

A Review of Applications Based on NFC Technology : A Step towards Making Universal NFC Receiver Using Android Device

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Abstract

This paper is based basically on the review of Near Field Communication technology which exists RFID technology and standards. It is an efficient technology for communications with short ranges. Smart Touch introduces the next connected experience focus on improved security and privacy. The work based on NFC is partitioned into different applications such as Train Ticketing, Restaurant bill payment & Car Parking Payment. One of the main advantages of NFC is that the device can be a reader but also it can simulate a smart card. Additionally, it would bring benefits to the setup of longer-range wireless technologies, such as Bluetooth, WIFI. The contactless payment standard is fully compatible with NFC. This work basically deals with the designing of NFC Receiver with multiple Applications mentioned above using android device with various apps. The Smart Poster concept and peer-to-peer applications, where NFC serves a open communication channel between devices that are physically close.

Keywords: Android, Mobile Computing, Near Field Communication, Peer to Peer Communication, Protocols and Standards

1. Introduction

Near field communication (NFC) is a set of standards for smart phones and similar devices to establish radio communication with each other by touching them together or bringing them into proximity, usually no more than a few inches. Present and anticipated applications include contactless transactions, data exchange, and simplified setup of more complex communications such as Wi-Fi. Communication is also possible between an NFC device and an unpowered NFC chip, called a "tag".

NFC is a set of short-range wireless technologies, typically requiring a distance of 10 cm or less. NFC operates at 13.56 MHz on ISO/IEC 18000-3 air interface and at rates ranging from 106 kbit/s to 424 kbit/s. NFC always involves an initiator and a target; the initiator actively generates an RF field that can power a passive target. This enables NFC targets to take very simple form factors such as tags, stickers, key fobs, or cards that do not require batteries. NFC peer-to-peer communication is possible, provided both devices are powered.



Figure 1. Applications of NFC

2. Literature Survey

2.1. Near Field Communication Technology

This paper discuss about the NFC technology and its use in different application. It also discussed about its technical specifications on which NFC can be used in applications.

An NFC enabled phone functions much lie standard contactless smart cards that are used worldwide in credit cards and in tickets for public transit systems. NFC phones also offers enhance security, enabling the user to protect the secure applications through the phones user interface features. It is discussed with the help of diagram shown in figure 2 below.

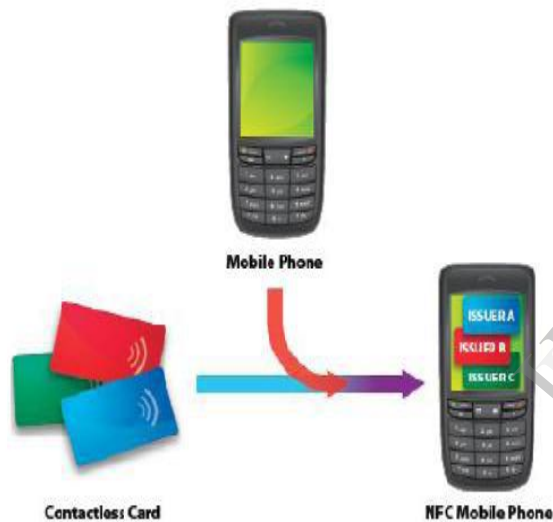


Figure 2. Concept of NFC Phone[1]

Also, two working modes of NFC Communications are discussed, they are Active Communication mode and Passive Communication mode.

Passive Communication Mode[1] shown in fig. 3 below includes the initiator device provides a carrier field and target device answers by modulating the existing field. In this mode, the Target device may draw its operating power from the initiator provided electromagnetic field, thus making the target device a transponder.

Also, in Active Communication Mode[1] shown in figure 4 below includes Both initiator and target device communicate by alternatively generating their own fields. A device deactivates its RF field while it is

waiting for data. In this mode, both devices typically have power supplies.

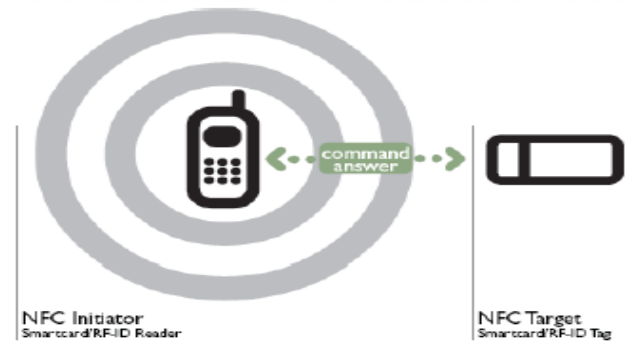


Figure 3. Passive Communication mode[1]

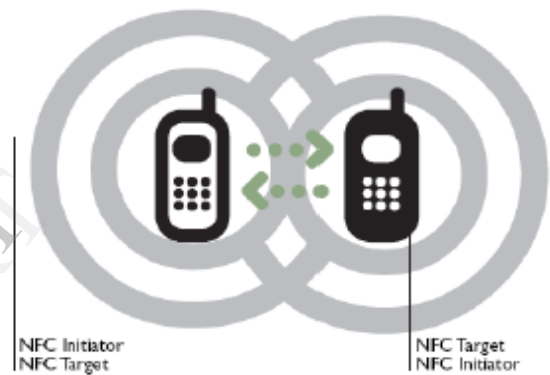


Figure 4. Active Communication mode[1]

Also, Interfacing of NFC module with microcontroller is being discussed with the help of block diagram. Here, Atmel AVR series ATmega128L is being taken as a reference. Also, operating modes of NFC such as peer to peer mode, reader / writer mode and card emulation mode is being discussed along with their merits and demerits.

2.2. Strengths and Weaknesses of Near Field Communication Technology

In this, strengths and weaknesses of NFC technology is being discussed with their operation in active and passive mode. An NFC application threats are being discussed such as Eavesdropping Threats , Data Modification Threats , and Man-in-the-Middle Threats[4] shown in figure 5 below.

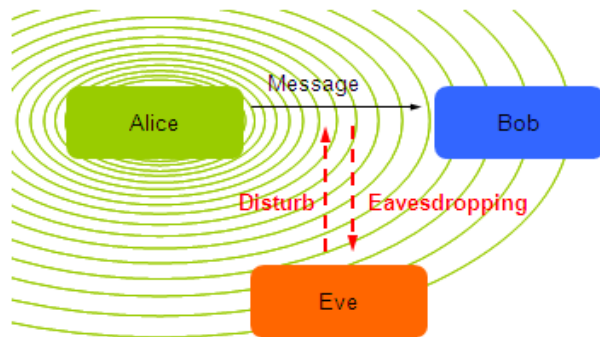


Figure 5. Eavesdropping and Data Modification Threats[4]

The solutions of the threats mentioned above are being discussed in this. Most of classical solution approach protecting the privacy of NFC communication is done by isolating them from any kind of electromagnetic waves. This can be made using what is known as a Faraday Cage (FC), a container made of metal mesh or foil that is impenetrable by radio signals (of certain frequencies). There are currently a number of companies that sell this type of solution.

Other solution is active jamming approach that disturbing the radio channel, RF signals. This disturbance may be done with a device that actively broadcasts radio signals, so as to completely disrupt the radio channel, thus preventing the normal operation of RFID readers.

In this way, this paper presented typical use cases for NFC interfaces. A list of threats has been derived and addressed. NFC by itself cannot provide protection against eavesdropping or data modifications. The only solution to achieve this is the establishment of a secure channel over NFC. This can be done very easily, because the NFC link is not susceptible to the Man-in-the-Middle attack. Therefore, well known and easy to apply key agreement techniques without authentication can be used to provide a standard secure channel. This resistance against Man-in-the-Middle attacks makes NFC an ideal method for secure pairing of devices. Additionally, an NFC specific key agreement mechanism, which provides cheap and fast secure key agreement is being introduced.

2.3. NFC Applications and its Protocol Standards

This paper discussed about various NFC applications in various areas such as in Mobile Payment Services, NFC Ticketing, etc. Also NFC

challenges are being discussed. The challenges of NFC technology[3] are:-

- NFC combined with mobile communication has great perspective. Nevertheless, mobile NFC applications are handset specific. This restriction requires from the service providers – mobile operators – to develop, test and maintain a unique application for each NFC enabled device. To make the issue even more difficult it is possible that also network specific issues are adding to the complexity and variety of applications. In order to make the NFC technology more handset independent a neutral technology platform needs to be used that can hide specifics of the various mobile devices.

- The recently elaborated operating models are supporting single application business models. It means that on the chip (which stores the business application), there is only one application running, although technologically it would be possible to host multiple (6-10) applications, service profiles simultaneously. There are multiple reasons of this situation.

Also, different protocols for NFC communication such as ISO 18092(NFCIP-1) or ECMA 340 and ISO 15963 is being discussed along with interfacing of NFC module with Processor is being proposed in that[3].

2.4. NFC in Future

This paper focuses more on future aspects of NFC technology in several applications discussed here[2]. Several future modes of NFC such as Card Emulation Mode, Reader/Writer Mode, Peer-to-Peer Mode are being discussed and this paper also focused more on future security aspects of NFC technology, that may be more advantageous for users. Also, benefits and future scenarios of various modes of NFC are indicated.

2.5. Secure NFC application for Credit Transfer among mobile phones

This paper discusses the most relevant issues of NFC technology and proposes, demonstrates, and evaluates an application that allows secure money transfer between mobile devices using NFC and Bluetooth technologies. It is demonstrated the usage of both technologies at the same time. It also focused on NFC peer-to-peer Applications and also describes the proposed mobile money transfer application approaches with their evaluation and result analysis[8].

Fig. 6 below shows proposed architecture of credit card transfer. Credit Transfer is possible because Google offers a peer-to-peer NFC application programming interface (API). This API supports data exchange between two enabled NFC devices. NDEF

message is needed to allow the communication between devices. A NDEF message was created with a generic control RTD and it allows the application identification in each device.

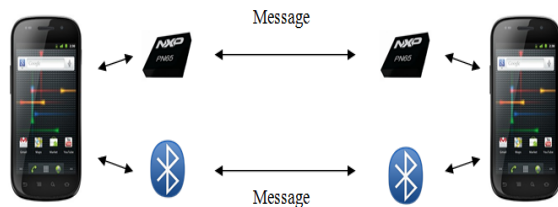


Figure 6. Illustration of the proposed Credit Transfer application architecture[8]

Also, illustration of credit card transfer is shown along with their demonstration and results are discussed in this paper.

2.6. Prototype of train ticketing application using NFC technology

This paper focuses on E-ticketing application[9] using NFC technology. e-Ticket is one of detrimental service in the field of online trade. E-ticket is an electric paperless document which commonly used to transportation ticketing. This particular document usually used to substitute's physical ticket in an airline. The main aim of e-ticket is reduce operational expenditure and improve the service quality for customer. This strategy has been ran smoothly for airline, so that it is feasible as well to be implemented within other transportation mode such as train, bus, etc. The usage of NFC discussed through 3 major ways: card emulation, reader mode, peer to peer (P2P) mode. Android based NFC Packet class have been designed. Thus, NFC technology can be used to simplify train ticket purchase process and electronic ticket distribution, especially cell phone electronic ticket.

3. Proposed System

Fig. 7 below indicates the block diagram of the proposed system. Near field communication is a technology for short range communication which can be use for contactless data transmission and reception between two devices wield with the technology .The main reason to apply this technology is to be implemented within ticketing application, payment application and public transportation application. When a cell phone equipped with NFC device ,that particular cell phone can be used as ticket of conference or theme

park and also a “mini wallet” which can be used in certain time.

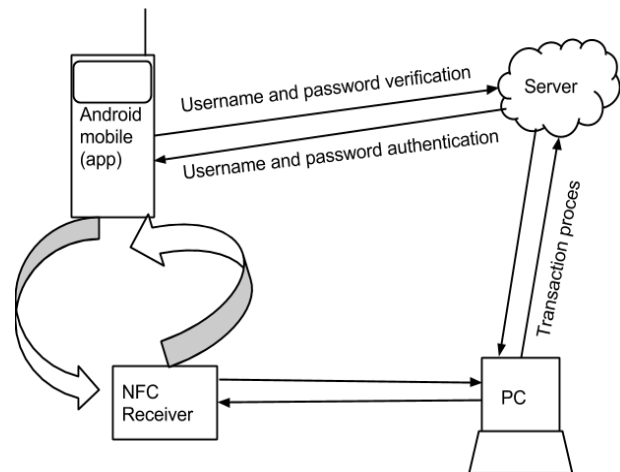


Figure 7. Block diagram of Proposed System

Moreover, the cell phone can also be used as payment tool and an automatic machine, toll payment, and some other transactions. NFC application is also can be used on a public transportation as a substitute of wallet and as a tool to ticket data writing. The proposed project consists of following requirement:

- Android app in mobile equipped with NFC tag.
- PC application for ticketing/payment.
- Server consisting of database of vendors, clients and Identity number of NFC receiver present at each vendor's site.
- Universal NFC receiver (can be used for multiple applications like ticketing ,car parking payment ,atm..Etc).

The Steps are discussed below:-

1. First, the customer needs to login into his/her android app by entering the assigned username and password which will be verified at the server end consisting of the customer database through internet connection.
2. If the data send by the mobile phone to the server side matches with the already stored database in server then a feedback will be given to the customer by the server regarding his/her authenticated status.
3. The customer then needs to do the scanning process using NFC-installed cell phone by placing it near to the universal NFC receiver installed on site present.

4. The username of the customer will be given to the NFC receiver when the scanning process occurs.
5. The NFC receiver will communicate with PC/laptop present along the vendor site by sending the user id and bill amount details which will then generate the bill with only the amount details which needs to be deducted from the customer account.
6. The PC/Laptop will then communicate with the server via internet for transaction purpose.
7. The PC/Laptop will send the server the following details: amount to be deducted , users and vendors id and asking the server for the permission of allowing to deduct the mentioned amount from the respective use id stored in its database.
8. The server at this time will check the user id and the vendors id in its database for the amount deduction, if verified or is present in its database.
9. Then the server will send the signal to the PC/Laptop which will then do the 2 way communication with the NFC receiver that will tell the mobile app of the customer asking him/her for the permission to deduct the mentioned amount from his account .
10. After which the payment is done on accepting the same by the customer. Here, NFC receiver acts as a gateway to communicate with user .

4. Conclusion

Thus, after reviewing several papers related to applications using NFC module, it is been observed that NFC applications already implemented are specific for a particular application, but not for a multiple applications. So, multiple applications are trying to develop with NFC module using Android device which will call it as universal NFC module receiver. Also, by adding some external circuitry during interfacing of NFC module with AVR At-mega controller circuit, performance of NFC communication is trying to improve, so that it will work more effectively for multiple applications. This will make the user's job more simple and will make the system friendly for use and more demandable in future.

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