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Near Field Communication for an Interactive World

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Abstract— This paper explains about the Near Field Communication Technology .Near Field Communication (NFC) is wireless communication technology to communicate with other NFC enabled devices with just one touch. In smartphones NFC created sensational things such as less time complexity for connection between the NFC enabled devices and data transfer rate is so high. NFC is just like Bluetooth and works better than that. In smartphone market NFC is like hot cake in present mobility field. It works within the range of 20cm or less. This paper gives the best option for the users who like to use wireless technology with NFC tags. The main advantage of this technology is, NFC enabled devices can work even when the devices is in switch off mode.

NFC poster is one of the posters which provides the users with the elicit feature like interacting with the NFC tags which are hidden behind the poster and the count of tags may depend on the type of poster we are using. This experience will enable the user that he/she is living in an interactive world.

Index Terms— NFC, Bluetooth, Tags, wireless, smartphone, data transfer, mobility.

1 Introduction

Near Field communication is a wireless technology ,with NFC we can establish connection between two devices without using physical medium .NFC uses RFID(Radio Frequency Identification) and is standardized in ISO/IES 18092.NFC is jointly developed by Philips and Sony, two leading players in consumer marketing. NFC supports peer to peer communication and enables consumer access to aggregated services, anytime, anywhere, with any type consumer stationary and mobile devices.

Near Field communication technology is just like Bluetooth technology and it works more efficient than Bluetooth. It can be operated in the range of 10cm.Normally to establish connection between two devices the devices can be tapped with each other because the operating range is less. NFC created a revolution in second generation proximity. With NFC data sharing can be done at data exchange rate 422Kb/s. NFC is designed for short distance communication, it is complementary to Bluetooth and 802.11 with their long distance capabilities. Near Field Communication also works in dirty environment, it does not require line of sight. It is easy and simple connection method, no complexity in connecting devices. Provides communication method to non-self-powered devices.

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2 NFC Communication Modes

NFC enabled devices can operate in two modes as active mode and passive mode. Passive mode is responsible for achieving significant power savings and extending the precious battery time. Devices operating in active mode can provide all the power needed for communication with passive devices through their internally generated RF field. In this manner the contactless smart card are powered and ensures that data remains accessible even the NFC enabled device is switched off.

NFC based communication between two devices is possible when one device acts as reader or initiator and another device as target or tag. Initiator is the one as its name specifies initiates the connection between the devices by generating RF signals. And coming to the target, it responds to the signal generated by the initiator.

INITIATOR—Initiator is an active device, which generates the radio signals to communicate with the tags/target.This is also known as Reader

TAG—Tag is a thin device just like memory chip, it contains an antenna and small amount of memory.

Fig 1: Reader

Fig 2: Card Emulation

3 NFC Operating Modes

NFC devices can operate in three different kind of modes based on the standards specified ISO/IES 18092,NFC IP-1 and ISO/IES 14443 contactless smart cards.

3.1 Read/Write Mode

In this mode the NFC enabled devices can read and write data to the other tags.in this case both the reader/writer and the tags/target should be in NFC data format.

3.2 Peer to Peer

In this mode, the NFC en abled devices can exchange information. For example consider Bluetooth and Wi-Fi links, here we use setup parameters to establish connection. With NFC enabled devices we can exchange digital photos, memo and contact details with one touch via NFC. Peer to Peer mode is standardized on the ISO/IES 18092 standard.

3.3 Card Emulation

This is the most used mode in NFC implementation; in this mode an NFC enabled device can act as reader when in contact with tags. In this mode the phone can act as tag or contactless card for existing readers.

4 Comparison with Other Technologies

There exist some similar properties between Near Field Communication and other wireless technologies like Bluetooth, RFID, Wi-Fi and infrared.

4.1 NFC and RFID:

Basically, the technologies Radio Frequency Identification and Near Field Communication use the same working standards. However, the essential extension of RFID is the communication mode between two active devices. In addition to contactless smart cards (ISO 14443 [7]), which only support communication between powered devices and passive tags, NFC also provides peer-to-peer communication. Thus, NFC combines the feature to read out and emulate RFID tags, and furthermore, to share data between electronic devices that both have active power.

4.2 Comparison with Bluetooth and Infrared

Compared to other short-range communication technologies, which have been integrated into mobile phones, NFC simplifies the way consumer devices interact with one another and obtains faster connections. The main advantage over Bluetooth is the shorter setup time, in less span of time NFC enabled device will connect with other, just with one touch the

connection can be established. No need to search for the devices to connect with them, the connection between two NFC devices is established at once in between 0 to 1 second.

5 Security Aspects

There are different possibilities to attack the Near Field Communication technology. 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 writeaccess.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 work 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 countermeasures in order to avoid or at least reduce the threats.

5.1 Eavesdropping

NFC offers no protection against eavesdropping. RF waves for the wireless data transfer with an antenna enables attackers to pick up the transmitted Monitoring data. In practice a malicious person would have to keep a longer distance in order not to get noticed. The short range between initiator and target for a successful communication is no significant problem, since attackers are not bound by the same transmission limits. Consequently the maximum distance for a normal read sequence can be exceeded. The question how close an attacker has to be located to retrieve a usable RF signal is difficult to answer.

5.2 Data Destruction

An attacker who aspires data destruction intends a corruption of the communication. The effect is that a service is no longer available. Still, the attacker is not able to generate a valid message. Instead of eavesdropping this is not a passive attack. This attack is relatively easy to realize. One possibility to disturb the signal is the usage of a so called RFID Jammer. There is no way to prevent such an attack, but it is possible to detect it. NFC devices are able to receive and transmit data at the same time. That means, they can check the radio frequency field and will notice the collision.

5.3 Data Insertion

This attack can only be implemented by an attacker, if there is enough time to send an inserted message before the real device starts to send his answers. If a collision occurs the data exchange would be stopped at once. In order to prevent such attacks the device should try to answer with no delay. Alternatively, again checking the RF field and also the secure channel can be used to protect against attacks.

5.4 Man-in-the-Middle-Attack

In order to show that NFC is secure against a Man-in-the-Middle-Attack we have to survey both, the active and the passive communication mode. In the following we distinguish between device A and device B that are exchanging data.

In passive mode the active device (A) generates the RF field in order to send data to a passive device (B). The aim of an intruder is to intercept this message and prevent device B from receiving it. The next step would be to replace it with a different message. The first step is possible, but can be detected if device A checks the RF field while sending the message. However, the second one is practically impossible. To send a message to device B the attacker would have to generate his own RF field. Hence, the RF field of device A has to be perfectly aligned which is not practically feasible.

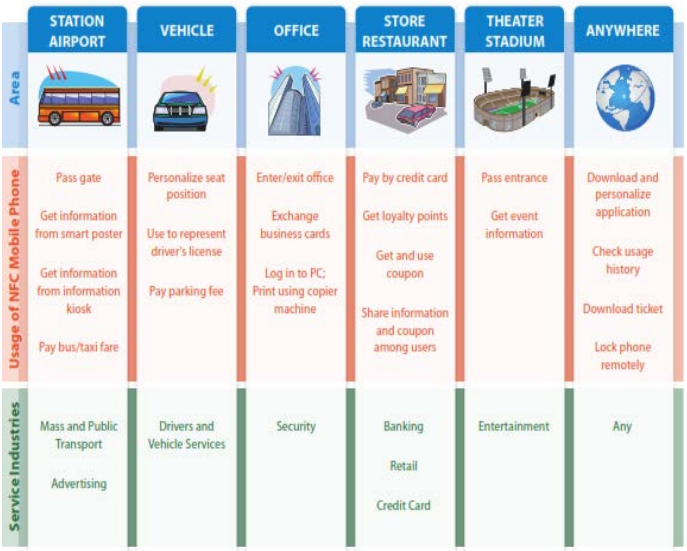

Fig 3: Life made easy with NFC

6 Why We Love It (Advantages)

Now a day Near-field Communication makes the communication technology to have multiple uses.Near-field Communication gives following flexibility to the users:

6.1 Convenience

NFC merges both the mobile devices and wallets and it is also intuitive, by making use of touch for payments, which gives a good convenience to users.

6.2 Versatility

NFC helps user in many ways by ranging itself from bank cards to movie tickets, reward systems, industries and even keys. This innovation makes users to manipulate through the development of software's.
It also includes all types of Electronic Devices (TVs, PDAs, digital cameras, AV (Audio Visual) equipment).

6.3 Safety

- NFC provides good security in case of mobile device is stolen. The NFC's Credit cards are more secure rather than a general credit card with magnetic strip.
- This requires PIN.

6.4 Natural connectivity

NFC makes user more flexible (natural) while connecting consumer devices i.e. by tapping each other. Even multiple users can connect at a same time.

6.5 Zero configuration

Two NFC devices that are closer to each other can start the communication automatically by Dialoging how to interact. No Further installation (setup) is required while transferring or receiving data between consumer devices.

6.6 Interactivity

The user interactive functionality of mobile phones enabled with NFC are touch screens, sounds and vibrations. This gives a pleasant experience to the user.

6.7 Smart key access

As NFC is introduced by leading electronic device manufacturers like Philips, Sony and mobile manufactures like Nokia, Samsung which enables NFC devices like PDAs or mobile devices to act as an electronic key to gain access on home, office, as ticket, lock for cars and even paying bills using your credit cards.

6.8 Enabling mCommerce

In order to pay bills online or to do transactions using your mobile, we generally use mCommerce or eCommerce which is a huge attraction for mobile devices and offers the consumers to make payments or transactions wirelessly. NFC-enabled mobile devices are well settled in the area of mCommerce as they were mainly meant to do transactions.

6.9 Real Time Updates

- Customers can easily get the information of offers and rewards that are given by the bank or reward system.
- Every updates are with in customer's hand.
- With the help of NFC, Staff Communication can also be done in a work place.

Some other advantages of Near Field Communication are mentioned as key points:

- **DIGITAL PAYMENTS-**payments via mobile devices.
- **Get information from the smart posters-**by tapping on the poster get the schedule, information present in poster
- **Access Things-**operate building blocks and cars.
- **Data Transfer-**data from one mobile device or PDAs to other by just tapping.
- **Secure communication-** transfer of data through safe channels by using Encryption.
- Used in crowded locations.
- Quick connecting, without any typing errors.
- Compatible with the existing RFID structures
- Cost efficient.
- Easy monitoring.
- Directly to users, no need of sales representatives to explain a product.
- Simple and reliable.
- Card less, no need to carry wallet.

7 Things to Consider (Disadvantages)

Based on the benefits given by the Near Field Communication, it also has its disadvantages which are shown below.

7.1 Agreements of use

We think that we can use anywhere and everywhere However if companies do not agree to integrate NFC into their business; Consumers can't use the NFC technology. For example, customers can't pick their interested coffee shop, stores to get the information on reward points.

7.2 Security

Major risk to NFC is hacking or phone phreaking. As mobile devices reduces our complexity by making as a hand held computers, hackers are trying to gain access to these tiny computers which includes lots of information regarding credit cards, bill payments, social security information ,etc.

As the technology advances, it makes hackers to do thing easily.
According to a survey, most of the governments take nearly 10 years to warm up on Near Field Communication technology.

7.3 Costly

In order to have NFC devices in society, both consumers and providers have to agree and enjoy this latest technology. As NFC is an expensive technology, small companies can't work on this technology which is a major drawback of NFC.

7.4 Not Enough Incentive

According to Wired Magazine, only ¼ Th of the Americans will have NFC smartphones by 2016 which is not at all enough incentive for businesses to enable NFC.

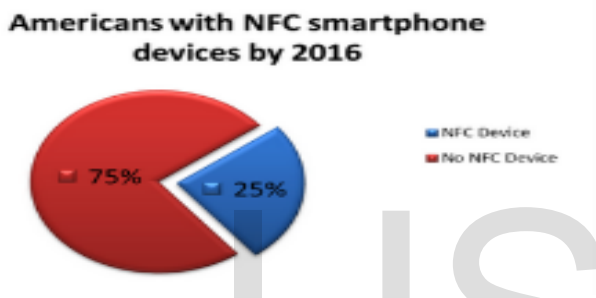

Fig 4: Usage of NFC smartphones Devices by 2016 in America.

Some other disadvantages of Near Field Communication are mentioned as key points:

- Consumers with smartphones can only work on the NFC technology.
- For payments with mobile devices, one has to wake up the mobile, type a password, wait until the app opens (boot) and input a password in the payment app. which is a late process when compared to credit card payment.
- Large amount of sensitive credentials are stored in smartphone, which increases the risk of losing the device or get hacked as the mobile phone is generally used in various ways.
- Payment through smartphones in online stores is only 1.5% which is a demerit for NFC.
- As NFC is a relatively new technology, there were no computable devices for communicating each other.
- NFC works in short ranges, which makes consumers each time to contact their mobile devices or PDAs for each communication.
- Lack of security makes merchant companies to think for adopting this technology initially.
- Data transfer rate is very less (maximum of 424kbps).
- The range for communication is also less i.e.10cms, at maximum 20cms.
- NFC can also be seen as disruptive technology. Example: if mobile devices are used for transferring files and therefore no longer USB's are used.

8 Working with Near Field Communication Posters

8.1 Public Posters

We are now introducing the latest advancement of mobile technology by implementing the NFC (Near Field Communication) technology in the public theaters so that it will be easier to select the film of you like and can enjoy it by just tapping on The NFC (near field communication) tag. For this we just use the smart poster as the medium and improve it by advancing the implementation and name it as "NFC poster". In this NFC poster we would like to implement 3 tags behind the posters of a film .It is introduced at theaters and at public places. Now it is easier for an individual to carry his/her mobile and use it as a wallet. If he just sees the poster, let us suppose that he went to a multiplex theater and if he is not able to choose the film which he wants to go then our product comes into act, and here as said earlier we would like to implement 3 tags. First, it will be coded in such a way that if any one taps on it then the tag will send the link of the trailer of the movies and the person will be provided with a facility of watching the trailer, after that if the person likes the trailer and wishes to watch the film then he has to tap on the second tag. The second tag will be coded in such a way that he will be provided the website for booking the ticket of the film present in the poster. This implementation will reduce the human effort a lot, instead of standing in a queue for buying tickets without opening the system and waiting for the browser's response. He will just tap on it and will be allowed to book the ticket within seconds. And the final tag is used by any individual after watching the film. If the person watches the film and if he likes it then he will provide the rating of the film by just taping on that tag. It can be easily implemented on the poster so that it will be user friendly. So here I like the advantage of the NFC tags in the public point of view. First is, NFC tag will attract the customers, making their payments as the mobile payments and the rating loyalty for the above NFC poster.

Fig 5: Public Posters using NFC.

8.2 Events Posters

Now coming to the second application of my NFC tags, this product will be mainly useful for the students and the idea is mainly implemented for the students' point of view. If we consider there may be many events and presentations available for the students' in different colleges and universities and usually the poster/banners and the pamphlets will be published. At this juncture if the organization introduces the NFC posters then this will help the students and will make the students to search for that particular college website and then types the URL (Uniform Resource Locator) etc., instead if we assume that the poster is present at the public bus stop which is embedded with three NFC poster he will move to the poster and then just tap it with the phone on the first tag. The main working of the first tag is that if any individual taps it then it will show the details of the college, events and other information related to the college. If suppose that the student is interested to participate in the events and presentations conducted by the specified college then he should be registered. So for registration he should just tap on the second tag which is usually placed next to the first tag which is separated by about 2 to 3 centimeters by which both the tags will not coincide with each other. If he taps the second tag he need to fill the registration form and choose the type of event and submit it to the college. And coming to the next tag if he needs the updates of the event or fest and the route of the college then this tag will help in doing that. Usually the students will be intimated whether his/her paper is selected and this can be performed by the user by just tapping his/her phone on the third tag so that he can find the selected papers by liking the college site by tapping the tag and is also implemented to find the route map to the college from the present place where he is tapping with his phone. This is done by linking the tag with the GPS (*Global Positioning System*) technology and which is used in giving the direction and distance in kilometer or miles from the present position from where he/she is tapping his/her phone. Here you are neither pairing your device nor switching on your Bluetooth, you're making this easier by just using the RFID (Radio Frequency Identification) and is also interactive for usage.

Fig 6: Event Posters using NFC.

8.3 Social Posters

Another implementation of the NFC poster is in the shows like art galleries, automobile workshops, electronic shows etc., let us suppose that we are using it in the art gallery there may be many arts present in the gallery. Before each art, the artist name will be mentioned, and if the NFC tags are implemented beside the artist name and on tapping this will directly link up the NFC mobile to the artist profile where we can view his/her profile and like his page. So that we can follow him/her through the social networking sites like Facebook, twitter etc., next coming to the automobile show, the cars will be placed with their names and specification. If a person wants to get the complete detail about the particular car, he needs to tap on the tag, by that he can know which company manufactured it, type of engine used, fuel economy, braking system, warranty and servicing availability (if any problem occurs) and other factors through the official website of the car and he/she will be able to see the car company's new releases from his mobile by liking the page of that car company. So that this will make the communication to fly high by just tapping for an easier life. There are also the NFC bands which can be tied to our wrists and we can use these bands in a similar manner to that of a NFC enabled smartphones. Suppose that you have gone for a walk without carrying your mobile phone or your wallet and you feel a bit thirsty at that time then we can use this NFC bands. The credit/debit card information will be stored in that tag and you can go to the nearest store and purchase a bottle of water and you can make your payment by just taking your band near the tag. And we can also make sure that this NFC technology is ecofriendly and will not expose much radiation so that it will not be harmful for an individual to carry and use it.

Fig 7: Social Posters using NFC.

9 CONCLUSION

In this real world, technology plays a vital role as it reduces the human efforts. Near field communication is also one among them which makes the life easier by just tapping through the NFC devices within short range. This type of technologies helps everyone by attracting customers in an interactive manner, mobile payments and rewarding loyalty. The implementation of NFC poster provides user with wide range of facilities like downloading teasers, reviews and movie ticket bookings and liking your favourite page in the social networking sites.So finally with a secured channel NFC provides confidentiallty, integrity and authenticity.

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