Near Field Communication – Applications and Performance Studies

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Abstract. Near Field Communication (NFC), is an integration of Radio Frequency Identification (RFID) technology with mobile devices. NFC offers a quick and convenient method of interaction between humans and NFC enabled devices. Current research concerning NFC appears to mainly focus on development of NFC enabled applications and services. In this paper, we study the performance of NFC devices by considering metrics such as achieved data rates and received power for several distances. Knowledge of these metrics may be useful for application developers to build applications efficiently. We have developed various applications on NFC enabled devices for public transport systems. We also describe the design of 13.56 MHz antenna which was used for measurements of the received power.

Keywords: Near Field Communication (NFC), NFC Antenna, NFC Applications, NFC Performance, RFID.

1 Introduction

Near Field Communication (NFC) is a short range wireless communication using RFID technology. It allows communication between NFC enabled devices. This bidirectional method of communication has a range of around 5-10 cm, with data rates of 106, 212 and 424 kbps. NFC technology has a large potential for mobile services and some of the potential applications include using the mobile phones to (a) Emulate smart cards like credit cards, library cards, etc.; allowing users to exchange their contact information or electronic money with each other; (b) Read information from NFC tags contained in smart posters or items such as DVDs or CDs; (c) Use mobile ticketing services, which enable the mobile phones to be used in public transportation travel cards that are common in large parts of the world. NFC devices can be operated in peer-to-peer mode, card emulation mode and read/write mode.

1. Peer-to-Peer mode: This mode works on the ISO/IEC 18092 standard where data exchange happens between two NFC devices. The data exchanged may be a simple text, image, URL, etc.

2. Card Emulation mode: In this mode the NFC device acts as an NFC tag for an external reader (similar to contact-less smart card), which enables e-ticketing and contact-less payment.
3. Read/Write mode: In this mode NFC communication is achieved by two devices, one of which is an NFC reader/writer and the other is a passive NFC tag.

Several applications based on NFC technology have been developed over the last few years. However, most of these deal with e-ticketing and smart posters. E-ticketing deals with enabling quick ticketing at bus and train stations and also payment of toll on highways. A similar concept may also be used for carrying out transactions at merchant establishments. A secure payment gateway is required in this class of applications. Smart posters help provide information about objects. This information may be in the form of text, images, URL, etc. Some of the typical advantages of NFC enabled devices include: (i) The NFC technology is compatible with existing RFID structures, existing RFID tags and contact-less smart cards. (ii) NFC technology is easy to use and familiar to people because users have no requirement to possess any prior knowledge about the technology. The user can automatically start a communication by bringing two devices closer. (iii) The transmission range of NFC devices is quite short, so when the user separates the two devices, the communication is aborted. This brings an inherent security in these devices where, if there are no devices close to each other then there is no communication.

Performance of NFC enabled devices is a very important aspect which has to be taken into consideration when developing an application. In this paper we evaluate the performance of these NFC enabled devices by considering the practically achieved data rates and received power via the NFC devices for several distances. These performance metrics are useful for application developers and manufactures which they may have to consider during design and development of a 'viable' application which does not degrade the Quality of Experience for the user. This paper answers the following questions: (a) What is the achieved data rate for transferring a reasonable size file? (b) What is the received power between two devices for several distances? (c) What is the realistic time duration the user has to wait to obtain a particular information from the NFC tag.

2   Related Work

In the last 5 years many NFC applications have been developed and implemented, some even on a large scale. NFC is expected to gain popularity in various fields over the next few years. The current state of applications and their future directions is discussed in [1]. The fundamentals of developing an NFC application and approaches to develop one are dealt in [2] and [3]. A mobile payment system based on RFID-SIM card is discussed in [4]. A discussion of critical aspects involved with the deployment of NFC for e-ticketing applications is presented in [5]. A system that enhances instant messaging tools with real-time location information through the use of NFC enabled mobile devices, called LocaTag, is