Patient Identification and Ward Round Management System for Mobile Devices

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Abstract- In today's world where man has reached the zenith of success health is constantly being compromised. With the increasing number of health issues across different parts of the world, there is a need of management system with efficient patient and doctor identification, to store and retrieve patient records to ensure a proper context between the patient and the correct medical documentation.. The proposed system can be used to ensure better doctor-to-patient, doctor staff, doctor-doctor collaboration to increase the health observes ability efficiency and thereby decrease healthcare costs.

.Keywords*:* Healthcare, Electronic Medical Records (EMR), Near Field Communication (NFC), Patient identification.

I. INTRODUCTION

Patient Identification and Ward Round System is an application designed to meet the data needs of the clinical staffs that is doctor or nurse in context to the patient and this assist in the management of patients admitted in the hospital .Our goal is to educate the clinical staff with appropriate health related data of the patients, so as to improve the efficiency of health care .in fact research finding shows that in a hospital, patient identification is a most basic requirement in clinical workflows and is a recurring task done at the time of admission, during rounds at bedside, and while doing radiology, physical therapy etc. It is done several hundred times a day however wrong identification may connect the patient to a different patient documentation. This paper provides a solution to this problem by proposing a NFC based patient identification and ward round management system for mobile devices which helps to store and query data related to the patients from the remote EHR based back end server. The user of the system may be a doctor or who wants to gain knowledge about the patient's medication history or test reports or even prescribe some new ones. The user of the system may be a nurse who needs to view the clinical data before administering drugs to the patient. The user of the system can also be a patient who needs to keep a track of his medical history for insurance related purposes.

II. PROPOSED SYSTEM

Proposed system constituent of following components

- Electronic Health Record

The Electronic Health Record (EHR) is a long term systematic accumulation of electronic record of patient health information generated by one or more encounters in any health care delivery setting. The Includes personal data like age height and weight, blood group, allergies , problems, essential symptoms and signs, medications prescribed, past medical history, immunizations, laboratory test reports and radiology reports , progress notes, The EHR automates and streamlines the clinician's workflow. The EHR has the ability to generate a complete record of a clinical patient encounter - as well as supporting other care-related activities directly or indirectly via interface - including evidence-based decision support, quality management, and outcomes reporting.[11]
The EHR system is designed to represent data that meticulously acquires the status of the patient in any health care delivery setting. It permits the patient's complete history to be examined without the obligation to trace down the patient's previous medical record volume and assists in ensuring that health care potential is improved. It minimizes the chances of data replication as there is only one modifiable file, which means the file is constantly up to date when viewed at a later date and eliminates the issue of lost forms or paperwork. Due to all the information being in a single file, it makes it much more effective when extracting medical data for the examination of possible trends and long term changes in the patient. [9]

- Near field communication:

NFC can be employed in a distinctive manner so as to improve the usability of the health care system and make it effortless for clinical staff . It can be a great way of tracking when doctors and other healthcare professionals visit a patient which would prevent any human error such as forgetting to mark in a log that the patient was visited. This could also work very well to stop doctors from giving medication to patients who already received the medication but it was not logged in the book.
"Not only can NFC tags provide medical professionals with information about what treatments a patient should receive, but they can also keep track of when nurses and doctors have checked in with that patient and when. Each time the tag is scanned, the information about who scanned it and when can be transferred to a database. In addition to improving treatment, NFC tags also have potential in the research realm.
A winner of last year's NFC Forum's 5,000 Euro prize was a program that helps track patients in low resource areas, and is currently being used in a pneumonia study of young children in Pakistan. Each child is given a bracelet with an RFID tag on it. The tag is scanned every time the child visits a participating health care organization. The clinical and laboratory data associated with that patient is collected and posted to a secure server in real-time."[12]

Drawback of Existing System

- Pen and paper measure (manual system):

Increased redundancy in clinical data of the patients and decreases efficiency because of the human errors. Increases the probability of patient identification error like medication error medication errors, transfusion error, testing error, and wrong person procedure, discharge of infants to wrong family, wrong test reports which can be dangerous or moreover trespass. Unaccredited access may trespass patient's privacy. Inconvenient for the staff as well as the patients.

- RFID tags:

RFID tags are more expensive less reliable and they are application specific. It requires separate reader and unique installation. Tag collision can occur when innumerable tags in the same area respond at the same time.

- Bar code:

It requires lots of efforts; as they must be scanned individually. It has security issues and can be easily damaged. Scratched or crumpled barcodes are major issues. Durability and cost are the major disadvantage in laser scanning

III. EXPERIMENT AND RESULT

3.1. IMPLEMENTATION:

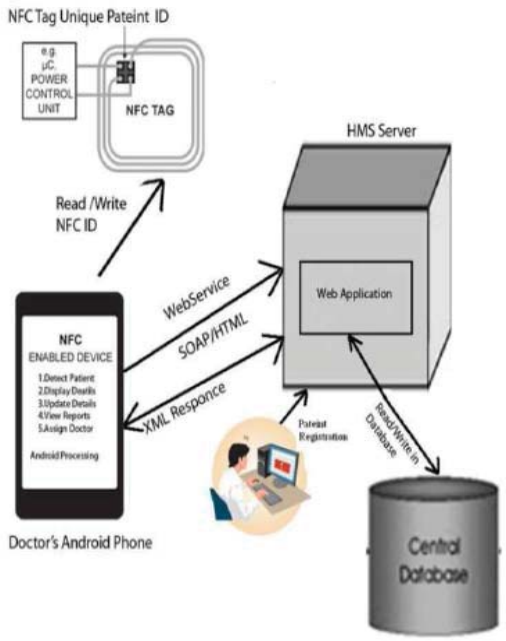

Fig1: System block diagram.

1. When a person gets Admit or Visit to the hospital, the healthcare information about the person will be accessed through there NFC tags which will be synchronized and stored temporarily on that particular hospital Electronic Medical Record Database .The doctor can easily access full information about the patient clinical information by inspecting the patient EMR instead of going through number of paper reports.
2. Patients once registered are equipped with a NFC wristband which has a unique ID. Every time a new ID is created for each new patient. Doctors and administrative staff are also assigned batches with Unique ID carrying Tag installed.
3. During a ward round, a physician, hospital Staff or nurse first need to present their batch for and authentication without with the patient cannot be treated. After the NFC enabled device reads the information it starts the NFC application with the read ID as a parameter.
4. Once authorized physician can read, update the Patient healthcare information by placing the NFC enabled mobile device Smartphone or tablet next to the wristband.
5. The application then sends requests to hospital server for the given ID.
6. The backend plug-in searches for the ID records and the corresponding record or ward round composition and return the data to the calling module.
7. The data received is extracted from the response and converted in a format to render the user interface. The doctors then can add and update the information.
8. Record saved on the NFC enabled mobile device forces the device to serialize it and send it back to the server, where records are stored in persistent database.
9. If the patient is been asked to take any tests then those test reports will also be updated in that Electronic Medical Record.
10. Based on the test reports the updates which the doctor prescribed will be updated too in their Electronic Medical Record.
11. Finally while the patient Leave or Discharge all those information which have been updated in his Electronic Medical Record will be synchronized and transferred back to his NFC tag which will hold the complete medical report and also about what happened that particular day.

3.2. Service description.

Type	Service	Description	Interaction	Involved Elements
Identification	Doctor Identification	The doctor information is showed when the doctor interacts with a Patient tag.	NFC	Doctor NFC phone and patient identification tag
	Patient Identification	The patient information is showed when the nurse interacts with a Patient tag.	NFC	Nurse NFC phone and patient identification tag
	Nurse Identification	The nurse is identified when she/he interacts with patient tag NFC mobile device is associated to nurse	NFC	Nurse NFC phone and patient identification tag
Access & Management	Touch Display Access	The patient is identified in the touch Display system.	NFC & Touch	Nurse NFC phone, touch display and NFC reader
	Clinical History Navigation	The nurse or doctor can review patients' Clinical history and pending reports.	Touch	Touch display
Synchronization	Upload of Clinical History	The nurse or doctor updates the record of the treated patients when she/he touches the NFC reader with her/his NFC phone.	NFC & Touch	Nurse NFC phone, NFC reader and touch display
	Download of Clinical History	The nurse or doctor interacts with the NFC reader for downloading the clinical histories of their patients.	NFC & Touch	
Control & Monitoring	Medication Administration	The doctor interacts with the Android phone and the patient NFC tag to control his/her Administration.	NFC	Nurse or doctor NFC phone, patient identification tag.
	Graphical representation of Clinical Tests and Samples	Doctor or nurse can view the progress of patient health on NFC phone.	NFC	
	Notifications	Doctor can receive notification on his NFC phone via mail to visit patient	NFC	

Fig2: Service description

3.4. NFC COMMUNICATION

Fig3: NFC

Near field communication, shorten NFC, is not a pair wise communication like we do in Bluetooth. Contactless communication allows a user to wave the Smartphone over a NFC compatible device to send information without needing to touch the devices together or go through multiple steps setting up a connection NFC is a set of short-range wireless technologies, typically need a distance of 12 cm or less.

Two major specifications exist for NFC technology: ISO/IEC 1443 and ISO/IEC 1800-3. The first defines the ID cards used to store data about patient, such as that found in NFC tags. While the latter ISO/IEC 1800-3 is an international standard for all devices communicating wirelessly at the 13.56MHz frequency using Type A or B cards, as near field communication does. The device is known as the interrogating device while the NFC tag is simply referred to as the tag.

3.4.1. How NFC works

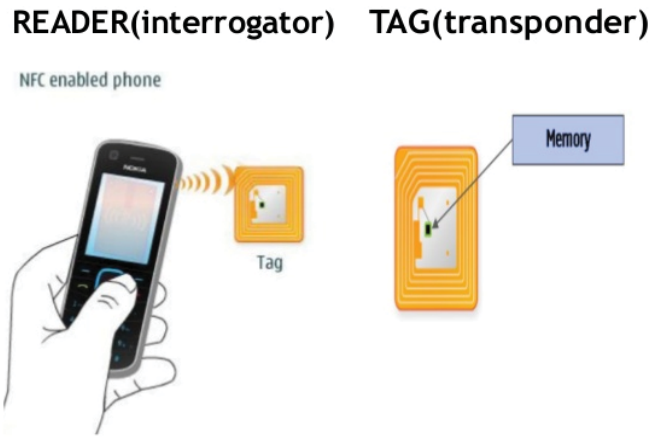

Fig4: NFC tag reader

To function, the interrogator sends a signal to the tag out. If the devices are in range to each other, the tag becomes powered by the incoming signal. This interrogator signal powers the tag, allowing it to be compact in size and operate without any battery or power source of its own.

The devices create a high frequency magnetic field between the loosely coupled coils in both the interrogating device and the NFC tag. Once this is established, a connection is formed and data can be passed between the tag and the interrogator. The interrogator sends the first message to the tag to find out what type of data the tag uses, such as Type A or B. When the tag answers, the interrogator sends its first commands in the appropriate specification.

The tag receives the instruction and checks if it is correct. If not, nothing happens. If it is a correct request, the tag then responds with the requested information. For sensitive transactions such as bank transaction, a secure communication is first established and all data sent is encrypted.

3.4.2. Operating modes of NFC devices

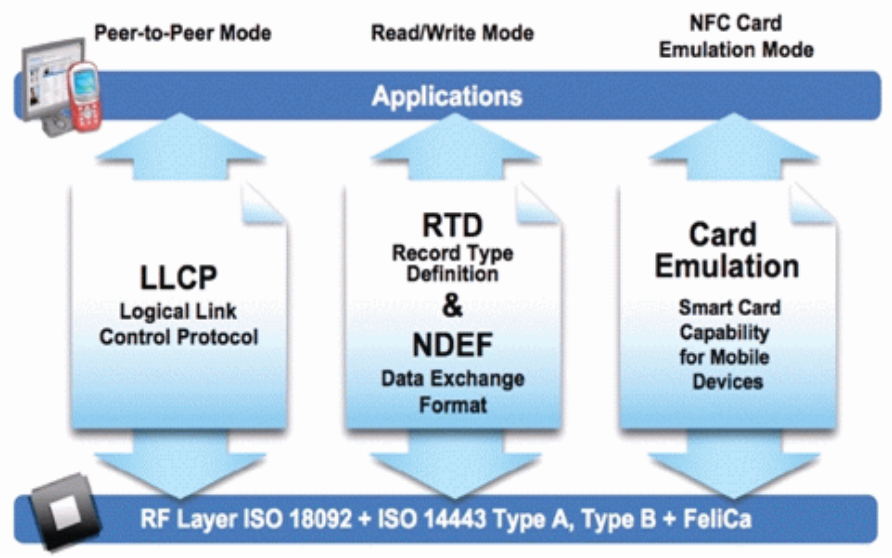

Fig5: NFC modes

The various modes on which NFC operates are based on the ISO/IEC 1892 NFC IP-1 and ISO/IEC 1443 contactless smart card standards.

- In reader/writer mode, the NFC device is capable of reading NFC mandated tag types, such as a tag implant in NFC smart phones. The read or write mode on the RF interface is compliant with the ISO 1443 and FeliCa schemes.
- In Peer-to-Peer mode, two NFC devices can exchange data. For example, you can share Wi-Fi link set-up parameters or you can interchange data such as virtual business cards and digital photos. Peer-to-Peer mode is systemized on the ISO/IEC 18092 standard.
- In Card Emulation mode, the NFC device appears to an external reader much the same as a traditional contactless smart card. This allows contactless payments or ticketing by NFC devices without changing the existing infrastructure.[2]

3.4.3. Benefits of Near Field Communication:

- Real Time Updates:
  Real time updates are essential in this fast paced world. Reading updated healthcare information of the patients can occur through the use of NFC. Doctor can instantly view, edit, update and synchronize update these details resulting in more efficient healthcare.
- Ease of use all the user has to do is wave her Smartphone over an NFC tag with the relevant information to get the details about the patient.
- Improved health Service:
  Nfc brings security and reliability to the system by eliminating the patient identification errors which is prevalent in existing system there by resulting in efficient health service.
- Low cost:
  Nfc eliminates the use of any additional reader and specialized software thereby reducing cost of implementation
- Secure communication:
  NFC prevents Eavesdropping due to the range of NFC itself. Since the devices must be fairly close to send signals, the criminal has a limited range to work in for intercepting signals. Then there are secure channels. When a secure channel is established, the information is encrypted and only an authorized device can decode it. NFC users should ensure the companies they do business with use secure channels.
- Portability
- Due to small and compact size of the tags it is portable and more convenient.

3.4.4. Android:

Android came into existence in 2003 at Palo Alto ,a California- based corporation by Andy Rubin, Rich Miner , Nick Sears and Chris White . That company was subsequently acquired by Google in . on August 17, 2005. The Android platform includes an operating system based upon Linux, a GUI, a Web browser and end user applications that can be downloaded.thus Android OS is a Linux-based open source platform for mobile cellular handsets developed by Google and the Open Handset Alliance.

Fig6: evolution of android

Android is hailed as “the first complete, open, and free mobile platform.” (ref)

- Complete: The designers took a comprehensive approach when they developed the Android platform. They began with a secure operating system and built a robust software framework on top that allows for rich application development opportunities.
- Open: The Android platform is provided through open source licensing. Developers have unprecedented access to the handset features when developing applications.
- Free: Android applications are free to develop. There are no licensing or royalty fees to develop on the platform. No required membership fees. No required testing fees. No required signing or certification fees. Android applications can be distributed and commercialized in a variety of ways.

The various versions of android are
Android 1.6 (Donut)Android 2.0 (Eclair)Android 2.2 (Froyo)Android 2.3 (Gingerbread)
Android 3.0 (Honeycomb)Android 4.0 (Ice Cream Sandwich)Android 4.1(Jelly Bean)
Android 4.4(Kitkat)[10]

IV.CONCLUSION

The system will work for diverse platform, thereby making the system to be implemented on Apple iOS and windows phone. System will be attractive and interactive to the user. Response throughput will be high since the system will run in real time environment. System will work towards reliability and consistency. Adding and Updating reports and medicine prescription will not affect the robustness of the system. Artificial intelligence can be incorporated and patient’s treatment information can be used to treat other patients if that treatment was effective. Data mining can be performed on clinical data to derive useful conclusions and provide information in a structured way so that they can get the most meaning out of it. Thus the application created is a preliminary version which can be implemented in hospitals, medical center, clinic, nursing home health centre etc and the enhancement can be made depend upon the requirement of the environment in which the application will be implemented.

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The system is conceptualized to provide an interface between the doctor and the patients for two-way communication. The main purpose of this study is to facilitate the remote cardiac patients in getting latest healthcare services which might not be possible otherwise due to low doctor-to-patient ratio.Â The current study addresses the issue of integrating a wearable sensor with mobile technology by developing a remote monitoring system for heart patients. In this study, we propose a location based real-time monitoring system comprising a wearable sensor, mobile application, and a web interface to overcome some of the issues, as mentioned in the literature. This paper provides a solution to this problem by proposing a NFC based patient identification and ward round management system for mobile devices which helps to store and query data related to the patients from the remote EHR based back end server. The user of the system may be a doctor or who wants to gain knowledge about the patientâ€™s medication history or test reports or even prescribe some new ones. The user of the system may be a nurse who needs to view the clinical data before administering drugs to the patient. The user of the system can also be a patient who needs to keep a track of h Based on the automatic patient identification via NFC using the mobile device, physicians can easily view recent ward round results and edit/add information without manually selecting the patient from a list. The application mainly shows new ideas and possibilities to improve medical workflows and usability and how mobile devices can make use of existing frameworks and backend services.Â In the work [14], a system for the management of medical staff rounds is described that uses NFC wristbands and mobile devices. However, it does not specify whether security services are deployed or not. Patientsâ€™ Data Management System Protected by Identity-Based Authentication and Key Exchange. Article. Mar 2017.