

Near Field Communication (NFC) – Wave is the new way forward

Manjushree Sahana V , Padmaja Annapureddy and Shilpa Chaudhari
School of Computing and Information Technology

Reva University, Bangalore, India

manjushreesahanav@gmail.com, padmaja.apureddy@gmail.com, shilpa.chaudhari@reva.edu.in

Abstract – Demonetization and Digitization, these two words rattled and stirred the fabric of the Indian Economy over the past few months and has changed the landscape of the financial industry. These measures by the government though felt inconvenient by the common person at first brought with it an excellent opportunity for technology framework to play a greater role in everyday life. With mobile applications and contactless payments, taking greater precedence than ever, adoption of technologies that bring convenience has become more important than ever. Through this paper, we intend to propose NFC (Near Field Communication) as a mode of communication that could revolutionize and change the way digital payments are made. NFC is a short range, contactless communication system based on Radio Frequency Identification (RFID) infrastructure that enables bi-directional communication between two devices. There has been a lot of progress made in the field of NFC over the recent years and the availability of NFC enabled devices has increased. Government's move to go digital and the payment scenario gaining momentum in India, more and more companies are investing on developing solutions that allow safe and secure financial transactions and improve user convenience. RBI's conceptualization of Payment banks and its licensing is one such move to move towards a cashless society (Examples of Payment Bank: PayTM, Airtel etc). A few examples of NFC mobile payment applications that are gaining higher visibility in recent times are Apple Pay, Samsung Pay and Android Pay. In this paper, we would review the NFC technology framework, study its implementation, explore different domains where NFC technology could be applied and compare it with other related technologies based on the Internet of Things (Iot) concept.

(Keywords: Near Field Communication (NFC), NFC tags, Secure payment systems, Biometrics)

I. INTRODUCTION

Near Field Communication, hereinafter referred to as NFC is a short-range communication system that uses the Radio Frequency Identification (RFID) infrastructure. It enables contactless communication

between two devices where in the pairing process is by waving one device over the other. This in turn makes it convenient, as users need not go through multiple steps or a complex pairing process when compared to other wireless technologies. NFC is capable of interoperability between different wireless communication methods like Bluetooth. NFC Forum, a group established in 2004 by Sony,Nokia and Philips (NXP) enforces standards that manufacturers should meet when designing NFC compatible devices. This ensures that NFC is secure and is easy to use with different versions of the technology. Due to its short range of communication, NFC is more secure and faster pairing offers higher user convenience. NFC Technology uses three components, a NFC Reader, an active/passive NFC compatible device and the radio frequency current that serves as the communication path between the two devices. NFC devices are full duplex – Able to send and receive data at the same time.

Due to its ease of use, NFC could be suitable for many applications. Some of them are:

- a) Commerce – NFC devices could be used in making payments similar to credit cards/debit cards and allow mobile payments to supplement/replace other payment systems.
- b) Social Networking – NFC could be used to share files, contacts, music and videos.
- c) Identity/Access Tokens – NFC enabled devices could be used as electronic identity documents to grant access.

Apart from the above, NFC could be applied to perform numerous functions in our everyday life by the use of NFC Tags.

NFC tags are passive devices, which mean that they do not have any power source of their own. Hence, they are dependent and draw power from the device that reads them. These tags could be programmed to perform specific functions For example; A NFC tag stuck to the door could turn home wifi on/off when you enter/exit the house on tap of the smartphone. These tags could also

be used to store information like medical prescription information, business card etc. There are different kinds of NFC tags available with different memory storage capacity and data transfer speeds. The strongest advantage of NFC tags is that they are inexpensive. Combine that with no power requirement, NFC tags are an effective and cheap mode of communicating with other smart devices.

II. RELATED WORKS

Chi-Huang Hung, Ying-Wen Bai, Je-Hong Ren have proposed an application using near field communication to unlock door-using Door unlock control system, which uses single button operation. This method also uses OTP as its authentication along with sleep state and stand by state to save power. A more security feature can be added to the system using Biometrics such as finger print, retina iris etc[1].

Balazs Benyo, Balint Sodor, Tibor Doktor and Gergely Fordos have proposed student attendance monitoring system using Near Field Communication. NFC enabled access terminals were used along with finger prints to mark attendance of the students, which helped teachers to track the regularity of the students [2].

NFC technology is also linked with ERP system, which was proposed, by Chuan-hong Zhou, Dun Qiao, Yi Zhang, Wu-Xia Bai, Chao Dai, Pu-jia Shuai. Technologies such as Networking along with RFID and NFC were used to getting the solution in this case. The Cryptography mechanism such as encryption and decryption were used for security purpose [3].

Another access control system, which was proposed by Morris William Diaz Saravia to use NFC in Automatic Vending Machine, Booking Bus Tickets etc. He has presented an idea of low cost NFC to be used in the above said scenarios [4].

Kasim Adalan, Burcu Erkmen have used Face Recognition and Voice controlled Door Lock System. An android application, which contained voice recognition system, was developed for security purpose. As and when NFC approached the door, voice command was recognized and the door was unlocked. An advanced security feature could be of retina or iris recognition system [5].

III. NEAR FIELD COMMUNICATION (NFC)

A. NFC – An Overview

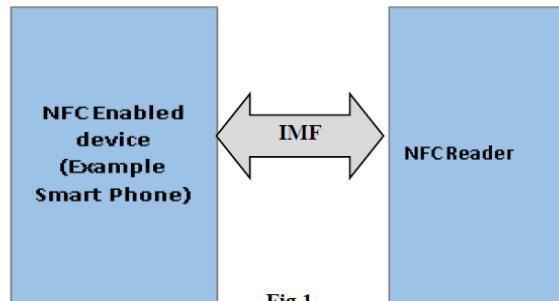


Fig 1

NFC is a technology based on the RFID framework that allows identification of things through radio waves.

As mentioned earlier, the NFC infrastructure consists of three components. They are an NFC enabled device, a NFC Reader and the Interactive Magnetic Fields (IMF) acting as a path for communication between the two devices.

NFC uses the RFID frequency, 13.56MHz for close range communication. The most common use of NFC has been access control to building or offices. An increase in people going online to shop and an increase in debit/credit card usage inspired by rising disposable income and an increasingly urban population, modes of payment have been gaining a lot of prominence in the recent past. NFC as a mode of accomplishing a contactless payment transaction is becoming increasingly popular. A contactless payment is a transaction where there is no physical contact between the paying device and the payment terminal. When a contactless payment is initiated, the customer taps or waves the NFC enabled device (Ex: Smartphone) over the NFC reader. At this point, the NFC technology gets into action. Information is exchanged between the NFC enabled device and the reader to complete the transaction. An important aspect to note here is that all the information that is exchanged between the reader and the NFC enabled device is encrypted and dynamic. This makes NFC based transactions secure which in today's digital world is of utmost importance. In the following sections, we would be discussing about the different areas where NFC could play a prominent role.

B. NFC – WAVE AND PAY

From barter system and cash only transactions in the past, the world of commerce and payments has come a long way. Throughout this journey, the main concerns have been simplicity, security and user convenience. Bank Notes, Coins,

Cheques and Payment Cards (Credit/Debit/Pre-paid) have all been products invented to enable easier payments. Ease of use and security have been two factors that have been vital for the retail commerce industry and have been the driving forces behind customer experience and retention. This in turn has prompted many companies to look for payment solutions that offer the above-mentioned factors. With the increased penetration of Smartphones and Wearables, NFC has emerged as the frontrunner in providing in-store payment solutions. Add to that the emergence of Biometrics as a feature on Smartphones/Tablets has made addition of security seamless and easy to use. An example of in-store or invisible payments would be Uber, which lets users step out of the cab after the journey, while the Uber app processes the taxi fare in the background.

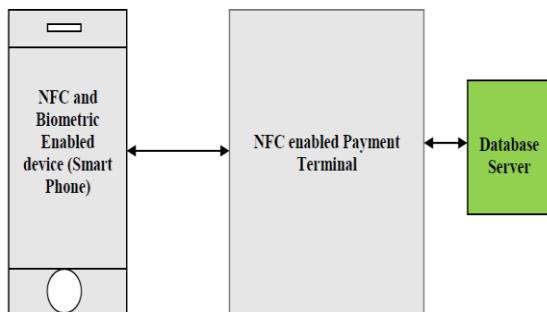


Fig 2

Let us look at a NFC based payment transaction at a retail store. As shown in Fig 2, the customer goes ahead and waves/taps their Smartphone over the NFC enabled payment terminal, which initiates the transaction and prompts the customer to authenticate using the Biometric feature on the Smartphone. This completes the payment transaction and the speed at which all this is accomplished is a vital factor in the customer experience metrics. The two factor authentication (NFC enabled device & Biometric authentication) provides enhanced security thereby granting assurance and peace of mind to the customer.

C. AUTOMOBILE ACCESS CONTROL

The world of automobiles has been one area, which has embraced technology, has kept itself abreast with the advancements in the technology arena, and has served as a practice pitch for automobile manufacturers trying to make their cars, trucks etc smarter and better than the competition. First, connected cars brought the infotainment systems of the car together. Speaking about now, the whole buzz has been around driverless cars that reduce human intervention to almost nil. All this advancement

apart, security and safety remains the major concern for the automobile industry. These factors have led manufacturers to use heavier sheet metal, include Airbags for the occupants, ABS braking systems etc as mandatory features in the vehicle. Though sounding not very important or minor, controlling unauthorized access to the vehicle is also a major concern. Through this paper, we propose an access control system that uses a combination of NFC and Biometrics to authenticate and control access to the automobile.

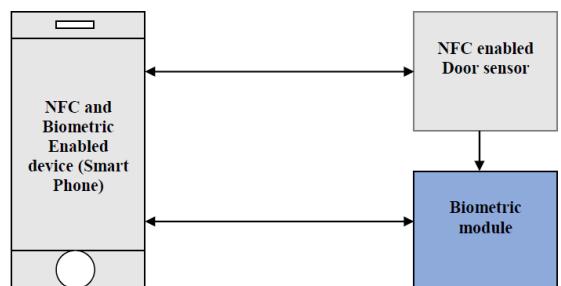


Fig 3

As described in Fig 3, an NFC enabled smartphone when paired with the automobile door that is inbuilt with an NFC reader becomes the authentication authority granting access only to authorized personnel. Once inside the automobile after successful access, a Biometric module could be used to further enhance and control the usage of the automobile wherein the vehicle would turn on the engine only after the occupant validates his identity.

This in turn removes the need of carrying the vehicle keys that is prone to theft/loss. The system proposed above removes the need of a key to access the automobile and also enhances the security of the automobile by having a two stage authentication system that prevent unauthorized access and usage of the vehicle.

There are times when we may have to let the automobile be used by other personnel (Example: By the service center personnel during routine maintenance). In such cases, we could use a NFC tag programmed to allow access, bypass the authentication system, and have the service center personnel register their identity on the biometric module temporarily.

Though cumbersome at times, the increase in interconnected technology has also increased the risk of unauthorized access and hacking. This makes it important to apply multiple layers of access control that could reduce the above-mentioned risk if not completely eliminate it.

D. Student Attendance Monitoring using NFC

As the number of students pursuing higher education in universities and colleges increase, automation has become a need in the education industry to reduce cost and increase efficiency. In addition, since lecture notes and other course related information is easily available over the internet, ensuring participation of students at lectures has become a difficult task and maintaining a record of students who attended the lecture has been a hard task. By the use of contactless technologies like NFC, Biometrics, we intend to develop a system that ensures reliable monitoring of student attendance at lectures and serves as a platform to implement these technologies for further education related tasks and set up a contactless university infrastructure. By using a combination of NFC and Biometrics for student identification, we propose to have reliable data of Student Attendance stored at the back end server for ease of access as shown in Fig 4. The student ID card is a smart card containing an NFC chip and a Biometric identifier which is authenticated by an NFC access point and a Biometric module which in turn is connected to the back end IT infrastructure that stores the student data for future access. The two step authentication system does ensure that the student bearing the ID card is the one that appears at the NFC/Biometric terminal for authentication. Students could wave the ID card at the terminal and would be prompted for Biometric validation(Example used here is Fingerprint authentication). If the biometric authentication succeeds, the student attendance is registered and information is sent to the back office. If the Biometric authentication fails, access is denied.

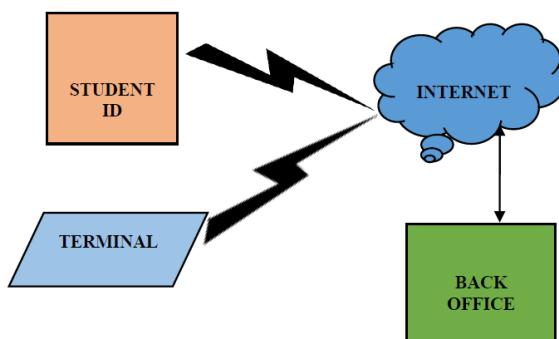


Fig 4

IV. FUTURE SCOPE OF NFC

NFC as a technology is secure, reliable and easy to use. NFC tags are an efficient way of deploying NFC for functions that could make our everyday lives more convenient. Add to that, the presence of NFC today on Smartphones and other smart devices has increased by a large extent making it more widely available and easier to deploy NFC based solutions.

Speed, Security and Ease of use has been the major selling points of NFC. In addition, NFC tags are inexpensive and could be programmed to perform several routine tasks or store information that could be put into use in different ways.

Some of the areas where NFC could play a major role in the future are:

- Restaurants – An NFC Touchpoint could enable the menu to pop up once an NFC enabled device is paired. The items ordered could then be passed on to the kitchen for fulfillment. The menu could also include brief information about each dish and its ingredients and health benefits, if any.
- Health Care Monitoring [6] – Data is very valuable when it comes to health care management. NFC could be deployed in health monitoring devices so that the data could be transmitted to an NFC enabled device and provide real time monitoring of the patient assisting in better health care management and treatment of the patient.
- Banking systems – NFC tags could be used as a media to store basic customer information (KYC) which could further reduce multiple forms to be filled each time a new transaction requiring KYC is performed. A combination of an NFC tag and an OTP sent to the customer's phone number as a text message could prevent unauthorised access and usage.

V. CONCLUSION

Higher penetration of Internet, Smartphones, Wearables etc has set the platform for deployment of wireless technologies like NFC to make our everyday lives more convenient. Security, Ease of use, Low power consumption, Wider availability and less expensive when compared to other technologies makes NFC more attractive for deployment. Also, when used in areas like Student Attendance Monitoring and Restaurants, it also turns out to be environment friendly by eliminating

the use of paper thereby contributing to lesser felling of trees. In addition, combining multiple technologies like NFC, Biometrics etc. makes it possible to integrate functions and achieve higher efficiency and save cost. A reduction of time and effort is also achieved by the same.

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