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Healthbook – Ubiquitous Solution For Heath Services

Atul Ujjwal, Bhupendra Manglani, Disha Akarte and Akash Jain

Department of Computer Engineering, Sinhgad College of Engineering, Pune, India.

Abstract—
HealthBook is a mobile application that provides the need of ubiquitous health care services very efficiently. It uses cloud computing for storage and retrieval of patient's and physician's data in real time. The field of cloud computing provides myriad of opportunities for innovation. Cloud-based services can proof important in emergency care delivery since they can enable easy & immediate access to patient's data from anywhere and via almost any device. Use of cloud has advantages like mobility, faster response, zero maintenance, fault tolerance, scalability etc. Medical services are among the important ones. These services involve a variety of activities right from calling an ambulance to a patient's discharge from the hospital. This paper proposes to use cloud computing and provide health services to its users. Cloud based services prove beneficial in medical services environment as they provide fast access to data from anywhere on almost all devices.

Keywords—Rural ICT; Cloud Computing; Mobile Platforms; Healthcare

I. Introduction

A Personal Health Record (PHR) provides a high level of patient satisfaction and enables continuity of care. PHR makes patient information available at the point of care and it also maintains privacy. In short, a PHR is a set of tools that allows patients to upload their health information as well as make it available to those who need it. The data of PHR can be changed or updated by the patient or by any other authority accessing it. Patients have access to all parts of their record. PHRs not only benefit patients but are also helpful to various healthcare providers. Since patients require health services from various healthcare providers, a ubiquitous, context-aware access to patient information is necessary. The combination of cloud computing and mobile computing provides ease of accessing patient data from anywhere and from almost any device. This paper focuses on providing instant access to the stored information in case of medical services.

Mobile healthcare services provide easy access to availability of medical services making it ubiquitous. The use of mobile-based services gives an access to variety of services like telemedicine, location-based services, emergency response and management, personalized monitoring proving a boon for both patients and medical service providers. Mobility introduces challenges like data storage, availability of resources, privacy and security. These challenges can be achieved by using cloud computing. Cloud computing helps us meet services on demand and provides easy access to shared data and resources.

Medical services consist of general and emergency medical services. General medical services involve provision of hospital numbers for appointments whereas emergency medical services consist of various pre and in-hospital activities. These activities are performed by various individuals (administrative, hospital staff and paramedical). These individuals differ on grounds of knowledge, experience and status. These activities are interconnected to provide services in case of emergency. Thus, during the process of development of this project, an essential emphasis has to be made over individual and combined processes.

The development of HealthBook provides ease of access to patient's data in case of emergency by any responsible authority. These authorities have access to patient's medical information like previous medical histories, blood group, allergies, uploaded blood and electrocardiogram reports

II. Cloud Computing

Cloud computing offers new model in which information delivery and consumption takes place, applications and information are accessed from web services and software is stored in servers. Cloud components communicate over web services. In cloud computing, linkage over business processes and IT services is considered. In a cloud computing environment, the data stored is accessed by healthcare providers through the cloud. A cloud provides sharing of data and reducing the amount of local storages required.The advantages of using cloud computing can be mentioned as: (A) Reduced Cost: Cloud technology is paid incrementally, saving organizations money. (B) Increased Storage: Organizations can store more data than on private computer systems. (C) Highly Automated:
No longer do we need to worry about keeping software up

to date. (D) Flexibility: Cloud computing offers much more flexibility than past computing methods. (E)More Mobility: Users can access information wherever they are. (F) Allows shifting focus: We do not need to worry about constant server updates.

The use of mobile helps us access data through cloud anywhere and anytime satisfying our purpose of providing instant services to the patients.

Once the patient has registered to the web service inputting all the required data like allergies, blood group, medical histories, medical images, etc then he/she is subscribed to the access to medical services through cloud. Business Process Execution Language provides a infrastructure for this purpose. Thus in this process we are automating the services provided by ambulance services and hospitals by making information handy. This paper deals with a prototype implementation of the above mentioned process.

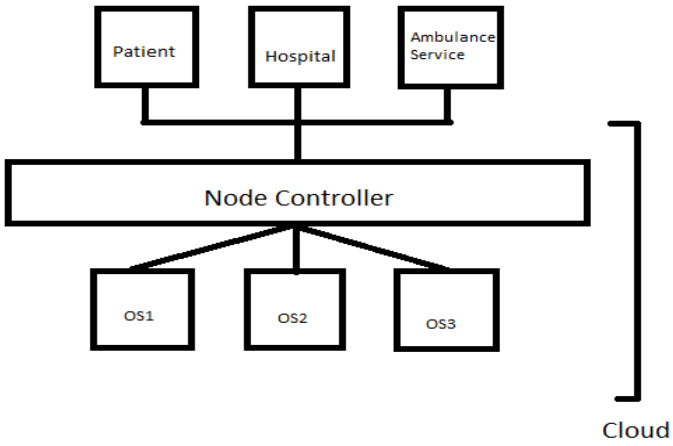
III. Overview Of Applications

We study the overview of the system applications from the following scenario of how HealthBook may work:

The patient is initially required to access the web application to register for the service of HealthBook and then use the mobile application made available over his/her mobile device and enter all the required details about the type of service needed.

1. The user fills in the details and selects the type of service. The application has various advantages like dropdown menus in order to provide fast access.
2. In case of emergency service, the user is supposed to call the ambulance service whose number would be provided through the mobile application.
3. The ambulance operator now comes into picture. The ambulance operator is responsible to access the patient information over the cloud which is possible using a unique patient_id provided to the patient at the time of registration to the service.
4. The ambulance service doctor is responsible to provide pre-hospitalization treatment like blood transfusion, oxygen, etc to the patient.
5. The ambulance service doctor also updates the provided treatment to the patient's profile so that it is accessible to the doctor who will be treating the patient after hospitalization.
6. Meanwhile, the application automatically sends a SMS over the patient's family physician's phone.
7. The Hospital staff is responsible to make required services ready prior to the patient's hospitalization so that there is no delay in the treatment.
8. The hospital authority also updates the patient's reports and provided treatment to the patient's profile so that it can be useful for future reference.
9. In case of general services, the patient is provided with the numbers of hospitals according to his query.

IV. Architecture



The above diagram shows the detailed architecture of the HealthBook system. The system consists of three operating systems namely OS1, OS2 and OS3. Database is distributed on all these OS. The node controller represent our main user namely patient. It is the cloud deployment platform.

The node controller comprises of the BPEL engine which has the designed BPEL rules and checks the queries accordingly and processes the output and makes it available over the user's device.

The node controller and the database servers are located over the cloud. The user fires a query to the node controller according to the services he/she demands. The node controller which consists of the BPEL engine processes this query using the information stored in the database. The node controller has a complete access to the database servers OS1, OS2 and OS3.

Let us see the working of the system in detail. The HealthBook consists of various BPEL-orchestrated services which are usually called by the patient or the ambulance operator or the hospital authority. The entire process begins after a call is made by the patient to the ambulance service. Appropriate web services are used for various services requested. Likewise, if an ambulance operator or hospital doctor requests for previous medical history of the patient then in that case an appropriate web service is invoked. Case history collected by the ambulance service doctor and the hospital doctor form two separate XML documents. These XML documents are automatically generated as the ambulance reaches the hospital and when the patient is discharged, respectively. The applications for HealthBook are licensed for use and these are provided only upon

registration to the service. The application software for PHR and HealthBook component are comprised of various web services which are deployed using BPEL rules. Users can interact with the application either by using desktops or mobile devices.

The architecture can be broadly termed consisting of following components:

- **PHR Application:**

This application is responsible for centrally locating the patient information as well as giving the patient privileges to view his/her profile anytime with an access to edit it. Thus, the PHR application consists of a data repository to store the data globally and not locally. The PHR application also consists of a user application which enables user and ambulance or hospital authority to access the patient's information.

- **HealthBook Application :**

This application stores the hospital and ambulance data which consists of the phone numbers and addresses. This also consists of various BPEL –orchestrated web services. Registered patients only can use these services. We use the software like J2ME, MYSQL, APACHE web server and NETBEANS IDE.

- **GUI**

This is a Graphical User Interface which provides front-end to the services provided by the processes. Users interact with the GUI to access PHR and HealthBook Application. The size of the GUI is flexible so that it can be easily accessed over any device. This property enables the efficient use of GUI in case of emergency when the application has to be accessed through a mobile device.

For cloud implementation we use AMAZON-EC2, this is a public cloud.

V. Conclusion

The healthcare organizations face the challenge of providing health services to patients with reduced costs and preventing errors. HealthBook provides a platform to provide health services to its users combining the ambulance as well as hospital services. Cloud computing is used for collaborated and coordinated provision of services. Cloud enables a global access to information hence, making it scalable and flexible. Also the patient information, treatment provided and present health records are updated over the cloud saving paper work and providing secure and easily accessible information to its users.

The system is easy to learn and access.

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