Design of Self-Service Speech Explaining System Based on Near Field Communication

Miss.Tejashri V.Patil, Mr. R.T.Patil

Abstract— With the huge development of tourism, intelligent electronic tourism guides are welcomed widely. This paper presents a self-service tourism guide system based on NFC (Near Field Communication) and ARM. This proposed system consists of NFC tags and handheld terminals. NFC device includes ARM Cortex-4 module, NFC reader module and USB device. It implements FAT32 file system to read audio files from USB device. Audio files get played on Headphones. This system is suitable for the museums, exhibitions, Airports, railway stations and other intensive places. When person touches tag to the NFC reader, reader passes information to system as per the data read from tag. System verifies its stored database and play respective audio file.

Index Terms— ARM, Near Field Communication (NFC), NFC device, NFC reader, NFC tag, USB device.

1 Introduction

The proposed system deals with the problem of different languages of tourists, with the huge development of tourism. Self-service speech explaining system in museum designed for people who cannot understand foreign language. In this system language is selected by tourist. User carries NFC device with personal information like language speaks, itinerary details. When tourist touches tag to NFC reader it sends data read from tag to the system. This system is built using STM32F4DISCOVERY high-performance discovery board and NFC reader communicating with each other using serial communication. Then system reads audio file in selected language from USB device having stored database in different languages. As per the tag information respective audio files get played on headphones. NFC is a technology used for contactless short-range communication. Active RFID transponders [reader/writer devices (RWDs)] for NFC applications are basically built up with common 13.56-MHz RFID readers with supported data rate 106,212-424 Kbit/s. NFC-enabled communicates via magnetic field induction, where two loop antennas are located within each other's near field, effectively forming an air-core transformer. A signal supplier coupled to the antenna circuit to supply a drive signal to cause the antenna circuit to generate an RF signal.

2 Near Field Communication (NFC)

Near-field communication (NFC) devices, which are derived from radio frequency identification systems (RFID). Near Field Communication (NFC) is a standards-based, short-range wireless connectivity technology that enables simple and safe two-way interactions between electronic devices. The two technologies, NFC and RFID, have much in common, but one of the main differences between them is demonstrated by the antenna design. Moreover, that the arrangement for the data exchange is no longer a card reader or a typical RFID but a Smartphone, is another outstanding element. It allows consumers to perform contactless transactions, access digital content, and connect electronic devices with a single touch. To make their use even more convenient, they shall always stay activated and scan the environment for passive communication partners. The NFC standard supports varying data rates, again to ensure interoperability between pre-existing infrastructures. The current data rates are 106 kbps, 212 kbps, and 424 kbps. When they come in contact with passive communication partners, NFC operates in three different modes. Each of these modes requires that NFC devices use a common data format for communications provides data exchange across distances up to 10 centimeters.

1. Reader/Writer (R/W) Mode
2. Peer-to-Peer (P2P) Mode
3. NFC Card Emulation (NCE) Mode

Because the transmission range is so short, NFC-enabled transactions are inherently secure.

- *Miss.Tejashri Patil is currently pursuing masters degree program in electronics engineering in shivaji University, kolhapur,India ph.no. 7588638725 E-mail: tejashripatil21@gmail.com*
- *Mr.R.T.Patil (M.E.). E-mail: rtpatil@tkietwarana.org*

3 How Systems Works

System contains NFC device & NFC tag.NFC device includes NFC reader, STM32F407VGT6 microcontroller and USB device. System works in read mode.

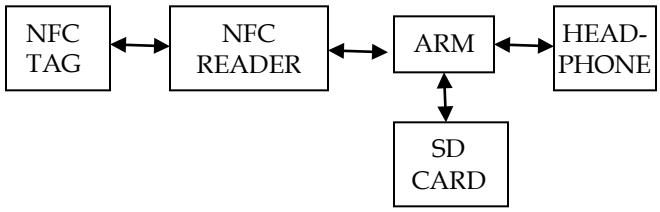

Fig. 1. Block diagram of NFC system

When a tag enters in the range of NFC reader's antenna, NFC reader supplies power to tag to build communication between tag and NFC reader. As NFC reader works in read mode it continuously burst the RF field. In reader mode, the initiator reads data from an NFC tag which already consists of

the requested data. In addition to the requirement that the NFC tag already consists of the requested data, it also consists of the program which performs returning the requested data to the initiator. When tag enters in RF field it reads information stored in NFC tag. This information is the identification number of NFC tag. NFC reader sends this information to ARM. NFC reader communicates with ARM using serial communication protocol. ARM reads the respective audio file (.wave) from an external USB device

3.1 STM32F4 Discovery Board

This board is built with STM32F407VGT6 microcontroller featuring 32-bit ARM Cortex-M4F core with onboard ST-LINK/V2. Two push buttons (user and reset) are used for switching the two operation audio play & tag hunting. It provides playback application to play encoded files. File stored in the USB key using PCM technique and having .wave file extension. The main of the playback application uses two buffers to decode the stored message. Once one buffer has played, the application reuses it to decode another frame. Playback application consists in decoding and playing an encoded message that has been stored into the USB device. When a USB key is used for mass storage, if the USB key is disconnected, the playback is stopped. When it is connected again, the playback is started. This application reads all wave files from the USB Key and displays only the .wave files that have the audio format PCM which is an uncompressed wave data format in which each value represents the amplitude of the signal at the time of sampling. The wave from the USB Key is parsed to detect the sample rate in order to configure the I2S accordingly.

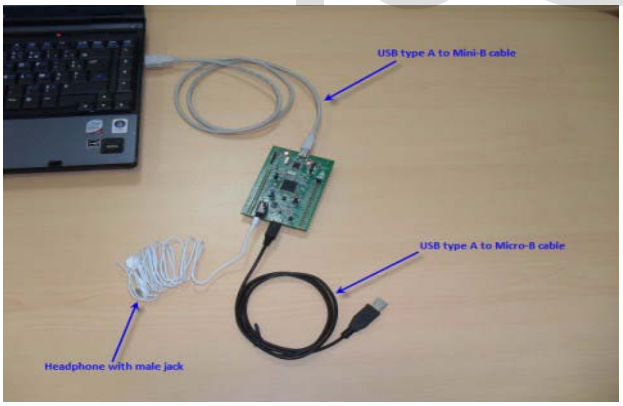

Fig. 2. Hardware connection for audio playback application

The tag hunting function is used to communicate with NFC reader.

3.2 CR95HF-NFC reader

The CR95HF is an integrated transceiver IC for contactless applications. The CR95HF manages frame coding and decoding in reader mode for near field communication (NFC). The CR95HF embeds an Analog Front End to provide the 13.56 MHz Air Interface. The CR95HF also supports the detection, reading and writing of NFC tags. Active mode includes two steps:

1. Ready: In this the RF is OFF and the CR95HF waits for a command from the external host via the selected serial interface (UARTorSPI).
2. Reader: The CR95HF can communicate with a tag using the selected protocol or with an external host using the selected serial interface (UART or SPI).

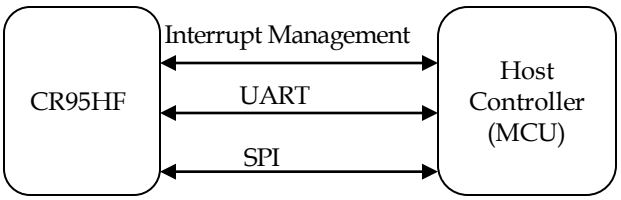

Fig. 3. Communication between NFC reader & ARM

In order to send commands and receive replies, the application software has to perform 3 steps.

1. Send the command to the CR95HF.
2. Poll CR95HF until it is ready to transmit the response.
3. Read the response.

The application software should never read data from the CR95HF without being sure that the CR95HF is ready to send the response.

3.3 Tag Detection & Identification reader

NFC tags are designed just like an RFID tag to be used at 13.56 MHz and therefore the tag design is similar. At this frequency range, RFID tags mostly use the theory of Strongly Coupled Magnetic Resonance. This is basically where two nearby loop antennae provide strong electromagnetic mutual induction resonance. This effect is also known as inductive coupling. During operation, other communication frequencies are disabled which allows very fast communication between coupled resonances. This phenomenon is valid only for loop antennae that are placed very near to each other.

4 Results

NFC is a branch of High-Frequency (HF) RFID, and operates at the 13.56 MHz frequency. NFC is compatible to blueooth.followinf table shows comparision of NFC with other technologies.

	NFC	RFID	Bluetooth
Network type	Point-to-Point	Point-to-Point	Point-to-Multipoint
Range	<10cm	<1m	10m
Speed	106,112,424kbp		721kbps
Setup	<0.1s	<0.1s	6s
Mode	Active-Active Active-Passive	Active-Active Active-Passive	Active-active

Use case	Pay, get access,share,initiate service, easy set up	Item tracking	Control & exchange data
Cost	Low	Low	Modrate

5 Conclusion

This is a good example of how NFC can help visitors to get more from their visit. Connectivity distance is less than 10 centimeters and it brings inherent security. NFC technology has the potential to change how system interacts with visitors. NFC has three operating modes; Reader/Writer, Card Emulation and Peer-to-Peer. All of the modes have different usage areas and provides different benefits. Integration of NFC technology with mobile phones which consists of mobility, relatively high processing power, Internet access ability etc. has a great potential to bring new opportunities to our lives. Furthermore, due to the short distance communication occurs so quickly. It is a more secure technology than RFID and Bluetooth due to its frequency and short distance specifications. NFC is an evolved from of RFID but its applications are run similar to Bluetooth. The many benefits and potential uses of NFC technology will continue to drive the technology and push innovation in the application fields.

References

[1] Haselsteiner, E.; Breitfuß, K. Security in near field communication (NFC). In Proceedings of the Workshop on RFID Security, Graz, Austria, 12–14 July 2006; pp. 12–14.

[2] Madlmayr, G.; Langer, J.; Scharinger, J. Managing an NFC ecosystem. In Proceedings of the 7th International Conference on Mobile Business, 2008 , Barcelona, Spain, 7– 8 July 2008; pp. 95–101.

[3] Agrawal, P.; Bhuraria, S. Near Field Communication. SETLabs Breifings 2012, 10, 67–74.

[4] D. Aamoth, "How the New Google Wallet Mobile Payment System Works," Time Magazine Techland, 2011.

[5] Ernst Haselsteiner and Klemens Breitfuß Security in Near Field Communication (NFC) *Strengths and*. *Weaknesses* Philips Semiconductors Mikronweg 1, 8101 Gratkorn, Austria

[6] Hongwei Du NFC Technology: Today and Tomorrow International Journal of Future Computer and Communication, Vol. 2, No. 4, August 2013 351

[7] Trends Gabriella Arcese , Giuseppe Campagna , Serena Flammini and Olimpia Martucci Near Field Communication: Technology and Market Department of Business Studies, Roma Tre University, Rome, Italy; Technologies 2014, 2, 143-163;

[8] Joan, B. "Difference Between RFID and NFC".)

[9] Busra Ozdenizci, Mohammed Alsadi, Kerem Ok, and Vedat Coskun Classification of NFC Applications in Diverse Service Domains International Journal of Computer and Communication Engineering, Vol. 2, No. 5, Sept 2013

[10] K.Preethi1, Anjali Sinha2,Nandini3 Contactless Communication through Near Field Communication International Journal of Computer and Communication Engineering Volume 2, Issue 4, April 2012

[11] Touch and Run with Near Field Communication (NFC) en Dodson Hristo Bojinov Monica S.Lam Computer Science Department Stanford University

[12] High Speed RFID/NFC at the Frequency of 13.56 MHz C. Patauner1, H. Witschnig1, D. Rinner2, A. Maier3, E. Merlin1, E. Leitgeb2 1NXP Semiconductors Mikronweg 1, 8101 Gratkorn, Austria

[13] "Near Field Communication in Cell Phones" Annika Paus 24.07.2007 Seminararbeit Ruhr-Universit¨at Bochum

[14] Near Field Communication (NFC) By: Zafar Ullah, Field Applications Engineer, Arrow Electronics, and Floyd Goodrich, Regional Technical Manager, Arrow Electronics.

[15] Near Field Communication Its Applications and Implementation BY: Mohammad Umair YaqubKing Fahd University of Petroleum & Minerals

[16] Clark, S. Museum of London Adds NFC. 2011. Available online:http://www.nfcworld.com/ 2011/08/16/ 39129/museum-of-london-adds-nfc/ (April 2014).

[17] Ceipidor, U.B.; Medaglia, C.M.; Volpi, V.; Moroni, A.; Sposato, S.; Carboni, M.; Caridi, A. NFC technology applied to touristic-cultural field: A case study on an Italian museum. In Proceedings of the 2013 5th International Workshop on Near Field Communication (NFC), Zürich, Switzerland, 5 February 2013; pp. 1–6.