Dedicated Smart Software System for Mobile X-Ray

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Abstract. In this paper, we describe dedicated smart software for mobile x-ray system. It can support mobile x-ray system and medical information system. Also, it provides web services that allow us to deal with the DICOM of medical information standard. In order to implement this smart software system, we describe about a PACS environment that is a kind of web based system. And we also describe the system architecture as a physical environment and process of system components. And then, we show the results of service such as mobile viewer and file upload service.

Keywords: mobile x-ray system, dedicated smart software, medical information system, DICOM.

1 Introduction

Recently, healthcare and variety of IT technology have combined with a medical device that related products have been released. In particular, the introduction of smart software has led to the integration of existing medical information system[1]. In addition, smart software technology is the ubiquitous healthcare that can make new medical service for the hospital. Further, various mobile x-ray systems have been developed in order to do the emergency environments such as emergency rooms, operating theatres and portable imaging at anywhere. It is expanding worldwide due to the technology's compelling advantages in productivity, X-ray dose and image quality. For instance, typical systems such as Carestream XDR[2], GE healthcare AMS Mobile X-RAY system[3] and Siemens[4] etc. Most of systems focus on mobile, portable and wireless using ICT technology.

We have been developing one system of mobile x-ray for diagnostics at out-patient clinics, operating room and emergency room. Therefore, we are required to research on how to use the smart device based on it and system development of mobile x-ray that can collaborate with the medical information system(by INFINITT Company).

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Firstly, we define the structure of the system and design an interface between each component. This is called Medical information system or PACS and dedicated smart device. It was adopted by basing on the Android OS[5, 6, 7] and exchanged of information between each system according to the standard DICOM[8, 9]. This paper focuses on the smart software research for supporting mobile x-ray system. It provides web services that are interact with mobile x-ray system and medical information system or PACS.

It is also organized a follows; Section 2 describes the whole system architecture and process of system components. Section 3 shows the implementation of system environments and the result of application service. Last of all, it is on chapter 4, we will describe about the conclusion and the content of future research.

2 Dedicated Smart Software System

2.1 System Architecture

Overall structures of the proposed system are as follows. It can configure outside or inside hospital environment by using the mobile x-ray system and communications infrastructure such as WiFi communication and wire/wireless environments. As Medical information System were include the mobile server which supports the smart devices.

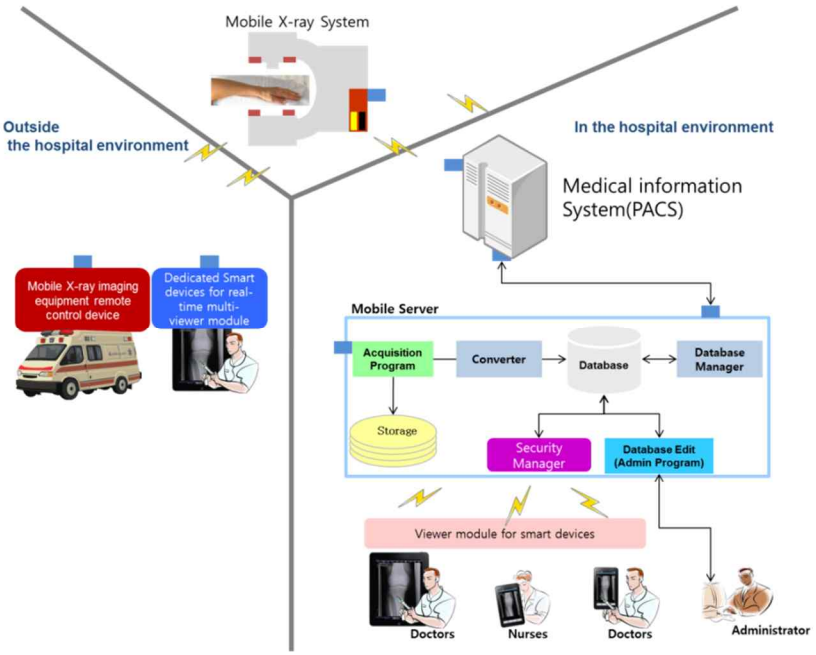


Fig. 1. The system architecture

Mobile x-ray system contains a multi-sensor sensing module that can transfer to the medical information system DICOM files by capturing the patient's body part. After that, it will send what we have captured to the dedicated smart device and Medical information system. It provides Image Information services in collaboration with the mobile x-ray system and the dedicated smart devices. Then, these smart devices in the hospital environment will provide medical information service connected to the medical information system. The dedicated smart device is used as the DICOM file. However, in the connection with the Mobile Server, smart devices generally deal with image files [10].

2.2 Interaction of System Components

Visualizing the whole system, Figure 2 below, shows the process of interaction between the components. The Net gate interacts with multi-sensor sensing module. Also, a medical information system includes the upload service and mobile server for interaction with the client like Web-based client devices. PACS storage that stores the DICOM files consists of a dynamic Access Control Service for all requests security processing.

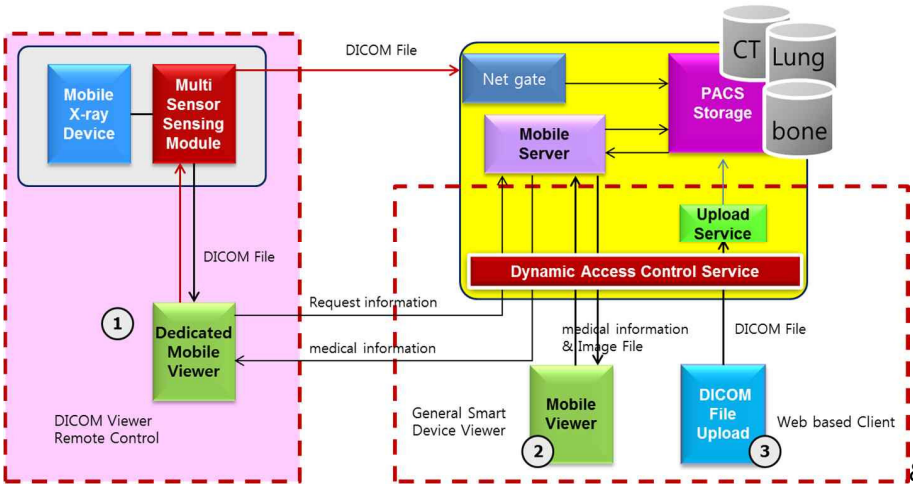


Fig. 2. Interaction of system component

Figure 3 shows the method call interface and interaction between each component. First, in order to generate a DICOM file and save it to the medical information system, mobile x-ray system have to invoke the C-store-RQ() method. Medical information systems, store_to_database(), is used to save to the database. In the Output Viewer, veiw_display(), uses the request(query) method to interact with medical information systems and smart devices, resulting values, transfer the DICOM file by dicomfile_send() method. In addition, the dicomfile_upload() for the DICOM medical information system stores file that is created from other devices. Also, by using the stepmotor_conrol() for controlling mobile x-ray system, smart device can make the position of the header change.

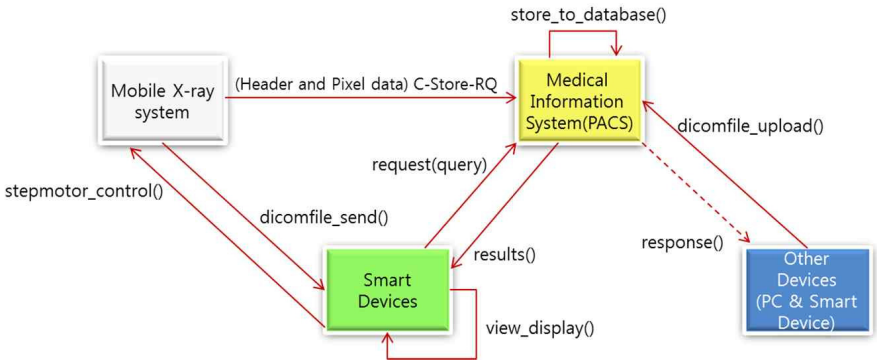


Fig. 3. Interaction of diagram for system and methods of interface

3 Construction of System and Results of Application Service

The physical environment of the proposed system is shown in Fig.4. Mobile x-ray system can be taken only a portion of the body. Multi-sensor sensing module is consisted of Step Motor module for control camera with multi-sensor-based ATMEGA128. Medical information systems are constructed in the IBM Z404 workstation server, the mobile device has the Android OS basing on smart phones, and PC system for view application service is connected to the general Internet.

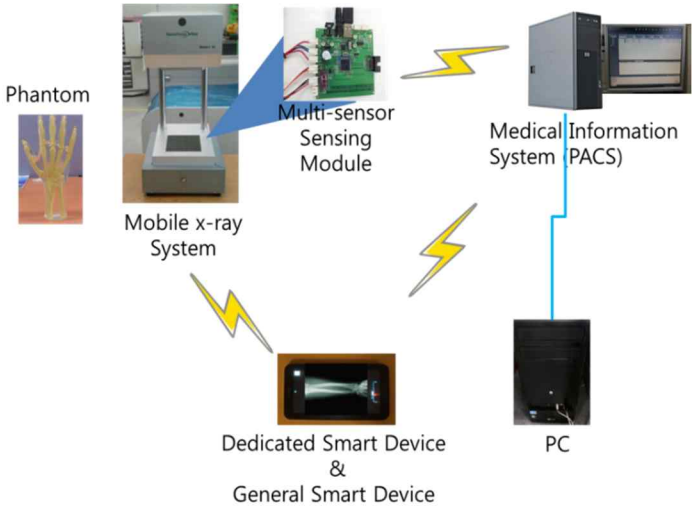
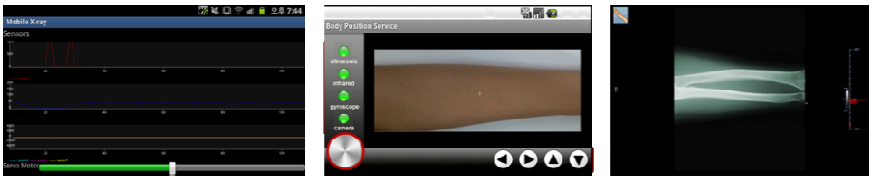


Fig. 4. Physical system environments

Figure 5 shows the results of the DICOM file viewer screen shot with a mobile x-ray system for position control whereas the main screen with the camera and multi-sensor data are collected by the dedicated smart device.



(a) Multi-sensor data (b) Main Control GUI (c) DICOM viewer

Fig. 5. The body position service result of dedicated smart device

Figure 6 shows the image lists that connect to medical information systems in smart devices.

Fig. 6. The image file viewer of general smart device

Figure 7, shows the results screenshot using the PC viewer and DICOM files that transfer to a specific directory on the medical information system in order to upload the DICOM files from the client PC.

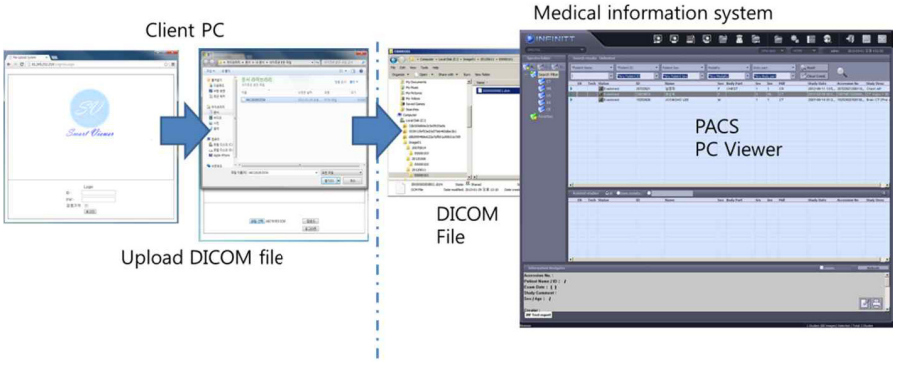


Fig. 7. Shows the results of upload service on medical information system from client PC

4 Conclusion

In this paper, we describe the dedicated smart software system to support mobile x-ray system. We have developed a software environment for medical information services such as viewer and upload service. This overall functionality of the current systems has been completed.

Mobile x-ray system has been developed successfully. In our future studies, we would like to improve the function of each software implementation and the interface between the Multi-sensing modules. We are also planning to add the Dynamical Access Control Service to medical information system.

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