

# Web Service 기반의 휴대용 건강 요약지 보고 시스템 구현

## Implementation of reporting system for continuity of care document based on web service

김종욱, 전소혜, 임청목, 박선영, 김남현\*

Jong Wook Kim, So Hye Jeon, Chung Mook Lim, Sun Young Park, Nam Hyun Kim\*

**Abstract** - The development of health information technology enables people to access, view and acquire personal health record. But still, there have been a number of obstacles such as the absence of the standard to realize the ideal Personal Health Record(PHR)system. In this study, we proposed the service model that serves periodic Health Record Summary which is made by a medical specialist to people who are in the busy lives. Healthcare data from EMR in a hospital including people generate themselves at home is sent to a physician to make a medical opinion, and then it is changed into Health Level 7 Continuity of Care Document (CCD) format for interoperability. After a physician writes his opinion about patient's health condition, it will send to people by email. People who receive the health record summary data by email can save them into a USB device to view own PHR and medical comments of a physician through a computer. It will help people managing their own health condition with an opinion of a medical specialist.

**Key Words** : Personal Health Record, Continuity of Care Document, Web Service, Health Level 7

### 1. Introduction

The importance of PHR is growing for collecting and analyzing patient's healthcare data regularly. There are various definitions of PHR, they have something in common. It is that ideal PHR enables a review and audit of healthcare data which is scattered among various clinical systems.

The PHR system built upon this concept offers integrated and comprehensive healthcare information, including the information that people generate themselves, such as family history, medication information, and vital signs. It also provides many other benefits, including efficient clinical management, reducing medical errors, improving quality of care improved diagnosis, reminders, simple warning tools, and improving the validity of information available to care providers.

Health Level 7 Continuity of Care Document is a electronic document exchange standard for sharing patient summary information among providers and for maintaining personal health records, which summarizes the most

commonly required pertinent information about current and past health status in a form that can be shared by all computer applications, from web browsers to electronic medical records. The advantages of the CCD are shared syntax and architecture, ease of rendering, extensibility due to the shared model, international and national acceptance, and integration into the EHR. Because of the benefits provided by the CCD, it is the only available standard to overcome the limitations of the PHR.

In this study, we constructed the healthcare management system to be able to give periodic medical summary information with doctor's comments based on the CCD standard to people who have difficulty of checking regularly health condition. Using this system, people can check the clinical information based on taking an object view of a medical specialist.

### 2. System configurations and Methods

#### 2.1 Personal Health Record

Today, people are exposed to lots of disease which can possibly be inherited from one generation to the next. If certain patient's healthcare data are scattered among various clinical systems, it is not only difficult to collect them, but also difficult to identify specific health status from successive data. PHR system enables health trend

#### 저자 소개

- 김종욱 : 연세대학교 생체공학협동과정 석사과정
- 전소혜 : 연세대학교 생체공학협동과정 통합과정
- 임청목 : 연세대학교 생체공학협동과정 통합과정
- 박선영 : 연세대학교 생체공학협동과정 박사과정
- \* 김남현 : 연세대학교 의과대학 의학공학교실 교수

monitoring through individual management of personal data during one's whole life, and makes effective health management by providing disease prognosis.

There is general concept of PHR system which the ideal PHR system would receive data from all constituents that participate in the individual healthcare; allow patient to enter their own data; and designate read-only access to the PHR system.

When the PHR system fluently connects with several EMR systems without any problems, people can accumulate lifelong health record and keep these data on own portable devices.

### 2.2 Continuity of Care Record

The HL7 CCD is the result of a collaborative effort between HL7 and the ASTM organizations to harmonize the data format of the ASTM's Continuity of Care Record (CCR) and HL7's Clinical Document Architecture (CDA). It is the standard for interoperable exchange of information to and from PHRs and shows the most commonly needed information about present and past health status. It is widely adopted for PHRs by many PHR vendors since the CCD is built upon the main reason to contain the pertinent clinical, demographic, and administrative data for a specific patient.

1) CCD Header: CCD is constrained by the HL7 CDA R2 specification in accordance with the requirements of ASTM E2369-05 Standard Specification for the CCR. Thus, CCD maintains same elements with HL7 CDA and provides additional constraints on some header elements (templateId, languageCode, code, effectiveTime, etc.).

2) CCD Body: Since CCD follows the same structure and logic of HL7 CDA, the XML CDA body has one of more sections that can nest and that are related through a component relationship. CCD has some kinds of sections such as purpose, problems, family history, alerts, vital signs, and results which may contain entries that convey the machine-computable semantics of the section and links to related information.

### 2.3 Web Service

For the purpose of interoperability of this system, we used web service as a software system which is designed to support interoperable machine-to-machine interaction over a network. As web service is applied to the system, people can access over a network, such as Internet, and executed on a remote system housing the requested services to check their own health information. Web service uses Extensible Markup Language(XML) messages that follow the Simple Object Access Protocol(SOAP) standard.

### 2.4 Simple Mail Transfer Protocol Server

Recently, electronic mail (email) is a great mean of communication among people in a computer. As many people today use own mobile which can access the Internet, the number of people using Email is growing.

In this study, we chose email as a mean for sharing patient summary information. To deliver email for patients, the Simple mail transfer protocol (SMTP) is used which is an Internet standard for electronic mail transmission across Internet Protocol (IP) networks by Internet Information Services (IIS).

## 3. Results and Discussion

### 3.1 System Architecture

Periodically, the Collector that can access EMR system via the Internet to collect the medical data including the medical data patients generate themselves such as blood pressure, blood sugar, and weight store the integrated medical information of a patient into the MS-SQL 2003 Database. The medical specialist logs in the application to make an opinion about the patient's health record and store it into the database. Then, the SMTP server will start to collect the physician's opinion and the summary medical data for making the CCD. Then, the server will send the CCD to patients by email. Every person who gets the email from a physician can download the PHR as a CCD into the USB, so that they can get a full view of the health information with doctor's comments by using the application in the USB.

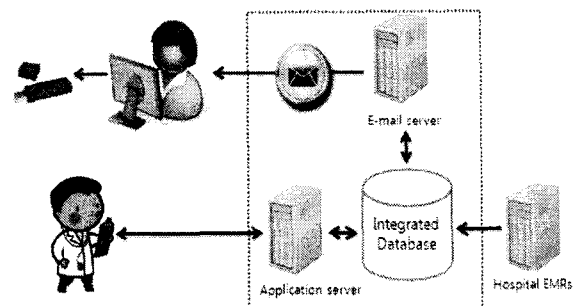


Fig. 1. System Architecture

### 3.2 The Physician's CCD Generator

Before the physician has a closer view on the patient's whole medical record, the Collector connects to the database to gather the related information, and then it will store the integrated medical data in the database.

When a physician login the CCD generator, it will automatically get the integrated medical information from the database. After the CCD generator gets the medical record, a physician can view whole of a patient's medical data, then give a proper comments on a patient. Finally, a physician saves the medical opinion, and then it will be stored in the database as the CCD instances.

We have chosen the 11 sectors to make the CCD document, such as family history, social history, allergy information, and plan information. Each has different code value to express different patient data and we used Logical Observation Identifiers Names and Codes (LOINC) code.

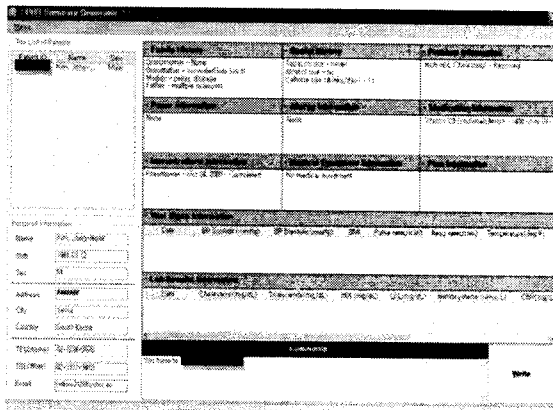


Fig. 2. The CCD generator by a physician

### 3.3 The Mailing Application

After a physician made comments about the health record, it will be stored in the database. The mailing application has the main thread which is continually searching for the CCD data in the database, and then begins to transform the CCD document from XML to HTML file. After the transformation, it starts to send email by the SMTP server.

(Fig 3) shows that the mailing application is sending email, after querying the medical data. It stores the log about whether it will be sent successively or not, so that it will be able to send email again that is fail to deliver.

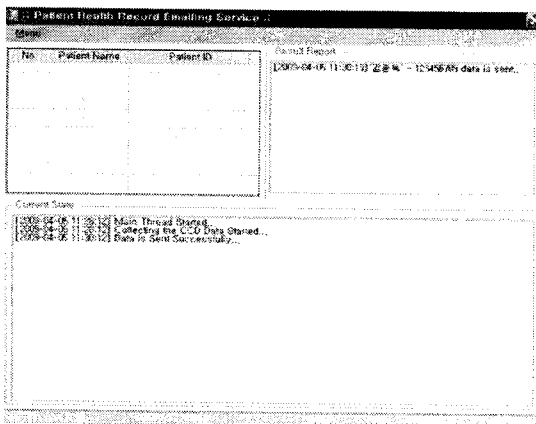


Fig. 3. The Mailing Application

### 3.4 The CCD Viewer in USB

Every person who gets the email from a physician can download the PHR as a CCD into the USB, so that they can get a full view of the health information through the application through the C#.Net application.

When the Viewer stores the CCD, it will validate the CCD against the CDA schema if it is well - form made, or not. If it is not validate, the program will give an alert to a patient. The CCD document from a physician is read only to protect the integrity of the data.

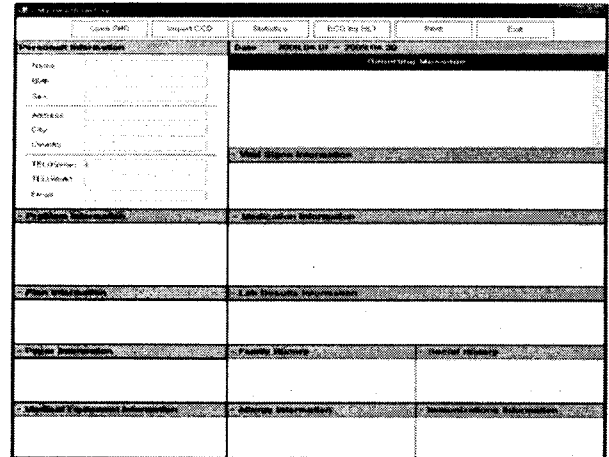


Fig. 4. The CCD Viewer

## 4. Conclusion

Here, we have developed the PHR system that can provide patients easy way to check their own medical record regularly without going a hospital and make doctors giving better care for patients. We also used the CCD as the best standard for the PHR to provide a standardized summary of personal medical information for presentation to health care providers.

As people store their own health record in the USB, it can be a lifelong personal health record. It also provides people to access the health record through a computer without accessing the Internet. People have the USB only consider where a computer is when they want to view their own medical record.

## References

This study was supported by a grant of the Seoul R&BD Program (10608) and the Korea Health 21 R&D Project, Ministry for Health, Welfare, and Family Affairs, Republic of Korea (Grant No: A040032).

- [1] R.H. Dolin, L. Alschuler, C. Beebe, P.V. Biron, S.L. Boyer, D. Essin, et al., The HL7 clinical document architecture, J. Am. Med. Inform. Assoc. 6 (2001) 552-569.
- [2] Li N, Yu BG. [Design and Implementation of the first page of electronic patient records based on HL7 clinical document architecture, R2.0]. Zhongguo Yi Liao Qi Xie Za Zhi 2007;31(4):263 - 6.
- [3] Dolin RH Alschuler L Boyer S Beebe C Behlen FM Biron PV Shabo Shvo A HL7 Clinical Document Architecture, Release 2 2006 J Am Med Inform Assoc 30 - 9.
- [4] HL7 implementation guide: CDA Release 2 - Continuity of Care Document (CCD).