International Journal of Advanced Smart Convergence Vol.4 No.2 145-153 (2015)
http://dx.doi.org/10.7236/IJASC.2015.4.2.145

IJASC 15-2-21

The Design of Integrated system for the cloud-based medical Information sharing

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Abstract

Development of IT technology, in combination with the medical area, a number of developments have been made of the digital advanced medical devices, also increased interest in health, sharing of medical information has become increasingly necessary. Standardization for medical information sharing to satisfy these requirements have been studied. However, the medical information system is to build a system independent hospital itself, is difficult to share and exchange medical data with other medical institutions. In this paper, we provide a medical cloud system that can share medical information. Use DBaaS of cloud services. And is an international standard to have a HL7 share information by forming a meta-schema, each of the data transfer, the format of the document oriented data solves the heterogeneity between hospitals. Extracts the required field name of examination information, to exchange information with each of the local information and mapping. Health diagnostic information in the present study and diagnosis through accurate information sharing and exchange is possible ongoing management.

Keywords: *HL7,Cloud System, DBaaS, Document Oriented Data*

1. Introduction

With the development of computers and information technology, it is influenced by the medical service. Also, people of life is increased, there is an increasing interest in health management. Health services is to HL7,Cloud System, DBaaS, Document Oriented Data be able to a healthy lifestyle through the care to the patient[1]. For example, in response to the inspection in a hospital, when receiving medical treatment back to another hospital, the information before the hospital it is possible to make a more accurate diagnosis and asked to forward, it is possible to prevent the duplication examination. However, there is a need for standardization can share the information to be able to extend the medical service. For the study of

Manuscript Received: Sept. 18, 2015 / Revised: Oct. 14, 2015 / Accepted: Nov. 10, 2015
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standardization is insufficient, the current hospital system, it is difficult to share and exchange information[2]. One of these reasons, a hospital medical system is to build their own system for each hospital. Current medical system, information exchange is performed via the HL7 is an international standard. HL7 is a protocol to be able to exchange information other hospital systems and hospitals. However, the system format is different for each hospital. So information exchange takes time long and it is a bottleneck occurs[3][4]. To solve this, in this paper, so that exchange of information cloud environment is performed. By using the concept of DBaaS (DataBase as a Service) in the cloud of services, to provide a cloud system of medical information. The medical information data each hospital has to allow interchange with other hospitals, using the HL7 message is a medical standard protocol. Then, by integrating data, and provides a cloud system which can share medical information in a data format of a document-oriented. Hospitals integration and sharing of data between will generate a HL7 messages, it integrates the data, to solve data heterogeneity among hospitals problems in a data format of a document-oriented. HL7 messages in it to create a meta table of HL7-based extracts only the required field name of health diagnostic information, and mapping of the metadata of each local information, to share and to integrate the data. In this study, it is possible to construct a system that can each medical information systems to share information or different. Thus, by utilizing the health diagnostic information associated with,, aging society, it is possible to ongoing management and more accurate diagnosis.

2. Related Works

2.1 Cloud

Cloud utilizes the Internet server, storage, refers to the available IT resources, such as an application as a service. In the concept of XaaS (Everything as a Service), platform, and provide us with hardware, such as a database, all the IT elements as a service. Basically, SaaS (Software as a Service), IaaS (Infrastructure as a Service), and is divided into such as PaaS (Platform as a Servce). SaaS is a cloud services, including all Hardware, OS, until the Application. Service provider provide cloud services, User use type. It is a service that gives user the only hardware required for users who wish to IaaS services. PaaS is a service that the user is willing to provide "environment" to be able to use the service[5]. And the service called DBaaS (DataBase as a Service) appeared recently. DBaaS stands for DataBase as a Service, a database in the cloud form, hardware, installation, operation, means a solution that provides as one of the service to monitor. In this paper, by using the DBaaS concept from within the cloud service, to save the medical information data that is integrated based on the HL7 is an international standard as a document-oriented data. And, to be sent through a series of network data, access to large amounts of data, consolidation, and so capable of distributed processing[6].

2.2 Domestic medical system

Currently, domestic medical information system, the purpose of providing guarantee a healthy life of human beings, by connecting the information communication technology and health care, anywhere the user at any time, their medical information - prevention, diagnosis, treatment, post-management - it is possible to confirm. Thus, the patient receive even outside the hospital, diagnostics in real time, the treatment can receive counseling, a reservation. In addition, spatially development of the Internet, and more time expansion, diversification of services, has expanded consumer needs. In conjunction with PACS and EMR to automate hospital operations, when the patient goes to the hospital and to shorten the waiting time of a patient through the sharing of medical information data, and provide rapid clinical and convenience. In the case of the doctor,

through a variety of information sharing for medical, supporting so that it can be performed more accurately in practice. In this way, medical information system, which has many advantages, it can problem occurs when the nurse with the initial introduction cost burden and doctors is the lack of knowledge of the computer. Also, the data format has a different problems depending on the development of the system manufacturer for each hospital. Therefore, in this paper, is an international standard based on the HL7 (Health Level Seven), to provide compatibility is a system capable of data between medical information systems[7][8].

3. Cloud-based medical integrated system

3.1 The proposed system

Patients with medical records is transferred even when the transferred to another hospital, in general, by using the method stored on a CD. This method is unknown was level to the current concept of the digital age. So it is very advantageous in a time-space utilization is to send the patient's history online. However, different from each other systems across hospitals, because the database format is different, there is cooperation has not been a problem between the systems of each other. Therefore, in this paper, to integrate an efficient medical information based on the HL7 standard in order to share between the various medical information systems, and high-speed transfer of the configuration of the HL7 message to the document-oriented data in the cloud environment. That is, the medical information data exchange method proposed in this paper is as follows. Connect to DBaaS system in a hospital that requires medical information of a patient, and requests information on the patient. Hospitals requested patient information, converts the medical information into HL7 message, and transmits it to the DBaaS system. In the transferred data DBaaS system, by the modules through a mapping process, by transferring to the hospital, the exchange of data ends. Structure of the message, such as a message of representation rules will be done using the HL7 standard in DBaaS system. The proposed medical DBaaS cloud system configuration in this paper, is shown in Figure 1, is as follows description of each element.

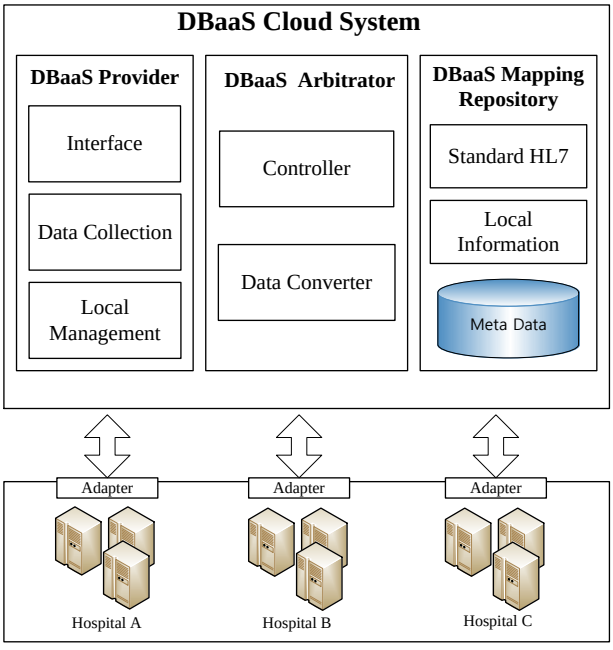

Fig. 1. System Architecture

3.1.1 DBaaS Provider: DBaaS providers associated with other medical information system to address the needs of users. The interface accesses the meta-repository, serves to perform a user's requirements. Local Management uses the transferred local information, which serves to connect its medical information systems. Data Collection is sending the data that has been requested from other medical information system.

3.1.2 DBaaS Mapping Repository: DBaaS Mapping Repository is for managing all of the metadata schema that is used for medical information exchange. Standard HL7 is an international standard. To solve the heterogeneous data issues between the medical information system. Meta Data registers mapping information between a Hospital Information System. Local Information finds the information from the local health information system that holds the data you requested.

Meta Data is mapped to the form as shown in the following figure 2. To form a HL7 standard schema of examination information, and the schema and the mapping of each hospital.

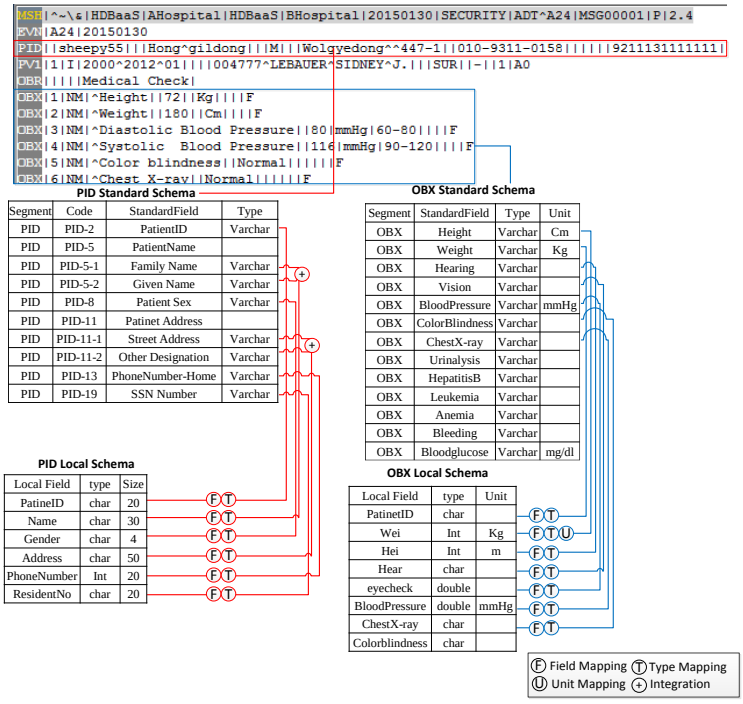

Fig. 2. HL7 and mapping of local information

Figure 2 shows the mapping of standard schema and local schema of HL7. F, T, U, respectively Field Mapping, Type Mapping, means Unit Mapping, + means that the integration of field. Therefore know each schema is a what mapping when mapped PID and OBX shows diagnostic information and patient information. With regard to the HL7 standard items, field names, are the definition of up to the size name. A standard entry in the HL7 message in this paper, since the move to the data format of the document-oriented, I have set the type to a character type. HL7 standard items and will be almost one-to-one mapping for the local item, the name and address on the local schema, have been taken in almost the field, in the standard schema, the name in the first and last name, address Street Address and the rest It has divided into address. Therefore, it is mapped on the local, name and address were to be mapped by integrating into one. Read the HL7 message, extracts the order and the field name of the field name for each segment, the data is extracted, to integrate with map locally.

3.1.3 DBaaS Arbitrator : DBaaS arbitrator plays a role in order to provide collaboration services between the HIS. Controller mediate medical information exchange between Hospital Information. Also it mediate the integration of data. Converter is receiving the requested medical information. it is converted into a standard mapping information.

3.1.4 Adapter : Adapter allows to connect the database to match the incoming mapping information for each hospital type. Data to be loaded, and to create a local query, can you send DBaaS System converts the data format of document-oriented based on local information.

3.2 The proposed system operation process

Operational processes of DBaaS system proposed in this paper is as shown in figure 3.

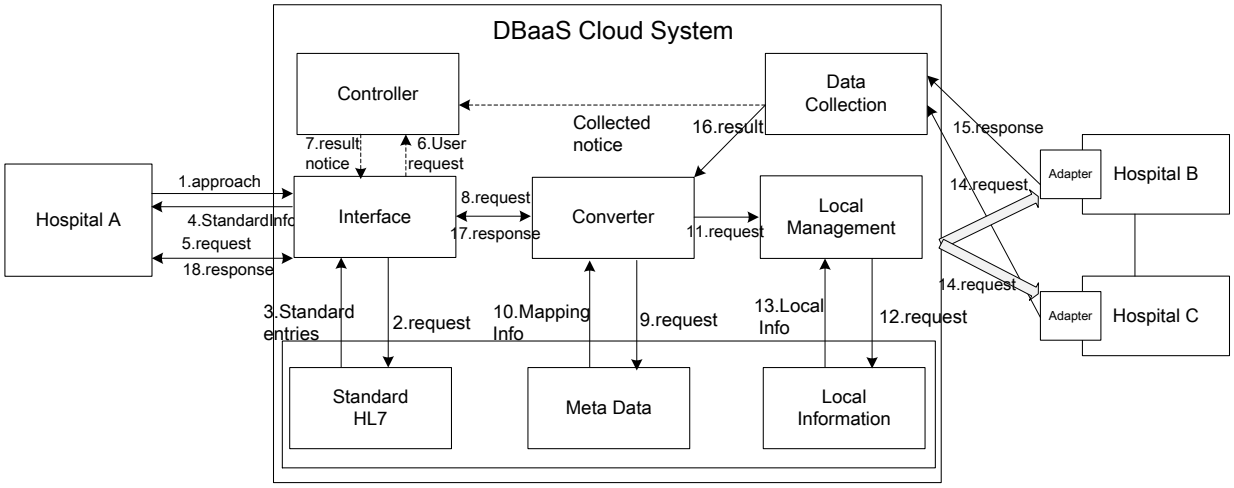

Fig. 3. The DBaaS System Operational Process

The steps of Figure 3 are as follows.

1 : It wants to request a connection to DBaaS system. Request to the patient's medical care date, name, it is necessary to enter the basic human information such as resident registration number.

2~3 : The input information by StandardHL7 part of HL7 message is generated,

4 : Is information to receive HL7 information created.

5: It begin to request information from other hospitals.

6~7 : The flow of the overall data of the information request Controller me to monitor and control.

8 : Request information through this process is sent to the Converter.

9~10 : Meta-data and request information of each hospital by mapping to transmit information.

11: It sends the mapping information,

12~13: IP of each hospital, in the Local Information that has information such as the Port, I look for the address of each hospital.

14 : Pull the number 13, the IP address of each hospital, through this process, to transfer to each hospital.

15 : The information you find in each hospital to be sent to the Data Collection.

16 : It transmits information were combined in Data Collection to Converter.

17 : It will send the medical information for the Convert request to the interface.

18 : It serves to transmit the request information to the hospital A.

Next, figure 4 is sequentially shows the relevant command of the adapter.

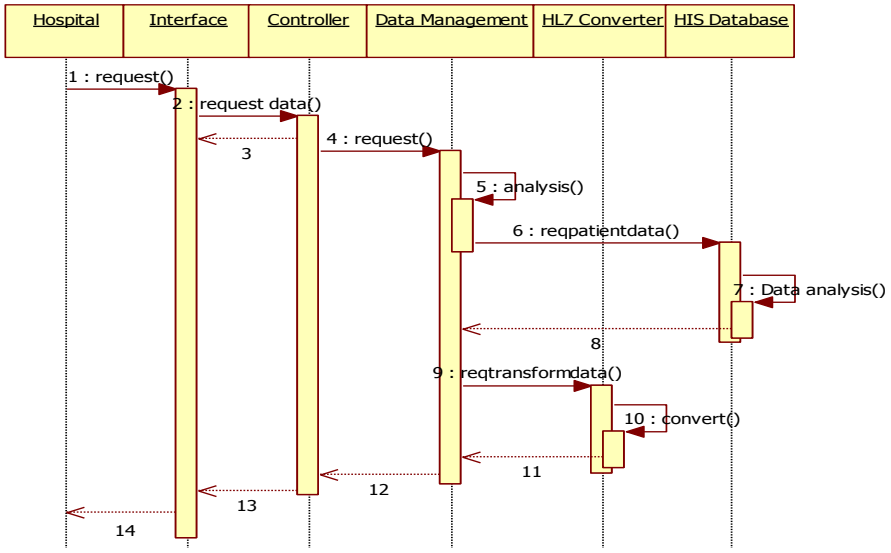

Fig. 4. Adapter Work Flow

It is the role of ⑤ number ~⑩ times Adapter from fig 4. First, ① number of request () is intended to request the information from the hospital, ② number and ④ number accepts the request of ① number, the flow of data in the form as shown in fig 3 is carried out. ⑤ number and analyzes information from the Data Management, and extracts the query to the request information. ⑥ number is transmitted to the Hospital Database, and extracts the data of the requested information data through the query from ⑦ number. It is transmitted to ⑧ number of re-Data Management, and re-converted to the HL7 format from ⑩ number by sending the data that was ⑨ number extracted into HL7 Converter. After that, it is responsible for sending the results in the order in which you call ⑪~⑭ times.

4. System Implement

4.1 Application Example

Implementation of the proposed medical information cloud system in this paper, is done in the following manner. First of all, we were using the C # and MySql for system implementation. And it was set to come out HL7 messages using the API called NHAPi. The order of the system is to first enter personal information to the patient, and transmits that information about it to the hospital. In connection list is given the information if there is information to the hospital so that the list of hospital of name and the hospital is displayed. And selecting the date and the hospital is to be displayed medical information results on the interface, the mapping of medical information, becomes visible and is formed as shown in fig 2. Figure 5 shows the overall interface, consisting of (a) ~ (d). First, fig 5 (a), in order to connect to the DBaaS System, inputs the personal information of the patient. If you then select the Create, HL7 message is generated and forwarded to each hospital. Next, fig 5 (b), if there is information based on the message transmitted from each hospital is a screen that displays a connection. At the top left of the check box list box, the list of hospital ahead to the right of the check list box, so that the day it is practice to enter. Then, it becomes to select an item and look like information if any Medical Check health diagnostics. In the application example, and to have a total of 12 health diagnostic information, press the more button, 6 health diagnosis of the item

is displayed. And fig 5 (C) is able to see the medical records of the date selected in fig 5 (B). Medical record, only the information that has been selected in fig 5 (b) is outputted. It can be seen by specifying a hospital that is checked in the list box. Finally, fig 5 (d), when you click the Save button, an interface to the exit at the coming screen try to see if there is no re-show abnormalities of information for the save. If there is abnormal when you press the OK If you are satisfied with the cancellation, the system will end.

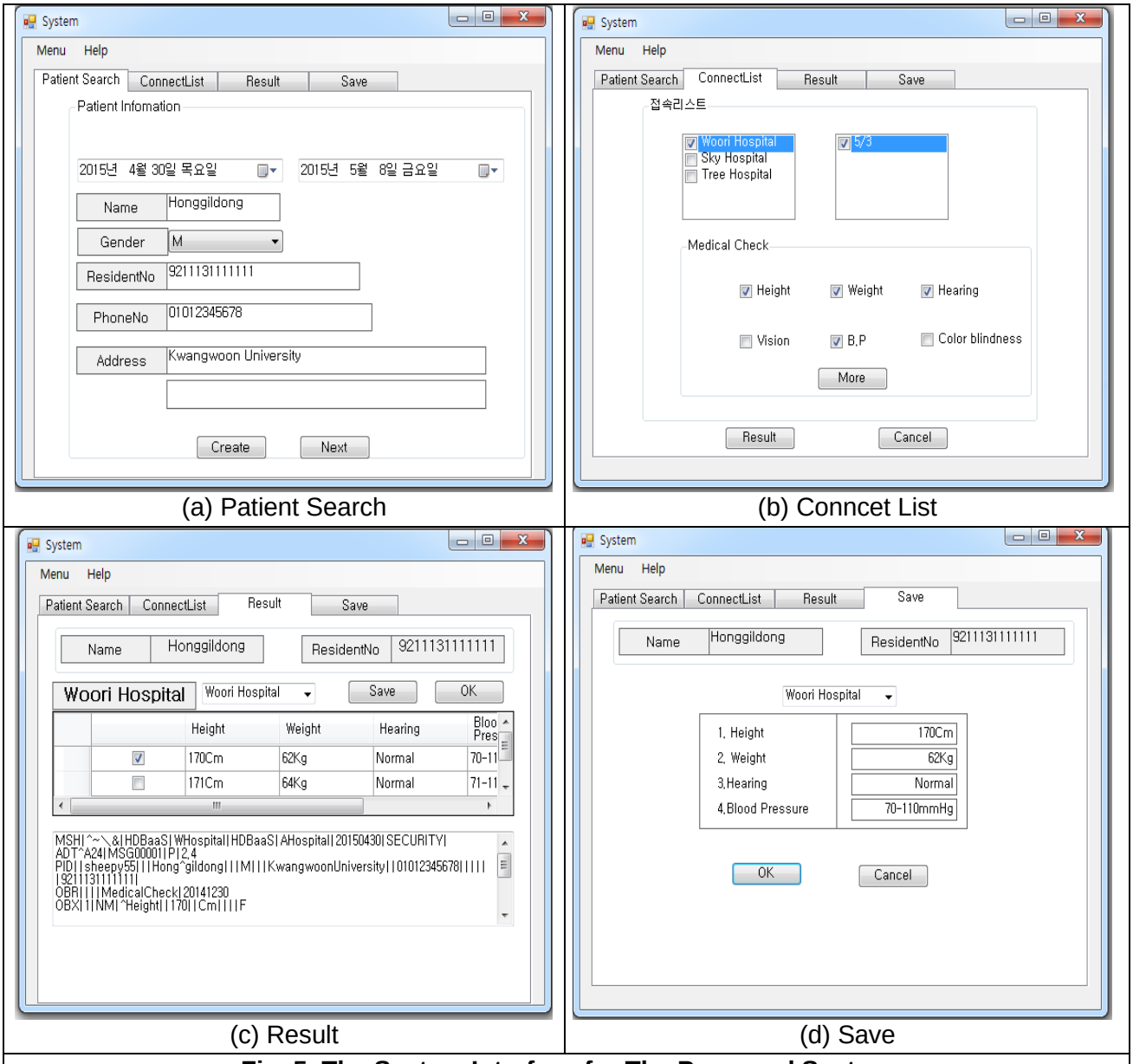

Fig. 5. The System Interface for The Proposed System

4.2 Comparison of Related System

Table2 is a comparative evaluation of the proposed system with the existing system.

Table 2. Compare of The Proposed System

	Existing System	Proposed System
Integrated System	Distributed processing system	Cloud System
Medical Protocol	HL7-based Relational database	HL7-based Document-oriented database
handling	Relational Database	File-based document-oriented database
Data Type	Table	Table and Document-oriented database
Data Scalability	Complex	Easy

First, the proposed system is an existing system, the same thing is that the exchange of information based on the HL7. However, the existing system processes in a distributed processing system. Hospital DB are the typical relational database. When exchanging the information, the medical information, to suit the type of each data, to be necessary to format the data. When transferring the data of large capacity sometimes bottleneck occurs. Data handling are the relational database to assist in the form of a table. And when expanding the existing systems, the data is increased and administration is difficult, the cost of the hardware is relatively increased, the development environment becomes complex. However, the proposed system, since the work with the data format of HL7 based document-oriented sharing of data is made simpler than the existing systems, it is also advantageous in the processing of a large capacity. Even more data, since it is not stored in the system, the development environment is simplified, the cost of the hardware is maintained.

5. Conclusion

In this paper, even medical information system is different from each other and integrated management of medical information data, we have proposed a medical integrated system sharing cloud-based as possible of data. The proposed system is to extract a field name for using the medical information metadata and the international standard HL7 of hospitals and integrate data exchange has established the data is available DBaaS environment. The system was reduced to integrate medical data exchange time information data without changing the conventional medical information system, and to enable the exchange of other type of database. Data integration is done through the HL7-based interface is an international standard protocol. This study has hospitals and hospital, and the range is expanded to a hospital and the patient such as the patient by preventing redundancy check each time a visit to the hospital, it is possible to save time and money. Future research plans are to conduct research on the health information data sharing via the mobile cloud environment based on the system proposed in this paper.

References

[1] Murero, Monica, and Ronald E. Rice, *The Internet and health care: theory, research, and practice*, Routledge, 2013.

[2] B. Orguna, J.Vub, “HL7 ontology and mobile agents for interoperability in heterogeneous medical information systems,” Computers in Biology and Medicine 36, pp. 817–.836, 2006.

[3] Ko, Li-Fan, et al., "HL7 middleware framework for healthcare information system," *8th International Conference on e-Health Networking, Applications and Services (HEALTHCOM), 2006.*, 2006.

[4] González-Ferrer, Arturo, et al., "Use of the virtual medical record data model for communication among components of a distributed decision-support system," *Biomedical and Health Informatics (BHI), 2014 IEEE-EMBS International Conference on*. IEEE, 2014.

[5] Armbrust, Michael, et al., "A view of cloud computing," *Communications of the ACM* 53.4, pp. 50-58, 2010.

[6] Ferretti, Luca, Michele Colajanni, and Mirco Marchetti, "Supporting security and consistency for cloud database," *Cyberspace Safety and Security*. Springer Berlin Heidelberg, pp. 179-193, 2012.

[7] Lee, Jane YeonJae, Robin A. Kearns, and Wardlow Friesen, "Seeking affective health care: Korean immigrants' use of homeland medical services," *Health & place* 16.1, pp. 108-115, 2010.

[8] Jang, M. J., S-M. BANG, and D. Oh, "Incidence of venous thromboembolism in Korea: from the Health Insurance Review and Assessment Service database," *Journal of Thrombosis and Haemostasis* 9.1, pp. 85-91, 2011.