

Near Field Communication in Mobile Technology

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Abstract—Near Field Communication (NFC) is a wireless short-range communication technology that works on the basis of existing standards of the Radio Frequency Identification (RFID) infrastructure. This technology allows data transfer by putting two devices close to each other. This paper gives various modes of operation in NFC which means that reader/writer, peer-to-peer, and card emulation and its application. In combination with NFC-capable Smartphone, it enables contactless transactions, in particular services for mobile payment. NFC integrates wireless payment and tag reading in mobile phones along with peer-to-peer communication. It can quickly setup a Bluetooth or a WLAN connection with a simple swipe. The intention of this paper is to describe basic characteristics and benefits of the technology and to present various use cases. Both existing NFC applications and possible future scenarios are explained in this context.

Key words: - NFC, RFID, Privacy, Devices, Tags

I.INTRODUCTION

NFC is a technology based on RFID and operates at 13.56 MHz's An RFID system consists of two components, a target, which is the object to be identified, and a reader. The reader is an electronic device that powers up and initiates contact with a target. The reader and the target are the main components of every RFID system [1]. In this paper, we have explained operating modes of NFC, Applications of NFC and advantages and disadvantages of NFC.

II. NFC TECHNOLOGY

NFC operates between two devices over a very short communication range. NFC communication uses the 13.56 MHz spectrum

as in RFID. Currently data transfer speed options are 106, 212, and 424 kbps. NFC technology operates in different operating modes. This technology is at first designed in favour of application similar to expense and ticketing [2] except it might exist functional during activity as well as common application, access have power over contented delivery, look closely to examine information/currency representation convey, neat publicity visiting the attractions application, healthcare and etc. potential be everlasting.

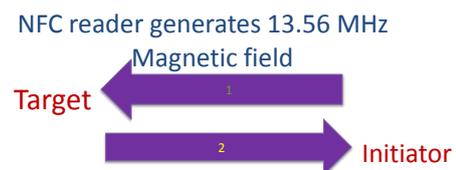
The NFC-Forum [3] is a non-profit association whose task is in the direction of assure the make use of NFC technology next to just beginning paradigm condition, ensure interoperability in the midst of strategy in addition to forces, and refining the marketplace in relation to NFC Technology.

NFC OPERATING MODES

There are three operating modes, reader/writer, peer-to-peer, and card emulation

(i) Reader/writer mode

This mode provides communication of an NFC mobile with an NFC tag. The purpose of the communication is either reading or writing data from or to a tag by the mobile phone. We can further categorize the mode into two different modes: reader mode and writer mode. In reader mode, the mobile reads data from an NFC tag; whereas in writer mode, the mobile phone writes data to an NFC tag.



When mobile phone is touched to NFC Reader, data(is resides in mobile phone)is transferred to reader.

Fig.a.Read mode

NFC enabled mobile phone sends query which also creates magnetic field and power the NFC Tag in 4cm. NFC Tag then saves the data to its internal memory



Fig.b. Write mode

(ii) Peer-to-peer mode

Two NFC mobiles using this mode exchange any data between each other. Since both mobiles have integrated power, each one uses its own energy by being in active mode in this mode. Bidirectional half duplex communication is performed in this mode similar to other modes, meaning that when one device is transmitting, the other has to listen and can start transmitting data after the first one finishes.

Initiator sends or request data from the target device in 4 cm



Target responds requests of Initiator

(iii) Card emulation mode

This mode provides the opportunity for an NFC mobile to function as a contactless smart

Fig.c. Peer-to-peer mode

card. Some examples of emulated contactless smart card are credit cards, debit cards, loyalty cards and so on. One NFC mobile may even store multiple contactless smart card applications concurrently. The card emulation mode is an important mode since it enables payment and ticketing applications and is compatible with existing smart card infrastructure.

NFC enabled mobile phones creates magnetic field and power the NFC tag within 4cm



Tag broadcast the answer which is then read by mobile phones

Fig.d. Card emulation mode



Fig.e. NFC Three Operating Modes



FIG .f. A typical NFC application scenario: A user spots a smart poster advertising an upcoming concert and taps the poster with his NFC phone (1). A dedicated pre-installed application opens on his phone displaying details of the concert. As the user has already registered an account and is signed in, he is able to directly buy a ticket (2). The ticket is securely stored on his phone. Later, on site of the concert, the access control gates are equipped with a NFC reader and provide immediate access to the user (3).

III. APPLICATIONS OF NFC

Near Field Communication (NFC) provides the possibility of linking virtual information between physical devices through proximity. Almost every object or place can be equipped with a NFC tag and thus provide proximate identification and useful related information to a nearby user of a smart device, like a tablet computer or a smartphone.

A poster advertising a music concert (see Figure 2) could for example not only offer information about the event itself to a user who taps the poster with his device, but also allow him to buy a concert ticket dispensed directly to his phone. The interaction technology behind remains invisible to the user, being unobtrusively stuck to the object, i.e. the concert poster, whilst being available anytime. When entering the concert hall, the validity of the ticket can be approved by simply waving the smartphone across a NFC reader device at the entrance control. After having enjoyed the performance, the visitor could share photos he's taken during the concert with another visitor by simply holding their tow phones together. And - just to follow this scenario - when taking the bus home afterwards, the user is not required to tediously gather coins the get a bus ticket at the vendor machine. Instead, when entering and leaving the bus, he touches

his phone to a reader device and the cheapest ticket price is automatically debited from his account. The presented scenario perfectly emphasizes possible key benefits of pervasive communication afforded by NFC technology: a larger degree of mobility and simplicity whilst decreasing the amount of physical effort required. NFC is perfectly suited for mobile payment and ticketing scenarios. The

Presentation of such applications will hence be the main part of this chapter.

A. Mobile Payment

Compared to traditional payment solutions, NFC payment primarily leads to faster and easier payment at the Point of Sale (POS), e.g. at the supermarket checkout or at a ticket vending machine. At present, a customer conventionally pays either by cash or with a debit card. In the first case when paying cash, the user is required to always carry cash money with him. Then, at the POS, the proper amount of invoiced money needs to be counted. This leads to a cumbersome and time-consuming procedure. Once an adequate payment terminal is available, paying with a usual debit card is certainly more efficient, but there is still an expenditure of time. The

appropriate card needs to be picked out of the wallet; it needs to be inserted into the terminal with considering the correct orientation and the right PIN needs to be entered.

With NFC payment a single movement of the hand is sufficient. By just waving the NFC-capable phone over the reader device, the payment is enforced. Entering a PIN however might still be necessary and advisable for security reasons. Moreover, the NFC phone can not only replace the debit card itself, but also store personalized discount coupons and bonus cards. This additionally contributes to making a traditional wallet becoming redundant.



Fig.g.The Wallet application is available for Android OS and compatible with MasterCard's Pay Pass NFC readers at shop checkouts.

B.Mobile Ticketing

Beside mobile payment another large segment capable for NFC applications is mobile ticketing. In certain cases, both mobile ticketing and payment could even be combined into powerful and innovative appliances with great usability. Mostly in the field of public transport, extensive RFID infrastructure for ticketing and access control is already in use. The advantage of such systems essentially is to get rid of buying paper-based tickets at retail shops or ticket vendor machines. Instead, a RFID compatible smartcard is used to check the ticket validity and to debit the appropriate ticket price for each journey.

1) Oyster Card:

One of the most popular systems for RFID based mobile ticketing is operating in London. The so-called Oyster Card works as contactless smartcard for prepaid mobile ticketing and can be used on all public transport services within the London area. All buses as well as entrance and departure gates of subway and train stations are equipped with RFID readers which the customers have touch with their Oyster cards when starting and ending their journey. Altogether more than 20.000 reading devices are installed in the field. In either case, the readers are able to read and write the cards in less than 300ms allowing a quick and straightforward access control and ticketing procedure. This form of system thus not only prevents travellers from using the transport systems without a valid ticket, but also can automatically debit the appropriate fare from the card depending on the travelling type and duration. As a matter of course the card needs to be topped up in advance. This is usually done via cash or credit card at kiosks or at certain vending machines placed at the stations. Flat rate tickets, e.g. based on monthly subscriptions, can of course also be linked to the Oyster Card. As being technically compatible, this immense RFID based ticketing system can be extended for NFC support without much effort. This means that the smartcard could be replaced by a NFC enabled mobile phone. Tickets could be either bought online and disposed directly to the phone in advance or - combined with NFC payment - debited from a bank account automatically.

After each journey the mobile handset could additionally display useful related information, e.g. the charged fare or the travel time, and hence provide further usability. In cooperation with Telephonic O2, Nokia, Barclaycard, Visa Europe and others, a six months trial for NFC based travel capabilities embedded in mobile phones has finished in 2008 with great success and positive user feedback. However, until now the London transportation system is still not working with NFC phones yet.

2) Movie, Concert and Hotel Ticketing:

The use of Near Field Communication does not only make sense for ticketing in public transport systems but also in various other areas that apply ticket reservation, ticket selling and admission control.

In this chapter an example for combining NFC with concert ticketing was already described: a user waves his NFC handset over a tagged advertisement poster and is redirected to a website where he can buy a ticket online. The ticket is cryptographically stored on the mobile phone and guarantees access on-site by being verified by a staff member with a NFC reading device or by an automatic entry barrier. The same procedure is applicable for movie tickets, conference entrance cards or hotel reservation. In the latter scenario NFC readers could for example be installed at the entrance of each hotel room. The NFC phones of the hotel guest could then operate as room keys providing access only to the booked rooms.

IV. PROS AND CONS

ADVANTAGES

1. Augmented Shopping Experience

Zap top uses NFC technology as a tool to create an augmented shopping experience. In this application, there is no exchange of personal, financial, or banking information. Zap tap is one of a few products that use NFC technology to connect consumers with a webpage featuring product information. There are no apps to download and nothing to install.

2. More Tech Companies Are Getting On Board

Current NFC concerns don't seem to bother tech companies, like Apple, who continue to embrace the new technology. Apple is working on a patent for an "NFC-infused iPhone which can connect to a multitude of devices and become a powerful controller."

This will make millions of iPhone users happier, as it will enable them to get in the game with the wonders of NFC. Of course, having Apple adopt such technology also shows the value in it and how secure it will be. With a company like theirs, privacy and security are always top of mind.

3. Quick and Easy Access

In the not-so-distant future, NFC technology could eliminate the need to carry a bus pass, loyalty cards, hotel keys, and event tickets. Soon, we will be able to check in on our mobile devices and download a virtual key (read: data) to our phones. Rather than using those plastic key cards, we'll simply walk up to our hotel room door and tap our phones against an NFC-enabled door to gain access to our rooms.

DISADVANTAGES

1. Sensitive Financial Data

While NFC's short read range (maximum of 20 cm) provides some security against transaction interference, there is still concern that it may be possible to steal data from an NFC system from a greater distance, with the use of an antenna.

2. Spyware or Malware Interference

Another concern is "man-in-the-middle" attacks, in which a hacker may be able to transfer a form of spyware or malware onto a phone through an interaction with that device. The affected device would then infect other devices it comes in contact with later.

V. CONCLUSION

NFC technology will grow hugely in 2014 as more and more merchants and customers are seduced by its power and flexibility. Merchants will be able to keep better track of their inventory and check out customers as they approach the register, or process items being purchased in mass. Customers will benefit by faster checkouts, shorter and quicker lines, and the eventual elimination of needing to carry a wallet at all. NFC smartphones will replace credit cards, social security cards, birth certificates, licenses, and

even passports. Users will be able to purchase tickets online and just walk past a scanner without slowing down or the need to keep track of tickets; customers will shop at the grocery store and bag their items as they go through the store and then just push their cart past the checkout without having to take a single item out of the cart; a single wave of their phone over a reader and all member discounts, and sales, will be applied to the total bill, and a charge will be made to their App selected credit card.

As with any method of identification and payment, security will always be a worry. As fast as technology implements a method of securing data and personal information someone is in the process of cracking it. With a combination of hardware, software, user knowledge, and caution, NFC will be one of the most secured and convenient methods of identification and payment in the years to come.

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