VOL. 10, NO. 3, MARCH 2015 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences


www.arpnjournals.com

ELECTRONIC MEDICAL RECORDS USING NFC TECHNOLOGY

A. Devendran, R. Jayam and P. Sindhuja
Faculty Dr MGR Educational and Research Instiute, Madurvoyal, Chennai, India

ABSTRACT

EMR-Electronic Medical Records are replacing Paper Medical Records which is now considered a key initiative in the Healthcare industry. It is because Paper medical records are easily lost and damaged and also disappears during emergencies. They are often incomplete with incorrect or missing information. Doctors therefore end up duplicating tests, making uninformed decisions and delaying care.
But are EMR/Electronic charts really any better? - Unless it is available to providers at the right time.

Keywords: electronic medical records, near field communication, wireless network, patients.

INTRODUCTION

Medical records like - Patient Charts/Case Sheets, Discharge Summary, Visit Summary, Family Card, Rx History, Drug Interactions, Medications, Allergies, Problems/Diagnosis, Social Problems and Population Based Care are critical aids for doctors/physicians in making a patient's Healthcare decision. Every year Healthcare industry players invest a major share of their budget in maintenance of medical records. Various non-profitable organizations also enforce restrictions on representation, maintenance and transfer of healthcare details within and outside the organization

Every now and then new technology arrives and influences our lifestyle and changes the perception of business in several ways. Many workflows in industry are being defined by technologies and EMR is one among them.

Nowadays more focus is on mobile industries and many technological applications bloom around it. We observed the new NFC technology, currently used in ticketing and payment systems, having great potential in healthcare industry. We did a detailed analysis of the NFC technology and healthcare workflows and found that it can be improved to a much better phenomenon with the application of NFC.

ELECTRONIC MEDICAL RECORDS

According to Karim (2008), different terms are used in the literature to explain electronic patient's healthcare data such as Electronic Health Records (EHR), Electronic Patient Record (EPR), Electronic Medical Record (EMR), Computerized Patient Record (CPR), and Computerized Medical Record (CMR). These names are given from time to time in different nations and in different healthcare environments.

METHODOLOGY

The methodology involves design and implementation of a health care framework. A framework with Near Field Communication tags carrying Electronic Medical Record, which is always available with the patient and hence to any provider (100% availability - primarily solving the EMR availability problem).

CORE TECHNOLOGY

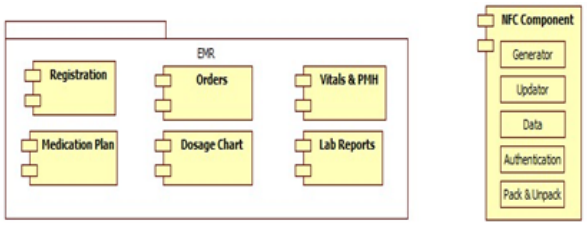
The proposed framework is based on NFC. NFC (near field communication) is actually an extension or a subcategory of RFID. It is very similar to other identification methods such as barcodes and QR codes however it uses invisible radio waves to identify an object from a distance. NFC is the newer version of RFID that is typically for use in a very short distance for making payments and downloading advertisements.

Near Field Communication (NFC) is a short-range wireless connectivity technology that enables exchange of data between devices and tags over a distance of up to about 10 centimetres. It's mainly aimed at making it easier to use services for payment, public transport and data sharing between devices but a number of other uses have been proposed.

- Identity documents
- Health monitoring and Identification of medication
- Mobile commerce, guiding of consumers in retail
- Time and attendance applications
- Electronic keys - car keys, house/office keys, and hotel room keys, etc.

Configuration and initiation of other wireless network connections such as Bluetooth, Wi-Fi or Ultra-wideband
Every year healthcare Industry all over the world invests a huge budget in terms of technology research and infrastructure for EMR maintenance and making it available to providers. Many emerging technologies solve critical industry problems cost effectively. NFC, an interesting technology solving the EMR availability problem when observed

Architecture - EMR and NFC



EMR COMPONENTS

Registration: Inpatient and outpatient registration responsible for creating and updating EMR. This module can be integrated to NFC component directly for synching with the NFC tag.

Orders: Component responsible for lab orders management. It is integrated with the centralized EMR system (or Hospital Information System) in many Healthcare facilities. This module can be integrated to NFC component directly for updating lab orders into NFC tag.

Vitals/PMH: Vitals and PMH (Past Medical History) updates the EMR system with current visit vitals and PMH details. This module can be integrated to NFC component directly for updating vitals/PMH into NFC tag.

Medication plan: All the medications/prescribed drugs of the patient are tracked with this component for efficient decision making. This module can be integrated to NFC component directly for updating medication of EMR in NFC tag.

Lab reports: Component responsible for lab reports management. It is integrated with the centralized EMR system (or Hospital Information System) in many Healthcare facilities. This module can be integrated to NFC component directly for updating lab reports into NFC tag.

NEAR FIELD COMPONENTS

Pack/Unpack: Responsible for encoding/decoding the patient EMR as compressed raw data.

Data: Actual patient EMR used in patient care

Authentication: Responsible for security - allows only authorized users/systems to update NFC devices/tags

Updator: updates patient EMR in current NFC tag

Generator: Creates patient EMR in current NFC tag

Electronic Medical Records EMR: sample interface for view/updating patient EMR details

ASSUMPTIONS

Hospital/clinic - with EMR system: standardized supporting HL7 protocol
NFC tags - with EMR details for every patient
NFC Enabled devices to read/update EMR details

We came up with framework of integrating NFC and healthcare workflows involving cost effective secured representation of EMR inside the NFC tag. With our framework we made EMR available in remote areas with limited/no sophisticated devices with hundred percent availability to doctors/physicians for every patient. We evaluated our framework by building a system to update EMR on clinical visit flow and integrating with an EMR system

SECURITY

- Access to data block - every read/write operation needs authentication
- Operating System/file system - data in device is encoded and stored as raw data

LIMITATIONS

The NFC tag (MiFare 1K) used for research is 1 KB size, which restricted the storage a maximum for 16 clinical visit details. Most of the NFC tags in the market have limited memory close to 1 MB. Storing images/multimedia information about EMR might not be possible with this limitation in the framework.

Mitigation - Even though store images cannot be seen and multimedia details, it store the observations done on them. i.e. the reports given by technicians/doctors can be stored, which will be a complete EMR information.

CONCLUSIONS

Most of the current NFC tags/cards have limited memory. Hence, representation of EMR data in NFC tags/cards play an important role in building the application with NFC tags as suggested in the objective. This implementation is the core part of the framework we implemented, along with a sample application for updating clinical visit information in EMR

Another major area of concern with EMR is the security of data when stored and during its transfer. Data safety mentioned above ensures that data is safe when stored in NFC tags/cards. Since, NFC transfers are within the range of centimetres - data breach in air is not possible and even if there is a breach all the data transferred is encrypted with 2-way blowfish encryption. Secured and comprehensive framework for transfer of information can be achieved by this algorithm.

REFERENCES

Agrawal P. 2007. Wireless communications", Springer Press, New York, USA.

Akram, Jalal-Karim. "Sharing and Viewing Segments of Electronic Patient Records Service (SVSEPRS) using Multidimensional Database Model, School of Design and Engineering", Brunel University, London, viewed 10 January 2009. http://bura.brunel.ac.uk/handle/2438/2982, 2008.

Koppar, R. Anant and Sridhar, V. 2007. A Workflow Solution for Electronic Health Records to Improve Healthcare Delivery Efficiency in Rural India. In: proceedings of International Conference on eHealth, Telemedicine, and Social Medicine.

Lorenz, Andreas and Oppermann, Reinhard. 2009. Mobile health monitoring for the elderly: Designing for diversity pervasive and mobile computing. Vol. 5, Issue 5, pp. 478-495.

Murphy, G. F. 1999. Electronic Health Records: Changing the Vision. Harcourt Brace and Co., Philadelphia: 5.

Paula, J. Edwards., Julie, A. Jacko. and François, Sainfort. "HCI Challenges Case Study: Implementing an Electronic Medical Record, Center for Interactive Systems Engineering", Georgia Tech, viewed on 25 February, <http://www.cs.indiana.edu/surg/CHI2006/RealityTesting/RealityTesting_EdwardsJackoMoloneySainfort.pdf>

Kulkarni, Prajakta. and Yusuf, Ozturk. 2007. Mobile patient healthcare and sensor information system, Journal of Network and Computer Applications, Vol. 34, Issue 1, pp. 402-417.

Bali, K., Rajeev. and Nilmini, Wickramasinghe. 2008. Achieving successful EPR implementation with the penta-stage model. International Journal for Healthcare Technology and Management. 9 (1), 97-105.

Bhat Ramesh. 1983. The Private/Public Mix In Health Care In India. Health Policy and Planning. 8(1), 43-56.