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Near Field Communication Short Range Technology

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***Abstract*—- Near field communication (NFC) is a technology for contactless identification and interconnection. NFC is a standard based short-range wireless connectivity technology. Based on the radio frequency identification (RFID), it uses magnetic field induction to enable communication between electronic devices. NFC is set of standards for smart phones and similar devises to establish radio communication with each other by touching them together. The number of short range applications for NFC technology is growing continuously, appearing in all areas of life. Mobile handsets are the main targeted devices for this technology**.

Keywords— RFID technology, Near field communication interface circuit.

I.INTRODUCTION

Near field communication (NFC) is a technology for contactless identification and interconnection. One of the main goals of Near field communication (NFC) technology has been to make the benefits of short range contactless communication available to consumers globally. NFC is set of standards for smart phones and similar devises to establish radio communication with each other by touching them together or bringing them into close proximity, usually no more than a few centimeters as shown in figure 1.

NFC always involves an initiator and a target; the initiator actively generates and RF field that can power a passive target. This enables NFC targets to take very simple form factors such as tags, stickers, cards that do not require batteries.

This is the main driver for the Near Field Communication Interface and Protocol (NFCIP-1), which is targeted towards the consumer electronics users that will be able to use the secure means of communication between various devices without exerting much intellectual effort in configuring their "network". The concept is strikingly simple: in order to make two devices communicate, bring them together or make them touch. This will engage the NFCIP-1 wireless devices' interfaces and configure them to link up in a peer-to-peer network. Once the configuration data has been exchanged using NFC, the devices can set up and continue communication for longer range and faster protocols like Bluetooth or Wireless Ethernet (Wi-Fi).

Near field communication (NFC) is a latest technology of transmitting over short range distance .Mobile handsets are the main targeted devices for this technology. Services built on the top of NFC enabled mobile handsets, enables users to share and receive information instantly, interact with other NFC enabled devices and even make fast and secure mobile payments. The applications targeted are contactless payment, ticketing, easy information access, and peer-to-peer communication. The NFC concept is based on integrating existing RFID technology, especially ISO 14443-based Mifare (Philips) and Felica (Sony), to portable consumer devices, such as mobile phones.

NFC is an open platform technology standardized in ECMA and ISO/IEC. These standards specify the modulation schemes, coding, transfer speeds and frame format of the RF interface of NFC devices, as well as initialization schemes and conditions required for data collision control during initialization for both passive active NFC mode.

NFC builds upon RFID systems by allowing two-way communication between end points, 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. It provide seamless medium for the identification protocols that validate secure data transfer.

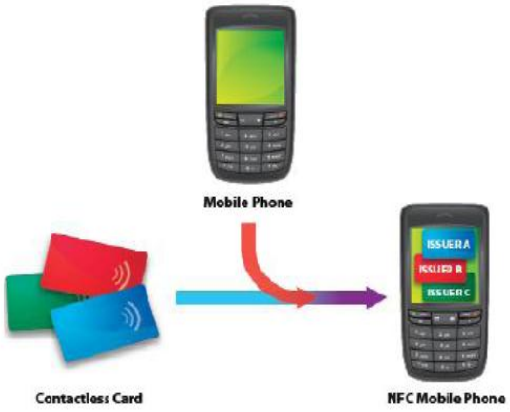

Fig 1: Concept of NFC phones

II. HISTORY

Near field communication (NFC) traces its root back to radio- frequency identification, or RFID. RFID allows a reader to send radio waves to a passive electronic tag for identification, authentication and tracking.

- In the year 2004 Nokia, Philips and Sony established the Near Field Communication (NFC) Forum.
- In the year 2006 initial specifications for NFC Tags.
- In the year 2006 Nokia 6131 was the first NFC phone.
- In the year January 2009, NFC Forum released Peer-to- Peer standards to transfer contacts, initiate Bluetooth, etc.
- In the year 2010 Samsung Nexus S: First android NFC phone shown
- In the year 2011 Google I/O "HOW TO NFC" demonstrates NFC to initiate a game and to share a contact, URL, app, video, etc.
- In the year 2011 NFC support becomes part of the Symbian mobile operating system with the release of Symbian Anna version.
- In the year 2011 research in motion is the first company for its devices to be verified by Master Card Worldwide, the functionality of Pay Pass.
- In the year 2012 March. Eat, a well known UK restaurant chain and Everything Everywhere (Orange Mobile Network Operator) partner on the UK's first nationwide NFC enabled smart poster campaign. In the year 2012 Sony introduces the "Smart Tags", which use the NFC technology to change modes and profiles on a Sony smart phone at close range, included in the package of the Sony Xperia P Smartphone released the same year.

III.SPECIFICATIONS

- As with proximity card technology, near filed communications mediated by magnetic induction between two loop antennas located within each other's near filed effectively forming an air core transformer. It operates within the globally available and unlicensed radio frequency ISM band of 13.56 MHz
- License ISO 21481 and ECMA
- Working distance with compact standard antennas: up to 20 cm.
- Supported data rates: 106, 2012, 424 or 848 Kbit/s

➢ There are two modes:

NFC protocol also distinguishes between two modes of operation: Active mode and Passive mode. All devices support both communication modes. The distinction is as follows:

In the Active mode of communication both devices generate their own RF field to carry the data.

In the Passive mode of communication only one device generates the RF field while the other device uses load modulation to transfer the data. The protocol specifies that the Initiator is the device responsible to generate the RF field.

3.1 Passive communication mode:

The initiator device provides a carrier filed and 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.

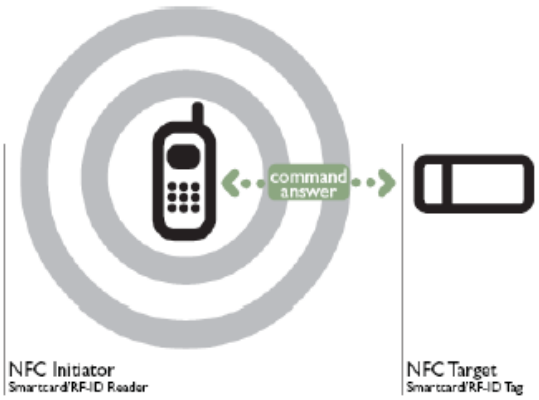

Fig 2: Passive communication mode

3.2 Active communication mode:

Both initiator and target device communicate by alternatively generating their own fields. A device deactivates its RF filed while it is waiting for data. In this mode, both devices typically have power supplies.

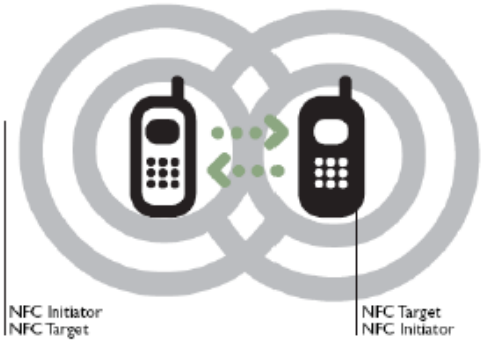

Fig 3: Active communication mode

IV.BLOCK DIAGRAM FOR NFC

The block diagram of Smart NFC Interface electronics is shown in Figure 4. In its basic form, the device contains two boards: 1) Basic Board, and 2) Communication Board.

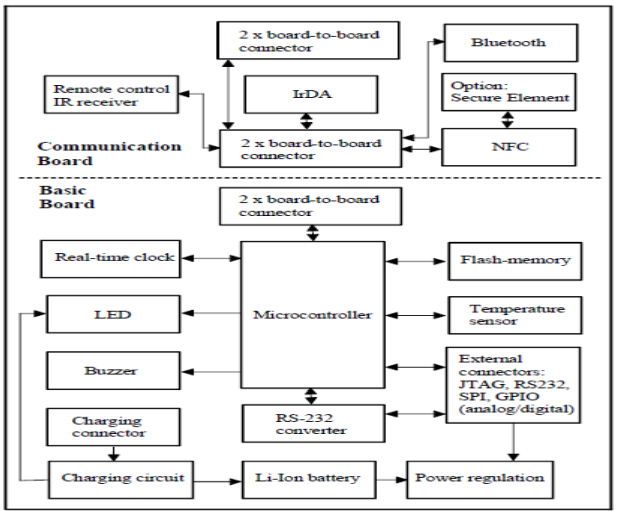

Fig 4:The Block Diagram of Smart NFC Interface Electronics

The device has a single 8-bit microcontroller (Atmel AVR series ATmega128L) which is equipped with 128 kilobytes of flash program memory, enabling easy reprogramming and debugging via JTAG interface. There are 4 kilobytes of internal RAM and 4 kilobytes of EEPROM in the microcontroller. There is also external 8 Mbit flash memory, connected to SPI bus of the microcontroller. This can be used for data logging purposes, for example. The circuit is equipped with Philips PCF8563T real-time clock circuit, whose main purposes are 1) enabling recording of timestamps for events (data logging applications, for example) and 2) serving as a wakeup timer, facilitating ultra-low power modes. A versatile power supply circuitry is used, enabling power to be taken not only from the internal battery, but also from RS-232 serial port or other external supplies. The power supply automatically adjusts to a wide range of input voltages. The battery charging connector and circuit is compatible with Nokia mobile phone chargers (specified to be compatible with Nokia ACP-12E charger). The charging circuit is connected to the LED, which indicates the charging status. While not charging, the LED is also software controlled by the microcontroller. Another supported UI feature is the buzzer. Many anticipated applications are related to sensors. These can be connected to the external connector or to board-to-board connectors. A temperature sensor is integrated to the Basic Board. On the Communication Board, the NFC is based on NXP Semiconductor PN531 circuit, which is connected to the microcontroller via SPI bus. A Smart MX secure chip can optionally be installed. Bluetooth (Class 2 Bluetooth radio) is based on Bluegiga WT12- A-AI module, which contains Bluetooth protocol layers up to RFCOMM and profiles, and is connected to the microcontroller by UART. IrDA support currently exists only in HW, based on Microchip MCP2150-I/SO IrDA controller and Zilog ZHX1403 IrDA transceiver. The same is true for the remote control infrared (IR) receiver.
The general purpose IO (GPIO) on the external connector also includes analogue input. This can be used to connect analogue sensors, for example. On the other hand, digital interfaces such as RS-232/UART and SPI can often be used. RS-232 levels are converted to logic level UART and vice versa by Maxim MAX3222CAP IC. The main idea of the Smart NFC Interface is to enable a user's interaction with various objects by mobile device and local communication.

NFC Enabled Mobiles

Fig 5: NFC Enabled Mobiles

V.OPERATING MODES OF NFC

NFC devices are capable of three operating modes:

1. Peer to Peer mode:

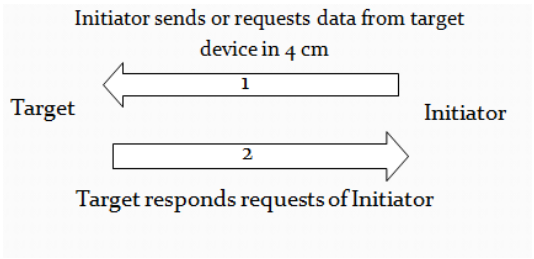

Fig 6: Peer to Peer mode

For example, you can share Bluetooth or WIFI link set up parameters, and exchange data such as virtual business cards or digital photos.P2P mode is standardized on the ISO/IEC standard.P2P is less used in when compared to other modes, though it is studied for device pairing, networking and file transfer operations. This mode is the classic NFC mode, allowing data connection for up to 424 kbps.

2. Reader/writer mode

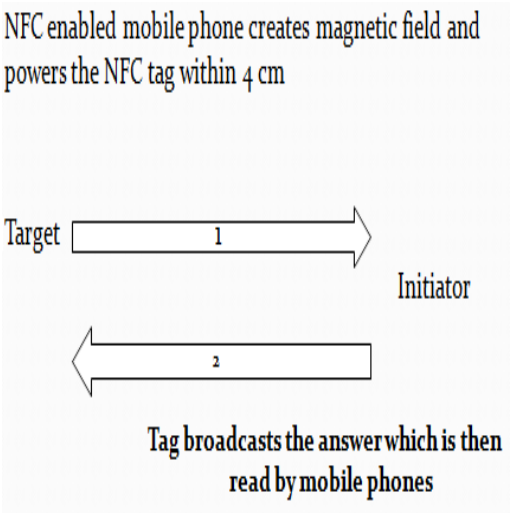

Fig 7: Reader mode

3. Writer mode:

NFC phones can read and write data from/ to NFC tags and smart cards.NFC enabled mobile phones act as a initiator and passive tags as a target. Active NFC device creates magnetic induction coupling and transfers energy to smart card. After the smart card is a powered communication start. In this mode data rates of 106 kbps are possible.

Many applications use this mode. In electronic voting application NFC tags were used to read the candidates data before voting using NFC mobiles. It is also used in Information gathering etc.

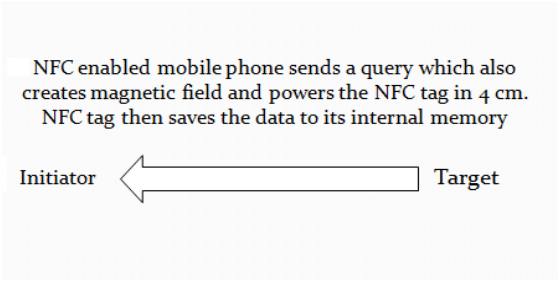

Fig 8: Writer mode

VII.ADVANTAGES OF NFC TECHNOLOGY

- No interference due to decaying fields
- Allows communication both between two powered and passive devices
- Convenient usage by simply holding the two devices close to each other.
- Short range communication (4 centimeters)
- Automatic coupling
- Inherent security
- Mobile phones can be used both as an information storage devices or an NFC reader.
- No need to carry an extra RFID card, Lower cost (less complex, circuit size, …)
- Both powered & non powered

VIII.DISADVANTAGES OF NFC TECHNOLOGY

- Data transfer rate is small compared to blue tooth and other wireless communications
- No protection in eavesdropping
- No protection in data modification
- Range is very less

IX.SECURITY ASPECTS

There are different possibilities to attack the Near Field Communication technology (NFC). On the one hand the different used devices can be manipulated physically. This may be the removal of a tag from the tagged item or wrapping them in metal foil in order to shield the RF signal. Another aspect is the violation of privacy. If proprietary information is stored on a tag it is important to prevent from unauthorized read and writes access. The read only tags are secure against an unauthorized write access. In the case of rewritable tags we have to assume that attackers may have mobile readers and the appropriate software which enable unauthorized read and write access if the reader distance is normal. In this we want to focus on attacks with regard to the communication between two devices. For detecting errors, NFC uses the cyclic redundancy check (CRC).

This method allows devices to check whether the received data has been corrupted. In the following, we will consider different possible types of attacks on the NFC communication. For most of these attacks there are counter measures in order to avoid or at least reduce the threats.

1. Data Destruction
2. Data Insertion
3. Man-in-the-Middle-Attack

X.APPLICATIONS

- In mobile phones there are three main use cases for NFC: card emulation, reader mode, P2P mode.
- Smart poster – The mobile phone used to read RFID tags on outdoor billboards in order to get info on the move.
- Mobile ticketing in public transport
- Smart poster
- Mobile payment — the device acts as a debit/ credit payment card.
- Smart poster — the mobile phone is used toread RFID tags on outdoor billboards in order to get info on the move.
- Bluetooth pairing

XI.CONCLUSION & FUTURE SCOPE

- NFC is compatible with existing RFID infrastructures.
- NFC is an efficient technology for communications with short range
- Smart Touch introduces the next connected experience focus on improved security and privacy. The main applications of NFC can be divided into payment and ticketing, information retrieval.
- Identity documents

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