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"A Survey on NFC (Near Field Communication) and FFC (Far Field Communication) With Respect To RFID (Radio Frequency Identification) for Next Generation Network Infrastructure"

Anwaar Ahmad Wani, Gowher Mushtaq

Abstract- This paper gives us the comprehensive analysis of security with respect to RFID (radio frequency identification) considering the Next Generation smartphone attributes i.e. NFC and FFC. The electromagnetic field that outlines the RFID antenna can be divided into two parts NFC & FFC; both are based on existing standards of the radio frequency identification network framework. NFC (near field communication) is a set of principles for Smartphone and alike devices to establish Radio Communication with each other. In this study we will try to survey the critical issues of NFC and FFC to find out the updated implementation issues for the Next Generation network infrastructures.

Keywords: RFID (radio frequency identification), NFC, FFC, Smartphone, Electromagnetic field, Next Generation.

I. INTRODUCTION

THE "Radio Frequency Identification (RFID) is the robotic recognition network system. RFID makes use of RF to identify "labelled" items .The data is then composed and broadcasted to a host device by making the use an RF Reader [1]. The data communicated by the tag or label can provides us the recognition either destination information or particulars about the product labelled, such as colour, date of purchase, price etc." A Radio Frequency Identification network system is made up of one or more tags that can store the data and exchange the data to one or more readers (or interrogators) over a wireless network. In feasible RFID systems, the readers are interconnected to a larger computer systems organization. The principle goal of an RFID system is to enable labelled particulars or persons to dynamically express their identity to other devices wirelessly. Like in our day to day life, today's technologies that are dependent on cutting-edge research, RFID technology is both very encouraging and debatable. As a result this robust technology is quickly spreading in various locations, while in other locations it has stopped to make outstanding progress thus far [2]. Developments in RFID Wireless technology are based on improvement from many areas like I say: molecular electronics for fabrication, electromagnetic field theory for systems applications, mathematics and computer science for data processing and security, Device physics and operations research for supply chain management. Also NFC is a very important wireless technology. Here we can have the integration of technology in Smartphones to make world's survival outstanding. Among those companies Sony and several organizations in the market today with the Existence of NFC in Smartphones of their own will be the part of Smartphones

In the future. NFC is based on various applications in our day to day life. We will not be need to carry cards, different electronic stuff such as access cards, debit cards / credit cards and identity will be the cards are already in the cell phone, and can be used them all over we want and will not exchange data with ease from any device to other. And also do not need to loop the keys because we can use only one phone on behalf of keys. Even more, we can purchase and save e-tickets on the smartphone and there is also a set of criteria to determine the work of smart phones and like devices to be the wireless contact them by touching each other or make them side by side, and not more than the gap of a few centimetres. There is also the present and certain applications include sharing of data, and simplified setup of more complex communication such as Wi-Fi. Communication is also possible between the device and the NFC chip unpowered NFC, which is named "tag" [3]. NFC is a short-range wireless technology that operates on the 13.56 MHz frequency, with transfer's rate of data up to 424 kilobits per second. NFC wireless communication starts when two NFC-compatible devices are put within proximity, around four centimetres. Think of waving your iPhone near a credit card reader at the counter of Chipotle. NFC is based on a communication regulation that specifies how two devices establish a peer to peer network communication in order to transfer data. The communication in NFC uses electromagnetic radio fields. This is converse to Bluetooth or Wi-Fi which use radio transmissions. However, NFC is compatible with both above mentioned technologies. It is significantly secure as the distance requirement is so close. NFC is distinguished by its intuitive interface and its strength to enable largely proprietary wireless networking platforms to interoperate in a seamless manner [4]. The primary uses are to:

- Connect electronic devices, such as wireless components at home or office system or a headset with a mobile phone.

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***** Correspondence Author (s)
Anwaar Ahmad Wani, Master of computer application (MCA), Kashmir University Jammu And Kashmir, India.
Gowher Mustaq, MSc. Information Technology, Uttrakhand Technical University Dehradun, Uttarakhand, India.

- Access digital content, using a wireless device such as a smartphone to read a smart picture embedded with an RF tag.
- Make contactless transactions, including those for payment, device access and ticketing.

In Far field the surrounding area comprises of the electromagnetic field around a device, such as a transmitting antenna, or the result of radiation scattering off a device. Non-radioactive 'near-field' nature of electromagnetic fields dominate close to the antenna or scattering object, while electromagnetic radiation 'far-field' behaviours dominate at longer distances. Far-field antennas come in a wide collection of shapes and sizes and generally can read tags between a few centimetres, up to more than 30 feet away in ideal conditions. Enough of options are available when selecting a far-field antenna such as circular or linear polarization, varying gain, and options for indoor or outdoor use. Due to the increased read zone when using far-field antennas, stray tag reads (i.e. reading unintended RFID tags) tend to be a common issue.

In Far Field Communication an interrogator antenna the tag are connected under one full wavelength of the carrier wave. The far field signal blights as the square of distance from the antenna, and is generally utilized in Ultra High Frequency and Microwave systems. Far Field Communication manipulates a backscatter radio link. RFID reader antennas transmit electromagnetic radiation (radio waves). Accordingly, when the RFID tag is outside of one full wavelength of the reader, it is called to be in the "far field." If it is within one full wavelength away, it is called to be in the "near field [5]." The far field blights as the square of the distance from the antenna, when the near field signal blights as the cube of distance from the antenna. Thus, passive RFID systems that commit on far field communications (particularly UHF and Microwave Systems) have a greater read range than those that utilize near field communications (normally low- and high-frequency systems).

The smartphone is actually a cell phone with an operating system which is built up with a personal digital assistant (PDA) features. Basically the term "smartphone" was not having any such type of interaction till 1997, when the most developed company Ericsson provides its GS 88 "Penelope" concept as a "Smartphone". The basic difference between smartphones and Next Generation phones can be unpredictable, and there can't be any official description for what represents the logic behind them. One of the most outstanding logic behind them is that the advanced application programming interfaces (APIs) on smartphones for managing third-party tools or what we can say applications can permit those tools/applications to have superior concatenation with the phone's OS and hardware then it is typical with Next Generation smartphones. With such type extraordinary work efforts in smartphone technology with more availability, they started up to maintain more economical opportunities of communications that may help us to study urban and rural schools, public and private colleges, and the "haves" and "have-nots". This is the one more way of routing the "digital divide".

Smartphone is a device which is having an advanced features like as Windows Mobile, internetworking apart from that it has got other computer processing efficiencies. It comes with boosted performances more than hardly making and receiving call and we can send text quotes. It may send and check email, display photos, surfing the internet and play video [6]. Smartphone like as iPhone and android-based devices provides us the infinite functionality because of its strength to run third party applications or tools. The concatenation of a personal digital assistant and a smartphone is able to run a computer program as well as it can run the operating system as well, which provides us the GUI download the software applications which we can access on the device such as Apple's iPhone with more than 350,000 tools and applications which in turn is able to perform a set of usable functions.

In next generation wireless communication devices being implemented in the whole world, 5G/6G mobile and wireless communication technologies have been extensively designed. The key factors in our day to life are user-centric mobile applications instead of traditional carrier-centric, high mobile data traffic, wide number of interconnected devices, long device/network duration, upgraded the quality of services, i.e., low delay, high-transmission rate, and small jitter etc. Thus we came to know about that a promising wireless technologies have been proposed to upgrade the Nature of wireless communications. Such technologies mostly concentrate on new spectrum with millimetre wave, wider bandwidths, new modulation techniques, enhanced small cell, and massive MIMO, etc.

In our modern life, internet is one of the most important technical infrastructures in our survival. It can be a simulator for our various ideas and success in the Next Generation. However, the present Internet may not be affordable of meeting various different requests for a long period of time. So fortunately, scientists and engineers trust that new technologies, protocols, and standards can be developed to meet the Next Generation Networking demands. The research on this latest Internet is said to be as a global research threat [7]. Nowadays, the researches mostly focus on the design, engineering, protocols, and operation of the new signal processing techniques in 3G/4G/B4G/L.

II. RESEARCH METHODOLOGY

The aim and motive of this research is to design a model for RFID (radio frequency identification) with respect to NFC & FFC of NEXT GENERATION NETWORK INFRASTRUCTURE. Actually, we are just analysing on the key features of NFC & FFC. After that we are following the scenarios so That we can combine the key features of NFC & FFC that will build a design model for the future Generation. As, we all know that NFC & FFC are two different RFID techniques. So firstly, we are going to introduce you about the RFID features, analysis, design, challenges:

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1.1. RFID (Radio Frequency Identification):

Radio Frequency Identification (RFID) is a form of robotic recognition technology (auto ID). Auto ID is constituted as form of data that are easily readable by machine. Other classification of Auto ID consists of electronic article surveillance (EAS) safety tags, different bar codes, magnetic stripes, optical character recognition, optical character group (OCG) etc. These Next generation technologies can also be recognised by those that require contact in order to be read (magnetic stripes), and those that do not (such as, bar codes, EAS, OCG, RFID). RFID vary from bar codes and most other contactless auto ID forms of data in that the data can be read in absence of a direct line of sight to the reader. Furthermore, read gaps can be relatively high (feet versus inches). Deploying RFID measures that:

- Compact human problem is needed for the proper information or data advancement.
- Enhancement will be fast-moving.
- With the systems installed and influenced correctly, data delivered through RFID is more accurate, authenticate and obtained at cheap costs.

This high-level quality of automation makes RFID authoritative to be an auto ID technology that could transform the way in which data is collected and utilized. Currently, RFID is employed in many applications, oscillating from electronic portions for locating goods during the supply chain. The usage of RFID technology in loop systems is as robust as applications for chasing goods. During 2008, the number of RFID chips used in different closed-loop, bulk movement tickets and cards was about equitable to those utilized in open- supply chain goods recording. A Radio Frequency Identification (RFID) system consists of readers (also called interrogators) and tags (or transponders). A simple system has a few readers, either static or mobile, and various tags, which are connected to items, such as cups, platforms, bags, etc. A reader transmits radiations with the tags in its wireless region and collects information about the items to which tags are connected. According to their working theory, tags are categorized into three tags:

• Active
• Passive
•. Semi-Passive

Active Tag: An active RFID tag is integrated with a power source required for tag's circuitry and antenna. The benefits of an active RFID tag includes readability from a gap of one hundred feet or more as well as potential to have other sensors which uses electricity for power. The main drawback of an active RFID tag is the limitations on the lifetime of the tag (5 years). These tags are more costly and tangibly bigger and these required the maintenance cost if the batteries are replaced. The Battery failure resulting in disconnection from electricity which can lead active tag in expensive misreads.

Passive Tag: The Passive RFID tag does not required a power source; the power is supplied by the reader. The tag draws power from the inductive coupling with reader antenna. The major drawback of a passive tag is that the tags can only be read at very short distances, typically a few feet at most.

Yet, there are many advantages .The passive tag works without a battery by which tags life time gets increased to more than 20 years. The tags are less costly (10¢) and much smaller. The passive tags have almost infinite applications in consumer goods and other fields.

Semi-Passive Tag: The semi-passive tags reflects the Radio Frequency (rather than transmit) RF energy back to the tag reader to send recognized information. Though, these tags contain ICs and also a battery that powers their ICs. This grants for various amazing applications, like as when a sensor is included in the tag so it can broadcast real-time attributes, such as humidity, temperature, and timestamp. By using the battery only to supply power to a sensor and simple IC — and not including a transmitter—the semi-passive tags obtains a compromise between cost, size, and range.

The simplified working model of RFID is shown in figure as below, which shows the flow through different component.

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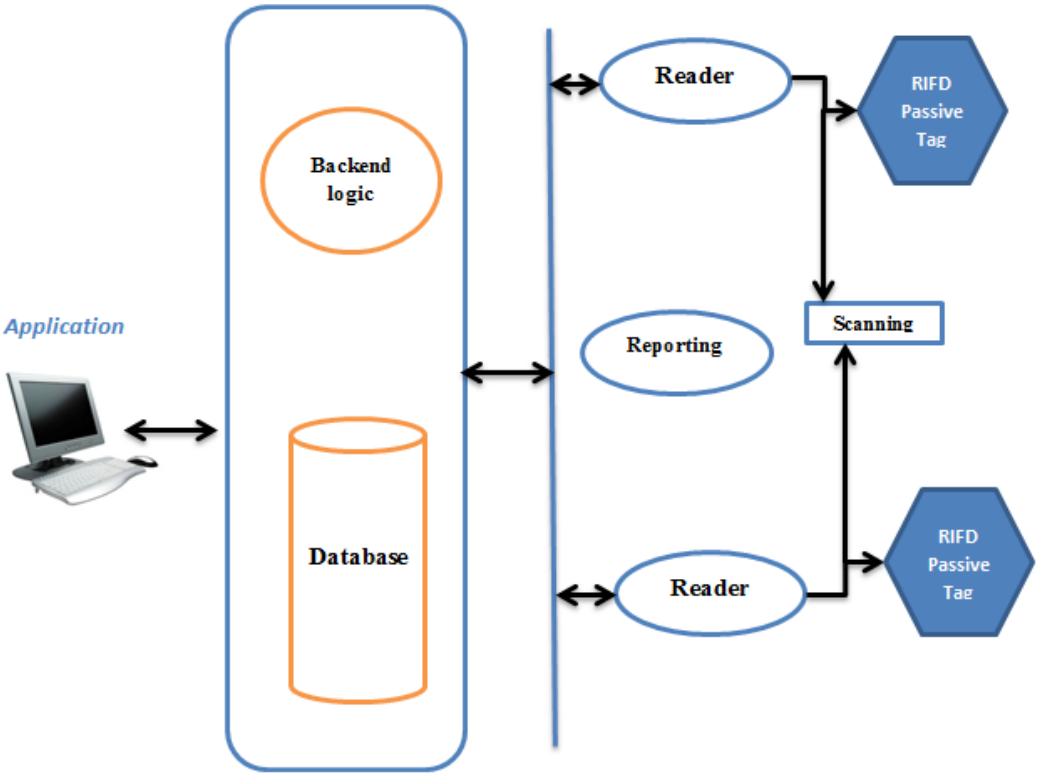

Figure 1. A Simplified RFID Model

In RFID reader and some other particular tags in routine are having a quite small use. The remedial of a sequence number does not give much information to the end-user and nor does it supports to maintain record of items in a management group. The complete energy of RFID arrives in consolidation with a tail end that stores additional information like confession about the items, when and where a positive tag was inspected. Moreover, the RFID system has been described through structure as explained in figure 1. RFID readers initially, scan tags and then transfer the information to the backend. At the backend in normal form consists of a database and a well-defined application interface. When the backend collects some extra source or what we can say information that particular information is stored in the database for future processing, and if needed it implements some calculation on associated disciplines. The application brings back the data or information from the backend. Through various scenarios, the application is collected with the reader itself. An example of this particular scenario is the uniform point in a shopping centre (Note that the specific example uses barcodes rather than RFID tags after all they are highly accepted, in spite of, the system would act in absolutely the same manner if tags were utilized). The application uses the transcribed identifier to take care of the current cost when RFID reader scans the barcode. In include to that, the application backend also transfers superior information for certified commodities. The backend also reduces the sum of appropriate commodities of that type and inform the manager if the quantity falls below a sure verge.

1.1.1. RFID classification

The classification of Radio Frequency Identification is showing below through a diagram

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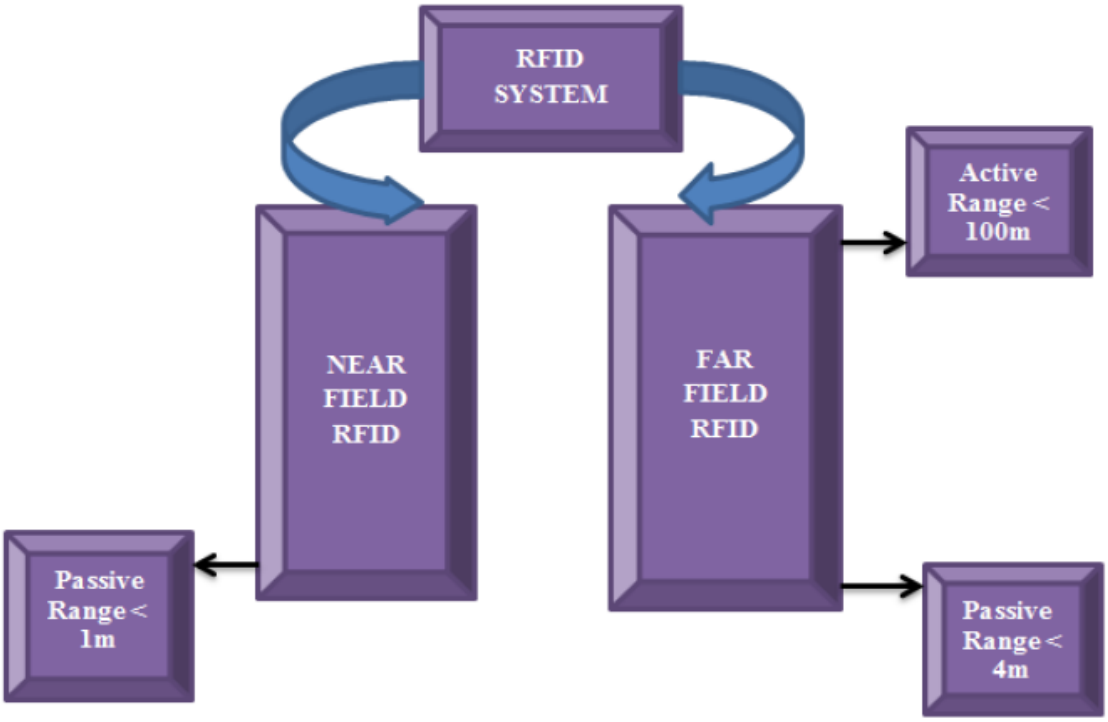

Figure 1.2 Classified Model of RFID

Two fascinating different RFID implementation prospective survives for transmitting energy from the reader to the tag: magnetic induction and electromagnetic wave capture. These two implemented designs take benefit of the EM properties that are associated with an RF antenna—the near field and the far field. Both can transfer enough energy to a remote tag to maintain its performance— Mostly in between 10W and 1mW, depending upon the tag type. (For better understanding, the formal energy an Intel Scale processor consumes is approximately 500 mW, and an Intel Pentium 4 consumes up to 50 W.) Through the various modulation methodologies, near- and far-field-based electromagnetic signals can also transmit and receive data for proper deployment.

1.2. Near Field Communication

Near field communication is made up of several communication protocols that allows two electronic devices, one of which is usable as a portable device such as a smartphone, to signify communication by bringing them within 4 cm (2 in) of each other. NFC-authorised portable devices can be enabled with apps, for example to read electronic tags or make transactions when connected to an NFC-compliant apparatus. The EM field in the near-field location is sensitive in nature-the electric and the magnetic fields are rectangular and virtual-static. It basically depends upon the type of antenna; one field (such as the electric field for a dipole or magnetic field for a coil) controls the other field. Most near-field tags rely on the magnetic field with the help inductive coupling to the coil in the tag. This mechanism behind this is that it is logically dependable upon Faraday's principle of magnetic induction. A current flowing through the coil of a reader yields a magnetic field across it. This particular field causes a tag's coil in the vicinity to brings out a small amount of current. Communication between a reader and a tag is over a structure or what we can mechanism which is named as load modulation. Any kind of deviation of the current in a tag's coil gives birth to a small current fluctuation in a reader's coil due to the mutual inductance between the two, and the fluctuation is recognised by reader. A tag deviates the current by modifying the load on its antenna coil, and hence that particular mechanism is called load modulation. Because of its simplicity, inductive coupling was originally maintained for passive RFID devices. Mostly it depends upon the application because near-field tags come in many form factors. The barrier between near-field and far-field areas is inversely proportional to frequency and approximately equal to c/2πf, where 'c' is called as the "speed of light". Thus, we came to know that only low carrier frequencies are used in near-field coupling tags; the expected common frequencies are 128 kHz (LF) and 13.56 MHz (HF). Like I say for example, the boundary distances are 372 m1 for 128 kHz and 3.5 m for 13.56 MHz one of the most important disadvantages of using low frequencies is that a large antenna coil will be required. Apart from that, the power of magnetic field of a magnetic dipole loop drops as 1/r6 in the near-field location or area, where r is the distance between a reader and a tag. One more downside is the low bandwidth and, hence, it results low data rate.

The two modes are:

Passive— the intruder device yields a carrier field and the target device answers by modulating the existing field. In this mode, the target device may draw its operating energy from the initiator-provided electromagnetic field, thus we are making the target device or system as a transponder.

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Active—Both initiator and target device communicate by alternately producing their own fields. A device deactivates its RF field while it is waiting for data. In this mode, both devices basically have energy supplies.

NFC deploys two different coding to transfer data. If an active device transmits data at 106 Kbit/s, a modified Miller coding with 100% modulation is used. In all other problems Manchester coding is used with a modulation ratio of 10%. NFC devices are mostly full-duplex—they are able to receive and transmit data at the same time. Therefore, they can check for future impacts if the received signal frequency does not match the transmitted signal' frequency

1.2.1. Unique Features Of NFC

What makes the communication so easy between the devices is that the NFC protocol produces some features which we cannot find in any other general purpose protocols. First of all I would like to inform you that it is a very short-range protocol. It supports communication at distances which we can measure in centimetres. The devices have to be completely touched another device to establish the link between them. This has two got important conclusions:

1) The devices can rely on the protocol to be inherently secured because as the devices must be placed very close to each other. It is easy to control and identify whether the two devices communicate by simply placing them next to each other or keeping them apart.

2) The rules to establish the protocol is naturally familiar to people: you want something to communicate or touch it. This allows us for the establishment of the network connection between the devices be completely automated and happen in a transparent and robust manner. The whole process explains that if devices identify each other by touch and connect to each other once touched.

3) Another excellent quality of this particular protocol is that it supports for the passive mode of communication.

4) The NFC protocol is also suitable with the globally used contactless smart card protocols FeliCa and Mifare. The NFC device also helps us to work with the smart cards and smart card readers conforming to these protocols in a flawless manner. Not only a card can be seen with an NFC device but it can also help us to use NFC device instead of a card.

NFC MODES: As shown in figure, the NFC forum defines three communication modes:

- Peer-to-Peer mode can be defined as a device to device link-level communication. This mode is not sustained by the Contactless Communication API.
- Read/Write mode allows applications for the transmission of NFC Forum-defined messages. This mode is not secure and supported by the Contactless Communication API. NFC Card Emulation mode allows the NFC-handset behave as a standard smartcard. This mode is secure and it is sustained by the Contactless Communication API.
- NDEF - NFC Data Exchange Format - standard exchange formats for URI, Smart Posters.
- RTD - Record Type Definition - An NFC-Particular record type and type name which may be carried in an NDEF record.

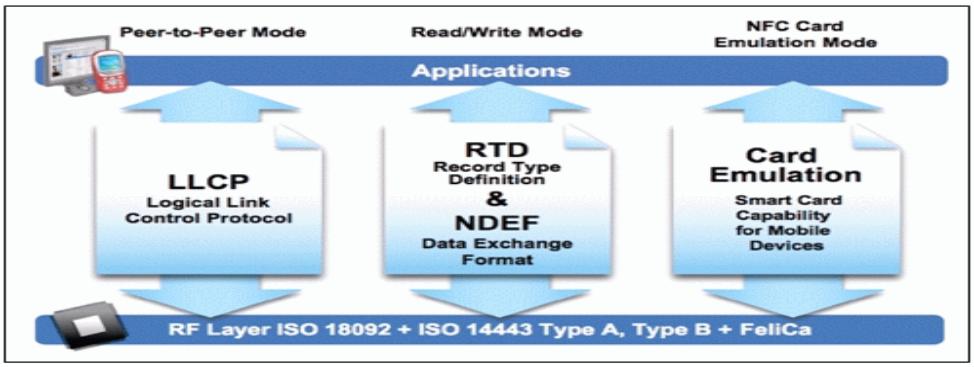

Figure 2 NFC Models

1.2.2. Advantages of NFC:

Convenience

Many consumers will "pay" for convenience because convenience is very important in today's society. NFC is a perfect source of convenience because it merges a mobile device with wallet(s). NFC is also quite intuitive; all it takes is a simple touch when using NFC for payments. NFC provides many advantages for improving workplace efficiency and customer service. It allows managers to maintain knowledge as to where their employees are if one were to use location services. In regards to improving customer service, the implementation of NFC transactional services such as, Pay Pass or Passbook, enables a fast and efficient experience for consumers.

Versatility

NFC can be well adapted for all kinds of situations ranging from bank cards to transit passes, movie passes, reward systems and even keys. Ideally, NFC is suited for a broad range of industries and uses because this innovation allows users to manipulate through the development of software's.

Safety

NFC enabled credit cards are much more secured than a credit card magnetic strip.

Near Field Communication provides secure communication to all users. It promotes the transfer of data through safe channels as well as the encryption of sensitive information. Although some risk still exists, these measures significantly reduce the threat of hackers and stolen information.

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Retailers no longer have physical access to your credit card information.

Ease of use

NFC has a competitive advantage over its rival, Bluetooth. It consumes less power and does not require the setup and connection establishment with another device like Bluetooth does. NFC allows users to connect to other devices in less than one second, whereas, Bluetooth connections take significantly longer.

1.3. Far field Communication

The EM field in the far-field region is radioactive in nature. Coupling here captures EM energy at a tag's antenna as a potential difference. Part of the energy incident on a tag's antenna is reflected back due to an impedance mismatch between the antenna and the load circuit. Changing the mismatch or loading on the antenna can vary the amount of reflected energy, a technique called backscattering.

Far-field coupling is commonly employed for long-range (5–20 m) RFID, and, in contrast to near-field, there is no restriction on the field boundary for far-field RFID. The Several emerging technologies in the UHF and LF bands try to exploit advantages of both near-field and far-field tags. UHF proponents are promoting near-field UHF tags for label tagging, which has been the sole domain of HF near-field tags. The advantage of using UHF here is the low tag cost, resulting from small antenna size. RuBee, a relatively new active RFID technology, operates in the LF band and employs long-wave magnetic signalling. It can achieve a read range of 30 m. Long-wave magnetic signalling has a great advantage: it is highly resistant to performance degradation near metal objects and water, a serious problem for UHF and Microwave far-field RFID.

The far field region of an electromagnetic field starts approximately two wavelengths from the antenna and extends outward. As the distance increases, the strength of the electromagnetic field decreases equal to the square of the distance the field is from the antenna. If the signal is picked up by another antenna this has no effect on the original antenna signal.

The far field signal decays as the square of the distance from the antenna, while the near field signal decays as the cube of distance from the antenna. So passive RFID systems that rely on far field communication have a longer read range than those that use near field communication.

1.4. Working Diffrence Between NFC & FFC

Now we will provide the working difference of both these NFC & FFC applications for the next generation network infrastructures to fulfil the aim of the methodology and implement the socio- technical undercurrent's for the future generation network standards. The working difference is given by the following table.

Table 1: Showing Comparison on the basis of Operations and Management

S.NO	NFC(HF)	FFC(UHF)	ATTRIBUTES	REMARKS
1	Rare	Very Less	Collision	No collision of reading tags and readers in NFC. In FFC, it is avoided through standardized algorithms approved by GS1 & GS2.
2	Standardized	Customizable	Form Factor Of Design	UHF can be tamper proof windshield tags to avoid theft or misuse.
3	Speed Low	Fast	Data Transfer Rate	Faster speed gives faster processing in UHF.
4	Up to 1 Meter	up to 12 Meter	Range Control	Better range, Better visibility, Better operations.
5	More CO & CO2 emission	Less Waiting Time Leads To Lesser Emission Of CO2 & CO.	Green Concept	FFC based solution should be preferred for advent's "GREEN TECHNOLOGY PHILOSOPHY".

1.5. *Nfc Model Vs Ffc Model*

The below model shows feature comparison of NFC VS FFC:

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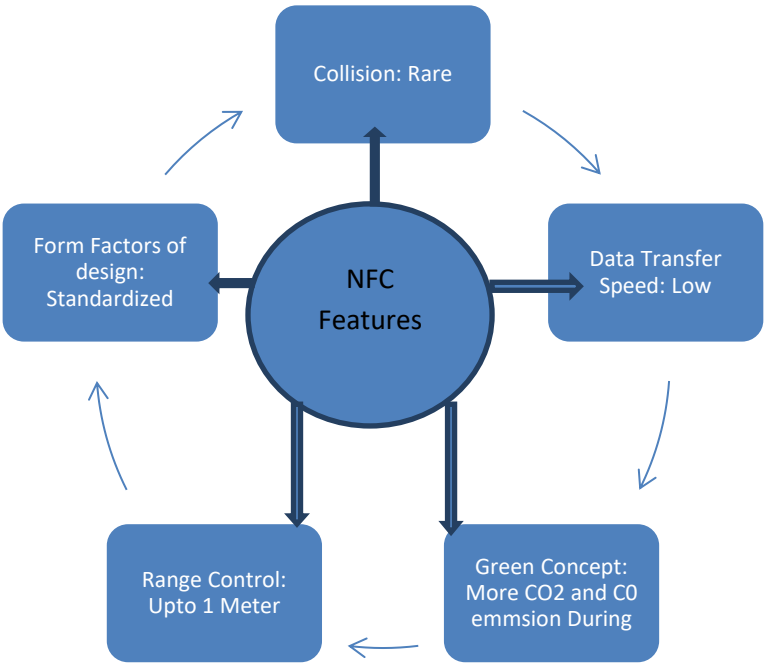

Figure 3. Feature Model of NFC

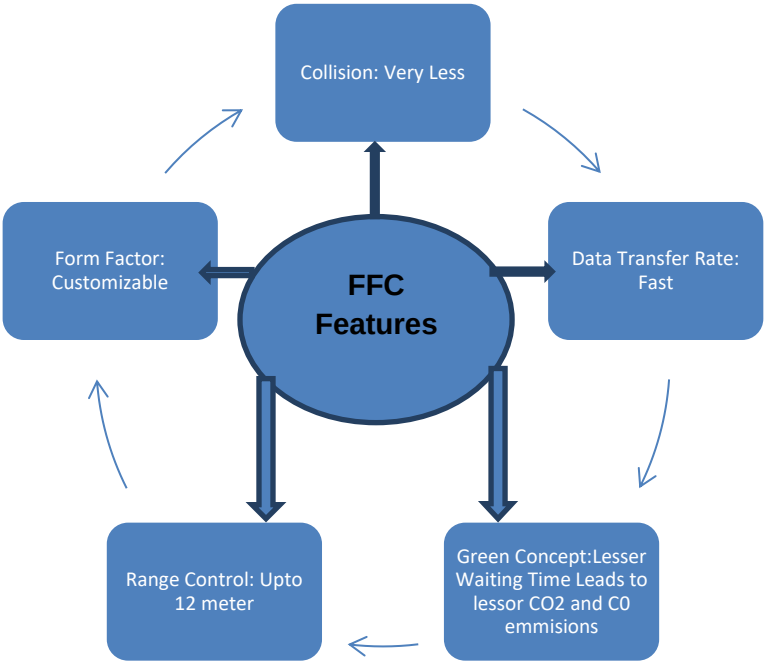

Figure 3.1 Feature model of FFC

III. Designed and Updated Model of NFC and FFC by combining the Features

Now, the design model that we are going to build in this research is to collect the overall features of NFC & FFC. So that the productive model should have the benefits of both these wireless technologies together in a NFC & FFC enabled devices collectively when implemented.

Thus Design Approach with combined features of Two RFID Based Wireless technologies that is NFC and FFC showing the working Mechanism for NFC and FFC enabled Devices. In Figure 3. We have built a Design of smartphone with respect to the Combined Features of NFC and FFC and the required model is shown as below:

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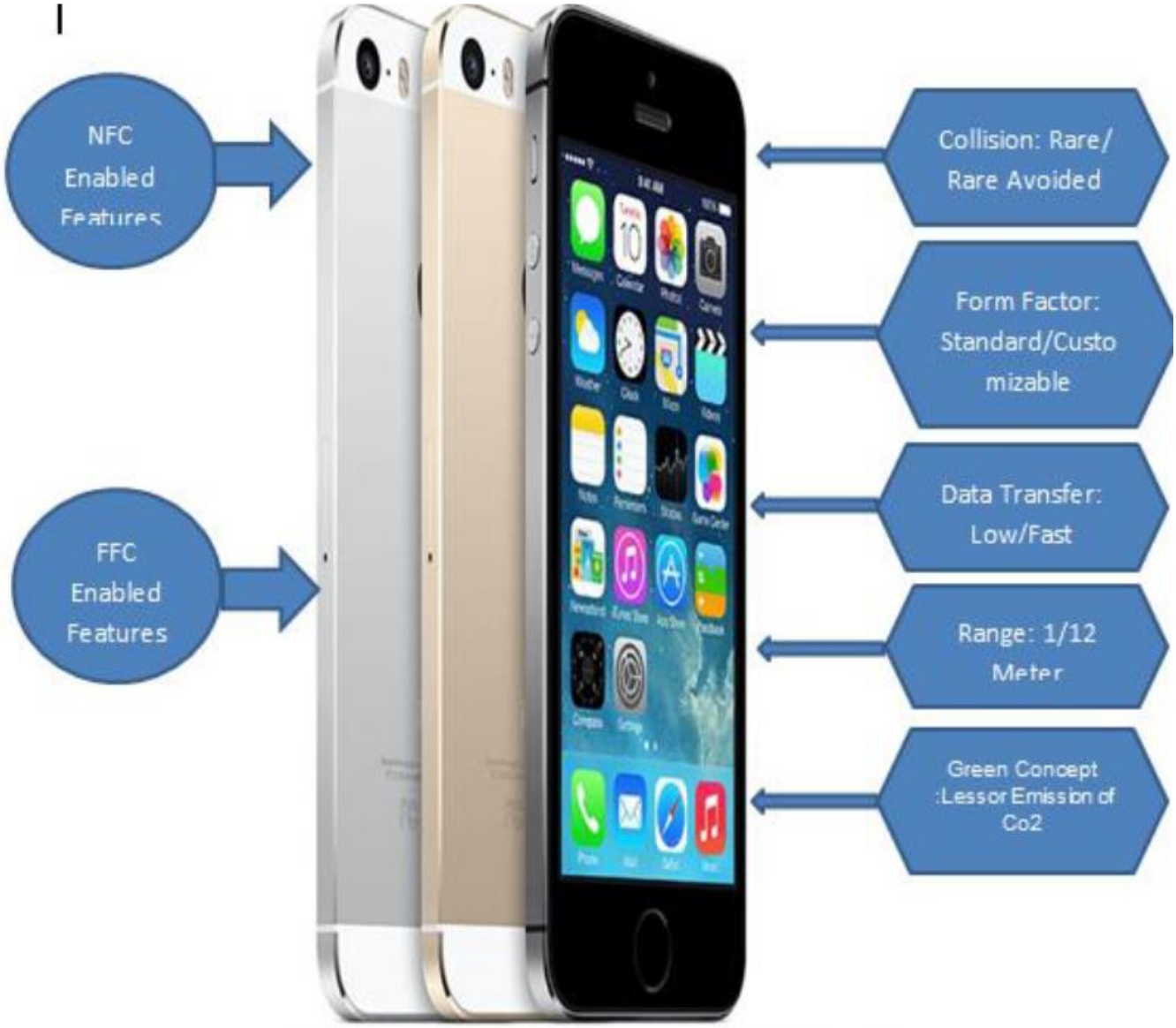

Figure 3.2 Design Model For NFC & FFC The Next Generation Network Infrastructure.

In our research we combine the features of NFC & FFC and produce a new model of NFC & FFC for NEXT GENERATION NETWORK INFRASTRUCTURE. The required model defines the data transfer rate can be efficiently implemented on NFC & FFC enabled devices. The model provides GREEN CONCEPT i.e. eco-friendly atmosphere.

The range feature from both techniques in a combined form deliver an output in a prominent way. Thus collectively helps in NEXT GENERATION NETWORK INFRASTUCTURE.

IV. CONCLUSION

The paper presents the study of the existing attributes of RFID (Radio Frequency Identification) for the Next Generation Network Infrastructure in which we have mainly analysed the key challenges of NFC (Near Field Communication) and FFC (Far Field Communication), also the working that we have mentioned in this paper is that we have combined the features of these two wireless technologies from which we came to know that if we are going to combine the most excellent features of NFC and FFC we can have the new design for the Next Generation Wireless Devices so that we can reduce the energy and in the same fashion we can decrease the time complexity between the devices and produces an efficient services for the Next Generation Network Infrastructures.

In Short, we presented a comprehensive survey and updated model by combining the main features of NFC and FFC so that we can use these two wireless technologies for the future Generation network devices like I say for example smartphone devices. Further we can Work with these two wireless technologies with respect to the RFID by which we can study about the future challenges of these two wireless technologies so that there may me more energy efficient utilization between the devices and by which there can be more reduction in CO2 & CO emissions.

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Anwaar Ahmad Wani I have completed Master of computer application (MCA) from Kashmir University Jammu And Kashmir. My research interest is GREEN COMMUNICATIONS.

Gowher Mustaq I have completed my MSc. Information Technology From Uttrakhand Technical University Dehradun and Also I have Completed my M.Tech in Computer Science and Engineering From Shri Ramswaroop Memorial University Lucknow. My Area of Interest is Green Communications.