A Review on Enhancing Healthcare System using Cloud Computing

Madhumita S. Patil
ME (CSE) Student, Department
of Computer Engineering,
SITRC, Nasik, Pune University

ABSTRACT

In rural areas healthcare system often needs to struggle due to challenges in preventive medicines and management of chronic diseases. These challenges can be overcome by equipping Doctors with Health Information technology and developing Electronic Health Record (EHR) system, enhancing collection of patient's medical history for future remedies.

Most of the health organizations are now shifting their medical records on cloud using EHR as cloud is becoming the large medical data store and also minimized the cost for maintenance of the infrastructure. Due to enhancement in monitoring and analysis of health condition, the cloud based EHR improved the care provision for rural areas, increasing the efficiency of Health care system to monitor the health status of mass population.

At the same time, data security, data protection and integrity has the main concern as the patient's health record can be confidential and secure. This survey aims at focusing on advantages of EHR using cloud and also on enhancing the security of the data stored as e-health records.

Keywords

Cloud Computing, Electronic Health Record (EHR), privacy preserving, Security, Disease management

1. INTRODUCTION

The traditional method of handling health record of the patient was paper based which made the healthcare system tedious and limited to the particular area. It's time to move from paper to paperless e-Records. Cloud introduces attractive data storage and enables to access it from anywhere in the world. We don't need to worry about the infrastructure management at our side [2].

Healthcare has always gained the importance in all community. It plays very important role and hence researches and projects have been implemented in the health sectors. This makes the healthcare sector as an expensive branch. These projects as well researches have been funded by governments in order to improve healthcare delivery.MHR (Medical Health Record), PHR (Personal Health Record), and EHR are the main branches of the health services. But EHR has a great effect as it stores the data related to the patient's health in an electronic format [1].

There are many countries where majority of population live in rural areas providing healthcare system with ease and immediate action is the major issue especially in case of the chronic diseases. The index of Primary Health Care Worker Accessibility to primary health care workers in western rural areas has recorded as a poor index [8]. The reason behind this is the lack of communication between the western and the rural areas. Hence there is a need to increase accessibility index to make sure all the facilities are provided to the primary health care workers in rural areas.

To fulfill all the above needs, implementation of the system with the combination of Electronic Health Record (EHR) and Cloud is proposed. EHR is a record in digital format that can enable the user to share data in different health settings [3].

The EHR system can be of the two types: *cloud based* or *client server*. Data storage is in-house for Client-server system, requiring the software and hardware to be installed in physician's office. The set up is costly and maintenance requires trained staff at the location which seems difficult at every rural area where EHR is based.

In cloud based system, a data is stored on external servers and hence can be accessed via web, requiring only the computer with internet/Wi-Fi connections.

The system is designed so that it will capture the state of patient at all stages. There is no need to track down the patient's previous medical records volume though it ensures the accuracy in data and proper medication to the patient.

But EHR integration i.e. the process of patient information sharing among health care providers and exchanging them over internet with other health care provider remains a challenge and serious concern since it is exposing to theft, security violation.

The system which was implemented in rural region of China says around 290000 people were added and compiled using this EHR system [3].

The storage of the health records needs the infrastructure which promises the secured storage and availability at any time. These features are provided by cloud computing [4] and have gained the attention from both the individual and industrial groups.

The migration of the health records from paper to these paperless e-Records has a greater relief among the service providers and also for the hospitals. This system also provides the greater communication between the city hospitals and the rural clinics. Though in the rural areas internet is unavailable and the local doctors may lack knowledge of how to tackle with the IT system a local vendor can be set up [7].This will maintain and manage all the EHR system and the connectivity with the City hospitals. The offline mode of the EHR system enables to make use in rural areas and hence enhancing the health care system to operate over disease management [3].

Furthermore, today's world where Smartphone and the tablets are taking over personal computers and the laptops, are also emerging into the HealthCare delivery system [14]. These devices are compatible with many apps that monitor your

daily activities to make you aware of your day to day habits. E.g. Apps monitors your walking habit in a day, few apps keep track of your sleeping hours etc.

These days many healthcare providers, insurance companies and even the private organizations make use of EHR system. In addition to this patient also can login to the EHR portal provided by the Health Service provider(s),as patient may have registered with many health providers for insurance or health checkups [5].

The recent studies have made the cloud as internet of services [6]. As mentioned above patients has started storing data not only on their personal computers but also on mobile phones and can share in case of emergency with their doctors or Health Service Providers over cloud or using internet. Hence the data security and integrity still remains a key concern.
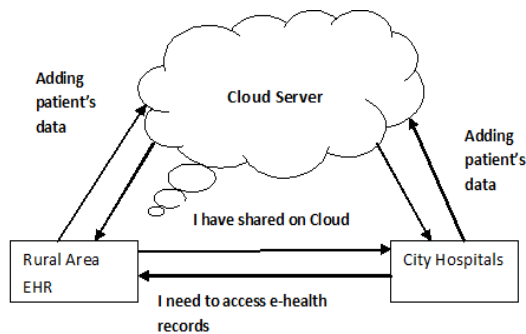

Fig 1: Representation of communication within the healthcare system using cloud

2. LITRATURE SURVEY

2.1 Empowering Village Doctors and Enhancing Rural Healthcare using Cloud Computing in a Rural Area of Mainland China

Author proposes the cloud computing significance in EHR system. They worked on the model where the communication between the City hospitals and the Village doctor (ViDs) will be easy and hence the disease management will not be a threatening issue.

The implementation of the cloud based EHR system:

2.1.1 Central Database Server:
The cloud data centre contains the central database server as the repository for storing EHR's and retrieving the patient's information. The information is stored in XML as unified standard which can be stored and retrieved by query.

2.1.2 Unifier Interface Middleware (UIM)
This part provides an interface that masks the heterogeneity of all sharing hospitals EHR standards, to enhance the communication transaction between central database and hospital system. It hold all types of the EHR standards , so it recognizes all type it communicates with sharing hospital via network. It's beneficial as rather than generating every hospital its own interface, one interface will be on the cloud and handle the heretroginity from there [15].

2.1.3 Cloud EHR web portal:
This layer provides application for EHR system. The proposed cloud health care system presents users a configurable EHR web portal for Central Database. The web portal is responsible for receive and send message between UIM and Hospitals [15].
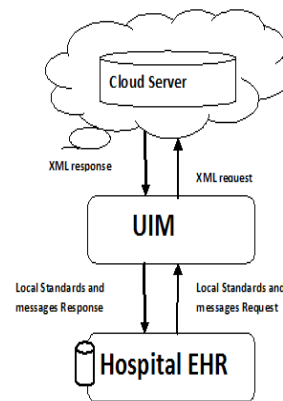

Fig 2.1: Healthcare System with its component

The study reveals that the implemented system can-not solve all problems related to chronic disease management in the region. It is estimated that 27.2% of the adult population in China has hypertension. Previously it was not possible to make the management for this high rate population but now the management is now enabled majority of population to benefit from the proposed EHR system.

Pros
1. This model enabled to calculate and maintain the ratio of diseases and the number of follow up patients

2. It also helps management to communicate to the EHR providers even from the rural areas as it support for offline usage. ViDs have a locally installed desktop version of the software. ViDs can maintain information into the system offline Data is then integrated when the connectivity with EHR is established.

3. This proposed solution makes use of the ViDs knowledge and the cloud to make a full-fledged Health monitoring system even at the rural side.

Cons
1. Due to lack of internet connection in few rural areas it does not supported for tele-consultation in case ViDs are not available

2. Even though the system is active in absence of Wi-Fi and internet but there are few scopes to "reinvention of healthcare".

2.2 Shared Authority based Privacy-preserving Authentication Protocol in Cloud Computing

The survey of above paper has all its focus onto storing the data on the cloud and makes it available at any place. But this traditional way concentrate on the authentication of the data and not the privacy of data when the user demands the access for sharing the data. This may be the case when the patient is having more than one Health service providers and one of them demands for the access of data from the other service provider for same patient.

The survey of this paper has proposed a shared authority based privacy-preserving authentication protocol. In this method the security protection and privacy preservation are taken into account without any information leak.

Pros:

1. Addresses new privacy challenges in the cloud and prevents the subtle privacy during the user ask for data sharing.

2. Anonymous access request matching mechanism enhances the user access request and shared access rights.

Cons:

1. The trusted third party is made as optional. This should be a mandatory party of the system to make it more reliable and to reduce the overhead at the cloud server by reducing the access requests for data sharing.

2.3 A Review on the State-of-the-Art Privacy-Preserving Approaches in the e-Health Clouds

To overcome the limitations of the proposed systems where the large number of data is been stored on third party entails the serious threat of data privacy, as the disclosure of the patient's record may be a disaster. The survey done by this paper focuses on the state of art privacy preserving approaches in e-Records. This survey has been made, as till the date there were no extensive researches done for secure e-Health records. The existing researches focused on:

1) Security and privacy challenges with contemporary privacy measures [9] [10].

2) Properties and security risks in Personal Health Records (PHR) [11].

3) Bio-medical architecture with security and risks [12].

This system proposes cryptographic and non-cryptographic approaches.

2.3.1 Cryptographic approach:

This approach focuses on the privacy using the cryptographic primitives like Public Key Encryption (PKE), Symmetric Key Encryption (SKE) [1].

2.3.2 Non-cryptographic Approach:

This approach unlike the above, use policy based authorization infrastructure. This enables the data objects to have access control policies.

With the help of the above approaches we can conclude that majority of the presented techniques fulfill the privacy-preserving requirements, like integrity, confidentiality and audit.

3. CONCLUSION

This survey paper highlights the use of the cloud, EHR and the security with authentication authorization along with the privacy preservation to make sure system is capable to work in integrity and it will offer healthcare providers ability to communicate in a controlled, safe and cost effective solution.

Patient privacy, data consistency and accuracy are the major concern for Healthcare systems. Protecting the confidentiality, Integrity, and availability of patient's information has a major effect. The secure and flexible structure which will be cost effective can be a helping hand for the Government and the medical system. Hence the cloud based EHR plays an important role following all the needs and requirement specified above.

Use of the privacy based protocol can enhance the existing system when the data is being shared between many users or specifically Health Service providers.

The highlights of this system can be in the following area:

- Use of the knowledge and skills of rural doctors offline

- Ease in chronic disease management

- Gives the way to operate over large scale Health Information Technology systems

- Create awareness among the population

The projects have given two main perspectives to handle over the large scale Health Information Technology system:

1. Cloud computing has great potential for supporting the rural health works.

2. HIT computing architecture helps in offline data backups and synchronization through the use of DTN data delivery make possible for overcoming challenge related to the limited Internet connectivity.

This survey also provides some perspectives useful for developed countries. Studies in the United States reveal benefits for small rural hospitals when they outsource IT systems from larger urban hospitals. The cloud-based EHR approach can be viewed as a further development of a model that enables urban hospitals to also support primary care workers in rural areas with systems that will more easily fulfill the criteria .This project reflects the overall potential for Information Technology (IT) to enable healthcare reform. Recently this occurred in Taiwan when emergency medical workers and the Ministry of Health utilized Facebook to move health reforms forward quicker than previously [16].

4. ACKNOWLEDGEMENT

5. REFERENCES

[1] B Assad Abbas and Samee U. Khan, A review on the state of the art Privacy Preserving Approaches in the e-health Records, IEEE Journal of Biomedical and Health Informatics, vol. 18, no. 4, July 2014.

[2] Hong Liu, Huansheng Ning, Qingxu Xiong, Shared Authority Based Privacy-preserving Authentication Protocol in Cloud Computing IEEE transaction on Parallel and Distributed System vol:pp no. 99 year 2014 Tavel, P. 2007 Modeling and Simulation Design. AK Peters Ltd.

[3] Che-Wei Lin , Shabbir Syed Abdul, Daniel L. Clinciu, Jeremiah Scholl, Xiangdong Jin, Haifei Lu, Steve S. Chen, Usman Iqbal, Maxwell J. Heineck, Yu-Chuan Li, Empowering village doctors and enhancing ruralhealthcare using cloud computing in a rural areaof mainland China, Computer method and Program in Biomedicine II3 (2014) 585-592, www.intl.elsevierhealth.com/journals/cmpb

[4] S. P. Ahuja, S. Mani, and J. Zambrano1, "A survey of the state of cloud computing in healthcare," Netw. Commun. Technol., vol. 1, no. 2, pp. 12–19, Sep. 2012.

[5] Bro R. Zhang and L. Liu, "Security models and requirements for healthcare Application clouds," in Proc. 3rd IEEE Int. Conf. Cloud Computer, Miami, FL, USA, Jul. 2010, pp. 268–275.

[6] Y. A. Mishra, R. Jain, and A. Durresi, "Cloud Computing:Networking and Communication Challenges," IEEE Communications Magazine, vol. 50, no. 9, pp, 24-25, 2012.

[7] E. Brewer, E. Demmer, M. Ho, R.J. Honicky, J. Pal, M. Plauché,S. Surana, The challenges of technology research fordeveloping regions, IEEE Pervasive Computing 5 (2006)15–23.

[8] Youli Han,Jihong Wei,Xinmin Song, Barber J. Sarah, Chunmei Wen, Xiaoying Zheng, Accessibility of Primary Health Care Workforce in Rural China, Asia-Pacific Journal of Public Health Asia Pac J Public Health September 2012 24: 833-847, first published on April 13, 2011.

[9] H. Takabi, J. Joshi, and G. Ahn, "Security and privacy challenges in cloud computing environments," IEEE Security Privacy, vol. 8, no. 6, pp. 24–31, 2010.

[10] Z. Xiao and Y. Xiao, "Security and privacy in cloud computing," IEEE Commun. Surveys Tutorials, Jul. 2012, vol. 15, no. 2, pp. 1–17,

[11] J. Li, "Electronic personal health records and the question of privacy," Computers, 2013, DOI: 10.1109/MC.2013.225.

[12] A. Rosenthal, P. Mork,M. H. Li, J. Stanford, D. Koester, and P. Reynolds,"Cloud computing: A new business paradigm for biomedical information sharing," J. Biomed. Informatics, vol. 43, no. 2, pp. 342–353, 2010.

[13] Spil, T.A.M, et al. (2010). Value, Participation and Quality of Electronic Health Records in the Netherlands. IEEE Computer Society. System Sciences (HICSS), 2010 43rd Hawaii International Conference on January 2010, 1-10.

[14] Paul J.F. White, Blake W. Podaima, Marcia R. Friesen , Algorithms for Smartphone and Tablet Image Analysis for Healthcare Applications, IEEE Access, 2014,vol. 2,831-840

[15] Hebah Mirza and Samir El-Masri, Cloud Computing System for Integrated Electronic Health Records, http://worldcomp-proceedings.com/proc/p2012/BIC4644.pdf

[16] S. Syed-Abdul, C.W. Lin, J. Scholl, et al., Facebook use leads tohealth-care reform in Taiwan, Lancet 377 (2011) 2083–2084.