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GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)

Course Activity Report

"RFID & Electromagnetic Card as a security system into Automotives"

Submitted in the partial fulfillment for the academic requirement of

6th Semester B.E. in

Sensors and Signal Conditioning (18EC63)

Submitted by

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Department of Electronics and Communication Engineering

CERTIFICATE

This is to certify that Mrs. Almas Kalal, Mr. Amey Kurade, Mrs. Anusha Naik and Mr. Kartik Gadad of 6th semester and bearing USN 2GI20EC019, 2GI20EC020, 2GI20EC024, 2GI20EC053 respectively has satisfactorily completed the course activity (Seminar/Project) in Sensors and Signal Conditioning (Course code:18EC63). It can be considered as a bonafide work carried out in partial fulfillment for the academic requirement of 6th Semester B.E. Electronics and Communication Engineering prescribed by KLS Gogte Institute of Technology, Belagavi during the academic year 2022- 2023.

The report has been approved as it satisfies the academic requirements in respect of Assignment (Course Activity) prescribed for the said Degree.

Signature of the Faculty Member
Date:

Signature of HOD

ABSTRACT

The increasing concern for automotive security has led to the development of advanced security systems that ensure the protection of vehicles from unauthorized access and theft. This abstract presents a proposal to incorporate Radio Frequency Identification (RFID) and Electromagnetic Card technology as a robust security system for automotives. The proposed system aims to enhance vehicle security by leveraging the unique identification capabilities of RFID and the enhanced security features offered by Electromagnetic Cards. RFID technology enables contactless identification and tracking of objects through radio waves. By integrating RFID tags within the automotive infrastructure, such as key fobs or identification cards, the system can authenticate authorized users and grant access to the vehicle. Additionally, RFID can provide real-time tracking and monitoring of vehicles, enabling efficient fleet management and theft prevention. The Electromagnetic Card technology acts as an additional layer of security within the proposed system. These cards generate dynamic magnetic fields that can be detected and authenticated by specific sensors installed in the automotive environment. The dynamic nature of the electromagnetic fields ensures enhanced security by making it difficult to replicate or tamper with the cards.

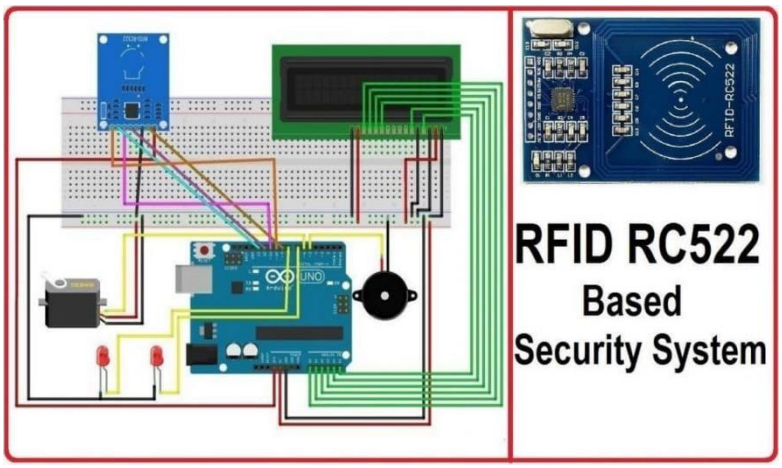
Overview

In this project, we have designed RFID RC522 Based Security System using Arduino LCD Display & Servo. RC522 is a very simple yet effective module. It is an RFID module and is used for scanning RFID cards. It's a new technology and is expanding day by day. Nowadays it is extensively used in offices where employees have issued an RFID card and their attendance is marked when they touch their card to the RFID reader. We have seen it in many movies that when someone places one's card over some machine then the door opens or closes. In short, it's a new emerging technology which is quite useful. Let's first have a little introduction to RFID. RFID is the abbreviation of Radio frequency identification. RFID modules use electromagnetic fields to transfer data between the card and the reader. Different tags are attached to objects and when we place that object in front of the reader, the reader reads those tags. Another benefit of RFID is that it doesn't require to be in a line of sight to get detected. As in barcode, the reader has to be in the line of sight to the tag and then it can scan but in RFID there's no such restriction. So, let's get started with Interfacing of RFID RC522 with Arduino.

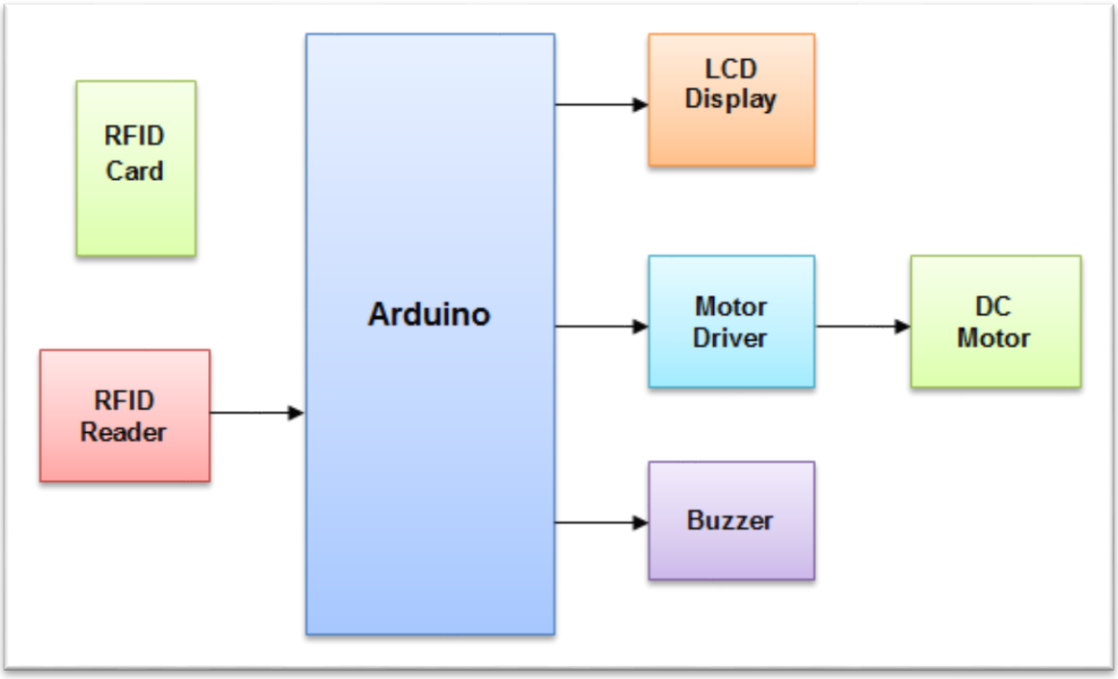
Introduction

RFID based security system using Arduino project has an RFID reader attached to it. RFID reader reads the unique alphanumeric code of RFID tags and sends it to Arduino. Then Arduino detects whether an RFID card is valid or invalid. If the card is invalid, then the system turns on the buzzer. However, if the RFID card shown by the user is valid then the DC motor is turned on and at the same time Relay is turned on. DC Motor is shown as a demo of a door lock (latch) opening. Also, a Relay is provided as an additional feature so that the user can connect any electromagnetic security lock to the system if required. Access Control is an important technique in the field of Security, where personnel may have restricted access to enter a place, use an object or consume something. Authorization is the process of verifying the credentials of a person and granting permission to access the resource.

There are various electronic security systems such as Password-based security systems and Fingerprint based locking systems. Arduino-based RFID access control system provides us with the feature of an automated access control system. Arduino security system provides keyless entry to the house/office.



Block Diagram



Components Used

1.Arduino UNO: It is the main processing unit of the project. It controls output devices; it also reads input from the RFID reader. Arduino sends various messages to LCD displays.

2.RFID Module: MFRC522 IC based RC522 RFID Module is a cheap yet reliable RFID Module for Arduino. The kit consists of the main RFID Scanner / Reader Module (with embedded PCB Antenna), a Smart Card and a Key Fob (both are of type MIFARE 1K Classic).

3.RFID Smart Card and Reader: An RFID tag is a smooth card of credit-card size (Fig. 3), which is read by an RFID reader.

4. MG 996R Servo Motor: Tower Pro's MG 996R is a digital metal gear servo with a high stall torque and can rotate up to 120 degrees. It is used to show a demonstration of door or gate opening. Motor driver IC is used to drive the motor

5.Buzzer: We have used a piezoelectric buzzer. This is a warning/indication that an invalid attempt is made to gain access to the system.

6.Electromagnetic card: A magnetic stripe card is a type of pass that permits the user to complete electronic transactions or access a locked physical space. The "stripe" contains embedded information that identifies its user.

7.LED

8.Breadboard

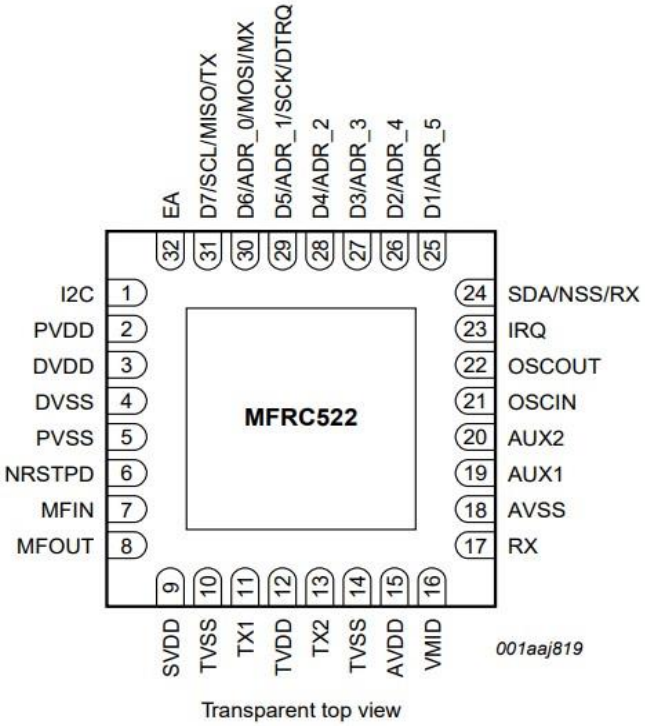
9.Power supply

10.Connecting Wires

11.Software: The software for this project is written in Arduino programming language. The Arduino UNO is programmed using Arduino IDE software.

MFRC522 IC based RC522 RFID Module

Pinning Information



Transparent top view

Fig 1

Quick Reference Table

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
AV_{DD}	Supply Voltage	$AV_{SS} = DV_{SS} = PV_{SS} = TV_{SS} = 0$ V,	[1][2]	2.5	-	3.6	V
DV_{DD}		$PV_{DD} \leq AV_{DD} = DV_{DD} = TV_{DD}$	[1][2]				
TV_{DD}			[1][2]				
PV_{DD}	Pad power supply	$AV_{SS} = DV_{SS} = PV_{SS} = TV_{SS} = 0$ V, $PV_{DD} \leq AV_{DD} = DV_{DD} = TV_{DD}$	[3]	1.6	-	3.6	V
SV_{DD}	MFIN/MFOUT Pad Power Supply	$AV_{SS} = DV_{SS} = PV_{SS} = TV_{SS} = 0$ V,		1.6	-	3.6	V
I_{HPD}	Hard Power-down Current	$AV_{DD} = DV_{DD} = TV_{DD} = PV_{DD} = 3$ V, N_{RESET} = LOW	[4]	-	-	5	µA
I_{SPD}	Soft Power-down Current	$AV_{DD} = DV_{DD} = TV_{DD} = PV_{DD} = 3$ V, RF level detector on	[4]	-	-	10	µA
I_{DVDD}	Digital Supply Current	$DV_{DD} = 3$ V		-	6.5	9	mA
I_{AVDD}	Analog Supply Current	$AV_{DD} = 3$ V, bit RCVOff = 0		-	7	10	mA
$I_{AVDD,RCVOFF}$	Analog Supply Current, receiver switched off	$AV_{DD} = 3$ V, bit RCVOff = 1		-	3	5	mA
I_{PVDD}	Pad Supply Current		[2]	-	-	40	mA
I_{TVDD}	Transmitter Supply Current	Continuous Wave	[1][3][8]	-	60	100	mA
T_{amb}	operating ambient temperature			-25		+85	°C

Fig 2

[1] Supply voltages below 3 V reduce the performance in, for example, the achievable operating distance.

[2] VDDA, VDDD and VDD(TVDD) must always be the same voltage.

[3] VDD(PVDD) must always be the same or lower voltage than VDDD.

[4] Ipd is the total current for all supplies.

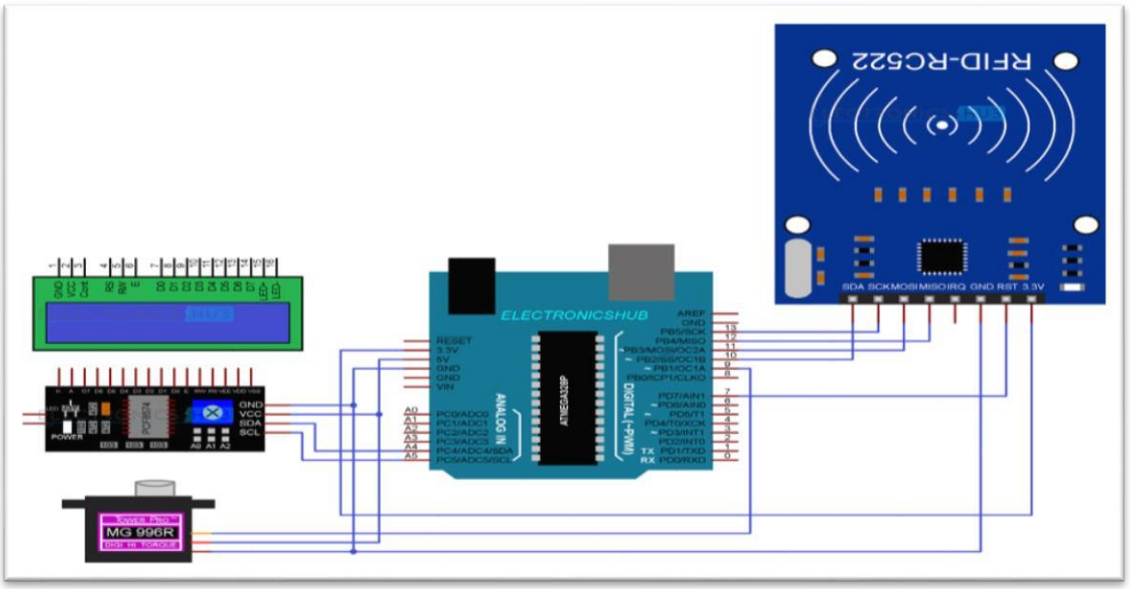
[5] IDD(PVDD) depends on the overall load at the digital pins.

[6] IDD(TVDD) depends on VDD(TVDD) and the external circuit connected to pins TX1 and TX2.

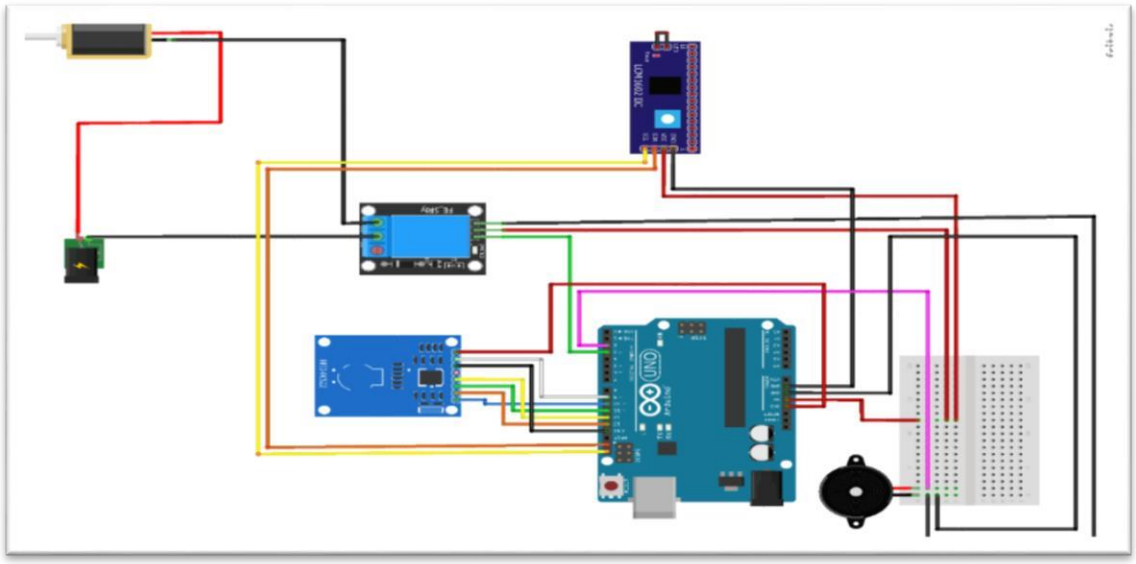
[7] During typical circuit operation, the overall current is below 100 mA.

[8] Typical value using a complementary driver configuration and an antenna matched to 40 □ between pins TX1 and TX2 at 13.56 MHz

Circuit Diagram



Schematic



Working –

Step 1: Rig up all the connections as shown in the circuit diagram.

Step 2: Arduino IDE will say 'Scan Your Card' o and is now ready for reading scanning RFID cards or key fobs.

Step 3: We programmed the RFID Card as the master card i.e., only RFID card has access and the key fob (Electromagnetic Card) doesn't.

Step 4: When I scan the RFID smart card, the Servo will activate which represents opening a gate or unlocking a door.

Step 5: This message is displayed 'Access Granted' message and also the UID of the card. If uploading is successful, you will see the glowing of LED.

Step 6: If I scan the electromagnetic card, the Servo remains in the closed position and buzzer is on indicating unauthorized access as it is not a master card.

Step 7: An 'Access Denied' message will be displayed on the screen.

Arduino IDE Code

```
#include <deprecated.h>

#include <MFRC522.h>

#include <MFRC522Extended.h>

#include <require_cpp11.h>

#include <SPI.h>

#include <MFRC522.h>

#define SS_PIN 10

#define RST_PIN 9

MFRC522 mfrc522(SS_PIN, RST_PIN);

// for a led

int lock = 6;

int serrure = 3;

char st[20];

void setup()

{

  pinMode(lock, OUTPUT);

  pinMode (serrure, OUTPUT);
```

```
  Serial.begin(9600);
  SPI.begin();
  mfrc522.PCD_Init();
  Serial.println("Access test via RFID tag");
  Serial.println();
}
void loop()
{
  if ( ! mfrc522.PICC_IsNewCardPresent())
  {
    return;
  }
  if ( ! mfrc522.PICC_ReadCardSerial())
  {
    return;
  }
  Serial.print("Tag :");
  String tag= "";
  byte caractere;
  for (byte i = 0; i < mfrc522.uid.size; i++)
  {
     Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
     Serial.print(mfrc522.uid.uidByte[i], HEX);
     tag.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
     tag.concat(String(mfrc522.uid.uidByte[i], HEX));
  }
  Serial.println();
  Serial.print("Message : ");
  tag.toUpperCase();
```

```
 if (tag.substring(1) == "33 B1 2E 98")
 {
   digitalWrite(lock, HIGH);
   Serial.println("TAG checked - Access allow !");
   Serial.println();
   delay(3000);
  // if you want to set a led
   digitalWrite(lock, LOW);
   digitalWrite(serrure, LOW);
   }
else if (tag.substring(1) == "21 D6 10 1A")
 {
   digitalWrite(lock, HIGH);
   Serial.println("TAG checked - Access allow !");
   Serial.println();
   delay(3000);
   digitalWrite(lock, LOW);
   digitalWrite(serrure, LOW);
   }
 else
 {
   Serial.println("Unknown tag - Access refused !!!");
   Serial.println();
   for (int i= 1; i<5 ; i++)
   {
     digitalWrite(lock, HIGH);
     delay(200);
     digitalWrite(lock, LOW);
     delay(200);
```

```
  }
  }
  delay(1000);
}
```

APPLICATIONS

1. Vehicle Access Control: The RFID and Electromagnetic Card system can be utilized to control access to vehicles. Authorized users, such as vehicle owners or designated personnel, can use their RFID-enabled key fobs or identification cards to gain entry into the vehicle. This eliminates the need for physical keys and enhances convenience and security.

2. Ignition System Security: By incorporating RFID and Electromagnetic Card technology into the ignition system, the proposed security system ensures that only authorized individuals can start the vehicle. The presence of an authenticated Electromagnetic Card and a valid RFID signal is required to activate the ignition, preventing unauthorized users from starting the engine.

3. Fleet Management and Tracking: The RFID functionality within the security system enables efficient fleet management and tracking. Each vehicle can be equipped with an RFID tag that provides real-time location information, allowing fleet managers to monitor the movement and status of their vehicles. This aids in optimizing route planning, improving logistics, and deterring theft.

4. Anti-Theft Measures: The combination of RFID and Electromagnetic Card technology acts as a robust deterrent against vehicle theft. The unique identification capabilities of RFID ensure that only authorized individuals can access the vehicle, while the dynamic magnetic fields generated by the Electromagnetic Cards make it extremely difficult for thieves to replicate or bypass the security system.

5. Enhanced Security in Car Sharing and Rental Services: Car sharing and rental services can benefit from the proposed security system by ensuring that only authorized users can access the vehicles. By equipping each vehicle with an RFID reader and integrating the Electromagnetic Card system, car sharing providers can prevent unauthorized individuals from using the vehicles, reducing the risk of theft or damage.

6. Secure Parking Systems: The RFID and Electromagnetic Card system can be integrated into parking infrastructure to provide secure and controlled access to parking facilities. Users can present their RFID-enabled cards to gain entry, ensuring that only authorized individuals can access the parking areas. This enhances the overall security of vehicles parked in these facilities.

CONCLUSION

In conclusion, the integration of RFID and Electromagnetic Card technology as a security system for automotives offers a comprehensive solution to address the growing concerns of unauthorized access and vehicle theft. The proposed system leverages the unique identification capabilities of RFID and the enhanced security features of Electromagnetic Cards to provide robust protection for vehicles. By eliminating the need for physical keys and implementing contactless access control, the system offers convenience to vehicle owners while ensuring that only authorized individuals can gain entry to the vehicle and start the engine. The dynamic magnetic fields generated by the Electromagnetic Cards add an additional layer of security, making it difficult for unauthorized users to replicate or bypass the system. The applications of this security system are diverse and encompass areas such as vehicle access control, ignition system security, fleet management and tracking, anti-theft measures, car sharing and rental services, and secure parking systems. These applications collectively contribute to improved security, operational efficiency, and peace of mind for vehicle owners and fleet managers. Further research and development are necessary to evaluate the feasibility, implementation, and performance of the proposed security system in real-world automotive environments. Additionally, considerations must be given to interoperability, scalability, and potential vulnerabilities to ensure the system's effectiveness and resilience against evolving security threats. Overall, the integration of RFID and Electromagnetic Card technology presents a promising approach to enhance automotive security, offering a reliable and advanced solution to safeguard vehicles and mitigate the risks associated with unauthorized access and theft.

Related Work –

[1] In article, the solution uses an Arduino UNO-based electronic door lock with RFID and a password. It serves as an electronic lock for doors, cabinets, and other places. In real life, the security system is significant in homes, workplaces, schools, and enterprises. The goal of this study is to create a keypad and RFID-based smart home security system. RFID is an ID card reader that uses an Arduino UNO to read ID card data. If the ID card reader is real, Arduino allows for keypad password entry. A lock-type solenoid unlocks if the password is valid. If the password is invalid, the solenoid locks. Smart cards and security management systems for users

can communicate with the electronic door lock system for home automation. This system is built with an RFID-enabled electronic door lock and a password-based Arduino UNO design. This article describes an electronic door lock system for home automation. The primary controller is a microcontroller called Arduino. The Arduino is a remarkably helpful gadget. They have many different applications. In order, for Arduino to receive and send data, additional components must be installed. Arduino is made to have all of that, and it is employed in industrial and educational applications since it is more cost-effective.

[2] Here the goal of this project is to create an intelligent lift access system that uses RFID (Radio Frequency Identification) and fuzzy logic as a safety controller for lift doors that will open in the event of a power outage. This research created an Arduino Uno-based lift access system with an RFID card, floor markers, and a fuzzy logic intelligence system. The information for each floor is stored on an RFID card that is located on each floor. Research and development (R&D) techniques are used in this study together with a waterfall development model. There are various stages to the research process, including requirement analysis, design, implementation, testing, operation, and maintenance. It may be inferred from the study and development of the intelligent lift control system that a waterfall model was used to build the system. RFIDRC522 reading distance testing, component functionality testing, and RFID response time measurement testing are all included in integration and system testing. According to the test results, the RFID-RC522 can be read and has a quick response time. Additionally, as a lift control system, the parts and all functionality work well.

[3] In this article, security is a top priority for any household. Numerous attempts have been made to secure the entrance and restrict access to the home in this age of steadily rising crime rates. Mortise locks, deadbolts, door chains, and other conventional methods all have their limitations. Some of them are frail but substantial in weight. Others are more of a hassle than anything that offers real advantages. This study suggests a safe door lock system based on RFID and aims to capitalize on its many benefits over conventional door security systems. A wireless technology called radio frequency identification (RFID) enables the creation of flexible, scalable control systems. In this work, an effort has been made to create a secure door lock system that offers some practical security measures and is user-friendly. Without significantly altering the programmed itself, the used components can be replaced with similar types of components. The use of an Arduino Nano board, for instance, to accomplish the same thing in a much smaller package size will be extremely beneficial in practical usage.

[4] This paper gives the outline of growing support for safe structures that need to be tried, as well as sincere and wise responses for the organizations and friends. Research has shown certain notable improvements that make programming much simpler and less time-consuming as a direct result of switching from microcontroller to Arduino. Arduino significantly simplifies the circuit and programming learning process. The benefit of the RFID system is that it operates contactless and without a line of sight. Future applications of this concept include a Smart ID cart that can be connected to wireless technologies to make it totally portable. The document addresses potential attacks that could violate someone's privacy as well as precautions. The RFID system went beyond simple item-level labelling. There is a great deal of interest in

reducing the price of producing RFID tags because of the wide range of uses for them. It turns out that 3D printing tags could replace conventional production because it is becoming more affordable.

[5] This article reviews recent technical studies on the issues relating to RFID (Radio Frequency Identification) security and privacy. This study investigates methods put forth by researchers to safeguard privacy and ensure the integrity of RFID systems, as well as the social and technical background of their work. It is amazing how a simple piece of technology, like an RFID tag, which is really just a wireless license plate, can give birth to the complicated jumble of privacy and security issues that we explore in this article. RFID security and privacy are interesting study subjects that integrate a variety of fields, including encryption, supply-chain logistics, hardware design, signal processing, and privacy rights. Small hardware components known as sensors are reminiscent of RFID tags. However, there is no distinction between active RFID tags and sensors other than name. The user's impression of security and privacy in an RFID system is another crucial component of RFID security. As RFID technology advances, it will be able to safeguard an increasing number of different types of logical and physical access. to develop practical RFID systems that allow for well-informed policy decisions.

[6] This paper presents the security of radio-frequency distinguishing proof (RFID). Most RFID frameworks contain an endeavor subsystem that produces the information procured from RFID subsystem exchanges valuable to a upheld commerce handle. There are diverse sorts of RFID labels in terms of the taken a toll, estimate, execution, and security instruments. Based on the control source, RFID labels are categorized into detached, dynamic, semi-active, and semi-passive. RFID frameworks may work totally different radio frequencies, extending from moo recurrence, tall recurrence, ultra-high recurrence, and microwave recurrence. Numerous security attacks can exploit the weaknesses of RFID systems. Numerous methods for lessening the vulnerability of RFID systems exist, such as cryptographic approaches, anti-collision algorithms, and additional mitigation tactics. Due to constraints in power and processing capabilities, RFID tag implementations require lightweight security mechanisms. Randomized hash locking is a viable option for monitoring individuals possessed with limited RFID tags.

[7] The article offers a comprehensive review of security and privacy guidelines for RFID-based IoT applications. It highlights the need for stronger measures to protect privacy and security in this context. The authors address research questions related to device safety, user privacy, RFID standards, and threat prevention. They provide a well-structured analysis of the subject, identifying areas for improvement and proposing guidelines to enhance security. The study focuses on RFID standards and their recommended security features, showcasing advancements in authentication protocols. It also discusses attacks on RFID-based IoT applications, highlighting compromised security goals and available mitigation strategies. The article recognizes the achievements made in secure RFID systems while emphasizing the need for further development. The proposed security and privacy guidelines are a significant contribution. They provide practical recommendations to enhance security by design for RFID-enabled devices. The authors acknowledge the limitation of not addressing data security within IoT devices, suggesting potential avenues for future research.

[8] This paper talks about a system that uses special chips to make sure only the right people can get into a car and prevent it from being stolen. The system uses a small computer piece called an Arduino Uno and a special technology called RFID. It tries to save money while also making things work better. The system makes sure the car engine stops if other security measures don't work by using an immobilizer. This idea is about using a special electronic system to enter a car without needing a physical key. It works using a technology called RFID. An alarm goes off if someone who isn't allowed tries to get into the car. When the alarm is turned off, the engine can start using the standby immobilizer. To turn on the car, you need to put the key in the special spot and push a hidden button. If you try to start the engine again after turning it off, you need to press a hidden button or the car won't start because of the immobilizer. The system has not been used in regular cars or trucks, but the paper says the tests were good. The paper didn't provide enough information about how good the RFID system is, how hard it is to really use it, and what problems might happen when using it.

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