

Introduction to NFC - Near Field Communication

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Abstract: Near Field Communication (NFC) is one of the emerging and promising technological developments, which provides means to short range contactless communication for mobile phones and many other devices alike. NFC has become a popular research area in many academics due to its increasing growth and its promising applications and efficient services. Understanding the current status of NFC research area is a must to maintain the advancement of knowledge in NFC research and to examine the gap between theory and live experiments. In this paper, we present a literature review on NFC technology.

Keywords: Near Field Communication

1. Introduction

Today the fast development and adoption of information technologies is changing the way of we do business significantly. The growing interest on electronic commerce to perform business transactions brought vital improvements, especially in contactless technologies [1]. Near Field Communication (NFC) has become one of the emerging technological developments in IT industry. NFC technology is a high frequency, short-range, low bandwidth and wireless communication technology which is based on Radio Frequency Identification (RFID) technology. It allows the user to transfer data within a small area (few centimeters). One of the major advantages of NFC over other wireless technologies available is simplicity (Madlmayr et al. 2008): transactions are generated (initialized) automatically after touching a reader, any other NFC device or an NFC compliant transponder. Due to the simplicity of NFC, it has become a new and exciting area for beginners, many NFC enabled applications and services are developed which are operating in mainly three different modes; reader/writer, peer-to-peer and card emulation [2]. The integration of NFC technology into handheld devices (mobile devices) offers many reliable applications; specifically payment, ticketing, loyalty services, identification, access control, content distribution, smart advertising, peer-to-peer data/money transfers, and set-up services.

A. Scope of NFC

NFC has become an emerging research area in many academics due to its rapid growth and its promising applications and related services. Due to its nature, maximum proportion of the NFC research can be represented as a design science

research (Hevner et al. 2004) which aims at building an innovative design artifact which has a problem relevance and rigorous nature. In the last few years, there has been a recognizable amount of increase in the number of research papers and activities regarding NFC. However, understanding the current status of NFC research area is necessary to maintain the advancement of knowledge in NFC research and to identify the gap between theory and practice. Thus, an academic review of literature is necessary to fulfill the needs.

2. Theoretical considerations

A. NFC (Near Field Communication)

Near field communication, or NFC, transfers data from one device to another. This technology (as well as Bluetooth) is common in keyless door entry systems. In the case of mobile payments, the customer must have an NFC-enabled smartphone and the merchant must have an NFC-compatible point-of-sale terminal. In order for the transaction to take place, the two devices have to be close to each other (or tap).

B. NFC Modes of Communication

There are three modes of communication in NFC technology,

- Read/Write mode
- Tag emulation mode
- Peer-to-peer mode

In read/write mode NFC phone can read or write to the tag. For example smart poster.

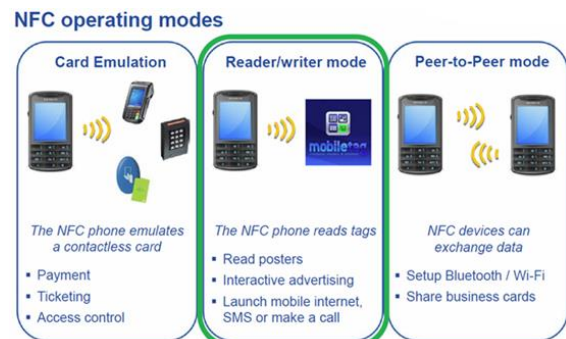


Fig. 1. NFC Modes of Communication

Contactless communication supports this mode [3].

While in card/tag emulation mode NFC phone works as a smart card. For example, mobile as e-wallet. Peer-to-Peer mode involves link level communication establishment between two NFC phones.



Fig. 2. Representation of NFC Payment

C. NFC Modes of Operation

RF signal transmission between transmitter and receiver is what distinguishes NFC and other RF wireless communication modes. NFC works upon the principle of straight magnetic/electrostatic coupling between devices instead of free broadcasting of radio waves, such as in Wi-Fi or Bluetooth. Due to its short range communication property, NFC devices can operate on low electric or magnetic field strengths.

3. How NFC works

There are four ways how NFC works.

- 1) Phone to phone
- 2) Phone to device
- 3) Phone to tag
- 4) Phone to reader

1) Phone to Phone

In this, two cell phones equipped with NFC can communicate with each other. They can share music files or pictures by just touching each other.



Fig. 3. Phone to Phone NFC Transaction

2) Phone to device

Here NFC equipped cell phone can communicate with any device. For example, by just touching cell phone with NFC equipped printer you can print the pictures stored in mobile

phone. Or by touching payment terminal you can perform payment transaction.

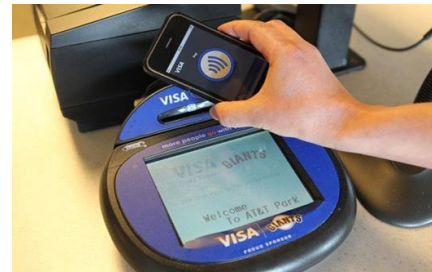


Fig. 4. Phone to Device Transaction

3) Phone to Tag

Tag contains data. Normally tags are embedded on posters for the purpose of marketing. Cell phone is placed/touched on the tag and data from tag is transferred to cell phone. For example there is a tag on bus terminal, on touching which bus timings and routines will be transferred to cell phones.



Fig. 5. Phone to Tag Transaction

4) Phone to Reader

We can purchase and store electronic tickets on our cell phones. Mobile phone can transfer data with external reader by just touching it with reader. So one can purchase ticket easily instead of standing and waiting in a long queue.



Fig. 6. Phone to Reader Transaction

4. NFC applications

A. Android pay

Android Pay is a free mobile payment app that comes preinstalled on new Android phones and is available for

download on Android 4.4 KitKat phones and later. You can store an unlimited number of credit, debit, gift and loyalty cards in the app, and shop at over one million stores using its tap-and-pay NFC technology. When you tap-and-pay at select merchants, your loyalty points and offers are automatically applied at checkout. Android Pay is available for in-store purchases only, but users will eventually be able to make purchases online and in thousands of Android apps.

B. How to use android pay

Android Pay uses NFC technology for in-store purchases. Typically, your Android phone will need a data or Wi-Fi connection to tap-and-pay, but may be able to access the device's memory for a few offline purchases. To use Android Pay at checkout:

- Open the Android Pay app
- You may be asked to enter a four-digit PIN (if your app has been inactive for a while or you have set up this extra security step)
- Hover the device near the payment terminal
- If prompted, choose "credit" regardless of the type of payment card you use
- The terminal will flash or beep to show that your payment was made.

C. How secure is android pay

When you add a card to Android Pay, you are allotted a unique virtual account number by Android Pay and Card

Network which represents your physical card. Your name and full card details, for easy identification except the last 4 digit of your card number, are never shown in the app and never shared with merchant. Android Pay does not have access to your bank account details.

5. Conclusion

As stated by Ngai et al. (2008), it is important for business and social science researchers to understand new emerging technologies such as RFID, NFC. With the development of more and innovative NFC enabled applications, the need for standards and policies is increased. At the same time, strategy for diffusion of NFC systems and economy of NFC systems need to be considered while developing new services, which includes the costs of designing, developing, controlling and updating of such systems.

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