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NFC based Secure Mobile Health Care System

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ABSTRACT
In this paper, a novel architecture for improving healthcare 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 Secure Medical Tags for reducing medical errors and Secure Health card for storing Electronic Health Record (EHR) based on Secure NFC Tags, mobile device using NFC P2P Mode or Card Emulation Mode. A basic security framework requirement for the applications is given. Since NFC NDEF format is prone to security attacks, low level APIs on Android based mobile devices have utilized, to securely access NFC tags. Simple touch of NFC enabled mobile devices can benefit both the patient as well as the medical doctors by providing a robust and secure health flow. It can also provide portability of devices and usability for health management in emergency situation, over populated hospitals and remote locations.

Keywords**:** *Radio Frequency Identification, NFC technology, Health care, Mobile*

I. INTRODUCTION

Think about the way in which mobile phones have made it so easy to be in touch with people friends, family, co-workers from just about anywhere no cards, no coins, no laborious connections or tedious routines to remember. Then think about what it would be like if you face the complexities of setting up network connection between devices. Awkward network settings can possibly be dealt with in the computer world but certainly not in the consumer electronics world. Think if other electronic devices in world would work as easily and as intuitively, if you could set up connections with a simple touch or transfer information from one device to another just by holding them close to one another. This is the main motivation for the Near Field Communication Interface and Protocol (NFCIP-1), which is targeted towards the consumer electronics users that would use the secured means of communication between various devices without applying much intellectual attempt in configuring their network. The possibilities for using Near Field Communication are nearly limitless. The powerful attraction of touch-less transactions will help knit NFC technology into the fabric of our daily lives[1].

Near Field Communication or NFC is a short-range high frequency wireless communication technology which enables the exchange of data between devices over about a 10 centimeter (around 4 inches) distance. The technology is a simple extension of the ISO/IEC 14443 proximity-card standard (proximity card, RFID) that combines the interface of a smartcard and a reader into a single device. An NFC device can communicate with both existing ISO/IEC 14443 smartcards and readers, as well as with other NFC devices, and is thereby compatible with existing contactless infrastructure already in use for public transportation and payment.

NFC incorporates a variety of pre-existing standards including ISO/IEC 14443 both Type A (normal) and Type B (banking/short range), and FeliCa. NFC enabled phones thus show basic interoperability with the preexisting reader infrastructure. Especially in "card emulation mode" a NFC device should at least transmit a unique ID number to a pre-existing reader.

II. SECURE MOBILE HEALTH CARE SYSTEM USING NFC

Mobile – Health is delivering health, defined as the state of complete physical, mental and social well being, via the mobile channel .No agreed industry definition for m-health. Note mhealth is not a subset of or mobilization of e -health. Mobile devices have unique attributes, including being personal to the patient, always with the patient, and always on and as well as helping to provide social context, eg.location. This makes mobile a more appropriate channel for delivering health than any other mass media. In the past few years, mobile health, or m-health, has drawn a lot of interest[2].

An Electronic Medical Record for each and every patient is the ultimate aim of this paper. The following are some steps of explanation.

1. While a person gets Admit/Visit to the hospital, the health 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 (EMR) Database .The doctor can easily access full information about the patient by viewing the patient EMR instead of going through bundle of paper reports.

2. If the patient is been asked to take any tests then those test reports will also be updated in that EMR.
3. Based on the test the updates which the doctor prescribed will be updated too in their EMR.
4. Finally while the patient Leave/Discharge all those information which have been updated in his EMR will be synchronized and transferred back to his NFC tag which will hold the complete medical report about what happened that particular day.

The block diagram of the NFC based secure mobile health care system is shown in Fig.1.

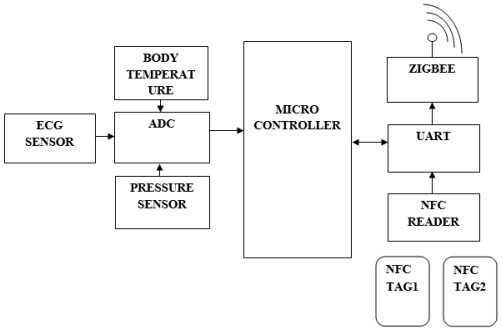

Fig.1 Block Diagram of NFC based secure mobile Healthcare system.

A unique ID is created for the patient, using a NFC tag. All his personal details and his medical history are stored there in that tag. Once the patient enters the hospital his tag will be waved in front of the NFC reader. By doing this the patient's entire details will be obtained in the hospital P.C. After this the patient has to be monitored then and there to maintain his status. So a temperature sensor, pressure sensor and a heartbeat sensor is connected to the patient. The readings of these sensors are collected in a regular interval and they are stored in the microcontroller (incase of real-time all the data will be stored in the cloud). So from this storage space the entire data will be obtained in the hospital P.C and when the doctor has to check the patient there is no need of visiting the patient regularly. Instead the doctor can obtain the entire details of the patient in the monitoring device from the hospital P.C by means of ZigBee technology[3].

From the hospital P.C (transmission end) the data is transferred by means of a ZigBee transmitter and at the monitoring block (receiving end) the data is received by means of a ZigBee receiver. Using a P.C interfacing component the data is obtained in the monitoring device (Personal Computer)[4].

The monitoring block of the above specified block diagram for ZigBee transmission end is shown in Fig.2.

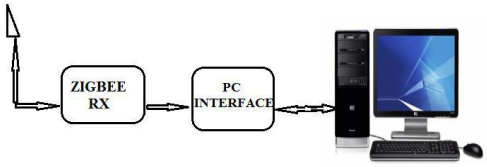

Fig.2 Monitoring Block used in ZigBee Technology

III. SIMULATION RESULT

The Proteus Design Suite is wholly unique in offering the ability to co-simulate both high and low-level micro-controller code in the context of a mixed-mode SPICE circuit simulation. With this Virtual System Modeling facility, you can transform your product design cycle, reaping huge rewards in terms of reduced time to market and lower costs of development. Proteus Virtual System Modeling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs. For the first time ever, it is possible to develop and test such designs before a physical prototype is constructed. The simulation result of NFC based secure mobile health care system is as shown in fig.3

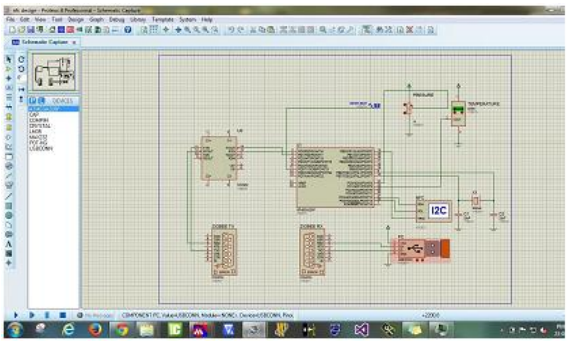

Fig.3 Simulation Result in Proteus Design Software

The Proteus Design Suite is wholly unique in offering the ability to co-simulate both high and low-level micro-controller code in the context of a mixed-mode SPICE circuit simulation. With this Virtual System Modeling facility, you can transform your product design cycle, reaping huge rewards in terms of reduced time to market and lower costs of development. If one person designs both the hardware and the software then that person benefits as the hardware design may be changed just as easily as the software design. In larger organizations where the two roles are separated, the software designers

can begin work as soon as the schematic is completed; there is no need for them to wait until a physical prototype exists. In short, Proteus VSM improves efficiency, quality and flexibility throughout the design process.

Proteus Virtual System Modeling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs. For the first time ever, it is possible to develop and test such designs before a physical prototype is constructed. This is possible because you can interact with the design using on screen indicators such as LED and LCD displays and actuators such as switches and buttons. The simulation takes place in real time (or near enough to it): a 1GMHz Pentium III can simulate a basic 8051 system clocking at over 12MHz. Proteus VSM also provides extensive debugging facilities including breakpoints, single stepping and variable display for both assembly code and high level language source. The applications of Proteus VSM are shown in Fig.4.

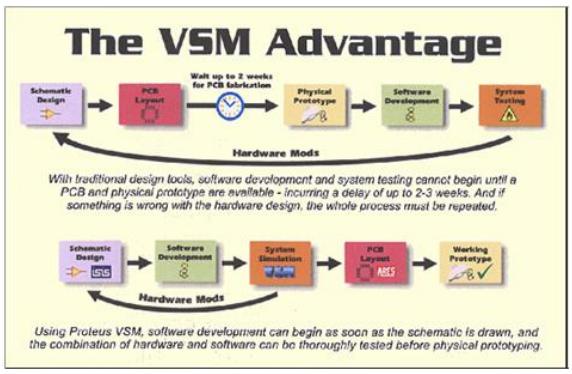

Fig.4 Proteus VSM Applications

IV. CONCLUSION

In recent years, NFC has become an attractive research area for many researchers and practitioners due to its exploding growth and its promising applications and related services. The number of publications in NFC research area is increasing continuously since 2005. With this report, a comprehensive survey on NFC technology is prepared. The project is an NFC-based secure mobile healthcare system. While each of the components has been presented individually before, the combination of these technologies, and its being designed for use within a developing nation such as India, is novel. As prices for mobile phones equipped with NFC readers and writers come down, more such applications will come to light, reducing medical spending, avoiding human error, increasing medical team response times, and improving information flow in previously information-poor environments. As described in this report, this project had started to build a framework that can help developers of such NFC-enabled secure mobile health care system in creating much more applications.

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