Near Field Communication (NFC)
The RFID Technology that can connect unpowered objects to internet achieving IoT at a cheaper price

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Abstract: - **The invention of Internet has made the day-to-day life facile and less complicated. A new revolution of the Internet is the Internet of things (IoT) where various devices and systems are connected to leverage data anywhere, anytime that is expected to spread rapidly, over the coming years. A new dimension of services will be unleashed due to this confluence and motivation thereby improving the Quality of livelihood. For Internet-enabled electronic devices, the Internet of Things is as close as the nearest hotspot. But what about all the objects too small, remote, or unpowered to make a secure Internet connection. The answer to this problem is NFC. NFC solves the problem of connecting unpowered objects that lack network access. By embedding NFC tags in unpowered, disconnected objects, you can add intelligence anywhere. Today there are 500 million NFC-enabled devices on the market, and eventually, the majority of things in our environment will have NFC tags on them. Hereby considering the real-world use cases of NFC tags by incorporating into the student's life it is shown how some of the problems a student faces in daily life can be solved, Making students life much more productive and comfortable .This can be done as NFC tags can be used for repetitive and mundane tasks and sometimes eliminate the need of remembering things by making unpowered things interactive, by these ten real-world use case scenarios of NFC in student life the author is trying to portray The revolutionary impact NFC technology has in making Internet Of Things a Reality and recognize NFC's role as a key enabler of the Internet of Things at the cheaper price.**

Keywords— IoT; NFC; STUDENT; RFID; TAG.

I. INTRODUCTION

Identification, sensing and communication technologies anytime, anywhere, any media" has been for a long time the vision pushing forward the advances in communications technology. In this context, wireless technologies have played a key role, and today the ratio between radios and humans is nearing the 1 to 1 value. NFC is one of the latest wireless communication technologies. As a short-range wireless connectivity technology, NFC offers safe yet straightforward and intuitive communication between electronic devices. Users of NFC-enabled devices can just point or touch their devices to other NFC-enabled elements in the environment to communicate with them, making application and data usage comfortable and convenient. With NFC technology, communication occurs when an NFC- compatible device is brought within a few centimeters of another NFC device or an NFC tag. The significant advantage of the short transmission range is that it inhibits eavesdropping on NFC - enabled transactions. NFC technology opens up exciting new usage scenarios for mobile device Near Field Communication (NFC) is a short-range, low power contactless communication between NFC-enabled devices that are held in the proximity to each other. Near Field Communication (NFC) is a specification for contactless communication between two devices. NFC is based on the technology used for RFID and is standardized in ISO/IEC 18092. It is limited to a distance between the two devices of up to 10 cm. NFC is intended to make it easier and more convenient to make transactions, exchange digital content, and connect electronic devices with a touch [1]. NFC operates at 13.56 MHz and has been developed jointly by NXP Semiconductors (formerly Philips Semiconductors) and Sony Corporation [2,3]. Because NFC can read and write to devices, it is believed that they will have a wider use in the future than standard smart cards. NFC involves an initiator and target. The originator, as follows from the name, initiates and actively generates an RF signal and controls the exchange of data (a payment device) where the

request is answered by a passive target (a Smartphone). The NFC protocol also distinguishes between two modes of communication: active and passive. Active is where both the initiator and target both communicate by generating their electric fields. They do this in half-duplex[4,5,7]; deactivating their RF field until no other device is transmitting. In this mode, both devices will typically have power supplies. Passive mode will be the more typical application where the initiator is the only device that generates an RF signal, the target device answers that call by modulating the existing field which the initiator device listens out for, and then processes, therefore, transferring data. Though RFID has huge scope to integrate devices, Unfortunately, RFID hasn't been incorporated into daily use .the problem was there was no standardising body hence leading to the compatible issues .to solve this In 2004, the NFC Forum (www.nfcforum.org) [10] was created to bring existing mobile RFID standards efforts together and create a short-range communication capability that would enable a host of novel applications.It has been a long road for NFC with little market adoption since its inception, Today, NFC's future looks more promising for the development of smartphones which abide by the NFC forum[10] standard and seeing major tech giants like Google which have supported the incorporation of NFC into the Android 2.3 operating system and it is predicted that over the next three years the market for NFC chips will grow by a factor of four and recently even Apple seems to be interested in NFC as can be seen in the new NFC reading capabilities of Apple's iOS 11 operating system .Below is the comparative table of various short-range wireless technologies with different parameters are tabulated.

Table 1: Summary of methodologies and technologies for 5G networks

Parameter	Bluetooth	Zigbee	NFC
Range	10–100 m	10–100 m	4–10 cm
Data Rate	0.8–2.1 Mbps	0.02–0.2 Mbps	0.02–0.4 Mbps
Cost	Low	Low	Low
Power consumption	High	Medium	Low
Spectrum	2.4 GHz	2.4 GHz	13.56 MHz
Security	Low	Low	High
Network topology	Piconets, scatternets	Star, tree, mesh	One to one
Devices per network	8	2–65,000	2
Usability	Moderate, data centric	Easy, data centric	Easy, human centric
Personalization	Medium	Low	High
Flexibility	High	High	High
Setup time	Approx. 6 s	Approx. 0.5 s	Less than 0.1 s

II. BACKGROUND

The world of RFID includes many standards that operate at low frequency(LF), high frequency (HF), and ultra-high frequencies (UHF). Within each of this frequency, domains are many standards that are incompatible with each other. NFC is a subset [8,9] of these rules operating in the HF band at 13.56 MHz under the ISO 14443, ISO 18092, and FeliCa standards, supporting a maximum data rate of 424 bits per second (kbps) up to10 cm. The NFC protocol not only supports communication between an active reader and a passive tag but also allows for peer-to-peer communication between two active users. Thus, a NFC-capable phone can both read a tag and receive and transmit data to another NFC-capable phone. Furthermore, tags can contain read/write memory, and today there are tag products with 4 Kbytes of Flash.. A NFC-smartphone can thus write arbitrary data into a tag as long as it fits in the available memory. When reading such a tag, a mobile device will obtain both a tag's unique identifier [1,2] and, if requested, the corresponding data contents. To support secure write access, the unformatted tag is initially writable for everyone, but it allows a client to set security key on internal blocks of data. This restricts tag writes to clients with access to these keys and permits additional data to be written, or updated data later time, with the knowledge that its unlikely to be corrupted by other users.The NFC protocol also distinguishes between two modes of communication: active and passive. Active is where both the initiator and target both communicate by generating their electric fields. They do this in half-duplex; deactivating their RF field until no other device is transmitting. In this mode, both devices will typically have power supplies. Passive mode will be the more typical application where the initiator is the only device that generates an RF signal, the target device answers that call by modulating the existing field which the initiator device listens out for, and then processes, therefore, transferring data RFID systems, which are composed of one or more reader(s)and several RFID tags. Tags are characterized by a unique identifier and are applied to objects (even persons or animals). Readers trigger the tag transmission by generating an appropriate signal, which represents a query for the possible presence of tags in the surrounding area and for the reception of their IDs. Accordingly, RFID systems can be used to monitor objects in real-time, without the need of being in line-of-sight; this allows for mapping the real world into the virtual world. Therefore, they can be used in an incredibly wide range of application scenarios, spanning from logistics to e-health and security.

From a physical point of view a RFID tag is a smallmicrochip1attached to an antenna (that is used for both receiving the reader signal and transmitting the tag ID) in a package which usually is similar to an adhesive sticker Dimensions can be very low: Hitachi has developed a tag with dimensions 0.4 mm_0.4 mm_0.15 mm. Usually, RFID tags are passive, i.e., they do not have on-board power supplies and harvest the energy required for transmitting their ID from the query signal transmitted by a RFID reader in the proximity. In fact, this signal generates a current into the tag antenna by induction and such a current is utilized to supply the microchip which will transmit the tag ID. Usually, the gain (power of the signal received by the reader divided by the power of the signal transmitted by the same reader) characterizing such systems is very low. However, thanks to the highly directive antennas utilized by the readers, tags ID can be correctly received within a radio range that can be as long as a few meters. Unfortunately, RFID hasn't been incorporated into daily use .the problem was there was no standardizing body hence leading to the compatible issues .to solve this In 2004, the NFC Forum (www.nfcforum.org)[10] was created to bring existing mobile RFID standards efforts together and create a short-range communication capability that would enable a host of novel applications thus standardizing the NFC has solved the compatibility issues .The NFC protocol not only supports communication between an active reader and a passive tag but also allows for peer-to-peer communication between two active users. Thus, a NFC-capable [1,2,7]phone can both read a tag and receive and transmit data to another NFC-capable phone. Furthermore, tags can contain read/write memory, and today there are tag Currently a new way of interaction approach by NFC technology, which is 'touching paradigm,' has been in question. This interaction can be identified as "the deliberate bringing together of two devices, to obtain services."

Figure:1 Touch-based paradigm for NFC

There exist three NFC devices, which can involve in NFC communication: NFC mobile, NFC tag, and NFC reader. Table3shows the possible interaction styles among those NFC devices. NFC technology operates in three different operating modes: reader/writer, peerto-peer, and card emulation modes where communication occurs between an NFC mobile one side, and an NFC tag, an NFC mobile, and an NFC reader on the other side respectively [8,9].
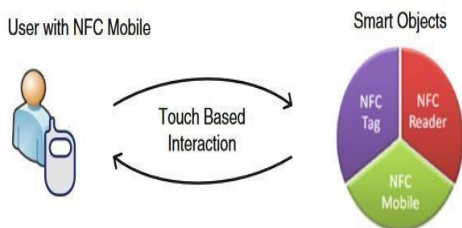
Table 2:interaction style of NFC devices

Initiator device	Target device
NFC mobile	NFC tag
NFC mobile	NFC mobile
NFC reader	NFC mobile

III. MAIN THRUST OF THE PAPER

Below ten real-world use cases of NFC tags are discussed below in each use case first the problem faced by the student is discussed and then a solution for that problem with the help of NFC tag is proposed for each real-world use case a figure is drawn for the better representation of how NFC is being used to solve a problem use case scenarios

- ❖ Making books interactive
- ❖ Creating a whole new type of alarms
- ❖ Making utensils interactive
- ❖ Creating interactive tablets container
- ❖ Sharing various social media id's with a tap
- ❖ Creating the interactive washing machine
- ❖ Check balance available in debit card at a tap
- ❖ Put mobile in silent mode while entering classroom and back to ringer mode at home with just a tap
- ❖ Play favorite playlist at anytime with a tap and dim lights while sleeping at a tap
- ❖ Creating an interactive calendar
- ❖ Making interactive books

Every book is given a 2 tag which stores the timetable of that classes and the other, not only supports keeps track of number of courses bunked and has total number of that respective subject classes in that semester and whenever the number of classes bunked becomes more, and attendance percentage becomes less than 80% it notifies you with a message and green colour and further whenever the audience becomes 75% it notices with a message with yellow colour and whenever the attendance becomes less than 65% it displays a message with red light . So whenever NFC mobile taps the tag1, it displays when the

classes will be there which helps the student to know at any time at what time he has that classes throughout the week and tag to assist in keeping track of attendance working as attendance management system.
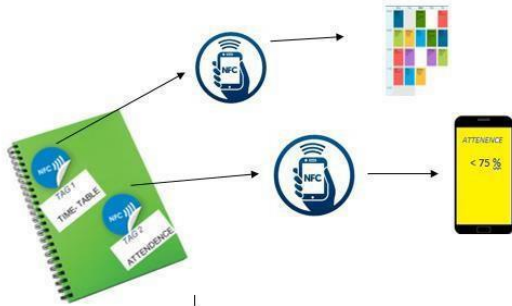

Figure 2 New type of alarm clock

Snoozing is one of the reason students cannot wake up at the time they have set the alarm so to tackle this problem an NFC tag is created such that until and unless user taps the mobile phone to the tag the alarm doesn't go off. Therefore the tag is placed at some distance wherein the user has to wake up walk up to the NFC tag and then he will be able to disable the alarm, this process makes the person active and has high chances that he may not back to sleep
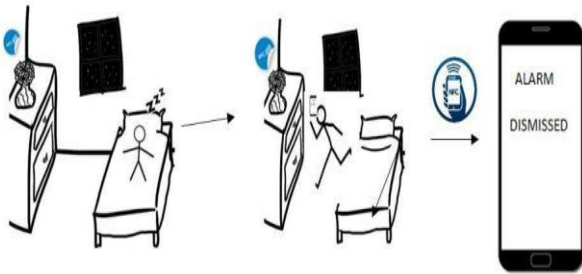
Figure 3

Creating interactive utensils by setting up a NFC tag that sets a timer in the mobile has an immense applications one of them is creating interactive utensils here whenever a person has to boil the milk it usually ends up getting spilled, usually it takes around 4 to 5 minutes for milk to boil and overflow hence whenever a user start boiling the milk he taps his phone to tag on the utensil and him free to roam around after 5 minutes the timer in the mobile rings and hence user will be notified, and he can switch off the gas accordingly making the life of student more efficient
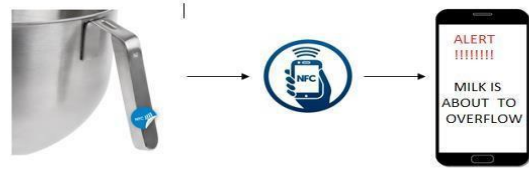
Figure 4

Creating interactive tablets container this generation students are very health conscious and are aware of benefits of vitamins and omega 3 fatty acids, and they consume cod liver oil and multivitamins tablets but they get over therefore the NFC tag is added every time the person takes a capsule he taps it, when the number of tablets in the bottle is less than 20, and mobile is tapped it automatically takes to the online shopping link stored for example Amazon link to buy new tablets keeping

Figure 5

Easily share social id here are many cases wherein a student meets new interesting people and would like to share their social media details with one another but the id names would be sometimes complicated and harder to tell orally hence an NFC tag can be used to store the links of the social media platforms hence by this method just by a tap social media id can be shared saving lot of time in which people can interact with each other

Figure 6

❖ Creating interactive washing machine
Sometimes students tend to forget their laundry hence they have to redo the laundry every time. This frequency creating a NFC tag that sets a timer in the mobile has an immense application one of them is creating interactive

washing machines here whenever a person loads the washing machine scans the NFC tag and sets the timer to an hour and him free to roam around after an hour the timer in the mobile rings and hence user will be notified, and he can switch off the gas accordingly making the life of student more efficient, and the person has to never forget the laundry again

Figure 7

❖ Check amount in debit card currency at a tap

The pocket money for the student usually depends on the money available in the debit card and every time to know the balance available an SMS has to be sent to the bank and then in turn the SMS will be forwarded back in which the available balance will be shown .this task can easily be automated with the help of the NFC tag such that whenever a tag is tapped it sends the SMS automatically to the bank number, the text along with the number the message has to be sent is stored in the NFC tag

Figure 8

❖ Switch to classroom mode and home mode mobile settings in a tap

Most of the time student forgets to put mobile to the silent mode, it is a typical scenario wherein the cell phone starts ringing in the class, and the entire class gets distracted, and
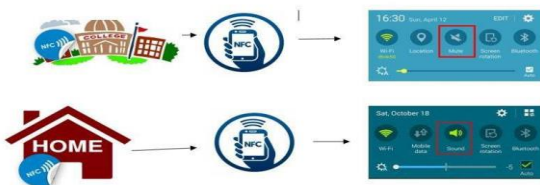
Figure 9

teacher gets annoyed and chances are student will be sent out of class and not be allowed to attend the class this major problem can easily be tackled with the NFC tag .a NFC tag can be made with settings such that when tapped mobile enters silent mode this classroom mode tag can be stuck at the entrance of the classroom and every time before going into puts mobile into silent mode .another NFC tag can also can not which can be home mode with settings such that when tapped mobile enters ringer mode .this is beneficial to the students live in many ways .

❖ Favourite playlist music mode and night mode using smart lamps and blue tooth speakers

most of the students have some form of favourite songs in a playlist which they daily listen there are any Bluetooth speakers who have NFC embedded this can be taken advantage of by just creating a music tag which when tapped starts playing favourite music playlist .another tag can be set up like night mode tag which when tapped can be dim the smart lights which are common nowadays

figure 10

Creating an interactive calendar academic calendar contains all the information regarding the exams and holidays, and other important events which are unique to the college and cannot in the regular calendar hence a calendar tag can be created which when tapped displays the schedule of events which are specific to the college like college day and dates of the internal exams

Figure 11

Future Trends

All the top five emerging domains IoT, cloud, mobile application, artificial intelligence, Big data can exploit and take reap uses with the NFC.In the near future almost 40 billion connected devices are expected to be in use by 2020 and NFC provides a simple solution for connecting IoT devices to a network .cloud computing has provided solution For devices where memory is an issue It helps in the storage, retrieval, and maintenance of large data with added advantages like ubiquity, consistency, reliability, etc. It, therefore, serves as the podium for uses of NFC technology in various innovative ways and integrating mobile applications will provide user interface and take IOT to whole new level .as it is evident that IOT will become main stream[4] in near future large amounts of data will be generated and hence using this vast amount of data set and using artificial intelligence domains like machine learning and deep learning patterns in the behavior of the people can be deduced and solutions which can be applied to millions of implemented in mass can be inferred and can be enormous scope for marketing as massive data set will be available for personalized adds .NFC as a companion technology to Bluetooth, NFC has emerged as a powerful tool to complement and enhance the consumer experience. Just tap a NFC-enabled mobile device to NFC-enabled Bluetooth devices [10], such as a speaker, printer, remote control or wearable device. In a flash, the devices will be automatically paired, and you can play music, send documents to print, or transfer data. There is enormous scope for further research on this topic as NFC tags can be used in almost any environment like creating interactive cloths as It provides a digital environment for the manufacturers; the system has the potential to identify cheap replicas, keep track of the loyal customers, minimize the wastage of resources by eliminating price tags and to keep track of the goods using a single relational database system. It can disrupt hospital management as entire hospital management system can be developed where each patient can be given NFC tag and smart libraries can be drawn up as it provides much more uses compared to barcode system, and even smart campuses can be developed by providing guiding system in this way possibilities for further research are endless

IV. CONCLUSION

The ten applications discussed are simple to implement because of the NFC capabilities but are of immense help for the student because some of the applications of NFC discussed are academic-related which is a crucial part of the any student it can be seen that NFC solves some of the simple core problems of our lives, but still it is not becoming the mainstream because majority are unaware of NFC technology and some of the challenges are so simple that generally, a person would think there is no solution for such problems . The Internet of Things (IoT) is in the process of transforming the way we live our lives by improving the quality of life with technological advancements in efficiency and safety. Consumers will be among the biggest beneficiaries as the home environment is one of the leading platforms for the promotion of smart ecosystems. The habits of individual users will be detected by devices within smart home ecosystems communication, and then that information will be used to optimize the environment. The connectivity of the IoT will enable the seamless communication among devices. Near Field Communication (NFC) can be used to help developers utilize internet-enabled devices to maximize the benefits of the IoT in daily life. It is evident that NFC will be beneficial for smart home devices as nearly 40 billion connected devices are expected to be in use by 2020. NFC provides a simple solution for connecting IoT devices to a network. Any device that is lacking a quality user interface (UI) can be given user-friendly controls with a single tap via NFC. In addition to its ease of use, other benefits include specific interaction through calendar interactions, read and write capabilities, and communication with devices that are powered down. NFC is a low cost and low energy solution that will enhance the IoT experience. A decade ago we would not have imagined a time in which our smartphones would connect us to everything and anything, and blend our work and play so seamlessly. But here we are. 700 million new smartphones shipped last year alone, most with the ability to communicate quickly via multiple wireless protocols. Manufacturing costs are down, sensors and tags are tiny – and most apps are free. From retail to healthcare, transport to consumer electronics, how we interact with the world around us is changing drastically. At last with NFC technology, the foundation is in place to make the Internet of Things a reality

V. ACKNOWLEDGEMENT

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Bio-data
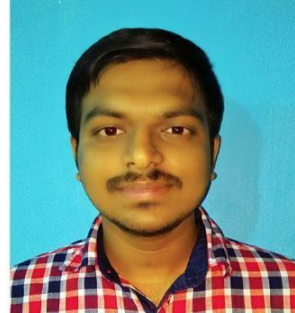
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