doctor the patient receives an alert either through an email or a text message as an authentication so that the data is not modified or accessed without his knowledge.

The system has the following modules:

Search module: To search the patients with the unique ID. The searching should be fast and efficient without any overhead.

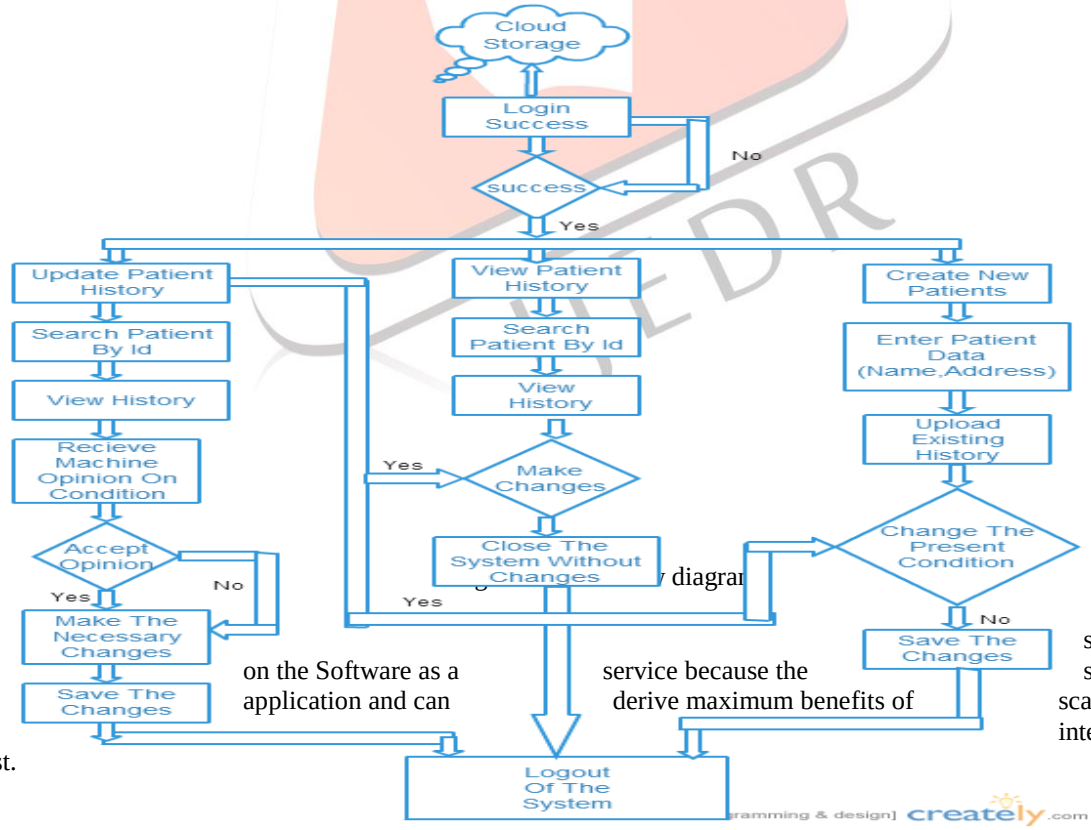
Update Module: It is used to update the changes in the patient's medical condition in the database and save it for future reference of doctors.

View Module: It is used to view the patient's history based on search by ID and give recommendations on health based on the stored data.

Create Module: This module creates a new ID for a new patient along with the details like name, address and then uploads related medical information on the database.

Login Module: This module allows users of the hospital to login into the cloud and access the system information.

Opinion Module: This module retrieves suggestions by taking the patients symptoms as inputs and diagnoses his medical condition based on pre- feeder data. Its on the doctor to accept or decline the opinions forwarded by the system. It is a decision making process done by a system emulated to work like a human brain. The opinion module uses a binary tagging technique to search the disease by mapping the systems with the respective disease from the database. This conversion of ASCII characters into binary make the processing faster.



The deployed system is to be as an on the Software as a service because the system functions application and can derive maximum benefits of scalability and integration at a reduced cost.

A. Challenges:

The system though with potential benefits, faces two major concerns of security and maintenance which cannot be eradicated, but can be minimized.

Security: Security is the biggest concern that refrains cloud users to trust the cloud service. How secure is the cloud, who can access the data, what are the chances of data loss are a few questions concerning the users. Since the cloud is considered to be a partially open connection wherein the data is managed by a third party organization, the customers or users find it difficult to believe that their data isn't viewed by others.. There are concerns over access of data and hacking into the system. The system aims to use encryption, third party authentication, communication through secure network channels and appropriate SLAs to deal with any such scenario.

Maintenance: The system contains records off a very huge number of patients as well as doctors. Managing the infrastructure and the resources for such high volume of data is a tedious task. Moreover the system should have a a very high availability with zero tolerance for error.

B. Conclusion and Future Work:

- The system is built to export the benefits of cloud computing in the health sector to make it more patient centric. The patients benefit with the ease of access to records, accessing data from any location with an assurance of security. Integration of standard medical procedures as well as data availability for medical research can be built as a part of the system.

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