Literature Survey on NFC, Applications and Controller

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Abstract— In 2004. The Near Field Communication forum was formed to promote and supervise the use of the NFC technology. Consequently many pilots have been launched worldwide in order to test and improve it.Near Field Communication (NFC), as an emerging and promising technology, is an integration of Radio Frequency Identification (RFID) technology with mobile devices.NFC-enabled mobile devices can act as contactless smart cards and are also capable to read and write data from/to those cards.I analyzed different NFC applications by classifying them into NFC operating modes to surface the nature of underlying value-added services and benefits that they provide.

Index Terms— NFC, Introduction, Overview on Applications, Technology , Challenges, Protocols and Standards.

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1 INTRODUCTION

During the last decade, wireless technology has grown significantly offering many applications including payment, ticketing and access control. Especially Near Field Communication(NFC) has become widely available on the market offering convenient services by simply touching NFC enabled objects in the proximity with commodity mobile phones.

In NFC, the communication occurs when two NFC compatible devices are brought together less than four centimeters, or simply by touching themselves. It operates at 13.56 MHz and can transfer data up to 424 Kbits per second [1]. In an NFC model two devices are involved in the communication, which are called initiator and target. Initiator is an active NFC device which is responsible for starting the communication. Also it has an embedded energy component whereas target can be either a tag, RFID card or an NFC device which responses the initiator's requests [2].

One of the advantages of NFC technology is that mobile devices can be used both as an information storage or an NFC reader. They can read information from NFC tags and display that information on the screen with an ability to make additional processing. Also they can be used as a digital storage e.g. storing credit card information.
Other most important advantages of NFC technology include;
• The technology is compatible with existing RFID
structures, existing RFID tags and contactless smart cards[1].
• It is easy to use and familiar to people because users
don't need to have any knowledge about the technology. All a user has to do is to start communication by bringing two devices together [3].
• The transmission range is so short that, when the user separates two devices, the communication is cut. This brings inherent security. If there isn't any other device close, there is no other communication.

2 OVERVIEW ON APPLICATIONS

Table 1 presents the applications examined. The first column indicates which NFC Mode underpins the application(CE=CardEmulation Mode,R/W=Reader/Writer Mode, P2P=Peer-to-peer Mode)[1].

Table 1: NFC Applications surveyed

NFC Mode*	Application nane	source
CE,R/W,P2P	Automotive Environment	[4]
CE,R/W	Ticketing	[3]
CE,R/W	Mobile Coupon	[9]
CE	Payment	[9]
CE	Electronic key	[10]
CE	Health monitoring system	[2]
R/W	Indoor Navigation	[7]
R/W	Smart Poster	[12]
P2P	File Transfer	[11]

*: CE=Card Emulation Mode, R/W= Read/Write Mode,

P2P=Peer to Peer Mode.

2.1 Application Scenario for NFC

There are several short range communication technologies such as RFID, Bluetooth, Bluetooth ULP (Ultra low power, known also as a Wibree), Zigbee and IrDA which provide flexible communication for several applications depending on which kind of communication is required. From these technologies,RFID is one of the promising technologies to be used with a human operator[6].
How NFC suits for different applications?
A.Suitability of NFC for industrial applications:

The benefits of NFC technology for industrial applications can be listed as follows:

 NFC enables intuitive, easy-to-use touch-based communication and interaction between two devices.
 Communication set-up latency with NFC is typically some hundreds of milliseconds, whereas with Bluetooth it is typically several seconds.
 In wireless sensor applications, NFC enables

longer lifetime of the sensor battery, or even batteryless implementation of the sensor.

B.Mobile Payment Services

Near Field Communication (NFC), is a relatively new technology that allows the handset to emulate both a contactless card and a contactless reader. Its ease of use when conducting short range communication and compatibility with existing contactless payment systems are some reasons why it is seen as a key enabling technology for mobile payment services.

C.NFC Ticketing

In 2006 the Roman public transportation company ATAC introduced the use of mTickets via SMS [10]. In order to access the service, the user had to perform a subscription to his mobile network operator; next the user has only to send a text message (with a particular syntax) to the service center. The network operator will reply with another text message indicating the ticket type, validity time and other related information. This system has some weak spots, especially regarding the cognitive load of the user: some people, in fact, have some difficulty in drafting an SMS and must also have the burden of remembering. the syntax of the text itself; moreover there are problems concerning security issues. The NFC technology can be a valid aid to overcome these problems thanks to its ease of use and to its higher security level

2.2 NFC Technology and its challenges
A. Technical aspects of challenging NFC based service Implementation
        NFC-based solutions collaborating with existing contactless and smart card standards have still deficiencies[5].Many problems can be derived from technical and technological barriers :
1) 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.
2) 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

B. Business aspect of challenging NFC based service

implementation

When defining the NFC-based services and applications, only a part of the problems are technology-related. In order to implement the services it is very important to work out the necessary and suitable business models and processes [9]. Hence B Benyo at.all suggest in their paper a generalized approach for NFC application development. The framework developed according to the generalized approach provides not only the opportunity to create a new skin for the already existing application, but also makes possible to rapidly implement the business logic and the user interface.

2.3 NFC Protocols and Standards
ISO-IEC Protocol
        ISO/IEC 14443 is one of a series of International Standards describing the parameters for identification cards as defined in ISO/IEC 7810, and the use of such cards for international interchange. This part of ISO/IEC 14443 describes polling for proximity cards entering the field of a proximity coupling device, the byte format and framing, the initial Request and Answer to Request command content, methods to detect and communicate with one proximity card among several proximity cards (anti-collision) and other parameters required to initialize communications between a proximity card and a proximity coupling device. Protocols and commands used by higher layers and by applications and which are used after the initial phase are described in ISO/IEC 14443-4.
        ISO/IEC 14443 is intended to allow operation of proximity cards in the presence of other contact less cards conforming to ISO/IEC 10536 and ISO/IEC 15693.

ISO 18000:
        Parameters for Air Interface communications at 13.56Mhz determines physical layer, Anti collision system and protocol values for 13.56Mhz RFID systems for item identification. this standard has 2 MODES of operation, intended to address different applications[12].

NFC-DEP Protocol
ISO 18092(NFCIP-1) or ECMA 340
This Standard defines communication modes for Near Field Communication Interface and Protocol (NFCIP-1) using in-ductive coupled devices operating at the centre frequency of 13,56 MHz for interconnection of computer peripherals. It also defines both the Active and the Passive communication modes of Near Field Communication Interface and Protocol (NFCIP-1) to realize a communication network using Near Field Communication devices for networked products and also for consumer equipment. The Standard specifies, in particular, modulation schemes, coding, transfer speeds, and frame for-mat of the RF interface, as well as initialization schemes and conditions required for data collision control during initializa-tion. Furthermore, this ECMA Standard defines a transport protocol including protocol activation and data exchange me-

thods.

Information interchange between systems also requires, at a minimum, agreement between the interchange parties upon the interchange codes and the data structure.

All NFCIP-1 devices shall have communication capability on 106 kbps and may switch to another transfer speed or stay at 106 kbps. All NFCIP-1 devices shall have communication capability on 212 kbps and may switch to another transfer speed or stay at 212 kbps. All NFCIP-1 devices shall have communication capabilities on 424 kbps and may switch to another transfer speed or stay at 424 kbps[12].

The mode (Active or Passive) shall not be changed during one transaction until the deactivation of the Target or removal of the Target, even though the transfer speed of Initiator to Target and the transfer speed of the Target to the Initiator may not be the same. The change of transfer speed during one transaction may be performed by a parameter change procedure.

ISO 15963
This International Standard describes numbering systems that are available for the identification of RF tags.
The unique ID can be used
− for the traceability of the integrated circuit itself for quality control in its manufacturing process,
− for the traceability of the RF tag during its manufacturing process and along its lifetime,
− for the completion of the reading in a multi-antenna configuration,
− by the anti-collision mechanism to inventory multiple tags in the reader's field of view.

3 Proposed Work

The objective of proposed thesis is to implement a Digital IP(Intellectual Property) for an NFC Controller by using the existing protocol in an efficient way to provide higher security with due considerations in reduction of connection establishment time which will be useful in different applications where higher security is expected
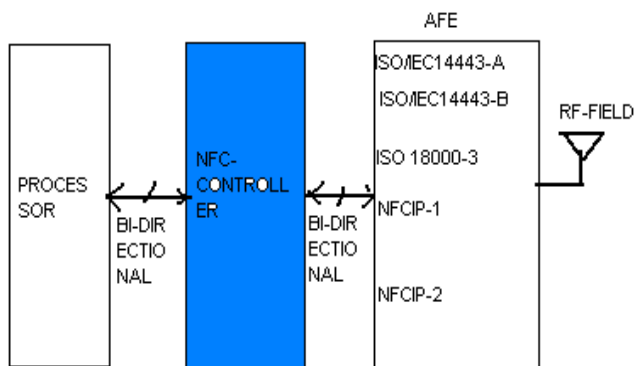

Fig: Block Diagram of proposed work

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CONCLUSION

In summary, Near Field Communication is an efficient technology for communications with short ranges. It offers an intuitive and simple way to transfer data between electronic devices. A significant advantages of this technique is the compatibility with existing RFID infrastructures. Additionally, it would bring benefits to the setup of longer-range wireless technologies, such as Bluetooth.

Mobile NFC opens up new opportunities in payment and banking. The Standards are extremely important because this is an area where many different actors (MNOs, banks, terminal producers, UICC producers ….) are involved. Most of the crucial standards are in place, but implementation of standards are not sufficiently widespread. It may take another year or two before mobile NFC will take off.

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