RFID Smart Card Door Lock

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Abstract— **RFID, or Radio Frequency Identification, is a low-cost technology that may be implemented in a variety of purposes such as safety, asset tracking, people tracking, inventory detection, and access control. We tried to develop and come up with a system for security which is digital and can be used in places that can only be accessed by authorized individuals. We installed a security system that included a door locking system that used passive RFID to activate, verify, and authorize the user and at the same time open the door for secure access.**

Keywords: RFID, Arduino, RFID tags, RFID readers, radio frequency.

I.   INTRODUCTION

Electronic door locks are becoming more prevalent among businesses as technology progresses. This type of door lock offers a number of benefits over traditional lock and key entry, including quick and convenient keyless entry.

This is a contactless technique where digital data is encoded inside the RFID tags gets recognized spontaneously by the electromagnetic field present inside the reader. The tag being the key in this case.

Many benefits of RFID include that tags that are lighter and cheaper as compared to others, with no requirement for a battery. Management of controlling, transaction, and operation tasks are all done by a centralized system. This mechanism operates in real time, with the door opening instantly as the user places this key onto to the reader.

Wireless data transmission takes place in Radio Frequency Identification technology. Due to a lack of consistency among manufacturing organizations in the past, this technology has not been widely adopted in industry. This is a technology that is comparably efficient and safe as opposed to the other available networks. A tag contains a particular identifier code.

II.   SYSTEM ARCHITECTURE

The following components are used for building this project:

- Power Supply Unit
- 4 Channel Relay
- RFID tags
- Arduino UNO Microcontroller
- Buzzer
- RFID Reader

A. Arduino UNO

It's 8-bit AVR RISC based microcontroller. It contains 2 KB RAM with writing and reading capabilities, 32KB ISP flash memory, 1KB EEPROM, 32 working registers, 23 input–output lines, 6-channel 10-bit A/D converter, three counters which come with compare modes, SPI interface and programmable USART.

B. RFID Reader

RFID Readers, which are commonly called Proximity Coupling Devices (PCDs), are used to analyze data from RFID tags. The reader in these passive tags energizes it by producing a radio signal, which is then sent and read by the reader. The reader converts the received data and sends it to the forwarding system via wired or wireless communication.

C. RFID Tags

An integrated proximity circuit card is also known as RFID tag which can be either actively powered or powered passively. RFID tags, also known as transponders, are made up of an antenna, a microchip, and a battery (for active tag only). The chip's size which is usually found by the antenna's size. The tag's frequency determines the size and shape of the antenna. Power source is available on board for Active tags, whereas passive tags are powered inductively by the radio signal generated by the RFID reader. In the absence of a reader, this tag can record sensor readings and even execute calculations.
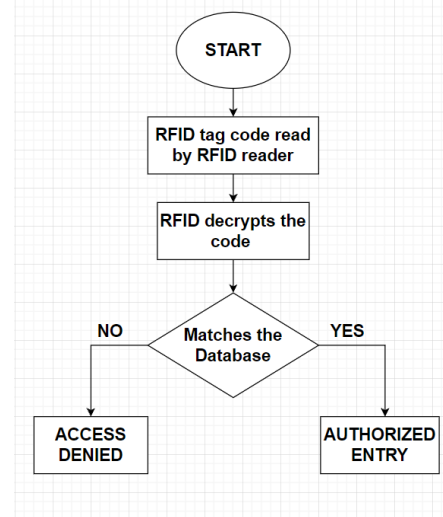

Fig. 1. Flow Chart of Design System

III.   METHODOLOGY

RFID system constitutes of namely two components, which are tag and receiver. A high frequency electromagnetic field

produced by a control unit, a module of radio frequency, and an antenna coil constitute to make up an RFID reader. The tag, on the other hand, is a passive component that consists just of an electronic microchip and an antenna, so when it comes into contact with the transceiver's electromagnetic field, voltage is generated via induction in the antenna coil, which functions as power for the microchip.

A plastic covered smart chip is used by these RFID key cards that utilizes a particular frequency to transmit a signal to the reader. Generally, the reader is placed on the door, which analyses the information recorded from the card and unlocks the door when it is within a specific distance of the reader. The door can be unlocked after this, which will autonomously lock when closed again.
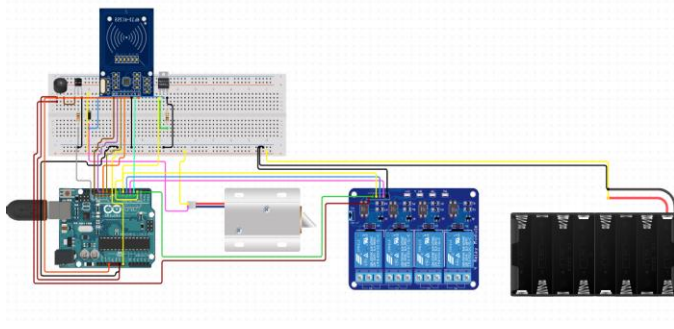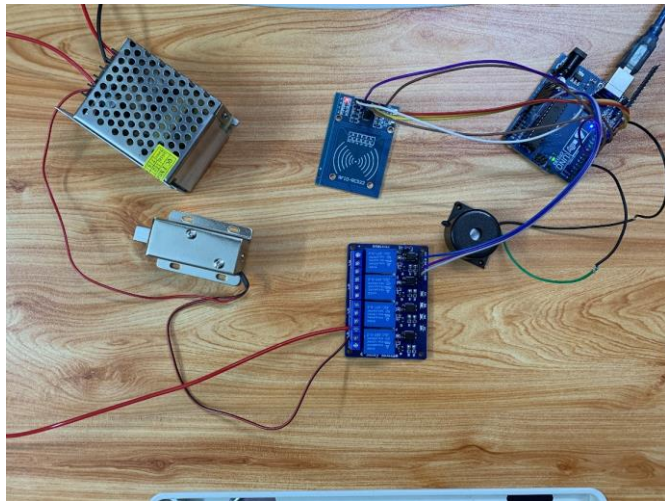

Fig. 2. Circuit Diagram

Fig. 3. Working Circuit Diagram of Proposed Design

IV. BENEFITS AND USES

A. Convenience

RFID locker locks are clear and simple to install because the tag card is simple to use and carry along as compared to keys. Key cards for such locks can be easily kept in your wallet. Physical contact with the lock is not required with RFID key cards.

B. Security

RFID key cards are significantly more difficult to copy than regular keys, giving you peace of mind when it comes to unauthorized users. For example, if a former employee had an extra key made, they may get access to the building

without permission after returning their original key. To prevent an unauthorized user from getting access to a facility or a storage locker, key cards can also be cancelled.

C. Future Scope

Unlike magnetic stripe locks, which can only be unlocked with a key card, RFID locker locks can be accessed with both a card and a mobile device. Bluetooth Low Energy (BLE) technology can also be utilized to access the locks because RFID uses wireless technology to trigger the lock mechanism. As a result, if carrying a key card is inconvenient, you can register your smartphone as the key and use it to open RFID locker locks. Many businesses now use RFID locker locks and RFID Mobile Access Locks to safeguard the safety and security of their employees and the company as a whole.

D. Flexibility

Multi-Locker and Multi-User functions are now standard on most RFID locker locks. Multi-User effectively means that multiple users can be registered under a single lock, such as an office building's main entrance door. Multi-Locker, on the other hand, means that a single user is allocated to multiple lockers, such as a hotel's master card, which is kept under the manager's supervision.

V. FUTURE SCOPE

Electronic locks are far more convenient and efficient than traditional mechanical locks. It can be unlocked easily by a simple key, which makes it more convenient. A magnetic card, a barcode, a fingerprint, or an alphanumeric code entered from the computer can all be used as the detector unlocking the electronic lock.

You can accomplish a variety of accounting tasks with their assistance. Electronic locks, in addition to unlocking and locking doors, can also be used to keep track of working hours. When an employee uses an RFID tag to unlock a door, the system receives a door open signal and records the time the employee arrived and departed the company.

A. Attached RFID Tag Readers

You can accomplish a variety of accounting tasks with their assistance. Electronic locks, in addition to unlocking and locking doors, can also be used to keep track of working hours. When an employee uses an RFID tag to unlock a door, the system receives a door open signal and records the time the employee arrived and departed the company.

B. Collection of Toll

There are active tags in cars and they also have serial numbers that are unique. This tag can be read so as to create an account associated with it when it crosses a toll booth to locate the serial number in the database and charged.

C. Tagging people

If people were to wear an RFID tag, most individuals would not want to be tracked. Certain people, on the other hand, are eager to be followed. Participants in any convocation or

convention, for example, may wear RFID-enabled badges to indicate their availability for discussion or to submit personal information. Other categories of individuals are seen to benefit from monitoring or should be watched out for safety reasons. Parolees should be watched, as should Alzheimer's sufferers, and even babies can benefit from this technology. RFID-enabled baby bracelets are available at some hospitals.

D. Investigation of motor vehicle accidents

RFID tags can be used as eyewitnesses in road accidents, and the concept operates as given ahead. An RFID device is received by each registered vehicle which is connected to the automobile with a pre-programmed unique code that is stored in databases with the vehicle identification number. Cops may use handheld RFID scanners to capture coded information as soon as they arrive at the accident site, allowing databases to be explored for particulars such as the vehicle's owner, make, and model. The timing of the fleeing motorist can also be identified in hit-and-run accidents. It is also feasible to get vehicle locations at their first points of collision.

E. Mobile Commerce

RFID tags and wireless LAN, which is WLAN are required by mobile (m)-commerce applications as they need a dual-mode communication architecture. In any given showroom, products such as camcorders which are digital and Televisions that come with inbuilt RFID tags, mobile computers with PDA-size might be utilized by customers to browse webpages, assess and compare the performance and features available, compare price, and make an order over WLAN. Surveillance security can be increased by adding RFID tags to these devices. As ecommerce applications grow in popularity, RFID technology will become more widely used.

F. Baggage Handling

Baggage handling and package delivery is a difficult activity that necessitates a big number of people, which is a costly resource. Humans do a variety of tasks, including receiving packages, sorting, assembling, and distributing them. The error rate can be significant due to human participation. While using an RFID tagging technology lowers human participation, it also automates the process to a degree, allowing for faster package delivery. RFID solutions for luggage and packaging companies, particularly the airline industry, are more efficient and reduce total system complexity.

VI. RFID RESEARCH ISSUES

A. Directory protocol

In this protocol, k packets are gathered by the reader, which then broadcasts a directory, and then finally transmits the k packets. Monitoring of directory is done by tags determine whether packets are scheduled, and the regular intervals when they wake up to finally permit the reader to begin a directory transmission. This is a much more equitable approach as compared to grouped-tag where the distribution of destination is significantly clustered. However, if the directory is too

huge, reading it consumes a substantial amount of time and energy.

B. Time-division multiple access (TDMA)

TDMA is a protocol in which each and every tag is assigned a slot where it can receive signals. The tag gets inactive in other slots. This is a protocol which is very energy efficient, however it has a very long latency when there are a lot of tags.

C. Random access protocol

In this case, one amongst all the packets is chosen in the queue at random to send, and finally this packet is counted as acquired only when the destination tag of the packet is active and functioning. Tags are active and functioning with a chance of p. The method consumes very little energy, but the chances of the packet reaching the target tag are small.

D. Pseudorandom protocol

A generator of pseudorandom numbers is utilized by the tags and specify their active/inactive slots on the basis of different seeds that are known. This is done to avoid total schedule overlap. If the reader knows the seed, they can figure out the tag scheduling.

E. Research issue of energy efficiency

Under low traffic loads and uniform destination distribution, the TDMA which is grouped-tag beats the protocol which is known as dictionary and another protocol called pseudorandom. Unless the target distribution becomes substantially clustered, in which case the best technique to be deployed is directory protocol, the pseudorandom protocol outperforms the directory protocol in the case of of energy savings and time. As a result, building a more energy-efficient approach remains a research issue worth exploring further.

VII. CONCLUSION

In this study, we used passive RFID to construct a digital security system that includes a door lock mechanism. When the user places the tag in contact with the scanner, the door locking system activates in real time. One of the most pressing issues of business owners in the modern period is the safety and security of customers, staff, and the overall firm. All business owners deal with lost keys, thievery, and forgotten pins on a daily basis. RFID locker locks are a fantastic answer to these issues.

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