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## Empowering Mobile Cloud Computing in Healthcare Environment: Ethiopia

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**ABSTRACT:** Now a days, healthcare system better to be supported by the latest technologies. The mobile cloud computing solves challenges faced healthcare industries of Ethiopia. This paper introduces healthcare approach which is designed based on mobile cloud computing technologies to be implemented for healthcare in Ethiopia. The main feature of this research is designing and implementing the healthcare system, which is developed by using mobile cloud computing future. The healthcare model and architecture based on the mobile cloud computing technology paradigm are introduced as well.

**KEYWORDS:** Mobile cloud computing, Healthcare,

### I. INTRODUCTION

The integration of healthcare with the Internet and mobile technologies has led to increased accessibility to healthcare providers, more efficient processes and higher quality of healthcare services [1]. With the advance of Information Technology, current healthcare systems are being transformed from traditional scenario that requires manual care and monitoring to more advanced scenario where patients can be automatically monitored and fast emergency response can be provided by deploying latest mobile sensing technologies, wireless sensor networks, and sophisticated back-end emergency processing centers.

To address the power limitation issue, the new solution includes mechanisms for controlling the energy consumption while maintaining the quality of care. Possible approaches include auto-switch network and algorithm to efficiently control monitoring interval. The new solution will emphasize on data contexts and context-sensitive applications to deal with deviations in physiological state variations. More importantly, MCC healthcare system adopts a federated Cloud model to address aspects of data ownership, protection and privacy.

Utilization of information technology in the healthcare sector is significantly underutilized, particularly in areas of operational efficiency. Most healthcare practitioners and institutions still rely on paper medical records, thus limiting collaboration and coordination between patients and physicians. Any modernization efforts in healthcare must include cloud computing as a center piece for this transformation. According to the National Institute of Standards and Technology (NIST), cloud computing can serve as a model that permits a set of configurable computing resources in sharing convenient and on-demand network access that are not usually provided in regular healthcare environments. Cloud computing has both the broad network access and resource pooling to support big data sets from electronic healthcare records (EHR). Both features facilitate the usage of computing resources by multiple consumers through different electronic devices such as mobile phones and tablets, providing more timely access to critical medical data. In addition, a cloud computing system is a measured service that has the ability to analyze and control resource usage in regards to the type of service provided e.g., storage and processing. In order for cloud computing to provide clients with the desirable services, it should be built on an infrastructure that facilitates the expected functions. The infrastructure is a combination of hardware and software resources, also referred to physical and abstraction layers, respectively. The physical layer includes the server, storage and network components, whereas the abstraction layer consists of the software installed to carry out the service. When it comes to consumers and their role in the cloud system, they don't

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need to manage the infrastructure itself; however, they do have the privilege of controlling applications and configuration settings. Consequently, the cloud infrastructure can be provided for organization and their multiple consumers, also for specific community or it could be for the general public [1]. In healthcare organizations, there are enormous amounts of data collected and stored daily. These data are important and vital for decision making and for delivering the appropriate treatment. Healthcare organizations need to have a system to be able to exchange data using cloud computing systems where patients' data are stored, retrieved and shared with other healthcare providers. Since the number of the healthcare data is continuously increasing, it will eventually affect the storage capacity of healthcare data servers and cause slowness in data retrieval. Cloud computing is the solution for the "big data" challenge [2]. It provides unlimited storage resources and facilitates the process of sharing patients' data between healthcare organizations [3].

## II. MOBILE CLOUD COMPUTING IN HEALTHCARE

It is the combination of two main abstraction are cloud computing and mobile computing and the other concepts such as wireless network these three are to bring the rich network operators, as well as cloud computing providers. Mobile computing: is a technology that allows transmission or transferring of data from one place to another place, transferring of data which means voice, video and document or file these are the collection of data or information.

Cloud computing: is a network of remote servers which is hosted on the internet to store, manage, and the structure of mobile cloud healthcare can be divided into three types of environment. Cloud computing environment including infrastructure, platform, software and healthcare services; with their support of servers, databases, storage and systems. Mobile computing environment including mobiles, satellite and Internet; with their hardware equipment and devices. Mobile devices environment including advanced mobile technologies and devices. process data, it is a internet based computing, where by sharing the resource software and information are provided to the computer and it delivers hosted service's over the internet. Mobile cloud computing is just used to share or store the information from one place to another without using any wired media. [3]

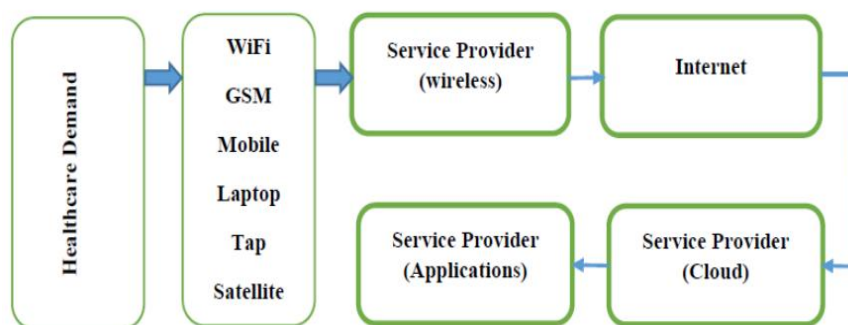


Fig 1. Structure of mobile cloud healthcare. [30]

MOBILE healthcare systems focus towards achieving two specific goals: the availability of e-health applications and medical information anywhere and anytime and the invisibility of computing [4]. Mobile pervasive healthcare technologies can support a wide range of applications and services including mobile telemedicine, patient monitoring, location-based medical services, emergency response and management, personalized monitoring and pervasive access to healthcare information, providing great benefits to both patients and medical personnel.

## III. RELATED WORKS

There are a few schemes of Mobile Cloud Computing applications in healthcare. For example, [6]It presents five main mobile healthcare applications in the pervasive environment. 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

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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. With the advance of IT technology, modern healthcare has driven significant development of distributed systems that can deal with smarter environments, adapt to specific context, and respond to critical events. This section describes recent researches in emerging healthcare systems. Mobile Healthcare Service (MHS): Mobile Healthcare Service (MHS) System is an infection control application that uses mobile device together with RFID (Radio Frequency System) technology to position and identify both persons and object that are inside and outside the hospital. Healthcare Alerts Management System (HAMS) Healthcare Alert Management System is a healthcare service application that runs on mobile devices to manage alerts in hospital [6]. All the urgent requests in a hospital are referred to as alert. Example of hospital alerts are operations rescheduling, laboratory result and adverse drug events. HAMS receive alerts signal and deliver them to the right person at the right time. These alerts are delivered via short message service (SMS) to the mobile device, e-mail notification to the involved users such as doctors and nurses. By having a HAMS which could effectively route and monitor alerts, the hospital is able to provide quality and cost-effective healthcare services to its customers. [7]

According to Hoang and Chen, Mobile Cloud for Assistive Healthcare (MoCAsH) which relies on intelligent mobile agents and context-aware sensor records in its context middleware component for adaptive monitoring and power/resource-saving had been proposed [8]. From this architecture, the limitations of Grid infrastructure have been solved by deploying the best suited Cloud features for resource scalability and user accessibility. The architecture design of MoCAsH which encompasses four main components: 1) sensors and mobile agents, 2) intelligent contextaware mobile cloud middleware, 3) collaborative cloud computing platform, and 4) a Cloud portal.

Generally, the above described researches are all deal with the healthcare sectors to manage and monitor their patients based on the specified technologies. In our Ethiopia there is no any organized means of interaction between the professionals and the patients from different geographical location to get consultation service online. So, our intention is to design and implement framework using mobile cloud computing technology for the simplification of interaction among the professionals and the patients.

## IV. PROPOSED MCC HEALTHCARE APPLICATION

In the healthcare environments specially in Ethiopia there are a lot of problems in using the technology in order to improve the interaction between the stakeholders. The current system has many problems related to this. All are using the manual based communication system which has many drawbacks. It is time taking to exchange information, impossible to get healthcare consultations online, patients are suffering because of the paper work juts to await until they know the results. Lack of online education about common diseases. There is no any platform designed to get a follow up online and other related problems are our motivations to do this research. The purpose of our study consists in the development of a medical framework able to solve a large variety of healthcare environment problems. Consequently, we designed mobile cloud architecture consisting of multiple distributed agents placed in the cloud environment for simplifying the communication and the interaction.

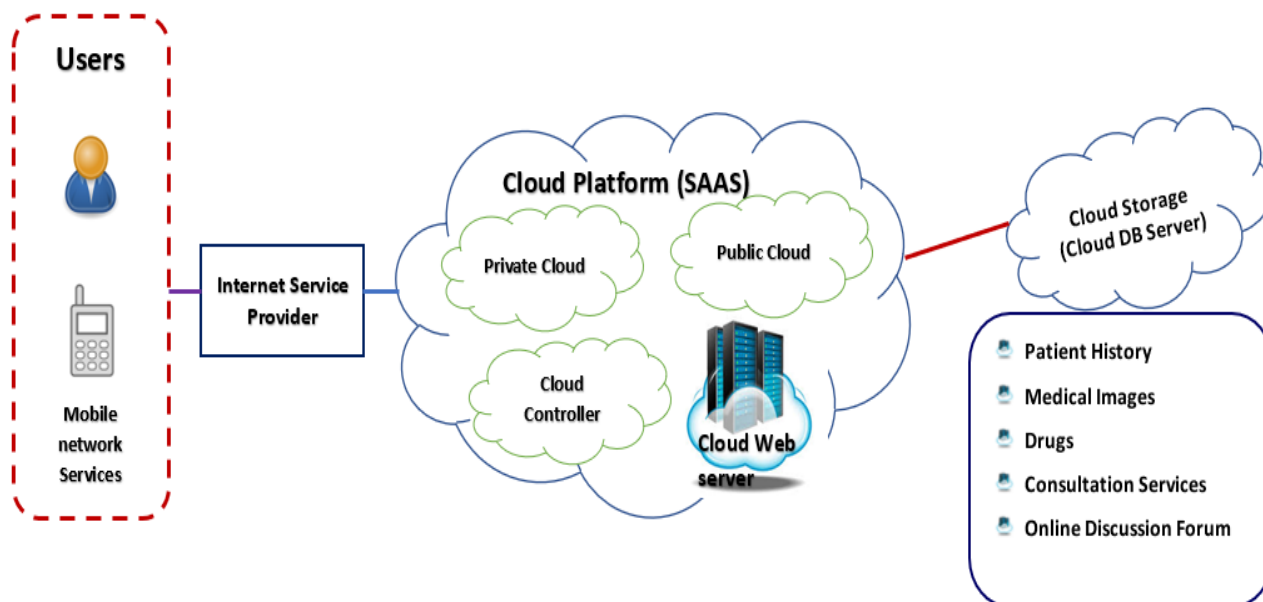
The main functionality of the prototype is to provide users with a mobile interface to manage healthcare information; the applications' platform is a tool for several users:

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**Fig II. Proposed Mobile cloud computing architecture for the healthcare system**

This research will collaborate the mobile computing feature with the healthcare environments. The communication between the physician, medical laboratories, nurses, pharmacists and the patients will be simplified by forming Mobile cloud computing based interaction. So basic functionalities in the healthcare industry will be undertaken by using MCC. Security, Performance issue of the mobile devices, the network infrastructure to implement it in every health sectors and other issues will be given special concerns. In our system diagnosis of patients will not be implemented. Generally, the we are designing and implementing a Mobile Cloud Computing (MCC) Framework for healthcare services to simplify the interaction among the stakeholders of the healthcare environment in Ethiopia. So, we studied the impacts of Mobile Cloud Computing on the healthcare environment, propose three tier architecture for the MCC based healthcare platform and designing and implementing MCC Based healthcare Framework to: deliver online health education for the patients, to provide online discussion forum between the healthcare professionals and the patients, to provide online health consultation service, to provide online monitoring service for the patients and to provide statistical data about patients for researches.

Ethiopian Ministry of Health is the mobile cloud service provider in which the healthcare system service is given to every member health industry in Ethiopia. So, ministry of health is responsible to control the central mobile cloud server. These is the physical location of the healthcare cloud servers and databases. But by implementing virtualization technology every hardware devices of the healthcare system are accessed and available everywhere at the member institutions.

The user accesses using the local device and in the browser the URL is decoded into protocol/host/file, i.e. host name converted to IP address. Then an issue request is sent to remote server using appropriate protocol.

With the mobile cloud web Server, the appropriate action to be taken is identified (insert documents, access documents, comparison), such as fetching a file, or passing request to an interpreter. As such support for thousands for concurrent users, multithreading (allow multiple processor to run concurrently) and caching (holding results in a temporary store to reduce recalculation) is achieved.

On the database server part, the interaction with the database is done using standard languages using database specific protocol over TCP/IP. The data structures for example tables are defined and modified themselves, that insertion, updating and deleting of data for example. Data maintenance should be maintained with backup and recovered. Access to compilation of queries should be optimized, with indexing or replication of tables.

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According to the proposed mobile cloud architecture the cloud database will provide the services for the authorized institutions which are authenticated as participants on the system.

Redundancy of physical devices is to reduce risks during downtime. Physical devices in the system should be repeated so that when the one fails the other will be functional instead. Device and network redundancy are like an insurance policy for industrial networks. Acting as a quick response backup system, the goal of network redundancy is to mitigate the risk of unplanned outages and ensure continuity of operation by instantly responding to and reducing the effects of a point of failure anywhere along the critical data path. When you consider the direct and indirect costs of unplanned downtime, it becomes clear that making the investment in network and device redundancy is a smart strategy.

**The proposed mobile cloud deployment model:** The cloud model used in this healthcare system is Hybrid cloud model. Since the healthcare system has its own private data that must be kept secured and since there will be resources which will be accessed with payment, using of the private cloud is recommended. In the other hand resources, which will be accessed with free cost and if the resources are not need to be secured, they will be deployed on the public cloud. So, in order to control these clouds building the hybrid type of cloud deployment model is recommended.

**The proposed mobile cloud services:** The cloud service proposed in this healthcare system is Software as a service model, this is because using SaaS has its own best futures in our system. Instead of buying software and then installing it, SaaS users subscribe to the software on a monthly or an annual basis. The relevant applications are used online through files saved in the cloud. Since the healthcare system is already configured, the healthcare has a ready-to-use application. This is not only reducing installation and configuration time, but also cuts down the time wasted on potential problems linked to software deployment. As long as an Internet connection is available, the applications can be accessed from any location. Since this SaaS healthcare system is cloudbased, it is easily scalable and can be quickly integrated with other similar systems. SaaS enhance the security protection of the healthcare system platform.

## V. CONCLUSION

The primary intention of these mobile cloud-based healthcare system is to interconnect healthcare institutions of Ethiopia in order to offer a solution which enables them to share information, to keep the information on the cloud. In this research work, we fill the gaps of healthcare by implementing healthcare system using mobile cloud technology. We have found mobile cloud Computing is very hot topics now days and many researchers are interested on it. Healthcare institutions since they are the sources of health-related issues, the mobile computing technology highly recommended to feed the gap between the patients and the physicians. Every health institution should be authenticated through their local cloud server to be involved in the central cloud server so that they can store patient history, drug information, medical images, consultation services and discussion forums in the database abroad the country.

## REFERENCES

- [1]. JubiRana, Abihijeet Bajpayee, "HealthCare Monitoring and Alerting System Using Cloud Computing," Key Search Technique, Feb 2015, "International Journal on Recent and innovation Trends in Computing and Communication, vol:3, Issue:2.
- [2]. Ambika.S, HamsaPriya.M, Lalitha.R, Rajakuamari.K, "Secure and Privacy Approach in Mobile Healthcare," SPOC (Secure & Privacy-Preserving Opportunistic Computing), April 2015, "IJRSET-International Journal for Innovative Research in Science & Technology, vol:1, Issue:11.
- [3]. M. Aminian and H. R. Naji, "A hospital healthcare monitoring system using wireless sensor networks," J. Health Med. Inf., vol. 4, p. 121, Feb. 2013.
- [4]. Qinghua Shen, Xiaohui Liang, Xuemin (Sherman) Xiaodong Lin, Henry Y. Luo, "Exploiting Geo-Distributed Clouds for E-Health Monitoring System with Minimum Service Delay and Privacy Preservation," Traffic-Shaping technique, March 2014, "IEEE Journal of Biomedical and Health
- [5]. Huang Lin, Jun Shao, Chi Zhang, Yuguang Fang, "CAM: Cloud-Assisted Privacy Preserving Mobile Health Monitoring," CAM (Cloud Assisted mHealth monitoring system), June 2013, vol:8.
- [6]. D. West, "How mobile devices are transforming healthcare," Issues Technol. Innov., vol. 18, no. 1, pp. 1-11, 2012.
- [7]. Ms. R. Parameswari, Dr. N. Prabakaran, "An Enhanced Mobile Healthcare Monitoring System in Mobile Cloud Computing," CMS (Centers for Medicare & Medicaid Services), December 2012, "International Journal of Advanced Research in Computer and Communication Engineering, vol:1, Issue:10.
- [8] Allen, S. (2011). Cloud Computing and Health Care Security. Cloud Computing Journal. Retrieved from <http://cloudcomputing.system.com/node/1796151>