

Near Field Communication and Its Applications in Various Fields

G.Gopichand^{#1}, T. Krishna Chaitanya^{#2}, R. Ravi Kumar^{*}

#1Final Year B. Tech, Dept. of ECE, KL University, Vaddeswaram, AP, India,

#2Final Year B. Tech, Dept. of ECE, KL University, Vaddeswaram, AP, India,

**Associate Professor, Dept. of ECE, KL University,
Vaddeswaram, AP, India.*

ABSTRACT:

In this paper basic concepts behind Near Field Communication technology which includes the working of Near Field Communication, advantages of NFC for short range communication, and applications of NFC in various fields like medical, military, cellular handsets, tourism and cultural field are discussed. NFC in medical field plays a prominent role which includes biomedical monitoring, heart rate monitoring, and in implant medical devices. Its application in military has been increasing day by day such that it can replace traditional use of RF communication in terms of short and secured wireless communication. NFC application in cellular handsets includes standards for selecting operating mode automatically. NFC application in tourism and cultural field helps the tourists a lot by providing information about their position and different tourist places.

INTRODUCTION:

Near Field Communication is a standard for wireless communication which helps to establish a short range radio transmission link between two devices like smart phones and other such devices. The radio transmission link can be established between two devices in a very short period of time, ranging from 100-150 milliseconds more over the two devices should be close not greater than 10 centimeters and it uses frequency band of 13.56MHz. Near Field Communication is a two way communication. More over Near Field Communication can also be used as one way communication by using passive NFC tag and it is a better replacement for RFID tag. When

compared to other wireless connectivity protocols like Bluetooth, Wi-Fi, etc., Near Field Communication provides more secured communication. Near field communication can be used in various fields and its application in medical field is more considerable now a days. IN addition to NFC application in medical devices it can also be used in contactless payment systems, credit cards and electronic ticket smartcards, and allow mobile payment to replace or supplement these systems.

HOW NEAR FIELD COMMUNICATION WORKS:

NFC works on principle of inductive coupling To understand NFC working let us understand inductive coupling with a basic example .consider two copper wires and coil them so that it is further useful when amplification of magnetic field is required.. Now connect one end of the copper wire to the battery which helps to create a simple circuit for flow of electrons through battery. Now connect the second coil to the voltmeter and we can observe the movement of needle in the voltmeter and when the coils are close to each other the needle moves from zero position in voltmeter which indicates the inductive coupling.

NFC technology uses the same principle with an NFC tag an electronic reader generating a magnetic field. Bringing NFC tag close to this field induces electricity with in the NFC tag. The reader detects new magnetic field from the NFC tag and register it.

Thus it allows bidirectional communication between devices at a very short distance. NFC uses inductive coupling the same way RFID tag do.

ADVANTAGES OF NEAR FIELD COMMUNICATION:

- Near Field Communication helps to provide high level security because it involves establishing connection only if two devices are brought close to each other, reducing the interference of third party.
- It helps to reduce the risk of swiping the card, entering the password and choosing from menu making the process more flexible and ease of accessing.
- Another major advantage of NFC is its design involving consumption of less power in its area of application and this is more considerable in implantable medical devices.
- The speed of establishing a communication link between two devices adds more advantage when compared to other devices which are not using NFC.
- Another advantage of NFC is its versatility. For example using NFC one can perform multiple tasks like check out at a store, purchase and load concert tickets to their smart phones, read information from smart poster, board the subway, and many other tasks all from a single device.
- Another advantage of NFC is its flexibility. Depending on the usage, NFC can be either active or passive. In active NFC acts as bidirectional communication where as in passive NFC act as single mode communication similar to RFID tag and NFC is better replacement for RFID tag to reduce the cost of system.
- NFC can be used for variety of data intensive applications which includes privacy and integrity by preserving cryptographic protocols that are appropriate for medical systems.
- NFC provides higher data rates compared to UHF-RFID. And NFC being internationally

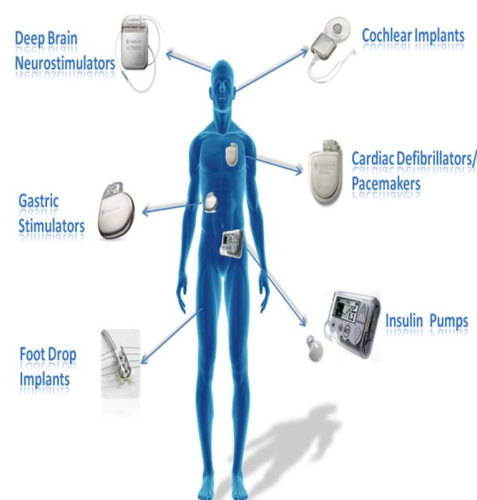
available. And the bandwidth of NFC channel can be increased.

- NFC not requiring battery or external electrical connection, making it compatible with other electronic devices
- Now-a-days NFC playing vital role in different fields such as medical, military, smart phones, tourism, commence field etc.,

NEAR FIELD COMMUNICATION APPLICATION IN MEDICAL FIELD:

NFC IN MEDICAL IMPLANT DEVICES:

WIRELESS IMPLANTABLE MEDICAL DEVICES

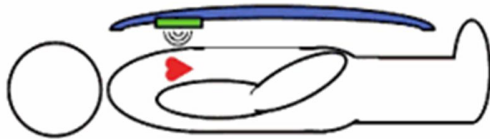


The utilization of implantable medical devices (IMD's) has been increasing day by day which further raises the need of their proper monitoring and maintenance. Wireless communication paves the way for this problem. In particular IMDs require privacy and security to reduce the third party interference and proper health maintenance. These features can effectively achieved by NFC compared with other wireless technologies.

HEART RATE MONITORING:

In day to day life heart rate should be continuously monitored which can be useful for hot diagnosis. An ideal solution for this measurement is using heart rate monitors using NFC. The designed Doppler radar unit is embedded in a sort of clothing such as garment and the unit is directly placed on the

patient's body, signals resulting from relative motion artifacts are greatly reduced. Due to short range operating system and quasi near field nature of electromagnetic communication, a reflected wave is generated at air-body interface. Such a device is as small as possible which can be embedded in clothing. The below figure indicates the design concept of Relative position of Doppler sensor module and patient's heart.

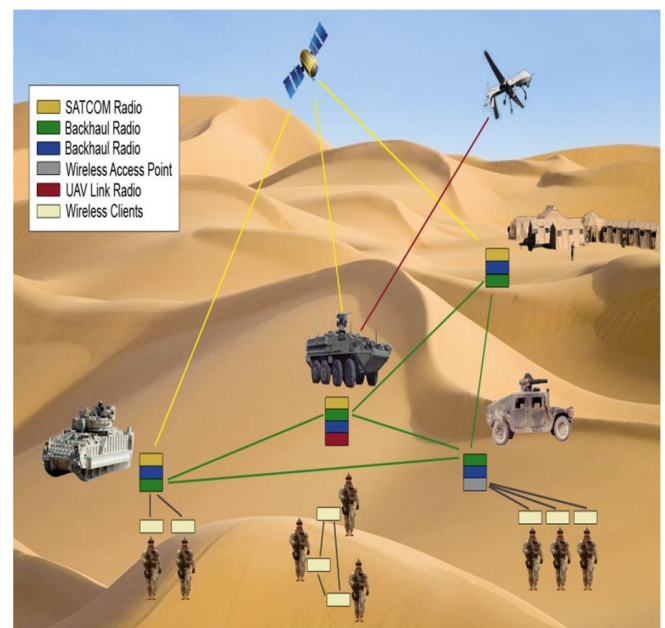


BIOMEDICAL MONITORING:

NFC provides speed and secure way of communication in hospitals. Doctors equipped with NFC-capable tablet computers can call up all the information on a patient within seconds, without any chance of data getting mixed up. A quick check of the patient's records before the required treatment or prescription of medicines ensures that the recommendations are just right for the patient in question. Chemists and pharmacists can also quickly check medicines in order to further diminish the risk of side-effects or to identify counterfeits if any doubt arises. In particular, those patients who are frequently in hospitals or doctors' clinics due to long-term or chronic illnesses will greatly appreciate the fact that NFC can also give them insights into the details of the medical procedures which they are undergoing, since there is nothing to stop information on patients' treatments or prescriptions being stored on a chip. Hence, NFC becomes the natural choice for wireless communicating between two medical devices. Medical devices using Near Field Communication can transmit data without any delay, since the data generated by medical devices are within the range of NFC. Devices, that resides in the body for long years are called implanted devices. Those devices should be highly energy efficient and conserve as much power as possible. For such applications NFC protocols are well suited as the reader can operate the tag when necessary. NFC is very easy to understand for old patients. NFC works similar to RFID tag in its passive form. NFC can be used to keep tabs on blisters and other drug

dispensing devices. This facility provides compliance monitoring. The usage of NFC is not limited to small, devices alone. NFC can also be used in large devices used for In Vitro Diagnostics (IVD), imaging, molecular diagnostics for wireless data transmission. For example, a biometric device called "MiniME" monitors various vital parameters like ECG, BP, pulse rate, body temperature, blood glucose, cholesterol and hemoglobin and transmits the data using NFC to the cloud.

NEAR FIELD COMMUNICATION IN MILITARY:



Near field communication plays a vital role in military particularly in the area of cordless communication where short range communication is essential which is major issue with RF communication.

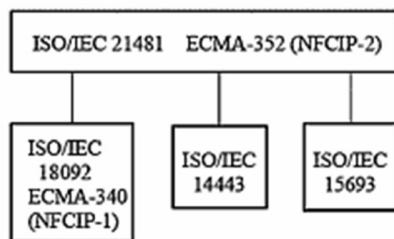
For example military used RF communication technologies such as Bluetooth which is not efficient because of its security and spectrum allocation problems. Spectrum allocation issue is observed majorly when the military squad comes across urban areas where unexpected problems occur due to over use of frequencies.

Spectrum allocation problem also adds complexity when long range communication is needed to

communicate with the squad who are at long distance; because it needs to keep the communication channels clean for their communication and not allowing the squads to communicate which are at shorter distances decreasing channel efficiency.

Near field communication also adds the advantage of fast communication because of no requirement of encryption techniques and its inherent property of security. However this is not possible with traditional RF communication which requires encryption techniques and complex algorithms in handling them.

NEAR FIELD COMMUNICATION IN CELLULAR HANDSETS:



NFC Deployment in cellular Handsets

The above figure shows NFC related standards which describes the procedure for selecting communication mode for the bottom layer. NFCIP-1 is specific communication mode for peer to peer communication. The standard that defines NFCIP-1 is ECMA-340. There are two modes of operation in NFCIP-1: active mode and passive mode. In active mode during data transmission process both parties create carrier for themselves. In passive mode only initiator creates carrier during communication with target devices. As a result less power consumed by target devices which is a good feature if it is using limited source of energy such as battery. Another standard ECMA-352 defines NFCIP-2 which selects the operation mode automatically during the start of communications.

NEAR FIELD COMMUNICATION APPLICATION IN TOURISM:

Any traveler will be discovering lots of new things. With NFC, tourist centres can make it much easier for their visitors to find their way around or go exploring. With the increase in the number of mobile

devices more and more devices will be supporting Near-Field Communication (NFC), which is a short range and wireless technology for data transfer without physical touch. NFC technology will open up new opportunities for various stakeholders in tourism from destination level to tourism researchers. NFC link identifies position of tourist and also provides information on sights in the vicinity, could make things a lot easier for tourists. Even more importantly, the automatic connection to tourists' Smartphone's makes it possible for tourist authorities to provide targeted information in the required language. Museums could provide links to background information on all their exhibits, also tailoring the language to the visitors. It would also be conceivable to have different information packages for day trippers and for experts, and everything would of course be available in an audio version if required. Smart Posters could also be of interest for cultural establishments and event promotions. They could not only provide additional information but also allow the purchase of tickets so that the visitor can saunter straight through the turnstiles, which of course would also function with the help of NFC.

CONCLUSION: Thus, near field communication finds its way in many fields of application. Development of near field communication technology protocols in terms of security and speed further can establish its requirement in many other fields.

REFERENCES:

1. *Principles of Inductive Near Field Communications for Internet of Things*
By J. I. Agbinya
2. <http://nearfieldcommunication.com/consumer/benefits-of-nfc/>
3. <http://electronics.howstuffworks.com/near-field-communication2.htm>

4. <http://www.hcltech.com/white-papers/engineering-services/near-field-communication-medical-devices>

5. http://en.wikipedia.org/wiki/Near_field_communication#NFC_Forum

BIBLIOGRAPHY:

G. Gopichand

Born in 1992 in Guntur dist. currently pursuing B.Tech final year in K.L.UNIVERSITY. His areas of interest are wireless communication and digital electronics.

Email: gopidon9@gmail.com

T. Krishna Chaitanya

Born in 1992 in Prakasam dist. currently pursuing B.Tech final year in K.L.UNIVERSITY. His areas of interest are wireless communication and Embedded systems.

Mr. Rayala Ravi Kumar pursued his masters, *M.E. in Communication systems from P.S.G. College of technology, Coimbatore in the year*

1998. For the past 15 years he is associated with Telecom industry and Academia at various capacities. For 5 years with telecom industry worked on development and feature enhancements



of Networking, Storage and Security products based on TCP/IP Stack, Network Management, Storage management, Intruder Protection and Detection Systems by serving at companies like Integra Micro Systems, HCL-CISCO, Emulex Communications and IBM as Software Engineer (R & D), Member Technical Staff, Engineer and Consultant. For 9 years in association with Academic Institutions worked as lecturer, Associate Professor, Professor and Head of the Department and Prof. In-charge for industry institute interaction cell. Currently he is working as associate professor in Dept. of E.C.E. at K. L. UNIVERSITY, GUNTUR.