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NFC BASED SMART DOOR LOCK SYSTEM

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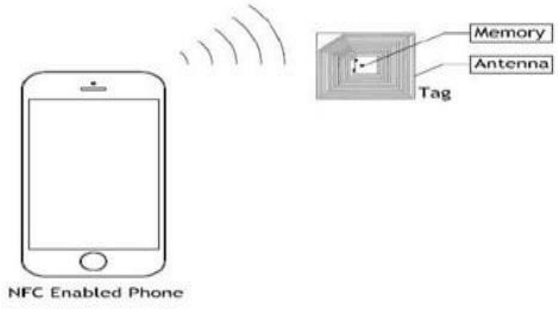
Abstract : **An inventive way to increase the security of access control systems is to use a smart door lock system that is NFC (near field communication) based. With the help of a smartphone with NFC capabilities, this system provides a safe and practical way to unlock doors. The proposed system consists of an NFC-enabled door lock module, a mobile app, and a database to control access rights. By simply tapping their smartphone on the NFC reader, users can easily gain access. The design, development, and implementation of the NFC-based smart door lock system are covered in this essay, along with an assessment of the system's efficiency, security, and usability. The findings demonstrate that the system offers a safe and simple access control mechanism with increased comfort and accessibility.**

INTRODUCTION

The NFC (Near Field Communication) based smart door lock system is a novel approach to secure and convenient access control. This system uses the NFC technology to enable users to unlock doors with a tap of their smartphones, eliminating the need for physical keys or cards. NFC is a short-range wireless communication technology that allows devices to exchange data when they are brought close together. The NFC-based smart door lock system consists of an NFC reader installed on the door, a mobile application installed on the user's smartphone, and a database to manage access rights. The user simply needs to tap their smartphone on the NFC reader to unlock the door, and the system can also provide additional features such as temporary access for guests, remote unlocking, and activity logs. This paper aims to introduce the NFC-based smart door lock system, its design, development, and potential applications, and to evaluate its performance in terms of security, usability, and efficiency. The NFC-based smart door lock system has the potential to revolutionize access control systems in both residential and commercial environments by providing a secure, convenient, and user-friendly solution.

A. Definition

This project focuses on developing a Near Field Communication (NFC) Smart Lock System that utilizes a smartphone's onboard NFC chip as a method to unlock a door.Near Field Communication (NFC) is a technology for contactless short-range communication. Based on Radio Frequency Identification (RFID), uses magnetic field induction to enable communication between electronic devices. The number of short-range applications for NFC -technology is growing continuously, appearing in all areas of life. Especially the use in conjunction with mobile phones offers great opportunities. Access is regulated using an NFC Smart Card which runs a simple user interface that allows an Administrator to grant or deny entry to any particular user. The goal of this project was to give access to a particular user. Access will be given to the user by using NFC Smart Card. Every NFC Smart Card contains Unique Identification (UID) Number, by using UID we grant or deny user entry. It is working on an NFC door lock that will be available to the general public at an affordable price. The goal of this project is to create a more convenient way to unlock your door than the traditional key. In the key's place is an NFC tag that will unlock the door by proximity. However, the improvements of this NFC door lock must outweigh the complications of implementation. The list of customer needs (in the Requirements and Specifications section) was constructed with that fundamental goal in mind. The design consists of two components. The first component is the actual door lock that must be installed in the door frame. This will be controlled by a magnetic lock and will need to be powered. The second component is a relatively small module that you can install anywhere near the door. This module is responsible for NFC sensing.



B. Development of NFC Technology

The increased gadget mobility made possible by mobile communications is now a key aspect of the rapidly developing technical world. Mobile phones already had a variety of ways to communicate with the outside world before Near Field Communication (NFC) technology was developed. The Global System for Mobiles (GSM), which also offers additional services like SMS, MMS, and even internet access, was largely used to establish up voice communication when mobile phones were first launched. Eventually, Bluetooth technology was developed to link computing devices, including mobile phones, with peripherals. NFC, a novel kind of communication, is currently becoming common in mobile smart phones. For this technology to work, two NFC-compatible devices must be put very close together. to convey a message. NFC can transmit information at a maximum rate of 424 Kbits per second while operating at a frequency of 13.56 MHz.\

1. TAG

A limited amount of memory and an antenna are included in the tag, which is a thin, basic gadget. It is a passive gadget that is magnetic field-powered. The memory can be read-only, re-writable, and writable only once depending on the type of tag.

FIG 2: NFC Tag

2. Reader

The reader is an operational device that sends out radio signals to communicate to the tags. In the case of passive mode of communication, the reader power supplied to the passive device.

FIG 3: NFC Reader

3. NFC Model

We use the Witty Fox NFC Communication module NFC tag type 4 offers the highest flexibility and memory of all the tags.it offers the functionality needed to perform true authentication. It has 3kb SRAM for NDEF messages the NDEF is a lightweight binary format, used to encapsulate typed data. It is specified by the NFC forum, for transmission and storage with NFC. SPI or I 2C interface to write and read NDEF messages to internal SRAM Interrupt register and output pin to indicate NDEF read or write completion. this has a 13.56 MHz RF interface that supports up to 848kbps**.**

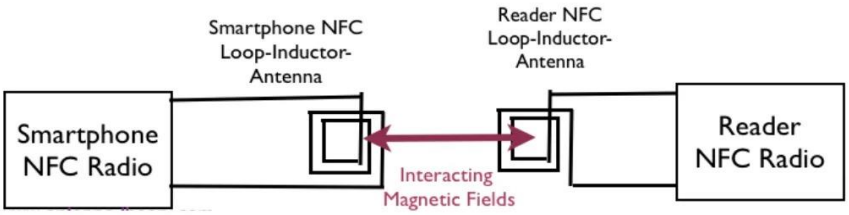


FIG 4: NFC Module

4.ESP32 Strom board

We are using a Witty Fox ESP32 Stromboard with support battery charging and wireless charging. This has inbuilt battery protection and charges and discharge model. Selectable power switch. This board has 200mA LDO 3.3 volt regulator for a wide operating voltage range**.**

Fig 5: ESP 32 Strom Board

5.Solenoid Electric Door Lock

In general, solenoids are electromagnets; they are constructed from a large coil of copper wire with a central armature (slug of metal). The slug is drawn into the coil's centre when it is activated. The solenoid can now pull from just one end as a result.

This specific solenoid is lovely and sturdy, features a slante d-cut slug, and a sturdy mounting bracket. It is essentially an electronic lock made for a straightforward cabinet, safe, or door. Typically, the lock is engaged, making it impossible to open the door due to the solenoid slug's obstruction. In this state, it makes no use of electricity. The slug pulls in so that it doesn't protrude any more and the door may be opened when 9–12VDC is applied.

The solenoids are shipped with the slanted slug as depicted above, but you may remove it using the two Phillips-head screws and twist it 90, 180, or 270 degrees to make it fit the desired door.

Check out this diagram to see how to connect a power transistor and a diode or other microcontroller to drive a solenoid. Don't try to power a solenoid with a 9V battery since a robust power source is required because a lot of current—about 500mA—will flow into the solenoid to charge up the electro-magnet.

Fig 6: Solenoid lock

PROBLEM STATEMENT

The issue with current smart lock systems is that anyone can open the lock if the RFID card is lost and duplicated. Consequently, if something goes wrong, there is no additional layer of security. If we have a fingerprint lock, we can make a copy of the fingerprint and open the lock. There is no additional level of security in IoT because we can only permit it by entering a password and unlocking it.

Digital locks can still be subject to hacking or other security flaws while being very advanced. Unauthorized people could be able to enter the locked space if the system is not correctly designed or executed.

Digital locks are subject to failure or malfunction just like any other technological device. A person could become locked out of a space or unable to secure the space if there is a power outage or other problem that stops the lock from working.

Digital locks come in a wide variety of designs, and not all of them are compatible with all kinds of doors or structures. It could be essential to change the space's layout or replace other components if the lock is incompatible with the hardware or software already in place.

METHODOLOGY

NFC is becoming popular in mobile smartphones. This technology needs two NFC compatible devices placed very near to each other (less than 4cm) to communicate. NFC operates at 13.56 MHz and can transmit information up to a maximum rate of 424 Kbits per second.

In NFC communication, two devices are needed. The first device is called the initiator which is an active device and is responsible for starting the communication, whereas the second device is called the target and responds to the initiator's requests. The target device may be active or passive. The communication starts when the active device gets close to the target and generates a 13.56 MHz magnetic field and powers the target device.

We use the Witty Fox NFC Communication module NFC tag type 4 offers the highest flexibility and memory of all the tags. it offers the functionality needed to perform true authentication.

It has 3kb SRAM for NDEF messages the NDEF is a lightweight binary format, used to encapsulate typed data. It is specified by the NFC forum, for transmission and storage with NFC. SPI or I 2C interface to write and read NDEF messages to internal SRAM.Interrupt register and output pin to indicate NDEF read or write completion. this has a 13.56 MHz RF interface that supports up to 848kbps.

ESP32 Strom board

We are using a Witty Fox ESP32 Strom board with support battery charging and wireless charging. This has inbuilt battery protection and charges and discharge model. Selectable power switch. This board has 200mA LDO 3.3 volt regulator for a wide operating voltage range.

Advantage

* NFC door lock is does not require to carry a key with you.
* You can provide entry for others with your discretion.
* Easy to use.
* Tag does not require power supply.
* Highly secured.

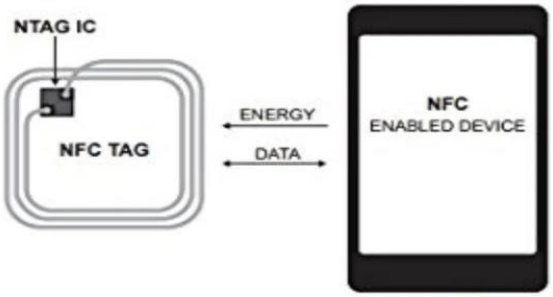
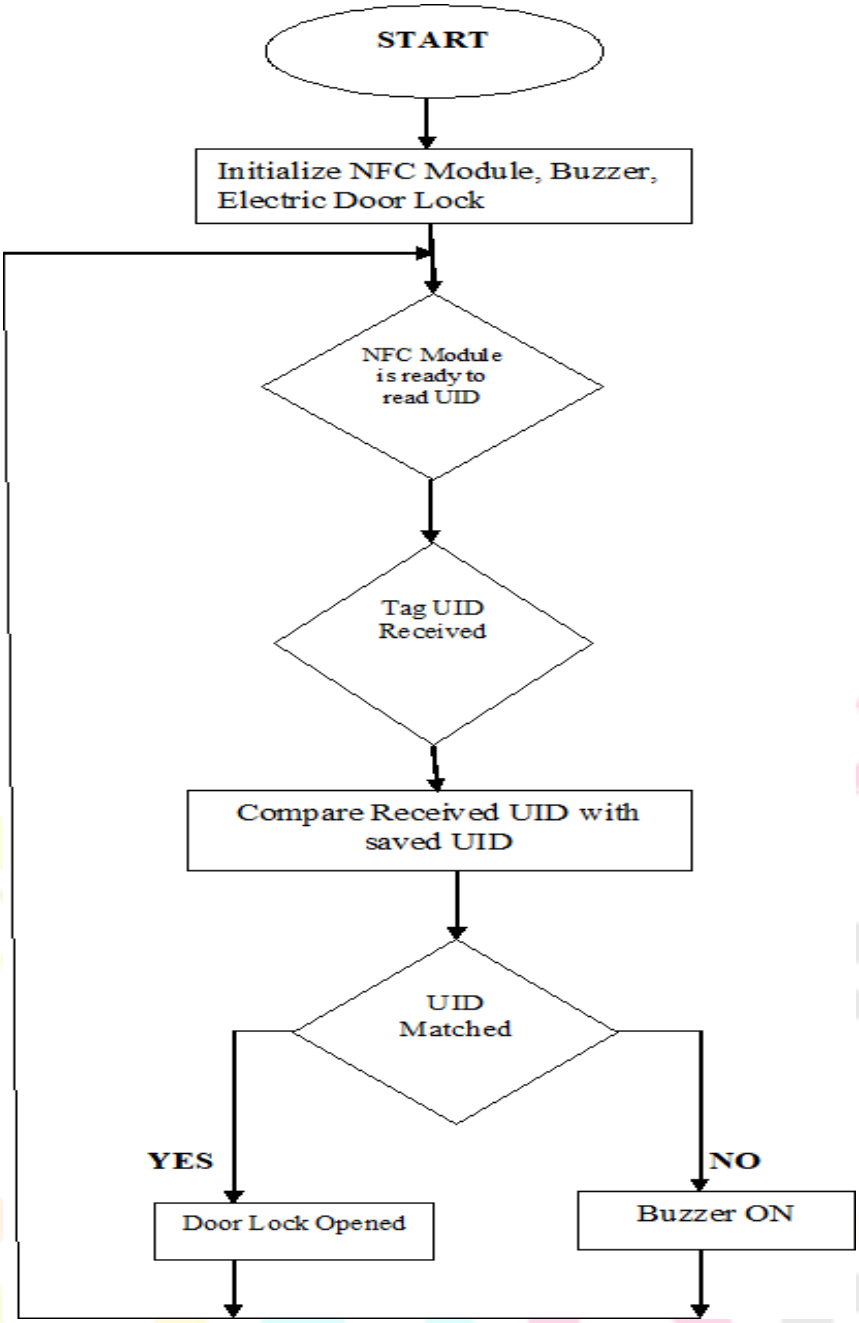


Fig7:How NFC works

FLOW DIAGRAM



FUTURE SCOPE

Future applications of this project include the Smart cart, which can be connected to wireless technologies to become fully portable in the near future. It is possible to execute mobile bill payment. It is possible to create and use a low-cost NFC scanner that can simultaneously scan several tags (items) for quicker processing and with fewer resources. The introduction of automatic scanning and product availability is possible. Due to the growth of the ecommerce sector, pay preparation features will become the newest fashion in the coming years. NFC-enabled advance door locks will become more popular in the next years.

CONCLUSIONS

This project concludes, allow only access granted user and stop the access deny user. It works based on Door Security using NFC Technology. By using NFC tags, we control the access to user. NFC based security and access control system is more secure and fast responded as compared to the other system like biometric. The advantage of the NFC system is contact-less and works without-line-of-sight. We can book accommodations online, and according to the IRJET paper, which our team used as a source for this study, there is no more sophisticated technology that allows us to directly book accommodations using a smartphone. Their technology does not provide the smartphone's NFC feature to unlock the lock.

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