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A Review of Near Field Communication Process: How do it works?

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Abstract: Living in digital era and surrounded with intelligent devices has made things easy for us, but we are still looking for ways to make the mainstay of human living easy so that it can be made without wasting time and energy. Monetary transactions are mostly done under the same conventional system in developed and developing countries. While few countries have successfully adopted new trends and development in the MP system and with the introduction of Near Field Communication (NFC) technology which is around for more than a decade and almost showing everywhere nowadays due to its convenience and mobility. NFC technology has paved a track for secure and fastest MP technology. In this paper the authors have discussed the types of tags, modes of operation, and usage of NFC for different purpose.

Keywords: Near Field Communication, NFC, Tags, MP, Proximity, Contactless

1. INTRODUCTION

Civilisations growth is based on value exchange system (Ferguson 2009). Paying methods have always remained in research area after the rapid penetration of information technology which had opened a new era for commercial world to step in from domestic to international areas and it provided a path for the FIs to start flourishing their services in new countries. Thus, for money transfers, FIS have provided many facilities like online transaction and remittance. Although, the competitive advantage for innovations in services has not been sustainable in past and easily replaced with something new to offer the same service (Staykova and Damsgaard 2015).

In recent past consumers have experienced a new type of system from offline to online to exchange values. The most common systems are cards, online transfers, and mobile devices (Polasik 2013; Brohi et al. 2018). The world has witnessed rapid penetration of mobile phones, which were used for making calls and receiving text messages. A new window opened with the advent of the smartphone by not limiting mobile phones for receiving calls and text messages but made the consumers to use the internet and enjoy community networking, watching videos, listening songs, playing games and downloading apps to satisfy every need of end user. Therefore, smartphone users increased from 400 million users in 2007 to 1800 million users in 2015 (Chaffey Dave 2017).

Value exchange carried out with at least one mobile device is defined as MP and mostly MPs are done through Interactive Voice Response (IVR), Unstructured Supplementary Service Data (USSD), Short Message Service (SMS), and Wireless Application Protocol (WAP) (Clerici, Pigni, and Quetti 2012). Additional technology alternatives have been introduced to facilitate MP between the merchant and consumers like contactless value exchange with NFC (Polasik, 2013). NFC equipped smartphone phone sales has increased dramatically from 275 million units in 2013 and estimated market share by 2018 will 1200 million units with an increase of 325 percent worldwide (IHS 2014). Projected numbers indicate that almost every smartphone will have built-in NFC in future and it is fastest growing technology, especially in the paying system and its tag emulations functionality has been used in such as Google Wallet, as well in ticketing system and paying for general transport (Igoe, Coleman, and Jepson 2014).

2. NEAR FIELD COMMUNICATION

NFC is closely related to Radio Identification system (RFID) which is used for tracking and identification of people without any line of sight (Madlmayr et al. 2008; Brohi et al. 2018; Khosravi et al. 2018). The main difference between NFC and RFID is, NFC works at short range which can be up to 4 inches and it is much faster and secure for MPs (Watts 2015). NFC is used for the exchange of data among various devices ranging from mobile telephones, personal computers, and RFID tags, and this technology is also integrated into various user devices such as mobile phones, personal digital assistants, also in televisions. Bidirectional operation between two

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devices with NFC makes it compatible with Bluetooth technology. **(Fig-1)** shows the interaction styles of NFC.

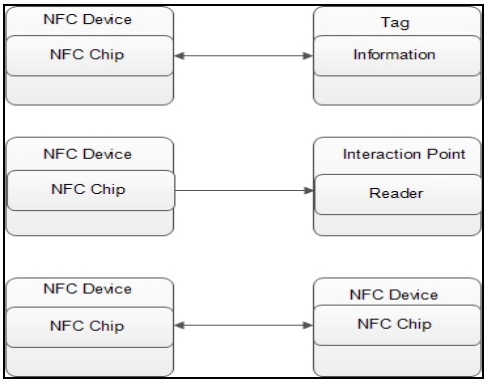

Fig-1: NFC Interaction Styles Source: (Rukzio 2006)

Further NFC uses Active mode and Passive mode operational settings for power saving that is another advantage of NFC technology. Thus, NFC is wireless short-range technology that functions in proximity which makes it secure from threats as compared to RFID, which functions at few meters range. Further NFC has three operational modes, i.e., card emulation, read-write, and peer to peer as shown in **(Fig-2)**.

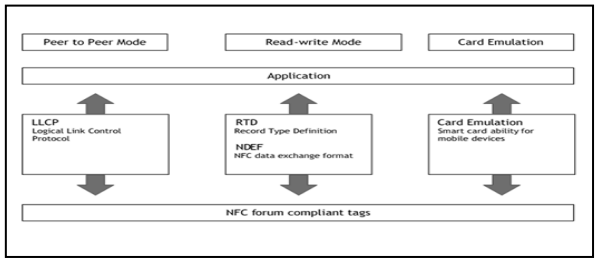

Fig-2: NFC operational Modes Source:(Ahson and Ilyas 2008)

A. Peer to Peer Mode

Peer to peer mode allows two NFC enabled devices to communicate with each other for sharing information and files with a simple touch.

B. Read-write mode

This mode allows NFC devices to read information stored on NFC tags like smart poster which is a great tool for marketing.

C. Card Emulation Mode

Card emulation mode empowers NFC device to act like smart or contactless cards that allow users to complete a transaction such as ticketing, purchases, and transit access controls. In this mode NFC enabled devices can communicate with external readers to perform MP and ticketing just like traditional contactless cards (NFC Forum, 2015.)

3. NFC TAGS

A most important feature of NFC devices is to connect with NFC tags (Khosravi et al. 2017), these tags are passive devices which means they do not generate power by their own rather they get functioning as soon as an active device comes in the range. To power a tag an electromagnetic induction is used to create a current in the passive tag, this is similar to wireless chargers. Such as the smartphone is used as an active device to generate a magnetic field to active-passive tags to complete the process. NFC sticker tags have an induction coil and tiny microchip on the back as shown in **(Fig-3)**.

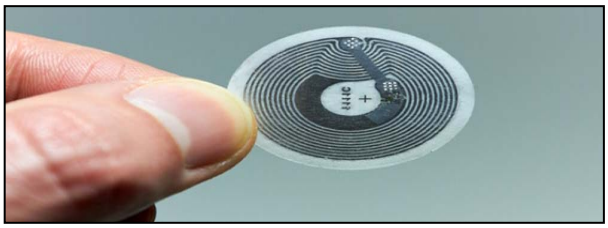

Fig-3: NFC Tag Source: (Triggs 2017)

Basically, there are five types of tags specifications defined which ranges from 1 to 5 and each has different storage capacity and format.

A. Type 1:

Type 1 tag is based on the ISO/IEC 14443A standard. These NFC tags have data collision protection and capable of read and re-write. Memory size availability is 96 bytes and it is expandable up to 2 Kbytes, which is more than adequate to store a site URL or other little amount of information. The communication speed of this NFC tag is 106 kilobit/s. Type1 tags are simple and cost-effective which makes them ideal for use. These tags are used for applications such as one-time provisioning, read-only applications, pairing devices with Bluetooth, and reading a specific tag when more than one tag is present (Böhler, 2015; Triggs 2017 Poole, n.d.; "Tag Type Technical Specifications - NFC Forum | NFC Forum,", "Tag Types and Modes of Operation – Near Field Communication,")

B. Type 2:

Type 2 tag is also based on ISO/IEC 14443A standard. These tags have data collision protection and capable of read and re-write. To prevent data modification, the end user can configure the tag to convert into read-only. The memory size of type 2 tags are only 48 bytes and this can be expended up to 2 Kbytes with a communication speed of 106 Kilobits/s. This type of tags is used for applications such as event tickets, day transit passes, URL directs, and low-value transactions (Böhler, 2015; Triggs, 2017; Poole, 2017)

C. Type 3:

Type 3 tag is based on Japanese Industrial Standard (JIS) X 6319-4. This tag is part of Sony FeliCa system and has data collision protection. This type of tag is with higher cost and it has 2 Kbytes of memory size with a communication speed of 212 Kilobits/s and type 3 tags can be used for more complex codes. These tags are used for applications such as transit ticket, e-money, e-tickets, electronic ID, membership cards, healthcare devices, and home appliances (Böhler, 2015; Triggs 2017 ; Poole 2017)

D. Type 4:

Type 4 tag is compatible with ISO14443 A and B standard series. These NFC tags have data collision protection and pre-designed at manufacture and they can be either read/re-writable, or read-only and the user cannot change the settings. The memory size can be up to 32 Kbytes and has faster speed which is between 106 kbit/s and 424 kbit/s (Böhler, 2015; Triggs 2017 ; Poole, 2017)

E. Type 5:

Type 5 tag is based on ISO/IEC 15693 standards. These NFC tags support improved RF communication, active communication mode, and NFC-V technology with new and legacy tag support. These types of tags are used for applications such as smart posters, ticketing, healthcare, library books, products, and packaging (Böhler, 2015)

4. DISCUSSION

NFC value exchange can be done by waive or simple touch of mobile phone over the terminal. Basically, NFC uses radio waves to send and receive information just like RFID which allows smartphones to communicate with readers, smart cards, and other NFC devices to transfer data and contactless exchange of funds. NFC transactions can be done by following few steps at first user are required to store her debit/credit card information in mobile wallet application, it can be done by scanning the plastic card or manually entering the required information. When performing the MP user should confirm the store accepts NFC MP. In addition, if a user's mobile is lost or theft, it cannot be used without passcode and fingerprint authentication, this feature adds value to the security at users end. Users can also scan the cards digitally to claim reward points, coupons, and other information stored on their phones (Triggs, 2017)

5. CONCLUSION

The argument in support of NFC is that its built-in inside smartphones and the tags are inexpensive and could be used for different applications. NFC technology has made many things easy for consumers from ticketing to MP in stores, in addition even though the user has forgotten to bring her wallet with herself and keeping the smartphone, she is able to complete the purpose of buying with the smartphone. NFC is growing fast enough so that everyone could get benefit from it in near future with different forms of consumer related activities.

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