Center for Emergency Medical Informatics

YONSEI UNIVERSITY
Department of Medical Engineering

Web-service based Healthcare Information Presentation using Portable Device over wireless and wired network.

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Introduction

- In an ubiquitous healthcare domain, mobile computing system using mobile devices such as mobile phones, personal digital assistants (PDA) are carried nearly everywhere by excellent mobility and ease of accessibility.
- Web services now support a single uniform method for application integration through the Internet at distributed computing environments.
- In this paper, we suggest a healthcare information system that provides medical information on both wired and wireless networks with the following functions.
- First, the system provides medical information used for desktops on wired networks. Second, the system has a mobile context server that reconfigures web contents according to the mobile device.
- The mobile context server applies context to the contents by using styles, an attribute override, and templates according to the resources of a given mobile device.
- In this manner the system support reconfigured web contents to the mobile device.

Materials and Methods

- When a user requests medical information through a wired network, the web server serves the information by connecting to the databases of the web server.

- The mobile context server optimizes web contents according to the type of mobile device. The mobile context server was developed by Micro-soft and is called the Mobile Internet Toolkit. The Mobile Internet Toolkit filters mobile devices and creates “Device Specific/Choice” structure.

- The Device Specific/Choice filter can describe a style according to the browser type by using style sheets. In this system, a page is divided and made up of the select/result structure.

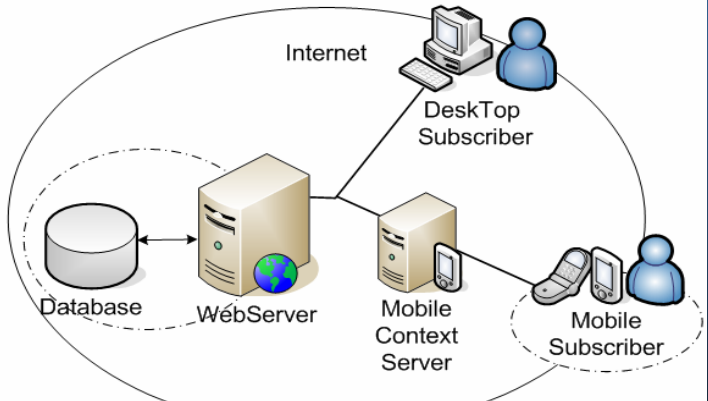

Figure 1 - The system architecture

- The system is conceptually composed of five main components: the web server, medical information database, mobile context server, mobile user, and desktop user.

Materials and Methods

- Using a tightly coupled application development approach provides certain safeguards from quality-of-service, security, privacy, data integrity, and complex transaction processing perspectives as compared to the Web Services architecture .

- After the system evaluates a mobile device's computing capacity, the system serves the web contents based on the context chosen by the mobile context server.

- When a user requests medical information through a wireless network, the mobile context server divides the con-tent pages according to the screen size of the mobile device. It also filters the pages according to mobile devices and then browses the adopted contents from the context server to the mobile web browser.

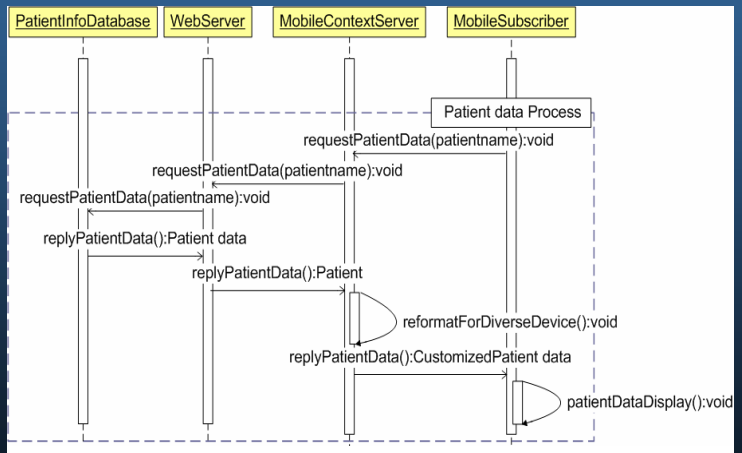

Figure 2 - Web service sequence diagram of a mobile device

- Figure 2 shows web service sequence diagrams of a mobile device.

- The mobile context server reconfigures contents offered by the web sever.

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Results

- The web server was served using Microsoft IIS 5.1 and Microsoft Windows XP Professional. Server application was developed by Microsoft ASP.NET based on C# .

- The medical information database was served by Microsoft SQL-SERVER 2000. The context server connected to the web server acted as the web server. The user system served on the wired network was browsed by Microsoft Internet Explorer 6.0.

- The mobile web browsers used in the wireless network were a Microsoft MME 3.0 emulator, Microsoft Pocket PC 2003 PDA, HP i-PAQ H2200, or LG SC8000.

Results

- Figure 3 shows the contents that are displayed on the web browser using a wired network.

- The desktops shown have an adequate screen size, so web contents can be displayed on one screen. In this case, the content consists of the date, patient list, diagnosis, patient information, symptoms, and patient images.

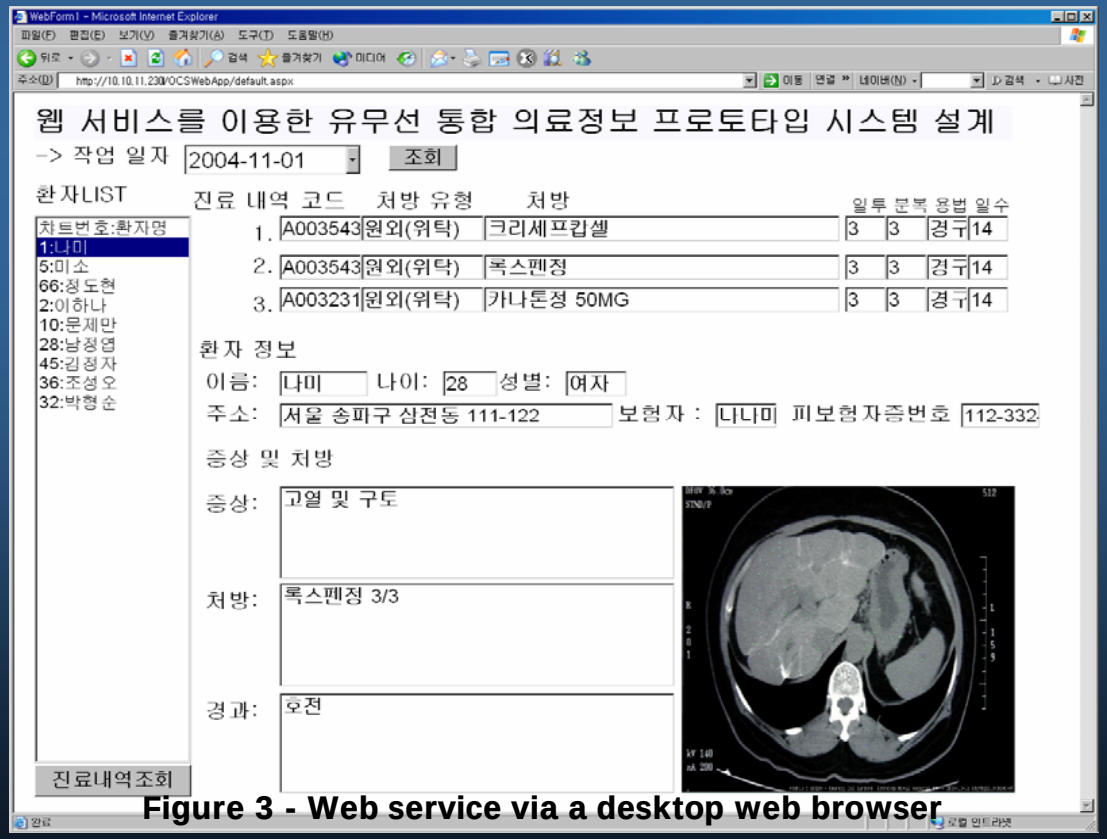

Figure 3 - Web service via a desktop web browser

Results-Experiment I

- This system is suggested to aid in faster diagnosis using medical information on both wired and wireless networks. It displays optimized web contents according to the user's browser resources.

- Figure 4 show the results displayed on a MME 3.0 emulator and HP i-PAQ H2200. This system can display optimized contents on mobile devices determined by the context server.

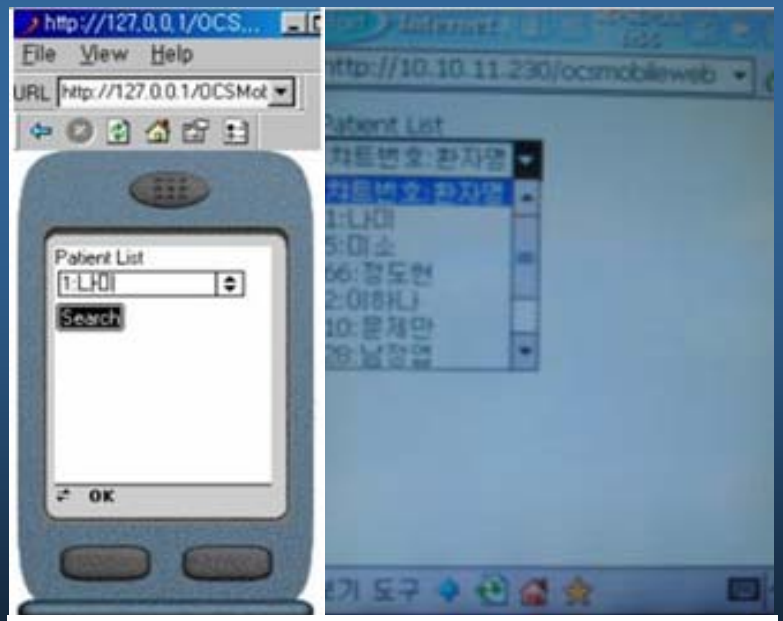

Figure 4 - Patient list page of various mobile browsers

Results-Experiment I

- Figure 5 shows the patient image. This application can enumerated the patient names using combo box control. Because each mobile device has its own screen size, the amount of information that can be displayed differs in each model.

Figure 5 - Patient image information

Results-Experiment II

- Figure 6 shows a divided web page for a mobile web browser. Our system divides the discharged web page into one “choose” page and eight “result” pages with considering the user friendly interface,

- C1 is a choose page of date and patient number. R1 is a result page of diagnosis confirmation. R2 is a result page of past history and present illness. R3 is a result page of physical exam. R4 is a result page of laboratory findings. R5 is a result page of result and plan. R6 is a result page of drug discharged. Finally, R7 is a result page of an MRI image

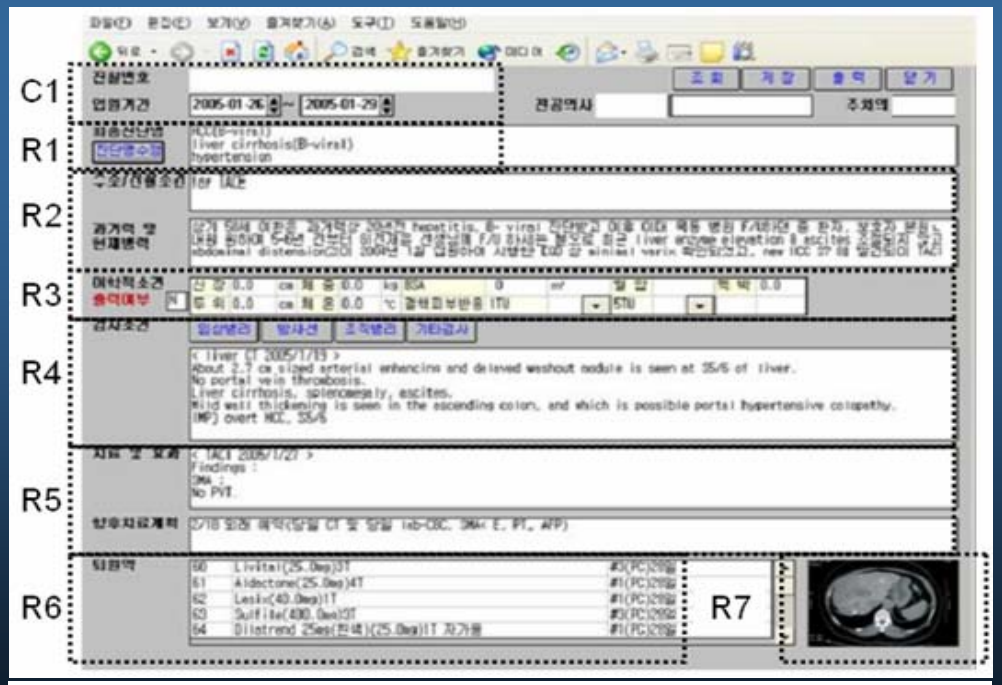

Figure 6- Discharge web page on the Order Communication System

Results-Experiment II

- As a result, the web service is considered an important technology to the healthcare system.
- Our proposed system solves some limits of mobile web services by using a mobile context server that applies context and serves information based on the type of mobile device.
- To develop this system from a prototype to a total healthcare system, additional patient information and research is needed, and a greater compatibility with divisions in dynamic web pages.

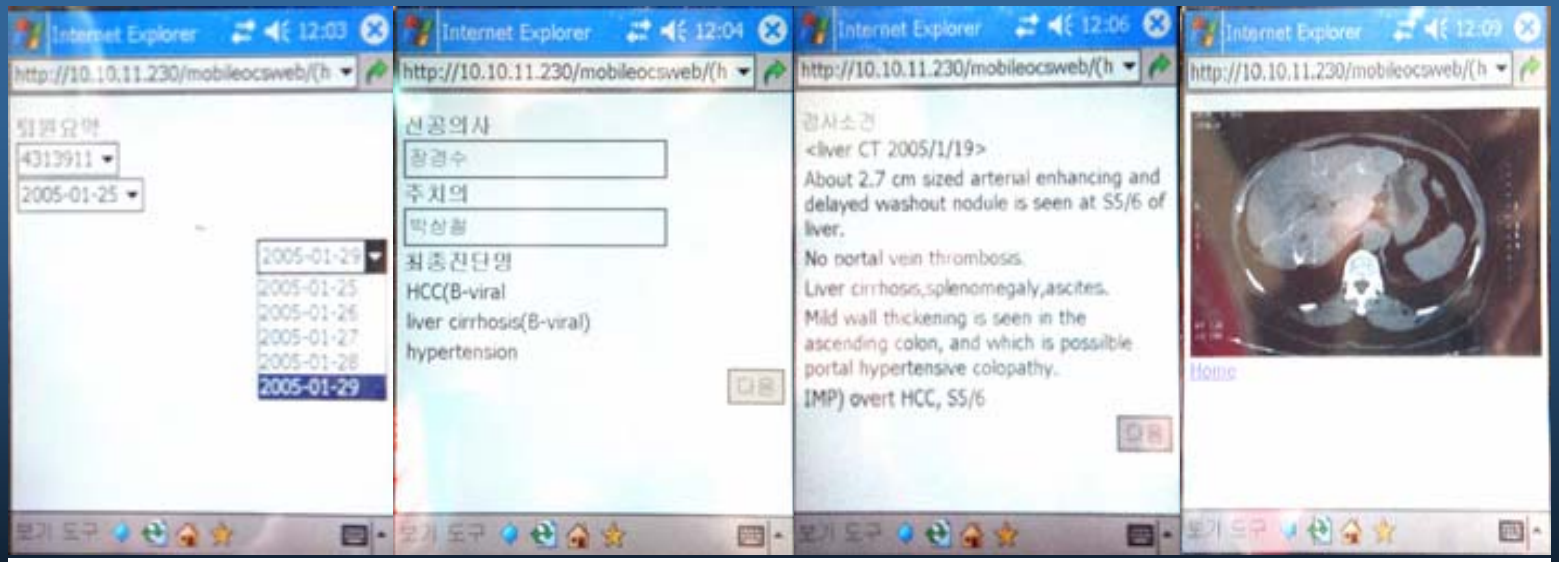

Figure 7. a) Date and patient number, b) Confirmation of diagnosis, c) Laboratory finding, d) MRI image

Discussion

- At present, there are not enough content applications to meet user requirements. Available existing web contents are mainly used for desktops on wired networks, but are not yet compatible with mobile web services.
- This paper suggested a healthcare information support system using Web services for wired/wireless integrated services according to the resources of a given device.
- This system solved some limits of mobile web services by using context server that applies context, and served information based on the type of device. So these results will help to implement effective web based healthcare information system at wired and wireless network environments.
- However, further complement research will be necessary. When regarding particularity of medical information system, enhanced security methods and healthcare information standard have to considered. Maybe HL7 can be one of alternative plan.

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