Near Field Communication (NFC) Technology in Smart E-Transactions

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Abstract

Near Field Communication (NFC) technology makes life easier and more convenient for consumers around the world by making it simpler to make transactions, exchange digital content, and connect electronic devices with a touch. Near field communication (NFC) is a set of standards for smartphones and similar devices to establish radio communication with each other by touching them together or bringing them into close proximity, usually no more than a few centimeters. 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 standards cover communications protocols and data exchange formats, and are based on existing radio-frequency identification (RFID) standards including ISO/IEC 14443 and FeliCa. The standards include ISO/IEC 18092 and those defined by the NFC Forum, which was founded in 2004 by Nokia, Philips and Sony, and now has more than 160 members. The Forum also promotes NFC and certifies device compliance.

Keywords: Smart phones, RFID, Digital Content, Tag

I. INTRODUCTION

NFC (Near Field Communication) is a low power, short-range (around 4 – 10 cm) wireless communication technology initially targeted for mobile phones and handheld devices. NFC not only functions as a passive tag containing stored information (like early RFID or contactless cards), but also provides a fast (up to 424 kbps), bi-directional, secure way to exchange data that is easy to integrate into small devices. When two such NFC enabled devices are brought into close range of each other (or touched together), magnetic field induction initiates the information exchange. NFC-like technology is not new; in fact, it is all around you. Early RFID tags simplified inventory control systems, streamlined identification with ID badges, and, when widely deployed for payment in public transport systems, increased efficiency and significantly reduced operating expenses.

1) Key Benefits of NFC:

NFC provides a range of benefits to consumers and businesses, such as:

- Intuitive: NFC interactions require no more than a simple touch
- Versatile: NFC is ideally suited to the broadest range of industries, environments, and uses
- Open and standards-based: The underlying layers of NFC technology follow universally implemented ISO, ECMA, and ETSI standards
- Technology-enabling: NFC facilitates fast and simple setup of wireless technologies, such as Bluetooth, Wi-Fi, etc.)
- Inherently secure: NFC transmissions are short range (from a touch to a few centimeters)
- Interoperable: NFC works with existing contactless card technologies
- Security-ready: NFC has built-in capabilities to support secure applications.

II. ESSENTIAL SPECIFICATIONS

Fig. 1: N-Mark Logo for Certified Devices

NFC is a set of short-range wireless technologies, typically requiring a distance of 4 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. A patent licensing program for NFC is currently under development by Via Licensing Corporation, an independent subsidiary of Dolby Laboratories. A public, platform-independent NFC library is released under the free GNU Lesser General Public License by the name libnfc.NFC tags contain data and are typically read-only but may be rewriteable. They can be custom-encoded by their manufacturers or use the specifications provided by the NFC Forum, an industry association charged with promoting the technology and setting key standards. The tags can securely store personal data such as debit and credit card information, loyalty program data, PINs and networking contacts, among other information. The NFC Forum defines four types of tags which provide different communication speeds and capabilities in terms of configurability, memory, security, data retention and write endurance. Tags currently offer between 96 and 4,096 bytes of memory.

As with proximity card technology, near-field communication uses magnetic induction between two loop antennas located within each other's near field, effectively forming an air-core transformer. It operates within the globally available and unlicensed radio frequency ISM band of 13.56 MHz. Most of the RF energy is concentrated in the allowed ±7 kHz bandwidth range, but the full spectral envelope may be as wide as 1.8 MHz when using ASK modulation.

Theoretical working distance with compact standard antennas: up to 20 cm (practical working distance of about 4 centimetres) Supported data rates: 106, 212 or 424 kbit/s (the bit rate 848 kbit/s is not compliant with the standard ISO/IEC 18092)

A. There Are Two Modes:

- Passive communication mode: The initiator device provides a carrier fields and the 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.
- Active communication mode: Both initiator and target device communicate by alternately 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.

Difference between Active and Passive devices

Table – 1
Difference between Active and Passive Devices

kbit/s	*Active device*	*passive device*
424 kbit/s	*Manchester, 10% ASK*	*Manchester, 10% ASK*
212 kbit/s	*Manchester, 10% ASK*	*Manchester, 10% ASK*
106 kbit/s	*Modified Miller, 100% ASK*	*Manchester, 10% ASK*

NFC employs two different codings to transfer data. If an active device transfers data at 106 kbit/s, a modified Miller coding with 100% modulation is used. In all other cases Manchester coding is used with a modulation ratio of 10%.

NFC devices are able to receive and transmit data at the same time. Thus, they can check for potential collisions if the received signal frequency does not match with the transmitted signal's frequency.

III. COMPARISON WITH BLUETOOTH

NFC and Bluetooth are both short-range communication technologies which are integrated into mobile phones. As described in technical detail below, NFC operates at slower speeds than Bluetooth, but consumes far less power and doesn't require pairing. NFC sets up faster than standard Bluetooth, but is not faster than Bluetooth low energy. With NFC, instead of performing manual configurations to identify devices, the connection between two NFC devices is automatically established quickly: in less than a tenth of a second. The maximum data transfer rate of NFC (424 kbit/s) is slower than that of Bluetooth V2.1 (2.1 Mbit/s). With a maximum working distance of less than 20 cm, NFC has a shorter range, which reduces the likelihood of unwanted

interception. That makes NFC particularly suitable for crowded areas where correlating a signal with its transmitting physical device (and by extension, its user) becomes difficult.

In contrast to Bluetooth, NFC is compatible with existing passive RFID (13.56 MHz ISO/IEC 18000-3) infrastructures. NFC requires comparatively low power, similar to the Bluetooth V4.0 low energy protocol. When NFC works with an unpowered device (e.g., on a phone that may be turned off, a contactless smart credit card, a smart poster), however, the NFC power consumption is greater than that of Bluetooth V4.0 Low Energy, since illuminating the passive tag needs extra power.

Uses

NFC builds upon Radio-frequency identification (RFID) systems by allowing two-way communication between endpoints, where earlier systems such as contactless smart cards were one-way only. Since unpowered NFC "tags" can also be read by NFC devices, it is also capable of replacing earlier one-way applications.

Fig. 2: Uses of NFC

IV. COMMERCE

NFC devices can be used in contactless payment systems, similar to those currently used in credit cards and electronic ticket smartcards, and allow mobile payment to replace or supplement these systems. For example, Google Wallet allows consumers to store credit card and store loyalty card information in a virtual wallet and then use an NFC-enabled device at terminals that also accept MasterCard PayPass transactions. Germany, Austria, Latvia and Italy have trialled NFC ticketing systems for public transport. China is using it all over the country in public bus transport and India is implementing NFC based transactions in box offices for ticketing purposes

Fig. 3: NFC Transaction

1) A Uses of NFC:

Matching encrypted security code and transporting access key; Due to short transmission range, NFC-based transactions are possibly secure; Instant payments and coupon delivery using your handset, as we do with your credit card or debit card; Marketing and exchange of information such as schedules, maps, business card and coupon delivery using NFC Marketing tags;

Pay for items just by waving your phone over the NFC capable devices;
Transferring images, posters for displaying and printing Social media e.g Like on Facebook, Follow on Twitter via NFC smart stickers in retail stores

A. Bluetooth and WiFi Connections:

NFC offers a low-speed connection with extremely simple setup, and could be used to bootstrap more capable wireless connections. It could, for example, replace the pairing step of establishing Bluetooth connections or the configuration of Wi-Fi networks.

B. Social Networking:

NFC can be used in social networking situations, such as sharing contacts, photos, videos or files, and entering multiplayer mobile games.

C. Identity-Document:

The NFC Forum promotes the potential for NFC-enabled devices to act as electronic identity documents and keycards. As NFC has a short range and supports encryption, it may be more suitable than earlier, less private RFID systems.

V. TYPICAL APPLICATIONS

Applications of NFC technology include contactless transactions such as payment and transit ticketing and simple and fast data transfers, including calendar synchronization or electronic business cards and access to online digital content.One example that demonstrates how NFC technology can help someone capture information: People walk past billboards and posters with product advertisements, but how often do they remember to act on their interest? By adding NFC-compatible "tags" to posters and magazine advertisements, people can read the tags with an NFC-enabled phone and act immediately, before they forget. A wide range of devices and machines are likely to become NFC enabled. Here are some examples:

- Mobile phones
- Vending machines
- Parking meters
- Check-out cash registers or point-of-sale equipment
- Personal computers
- Posters, street signs, bus stops, and local points of interest (with NFC-readable tags only)
- Product packaging, etc.
  - Access control
  - Information collection and exchange
  - Loyalty and coupons
  - Payments
  - Transport

VI. NFC FORUM

The NFC Forum is a non-profit industry association formed on March 18, 2004, by NXP Semiconductors, Sony and Nokia to advance the use of NFC short-range wireless interaction in consumer electronics, mobile devices and PCs. The NFC Forum promotes implementation and standardization of NFC technology to ensure interoperability between devices and services. As of March 2011, the NFC Forum had 135 member companies.

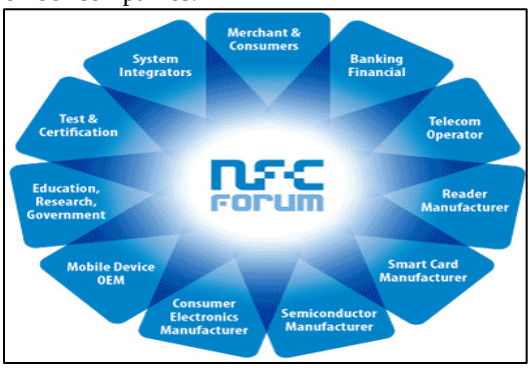

Fig. 4: NFC Forum

VII. NFC-ENABLED HANDSETS

In 2011 several handset vendors released more than 40 NFC-enabled handsets. According to analyst firm Berg Insight, global sales of handsets featuring Near Field Communication (NFC) increased ten-fold in 2011 to 30 million units. Growing at a compound annual growth rate (CAGR) of 87.8 percent, shipments are forecasted to reach 700 million units in 2016.

VIII. CONCLUSION

This NFC technology is a newly developed contactless communication technology, which enables the user to quick transaction. And this technology is highly efficient than others technologies. If this is implemented all over the world then the entire transaction in any part ant of any kind will be very fast and transactions may be done in one-by-ten of a second.

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