Advanced Science and Technology Letters
Vol.136 (ITCS 2016), pp.91-95
http://dx.doi.org/10.14257/astl.2016.136.22

# Mobile Cloud Hospital Information System based on XMDR-DAI

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**Abstract.** This paper designed XMDR-DAI-based hospital information system in mobile cloud environment. The system supported data interoperability service between systems in the process of transmitting data collated from BSN (Body Sensor Network) environment to the hospital information system. This study suggested XMDR-DAI-based MCBS (Mobile Body Cloud System) in the mobile cloud environment. The system integrated sensor information obtained from BSN to support interoperability service for medical information between HIS (Hospital Information System).

**Keywords:** XMDR-DAI, BSN, HIS, Data Interoperation, System Integrated.

## 1 Introduction

Among many researches on mobile health care, some researches attracted attention for such as removing unnecessary duplicated check-up or excessive medical expense by collecting information from body sensor, which is obtained through mobile device attached to bodies of patients [1]. Currently, as the body sensor devices were developed by different manufacturers with individual software and communication protocol, the body sensor data was hardly interoperable with HIS (Hospital Information System) [2]. Moreover, as the structures of database in each medical organization's system were heterogeneous, it was difficult to share the data. Thus, this study suggested XMDR-DAI-based MCBS (Mobile Body Cloud System) in the mobile cloud environment. The system integrated sensor information obtained from BSN (Body Sensor Network) to support interoperability service for medical information between HIS. The service converted and integrated IEEE 11073-based sensor information to HL7-based medical information to transmit bio-information to the hospital information system [3, 4]. Furthermore, data collision, occurred during the process of sharing personal health data between the medical organizations, was solved by data integration service in application of XMDR-DAI [5], which was one of cloud technologies. This paper was structured as follows: The 2nd chapter introduced the relative researches. The 3rd chapter illustrated the suggested model, the 4th

ISSN: 2287-1233 ASTL

chapter described the conversion algorithm, and lastly the 5th chapter contained conclusion and discussion.

## 2 Related Work

### 2.1 Body Sensor Network (BSN)

Currently, body sensor network was utilized to monitor personal health conditions, play motion sensor-based games, share information, and etc. While necessity of multi-functional, small-sized, and medical mobile devices and request of developing personalized health check-up and management were increased, bio-information of personal bodies was transmitted to medical organizations in real time based on ubiquitous environment, and sensor technologies and wireless communication technologies with servers were converged to receive personal information for the patients' self-treatment service [1]. Moreover, technologies of detecting, analyzing, and transmitting bio-signals were converged, and real-time automatic transmission technologies were in development using data-mining. In Japan, one of the researchers measured and managed personal health conditions through self-communication and established in-home monitoring system to constantly monitor patients' health conditions, alarm deviations from normal conditions in early stages, predict the future health conditions, and utilize the saved data in detecting any symptoms. Furthermore, in Europe, one of researches measured breathing, oxygen saturation, pulse, blood pressure, pupil size/response, and etc. to transmit GPRS[6] (General Packet Radio Service) and UMTS[7] (Universal Mobile Telecommunications System)-based wireless broadband data.

### 2.2 XMDR-DAI Technology

XMDR-DAI [5] was an agent adopted to solve metadata schema, data structure, and semantic collision occurred due to data integration using XMDR, which was an expanded concept of MDR; the technology saved metadata of relational database to object-oriented database. In other words, it was storage integrating data by combining MDR and ontology to solve collision between schema structures and instances of dispersed data. This study composed the association of BSN's metadata with XMDR-DAI to support data interoperability service for using the medical information effectively.

### 2.3 Hospital Information System (HIS)

The structure of hospital information system was divided by 3 main levels such as levels of central government, region, and patient transport [2]. Generally, all kinds of hospital information system supported client-server architecture for networking and processing. Locations of processing the hospital information system were mostly

 

residential. Due to development of smart phones, it supported application services for the smart phones. An official standard for exchanging patients' information between the hospital information systems was not existed, but there was HL7 project supporting ISO for data types and data exchange. HL7 improved monitoring of drug uses and researches of the effects using the patients' medical information and moreover it enhanced to prescribe more appropriate drugs. Data integration through HL7 would improve the integrity of patients' information and reduce the items of information [3, 4]. Furthermore, it grafted cloud computing system to the hospital information system for loading the information from the cloud servers as a perfect function.

## 3 Proposal System

### 3.1 System Overview

The overview of system suggested in this study was shown in the <Fig. 1>, composed of a patients' group, a doctors' group, HIS cloud, and the suggested system. Each group was described as follows:

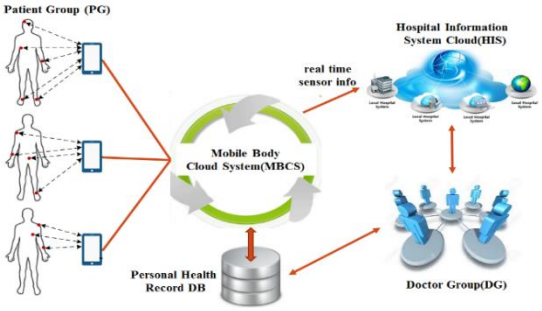


**Fig. 1.** Mobile Cloud System and Hospital Information System

● Patients′ group: This group obtains the bio-information from sensor data attached to their bodies in real time through Bluetooth of their smart phones.

● Doctors′ group: This group receives the patients′ information from each local HIS cloud through wireless communication. As they are transmitted the patients′ information in real time, they can immediately give prescription to the patients.

● HIS Cloud: This group of hospital information systems is dispersed by regions, and it contains patients′ information of each hospital. This system group is associated between hospitals.

● MBCS: The information transmitted from sensors, attached to patients, through smart phones is integrated and transmitted to HIS cloud according to its standards.

The transmitted information is more easily shared between dispersed PHR of hospitals based on HL7 to obtain patients' condition information in real time.

### 3.2 System Operation and Structure

The <Fig. 2> illustrated elements and structures of MBCS as suggested in this study.

● BSN Sensor: BSN sensor collects, adjusts, and manages sensor information of patients′ bodies through nodes for monitoring.

● Mobile Service Manager: Mobile service agent facilitates doctors to check the sensor information through mobile devices and manages the information. In other words, the doctors check patients′ information in real time, and they search, save, and share the patients' medical information in HIS cloud through mobile phones. Accordingly, the patients' medical information is shared between the doctors.

● Acquisition Data Agent: It provides and manages transmission service to identify the transmitted information from the patients′ group in real time through HIS.

● Security Manger: It encrypts the sensor information transmitted to HIS cloud through data agent for its security.

● XMDR-DAI Manager: XMDR-DAI manager associates the medical information of between local hospital DB and doctors′ group. At this time, schema collision occurred in the process of sharing the medical information is solved by XMDR-DAI. To associate with HIS, IEEE 11073-based information was integrated to HL7-based information.

<Fig.2> is a process for performing a process for transferring the sensor information that has been integrated with MBCS based on XMDR-DAI System for HIS. Description of the execution of each process are as follows. Patient Group acquires sensor data generated by the body sensor via Bluetooth to patient smartphone. Acquired data is transferred in real time MBCS System. When transferring the sensor information of each patient to the Hospital Information System, for interoperability of data, and to integrate a standard HL7 and IEEE11073 of medical information. Integrated data, after performing encryption on the Security Manager for security, to be transferred to the HIS. Doctor Group saves the health information of patients who have been sent from the HIS to the smartphone. The stored data in the mobile cloud environment, it is possible to exchange data between the doctors.

 

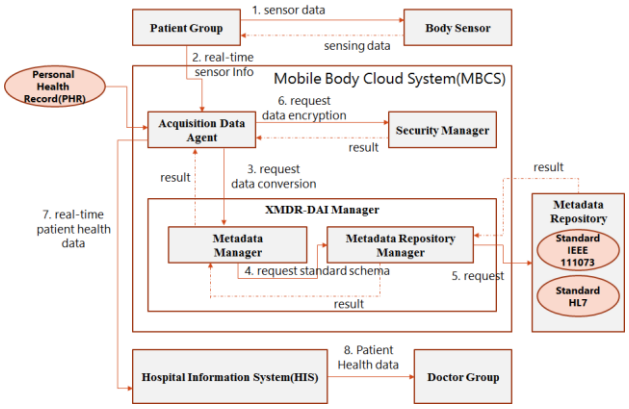


**Fig. 2.** System Operation

## 4 Conclusion

This paper suggested XMDR-DAI-based MCBS to collect, filter, convert, and integrate body sensor data in mobile cloud environment to provide patients more fundamental prevention of disease, improvement of health conditions, and convenience. Moreover, the data collision occurred in the process of sharing personal medical information between medical organizations was solved by data integration service in application of XMDR-DAI, which was one of cloud technologies. In future studies, the data measured through several types of body sensor devices should be converged with patients' medical information to analyze the patients' conditions and predict emergency, and the predicted emergency should be immediately noticed to the hospital information systems and doctors.

## References

1. Lo, Benny PL.: Body sensor network–a wireless sensor platform for pervasive healthcare monitoring. Na (2005)
2. Suzuki, H.: Hospital information system. U.S. Patent Application No 10/650,615, (2003)
3. Dolin, R.H.: "The HL7 clinical document architecture." Journal of the American Medical Informatics Association 8.6 (2001)
4. Benson, T.: Principles of health interoperability HL7 and SNOMED. Springer Science & Business Media, (2012)
5. Park, H.-K., Moon, S.-J.: "DBaaS Using HL7 Based on XMDR-DAI for Medical Information Sharing in Cloud." International Journal of Multimedia and Ubiquitous Engineering 10.9 (2015)
6. Leppisaari, A., Hämäläinen, J.: "General packet radio service." U.S. Patent No. 6,532,227. 11 Mar. 2003.
7. Pillekamp, K.-D., Tasto, M.: "Universal mobile telecommunications system." U.S. Patent No. 6,535,731. 18 Mar. (2003)