

International Journal of Advance Research in Computer Science and Management Studies

Research Paper

Available online at: www.ijarcsms.com

An Android Enabled Mobile Cloud Framework for Development of Electronic Healthcare Monitoring System using VPN Connection

R. Parameswari¹

Research Scholar
Dept. of Computer Applications
St. Peter's University
Chennai - India

Dr. N. Prabakaran²

Asst. Professor
Dept. of Computer Applications
Rajalakshmi Engineering College
Chennai - India

Abstract: Cloud computing is on-demand computing that does not reside at the users' premise. Instead, the computing resources are owned and managed by a service provider and the users access the resources via the internet. Conventional healthcare systems based on patient records are being considered as electronic format empowering patients to access their records via internet. Remote patient monitoring is becoming more feasible as specialized using Virtual Private Network (VPN). A mobile VPN is described in service provider networks co-operate to dynamically extend a virtual routing area of a local service provider network to the edge of all visited service provider network and thereby enables IP address continuity for a roaming wireless device. This paper presents the implementation of electronic healthcare monitoring system which provides data storage, processing and accessing information through mobile cloud using the Virtual Private Network which improves the privacy and security of the data. An android open-source cloud computing technologies as the mechanism to build an affordable secure and scalable platform that supports billing as well as Electronic Health Record operations. The client applications are mobile apps run from Google's Android enabled devices that offers easy networking procedures and low design complexity. The developed system has been proposed to present system's client, which operates on a mobile device and acquires data from the EHR and E- billing system connecting to a cloud server within the Virtual Private Network offered by the Hospital or clinic.

Keywords: Mobile Cloud computing, e-healthcare, Virtual Private Network, Android OS, EHR.

I. INTRODUCTION

Many healthcare professionals, hospitals and insurance agencies maintains the paper-based records, billing of the patients which is been converted later into computer-based billing and records which can be abused, modified or lost for malpractice done by frauds either for money or grudge. Hence the personal information of the patients is revealed, bogus information are entered and misused in traditional Healthcare system. Moreover Traditional healthcare system depends on the centralized server which is unreliable, insecure in accessing, storing medical data regardless of time, cost and location. Hence it is more complex and lack privacy and cost involved in integrating medical information is expensive. Given this scenario, Electronic Healthcare system is used to reduce healthcare differences and ensures adequate security and privacy. To overcome these issues introduce cloud computing concept in electronic healthcare monitoring systems.

Android operating system is used as a client application which focuses on two specific goals: the availability of e-healthcare applications and medical information anywhere, anytime and invisibility of computing Mobile Apps basically support Electronic Billing System, Electronic Health Record, Electronic Medical Record and Personal Health Record activities

of patient and their medical history which can be accessed individually by patient, healthcare provider, healthcare payer by authenticating themselves with server side database. This application is developed by open source cloud computing technologies, to build an affordable, secure and scalable platform that support electronic healthcare monitoring system using Virtual Private Network connection. A VPN is a technology that uses a public network reside in cloud storage to connect remote monitoring or users together while using a VPN connection, organization ensure security to protect the data as well as anyone can't able to read the encrypted data. Android healthcare monitoring application system has been developed for cloud server within the mobile Virtual Private Network of public network. This system can be established the flow of data between cloud server and android application securely.

II. OVERVIEW OF E-HEALTHCARE MONITORING SYSTEM AND CLOUD COMPUTING

The advancement of telecommunication in medical field makes the diagnosis and treatment of people easy. Now monitoring the health of patient details and to provide him treatment on time is possible. But their some issues related to physical data storage, privacy of accessing user data, security etc. But with the help of the cloud computing these issues are reduced now. Cloud Computing is an on-demand network access to computing resources such as networks, servers, storage, applications, and services which can be quickly accessed, managed by a service provider and any users can access the resources via the internet. This cloud model promotes availability and is composed of essential characteristics, deployment models, and various service models.

Electronic healthcare monitoring system is accessed by all the participants' healthcare system such as patients, healthcare providers healthcare payers, health insurance and billing system using open source cloud which acts as a server that faces several challenges, like data storage, management (Eg. physical storage issues, availability & maintenance), interoperability, availability of resources, security and privacy.

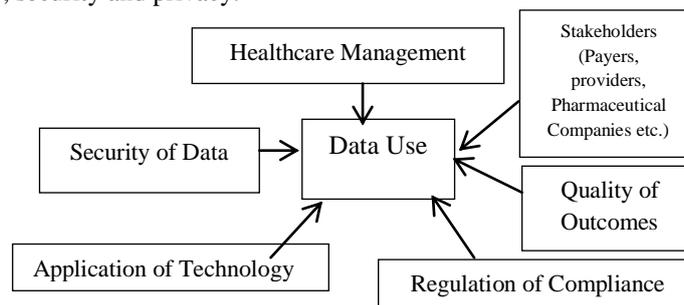


Fig: 1 Framework for Data Analytics

A data analytics framework can be used by various stakeholders to not only manage disease treatment but also improve the quality of patient outcomes. However, the security of data is paramount. Data use should focus on patients' protected health information for research, but their privacy should be protected in compliance with HIPAA (Health Insurance portability and Accountability Act). This federal act sets standards for protecting the privacy of your health information.

III. RELATED WORK

The Mobile healthcare service is provided by the mobile health providers. The provider gives the facility of health monitoring according to patients convenience with the maximum use of mobile device. The main aim of this paper is to provide the patient's healthcare information stored in cloud server and to retrieve the date more securely using Virtual Private Network. The VPN provide the high quality of connection for each user while handling its maximum number of simultaneous connections. The main use of the tunneling protocol is to add a layer of security that protects each packet on its journey over the internet. When the packet is travelling with the same transport protocol without the tunnel, this protocol defines how each computer sends and receives data over its ISP. Each inner packet still maintains the passenger protocol such Internet Provider or Apple talk, which defines how it travels on the LAN at each end of the tunnel. The tunneling protocol used for encapsulation adds a layer of security to protect the packet on its journey over the internet. The healthcare monitoring system provides a way

in which the patient details are anytime, anywhere required and these data is highly secured because of Virtual Private Network connections [9]. A VPN is a technology for establishing a private data communication network in a public network relying on an ISP & NSP. According to networking types the VPN can be divided into a fixed VPN & mobile VPN. Fixed VPN: It provides users with VPN access through fixed communication network. Mobile VPN: It provides users with VPN access through such mobile communication network as a General Packet Radio Service (GPRS), Wide-based Code Division Multiple Access (WCDMA), Code Division Multiple Access (CDMA), Long Term Evolution – System Architecture Evolution (LTE-SAE) network. In General, a mobile VPN is described in service provider networks co-operate to dynamically extend a virtual routing area of a local service provider network to the edge of all visited service provider network and thereby enables IP address continuity for a roaming wireless device.

The VPN protect the user data while it's travelling on the public network over cloud storage on the server side data base. If any intruder intercepting the data they couldn't read or use it. An android healthcare monitoring system will be developed for cloud server with in the Virtual Private Network of public network, in which establishes the flow of data between cloud server and android application securely.[9]

IV. PROPOSED SYSTEM ARCHITECTURE

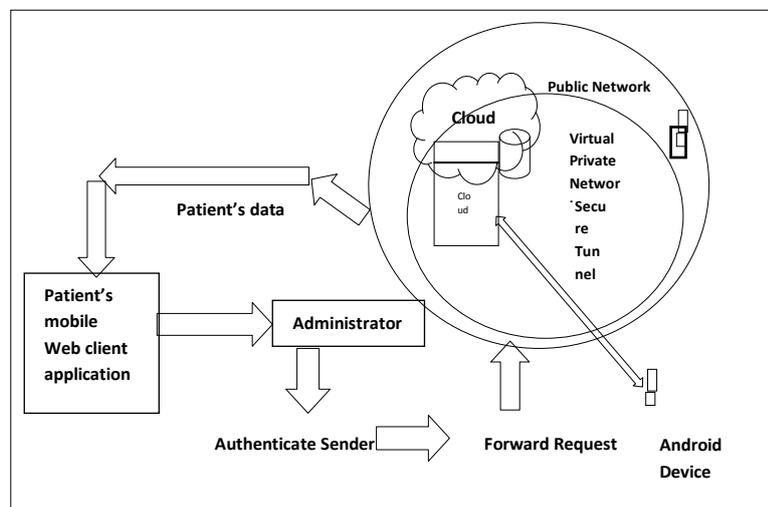


Fig: 2 VPN Connections in Public Network

Fig: 2 illustrate the proposed system architecture for developing and deploying the electronic Healthcare monitoring system application that utilize Cloud Computing and the VPN connection of the public network. The main mechanisms of a Cloud Computing Service provide the platform front-end interface that communicates directly with patients' and allows the management of the storage content. The Patients' details are available anytime; anywhere whenever required and these data is highly secured because of VPN connection. The interface can be a web client or a standalone application.

The Cloud Server which manages the physical infrastructure (e.g., storage elements) and is also responsible for performing maintaining operations (e.g., backing up data, etc.) The Cloud Platform interface is also connected to the Cloud Service module using Public Network which handles the user requests. The Cloud Infrastructure module manages user account, accessibility and billing issues. The existing paper [2] has demonstrated the Patient Health Record application obtains and displays patient records stored into the cloud. Data in Cloud are seamlessly stored and presented to the user as if they reside locally. This means that the Cloud repository is presented as a virtual folder and does not provide the features of a database scheme. This work has been now extended to provide all the patients related information to flow more securely using VPN in the public network and to include the functionality of communicating with Cloud Computing platforms and support communication through Web Services. In this context, electronic Healthcare monitoring system has been developed based on Google's Android mobile Operating System (OS) using the appropriate software development kit (SDK) [3]. Android is a mobile operating system

running on the Linux kernel. Several mobile device vendors already support it. The platform is adaptable to larger and traditional smart phone layouts and supports a variety of connectivity technologies (CDMA, EV-DO, UMTS, Bluetooth, and Wi-Fi). It supports a great variety of audio, video and still image format, making it suitable for displaying medical content. Finally, it supports native multi-touch technology, which allows better manipulation of medical images and generally increases the application's usability. In order to provide the user with data querying functionality, medical records and related data (images and bio signals) are stored into a SQLite file. SQLite is the database platform supported by Android. The file resides into a specific location at the Cloud and is retrieved on the device every time user needs to query data. The query is performed locally and the actual location of the data in the cloud is revealed to the applications. The database file is updated and uploaded into the Cloud every time user modifies data, respectively [9].

V. APPLICATIONS OF MOBILE HEALTHCARE

There are a few schemes of Mobile Cloud Computing applications in healthcare. For example, presents five main mobile healthcare applications in the pervasive environment [4].

- **Comprehensive health monitoring services** enable patients to be monitored at anytime and anywhere through broadband wireless communications.
- **Intelligent emergency management system** can manage and coordinate the fleet of emergency vehicles effectively and in time when receiving calls from accidents or incidents.
- **Health-aware mobile devices** detect pulse-rate, blood pressure, and level of alcohol to alert healthcare emergency system.
- **Pervasive access to healthcare information** allows patients or healthcare providers to access the current and past medical information.
- **Pervasive lifestyle incentive management** can be used to pay healthcare expenses and manage other related charges automatically.

VI. IMPLEMENTATION

With the advent of mobile devices, patients now have the ability to monitor their health indicators by the second and contact their physician with any concerns. Patients mainly track weight, vital signs, calorie intake, sleep patterns, etc. in real time. The dominant functionality of the application is to provide patients related data with a mobile user interface for managing healthcare information more securely using Virtual Private Network. The patients' data may reside at a distributed Cloud Storage facility, initially uploaded/stored by medical personnel through a Hospital Information System (HIS). Cloud-based services are being used in the healthcare industry to exchange medical, financial and other sensitive data across healthcare information exchange (HIE) networks. The content resides remotely into the distributed cloud storage in VPN in the public network; but access is presented to the user as the resources are located locally in the device. Patient Health Record Management: Information regarding patient's status, related bio signals and image content can be displayed and managed through the application's interface. Image viewing support: The DICOM medical image protocol is supported, while the JPEG2000 standard has been implemented to support loss and lossless compression, progressive coding and Region of Interest (ROI) coding. The progressive coding allows the user to decode large image files at different resolution levels optimizing this way network resource and allowing image acquisition even in cases network availability is limited. The code for performing wavelet decoding on mobile devices in has been modified to support the JPEG2000 standard on the Android platform. Image annotation is also supported, using the multi-touch functions of the Android OS. Proper user authentication and data encryption: User is authenticated at the Cloud Computing Service with SHA1 hashing for message authentication and SSL for encrypted data communication. [9]

VII. CONCLUSION

The development of this system is based on android open source platform, which provides cost effective and fast retrieval of healthcare related information to access more securely using Virtual Private Network reside on the public network. The presented system provide a secure connection to a centralized for cloud server with in the Virtual Private Network of public network, in which establishes the flow of data between cloud server and android application securely. To address the security challenges and policy for all patients and service providers who use mobile devices should be developed. Hacking and malware infections must be handled using application control and patching. Universal standards should be developed and regulations put in place to ensure privacy and security. The mobile health care system can improve the quality of patient care and reduce medical cost for both patients and hospitals.

VIII. FUTURE WORK

In our future research work might be improve security and implementing user authentication techniques for both patients and administrator module. Medical billing insurance claims can be included to the existing system as future enhancement that will eliminate spurious insurance claims. This proposed system only designed for the concept of Virtual Private Network in cloud computing, in future, this should be done to improve in practical use.

References

1. Ben Ramsey "Designing RESTful Web applications" released on September 13, 2007.
2. R. Parameswari, Dr. N. Prabakaran, "An Enhanced Mobile Healthcare monitoring system in Mobile Cloud Computing" in International Journal Advanced Research in Computer and Communication Engineering , Vol 1 issue 10, Dec 2012.
3. Shih-Hao Hung, Chi-Sheng Shih, Jeng-Peng Shieh, Chen-Pang Lee, and Yi-Hsiang Huang: "An Online Migration Environment for Executing Mobile Applications on the Cloud" in the Proceedings of 2011 Fifth International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing.
4. U. Varshney, "Pervasive healthcare and wireless health monitoring" Journal on Mobile Networks and Applications, Vol 12, no.2-3 pp 113-127, March 2007.
5. Android Developers website. <http://developer.android.com/>
6. Charalampos Doukas, Thomas Pliakas, and Ilias Maglogiannis: "Mobile Healthcare Information Management utilizing Cloud Computing and Android OS" in the Proceedings of 32nd Annual International Conference of the IEEE EMBS Buenos Aires, Argentina, August 31 - September 4, 2010.
7. Dimitris Tychalas & Athanasios Kakarountas: "Planning and Development of an Electronic Health Record Client based on the Android Platform" in the Proceedings of 2010 14th Panhellenic Conference on Informatics.
8. Abdullah Alshalan & Garrett Drown: "Cloud VPN".
9. Vinutha.S, Raju.C.K, Dr. M. Siddappa," Development of Electronic Hospital Management System utilizing Cloud Computing and Android OS using VPN connections" in International Journal of Scientific & Technology Research, Vol 1, issue 6 July 2012.