

NFC Based Android API Healthcare System

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Abstract—With the recent increase in usage of mobile devices especially in developing countries, they can be used for an efficient healthcare management. In this work, we have proposed a novel architecture for improving health care system with the help of Android based mobile devices with NFC and Bluetooth interfaces, smartcard technology on tamper resistant secure element (SE) for storing credentials and secure data, and a Health Secure service on a hybrid cloud for security and health record management. The main contribution of this paper is proposal of applications for: i) Secure Medical Tags for reducing medical errors and ii) Secure health card for storing Electronic Health Record (EHR) based on Secure NFC tags, mobile device using NFC P2P Mode. Since NFC NDEF format is prone to security attacks [2], we have utilized low level APIs on Android based mobile devices, to securely access NFC tags such as MIFARE. Simple touch of NFC enabled mobile devices can benefit both the patient as well as the medical doctors by providing a fast and secure health flow. It can also provide portability of devices and usability for health management in emergency situation, overpopulated hospitals and remote locations.

Keywords: Android based mobile devices, NFC, Bluetooth interfaces, secure element (SE), Electronic Health Record (EHR), NFC P2P Mode, MIFARE.

I. INTRODUCTION

The purpose of the project entitled as NFC BASED SECURE MOBILE HEALTHCARE SYSTEM is to computerize the front office management of hospital to develop software which is user friendly, simple, fast, and cost effective. It deals with the collection data of patient's information, diagnosis details etc. Traditionally, it was done manually. The main function of the system is to register and store patient details and doctor details and retrieve these details as and when required and also to manipulate these details meaningfully. System input contains patient details, diagnosis details; while system output is to provide proper treatment details.

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II. TECHNOLOGY

NFC [1] is an upcoming wireless technology which provides simple interfaces for device to device communication as well as access to NFC, RFID and smartcard tags [6]. NFC enabled mobile device can operate in three modes: i) Reader mode: in which device can read and write to NFC based passive tags. ii) Peer to Peer (P2P) mode in which NFC devices can interact and exchange information with each other iii) Card emulation mode: in which NFC device can operate as a contactless card. NFC enabled mobile devices have a secure element (SE) which is a secure microprocessor (a smart card chip) that includes a cryptographic processor to facilitate transaction with authentication and security, and provides secure memory for storing applications and credentials. It comes in different form factors such as embedded, micro SD card or a UICC (SIM) card [9]. Due to simplicity of accessibility we have used SWP enabled micro SD card as a SE to manage cryptographic keys as well as patient medical records. SWP is a contact based protocol between Contactless frontend (CLF) and UICC. It is Java Card 2.2.2 compliant.

III. UNITS

SI unit for frequency is Hertz .In this paper communication will be measured in terms of frequency. Many mobile phones now use electric-field NFC (operating at a frequency of 13.56 MHz

IV. HELPFUL HINTS

A. Abbreviations and Acronyms

NFC Nearest Field Communication
SE Secure Element
GUI Graphical User Interface
NDEF NFC Data Exchange Format
EHR Electronic Health Record

V. PROPOSED APPLICATION MODELS

A. Secure Medical Object Identification using NFC Tags

Reliable medical object identifiers are important for reducing errors in the hospital workflow, like giving correct medicine to a patient. We propose architecture of an application for issuing secure identifiers to reduce the error and also to prevent security attacks like modification, repudiation and masquerading. The secure NFC passive tags have been used for identifiers, specifically MIF ARE Classic. Bluetooth Low Energy (BTLE) stickers have lately been used to identify objects. But since they require a dedicated battery to operate , NFC passive tags are cheaper for identifiers to be used in healthcare. As discussed in section II, NFC tags with NDEF format are prone to security flaws [2].

Hence basic NFC-A interface can be used to access smartcards from a mobile device. A valid mobile reader must have security key for read access and a valid writer must have security key for update access. The tag is issued by a healthcare admin mobile device. It retains security keys in its SE for issuing tags. To enhance security, the access keys of the tag could be updated on a periodic basis for retaining secure IDs on the medical objects.

B. E-Health Card using NFC Tags

The secure tags used for application in V-A, are used for a different application for storing EHR on Health card of a patient. This is similar to a smartcard based Health card. But, here we suggest smartcards that can be securely and easily be accessed using mobile devices. The tag could retain patient identification information along with emergency information, Insurance information and health records. The tag could be organized into different sections, each administered separately by different set of security access keys. Similar to the secure tag application, this card can be issued and updated by an authorized health admin mobile device mobile admin patient can register at the mobile admin and then later show to an authorized doctor with mobile doc in an OPD which would have the required access keys Kr and Kw for reading and updating the health records respectively. All NFC information can be retained with a timestamp. Due to limitation of space on the card, it can only retain recent health records. Detailed health records can be retained on a storage server of the Health Secure service on hybrid cloud. At the end of the visit the patient can present the tag back to the administrator to tap and store his visit detail on the hybrid cloud. At any point of time if patients past records are required, they can be retrieved over secure wireless interface (like HTTPS) from the hybrid cloud, using the patient ID on the tag. This application will help the patient to retain the recent health records on a cheap yet secure tag equivalent to a smartcard.

VI. RELATED WORK

The contents of the journal are peer-reviewed and archival. Emergency NFC tags retain patient, medical emergency information. But the work does not consider write protection and reusable NFC tags. NFC mobile device is have been used for storing credentials to be used for billing and Identity . We propose using it for health care application with credentials and a much stronger security requirement since it is accessed by number of people and the quantity of data could be large. Smart poster proposes using secure NFC tags since "NFC tags are vulnerable to spoofing as well as cloning", with a web server to securely retain the details of the poster.

VII. CONCLUSION

In this work, we have proposed applications based on NFC enabled Android mobile devices for improving healthcare process for secure medical object identification and patient Health card on an external tag or mobile device itself. The applications are simple to use with a simple touch of NFC for secure communication. This will improve the health flow in crowded hospitals of developing countries like India as well as of developed nations. The business model will benefit the patients as well as medical professional since they can use the commonly retained mobile devices conveniently.

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