RFID LOCK INCORPORATED WITH A TEMPERATURE SENSOR USING ARDUINO

PROJECT REPORT

Bachelor of Technology in Electronics Engineering

By

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RFID Lock Incorporated with a Temperature Sensor

1- ABSTRACT:

Security is one of the major concerns for households, offices, malls, hotels, etc. There have been various approaches to address this concern. Door locks are one of the ways used for solving the above problem, but traditional door lock security systems have various loopholes that could be broken down to gain access to the desired places and it creates a concern for a secure lifestyle and proper working environment. RFID and key locks are two popular locks that are used by most of the people everyday.

RFID stands for **RADIO FREQUENCY IDENTIFICATION** and it is a non-contact technology that is broadly used in many industries for tasks like personnel tracking, access control , supply chain management, books tracking in library and many more. Many companies use RFID locks for business efficiency since they track the person carrying the card and record their movements with a smart card system. RFID or password based door lock systems can be used to enhance security and privacy. Each key card has data encoded on an RFID chip that is machine- readable. RFID can also be implemented with a biometric system of fingerprint detection. The physical advantage of RFID locks is, since there is no exposed card slot , RFID locks are generally waterproof. They also provide easier, better access control than key locks or traditional locks. Data on keywords is secure because it takes specialized equipment to read it . This maintains the lock security system and this is a technological advantage of RFID locks. RFID cards can be programmed and reprogrammed as the aspects of security requirements change . For example, if an employee leaves, the card can be deactivated or reprogrammed for a new employee. It also allows changes to areas that person can access as their permission grow and change .

2- IDEA-

We are designing an Arduino UNO device based flexible working device that provides physical security using RFID technology. The RFID lock can be implemented as only the user identified by the valid RFID card could be able to unlock. At public places, like malls and hospitals such locks can be integrated. An additional feature to be incorporated along with the RFID fingerprint lock is the temperature sensor. The temperature sensor programmed to sense the temperature and unlock the lock automatically above a certain fed in programmed input high temperature would be of use in case of fires.

3- BACKGROUND-

The study of different types of security systems that are used in houses and offices nowadays has been analyzed. It has been found that although these methods are helpful in the initials days, but eventually they become outdated and pose much threat to security. The implementation of such security systems requires more investment. The pros and cons of such systems has been discussed below-

(a) Password authentication

This method is simple to use and deploy but on the other hand it does not provide strong identity check.

(b) Face detector lock

It strengthens security measures but threatens individual and societal privacy.

(c) Voice recognition

The method of speech recognition is faster and thus it take lesser implementation time but takes a longer time for training and setting up of the model.

(d) Iris scanner

It requires no physical contact for detection but on the other hand it takes requires close proximity to the detector which may cause discomfort for individuals.

(e) RFID reader authentication

RFID data can be stored, managed and shared online. An active, battery-powered RFID, is equipped with an infrastructure that leverages WiFi to communicate data to healthcare systems. RFID does not track in real time and is used for items that are important for the function.

4- USES IN REAL LIFE-

•Many kiosks use RFID to either manage resources or interact with users.

•DVD rental kiosks use RFID DVD tags to make sure customers receive their selected movie rental.

•Embedded RFID reader interrogates badges or cards in interactive media displays.

•Use of RFID is growing and expanding as more industries and companies are investing in this technology.

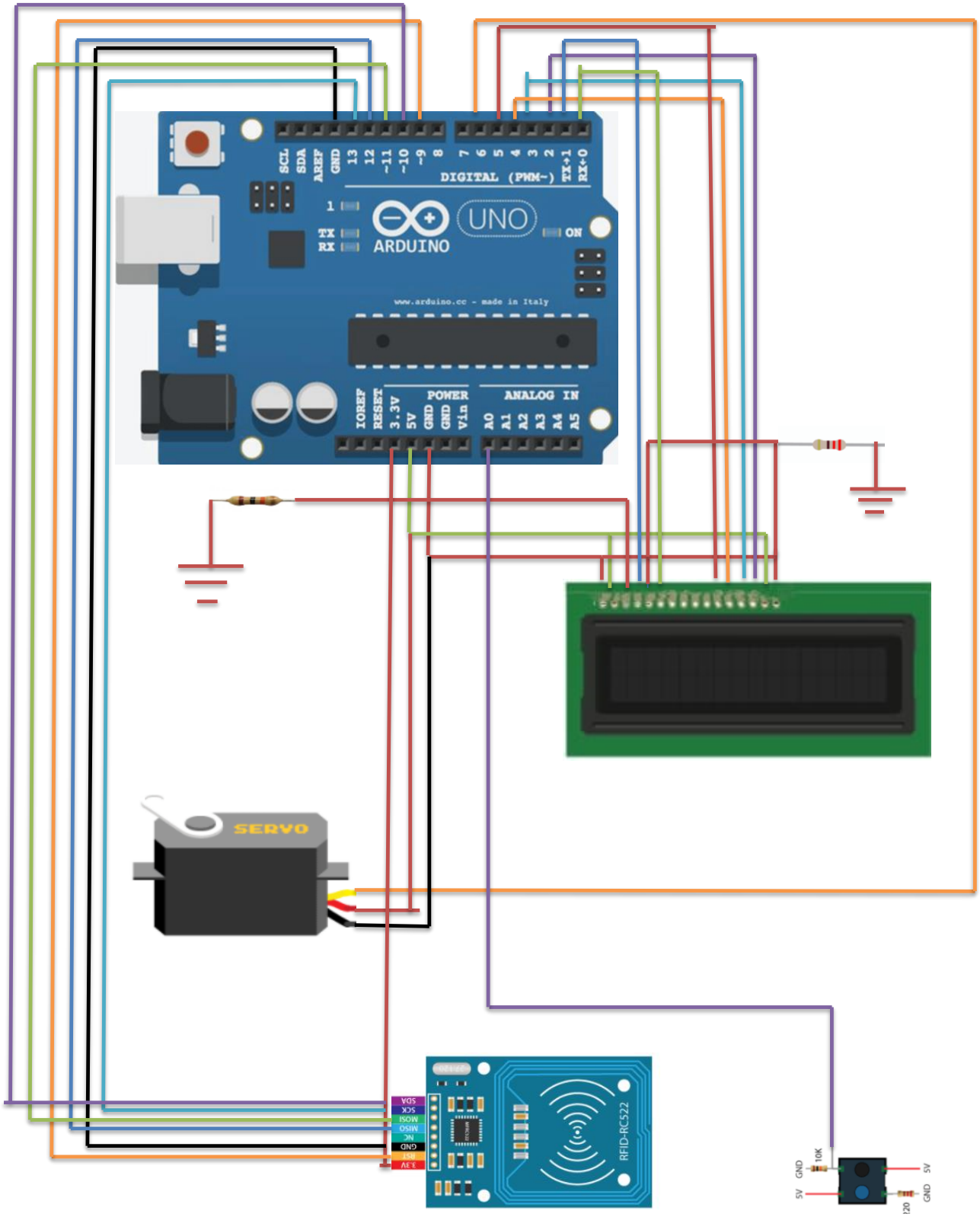
•Employees using RFID can get an accurate scan from several feet away and process dozens of scans in just a second.

•Amazon, BJC HealthCare, General Steel and Inditex are some companies where RFID is used.

5- HARDWARE USED-

- Card Reader Module for RFID RC522 with Smart Card Chip
- SG90 Micro Servo Motor 9G
- 16x2 LCD Display Module Based on HD44780 Controller
- Arduino UNO
- Solderless Circuit Breadboard with Flexible Breadboard Jumper Wires
- Semiconductor CNY70 optical sensor

6- CIRCUIT-


DIGITAL (PWM~)
UNO
ARDUINO
ON
www.arduino.cc - made in Italy
POWER
ANALOG IN
SERVO
RFID-RC522
SDA
SCK
MOSI
MISO
NC
GND
RST
3.3V
GND
10K
5V
5V
GND

SOURCE CODE-

```
#include <SPI.h>
#include <MFRC522.h>
#include <LiquidCrystal.h>
#include <Servo.h>
#define RST_PIN   9
#define SS_PIN    10
byte readCard[4];
char* myTags[100] = {};
int tagsCount = 0;
String tagID = "";
bool successRead = false;
bool correctTag = false;
int proximitySensor;
bool doorOpened = false;
// Create instances
MFRC522 mfrc522(SS_PIN, RST_PIN);
const int rs = 1, en = 0, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
Servo myServo; // Servo motor
void setup() {
  // Initiating
  SPI.begin();       // SPI bus
  mfrc522.PCD_Init(); //  MFRC522
  lcd.begin(16, 2);   // LCD screen
  myServo.attach(8);  // Servo motor
  myServo.write(10); // Initial lock position of the servo motor
  // Prints the initial message
```

```
  lcd.print("-No Master Tag!-");
  lcd.setCursor(0, 1);
  lcd.print("    SCAN NOW");
  // Waits until a master card is scanned
  while (!successRead) {
    successRead = getID();
    if ( successRead == true) {
      myTags[tagsCount] = strdup(tagID.c_str()); // Sets the master tag into position 0 in the array
      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print("Master Tag Set!");
      tagsCount++;
    }
  }
  successRead = false;
  printNormalModeMessage();
}
void loop() {
  int proximitySensor = analogRead(A0);
  // If door is closed...
  if (proximitySensor > 200) {
    if ( ! mfrc522.PICC_IsNewCardPresent()) { //If a new PICC placed to RFID reader continue
      return;
    }
    if ( ! mfrc522.PICC_ReadCardSerial()) {   //Since a PICC placed get Serial and continue
      return;
    }
```

```
tagID = "";
// The MIFARE PICCs that we use have 4 byte UID
for ( uint8_t i = 0; i < 4; i++) {  //
  readCard[i] = mfrc522.uid.uidByte[i];
  tagID.concat(String(mfrc522.uid.uidByte[i], HEX)); // Adds the 4 bytes in a single String variable
}
tagID.toUpperCase();
mfrc522.PICC_HaltA(); // Stop reading

correctTag = false;
// Checks whether the scanned tag is the master tag
if (tagID == myTags[0]) {
  lcd.clear();
  lcd.print("Program mode:");
  lcd.setCursor(0, 1);
  lcd.print("Add/Remove Tag");
  while (!successRead) {
    successRead = getID();
    if ( successRead == true) {
      for (int i = 0; i < 100; i++) {
        if (tagID == myTags[i]) {
          myTags[i] = "";
          lcd.clear();
          lcd.setCursor(0, 0);
          lcd.print("  Tag Removed!");
          printNormalModeMessage();
          return;
```

```
      }
     }
     myTags[tagsCount] = strdup(tagID.c_str());
     lcd.clear();
     lcd.setCursor(0, 0);
     lcd.print("   Tag Added!");
     printNormalModeMessage();
     tagsCount++;
     return;
    }
  }
}
successRead = false;
// Checks whether the scanned tag is authorized
for (int i = 0; i < 100; i++) {
  if (tagID == myTags[i]) {
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print(" Access Granted!");
    myServo.write(170); // Unlocks the door
    printNormalModeMessage();
    correctTag = true;
  }
}
if (correctTag == false) {
  lcd.clear();
  lcd.setCursor(0, 0);
```

```
      lcd.print(" Access Denied!");
      printNormalModeMessage();
    }
  }
  // If door is open...
  else {
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print(" Door Opened!");
    while (!doorOpened) {
      proximitySensor = analogRead(A0);
      if (proximitySensor > 200) {
        doorOpened = true;
      }
    }
    doorOpened = false;
    delay(500);
    myServo.write(10); // Locks the door
    printNormalModeMessage();
  }
}

uint8_t getID() {
  // Getting ready for Reading PICCs
  if ( ! mfrc522.PICC_IsNewCardPresent()) { //If a new PICC placed to RFID reader continue
    return 0;
  }
```

```
  if ( ! mfrc522.PICC_ReadCardSerial()) {   //Since a PICC placed get Serial and continue
    return 0;
  }
  tagID = "";
  for ( uint8_t i = 0; i < 4; i++) {  // The MIFARE PICCs that we use have 4 byte UID
    readCard[i] = mfrc522.uid.uidByte[i];
    tagID.concat(String(mfrc522.uid.uidByte[i], HEX)); // Adds the 4 bytes in a single String variable
  }
  tagID.toUpperCase();
  mfrc522.PICC_HaltA(); // Stop reading
  return 1;
}
void printNormalModeMessage() {
  delay(1500);
  lcd.clear();
  lcd.print("-Access Control-");
  lcd.setCursor(0, 1);
  lcd.print(" Scan Your Tag!");
}
```

7- WORKING OF RFID LOCK:

RFID cards are designed to transmit a signal on a specific frequency to the card reader , via a small device known as a smart chip embedded inside the plastic . Once the lock on the door has received this signal from the card reader, it can then be opened using the door's lockers or push bar , as it would normally be.

Here is the working video of model :

https://drive.google.com/file/d/1ntt5mHxiwARo557SdwpcebGUAnuHC-88/view?usp=sharing

8- IMPLEMENTATION-

We will use tags that are based on the MIFARE protocol and the MFRC522 RFID reader. These tags have 1kb of memory and have a microchip that can do arithmetic operations. Their operating frequency is 13.56 MHz and the operating distance is up to 10 cm depending on the geometry of antenna. If we bring one of these tags in front of a light source we can notice the antenna and the microchip. As for the RFID reader module, it uses the SPI protocol for communication with the Arduino board . We implement the system using passive tags . The RFID tag is detected when touched or come in the range of few millimetres from reader. The tag is automatically detected by RFID reader in every millisecond and reader sent the information containing by tag to the central control through serial port.

RFID MODULE	ARDUINO
3.3 V	Pin 3.3 v
RST	Pin 9
GND	GND
MISO	Pin 12
MOSI	Pin 11
SCK	Pin 13
SDA	Pin 10

First we have to set a master tag for the master to be identified and then the system goes into normal mode. If we scan an unknown tag the access will be denied, but if we scan the master we will enter a program mode from where we can add and authorize the unknown tag. So now if we scan the tag again the access will be granted so we can open the door. The door will automatically lock after we will close the door . If we want to remove a tag from the system we just have to go again into program mode , scan the tag and it will be removed.

9- CONCLUSION:

In this project we have implemented a digital security system contains door lock system using passive RFID . A centralised system is being deployed for controlling and transaction operations. The door locking system functions in real time as when the user put the tag in contact with the reader , the door opens and the check- in information is stored in central server along with basic information of the user. Here we utilise RFID technology to provide solution for secure access of a space while keeping record of the user.