VIETNAM NATIONAL UNIVERSITY HO CHI MINH CITY
HO CHI MINH UNIVERSITY OF TECHNOLOGY
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REPORT

ELECTRICAL ELECTRONIC CIRCUITS

TOPIC PROJECT:

CARD RECOGNITION FOR LOCK DOOR SYSTEM

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I. INTRODUCTION

1. Overview

We can say that the 21st century has been strongly developing in the Information Technology (IT) .IT is changing the world quickly and step-by-step bringing the knowledge of humanity closer together. It is thanks to the development of smart systems around the world. Today, smart system has played an important role for us people. Smart system will install in workplaces, houses, public places, ... Its help people control intelligent equipment faster, more convenient, more efficient and not limited in space and time with cheaper prices.

With that importance, each of us needs to equip ourselves with a basic knowledge of programming in system. If you have a vast amount of knowledge about this background, then you will have a very easy job search opportunity. Because, you can take on IT jobs at companies that are not specialized in IT, but these companies all have IT applications to manage, especially smart systems in organizations such as banks, manufacturing companies. services, restaurants, hotels, e-commerce companies, schools, … Due to these real needs our team decided to using "Card Recognition For Lock Door" in order to make the system practical and practical.

2. Research basic Radio Frequency Identification (RFID)

2.1. What is Radio Frequency Identification?

Radio Frequency Identification is a technology used to connect radio waves to automatically identify and track identification tags attached to objects. This technology uses an electronic tag containing information electronically stored, subject to track. A tag has a circuit that collects energy from the RFID reader radio waves emitted when querying, and uses this energy to transmit the tag's information code. Effective range is several centimeters. Active tags with local power (such as batteries) are up to hundreds of meters from the RFID reader. Unlike barcodes, the tag does not need to be in the reader's line of sight, so it can be attached to the object being tracked. This technology allows to identify objects through the radio receiver system, from which it is possible to monitor, manage or track each object. An automatic identification method

based on remote data storage, using an RFID tag device and an RFID reader. RFID thus a method of Automatic Identification and Data Collection AIDC (Automatic Identification and Data Capture).

2.2. Design of the RFID system

An RFID system or device is made up of two indispensable basic components that are the RFID code generator, often referred to as the RFID tag and the reader. This reading device will be fitted with an electromagnetic wave antenna, the RFID transmitter will be attached to the identifiable object, each RFID tag device contains a certain number and does not overlap.

2.3. Characteristics

- The RFID system uses a wireless system to receive and transmit radio waves, not to use light rays as bar codes.

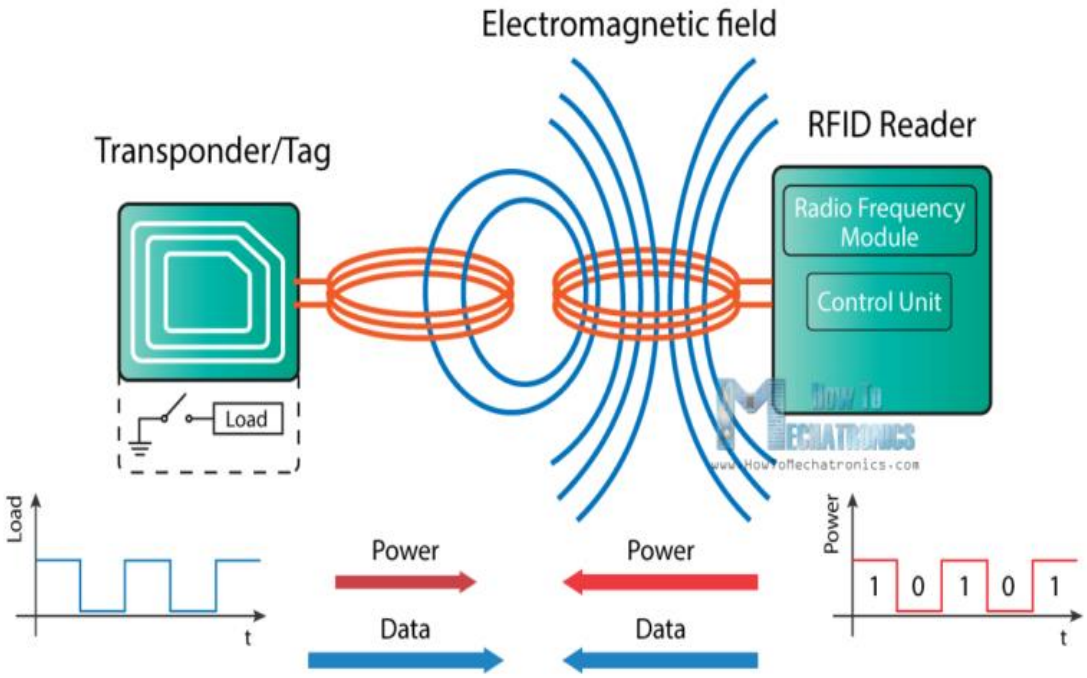
- The frequencies commonly used in RFID systems are 125Khz or 900Mhz.
- Information can be transmitted over small distances without the need for physical contact.
- Can read information across environments, materials such as: concrete, snow, fog, ice, paint, and other challenging environmental conditions where bar codes and other technologies cannot promote fruit.

2.4. Operation

2.4.1. How RFID works?

The RFID reader emits electromagnetic waves at a certain frequency, when the RFID tag device in the active area senses this electromagnetic wave and receives the energy, then transmits it to the RFID Reader to know the code. mine. From there, the RFID reader can identify which tags are in the active area.

2.4.2. Principle of operation



The tag is powered, it can extract the information passed from the reader and send the message back to the reader, using a technique called load manipulation. Turning the load on and off at the tag antenna will affect the reader's antenna power consumption which can be measured as a voltage drop. This voltage change will be recorded as 0 and 1, and that's how the data is passed from the card to the reader.

There is also another way of transferring data between the reader and the tag, called a backscatter coupling. In this case, the tag uses some of the received energy to generate another electromagnetic field that will be selected by the reader antenna.

2.5. Security

RFID chip tags contain many different identification codes, usually 32bit corresponding to more than 4 billion different codes. Beside when shipped each RFID chip card is assigned a different number. Therefore, an object is attached with an RFID chip, the possibility of mistakenly identifying the object with another RFID chip tag is very low, the probability is 1 in 4 billion. In general, with the above way of working, RFID has a very high security and safety, we can safely use it in object monitoring problems.

3. Applications

- In transportation and transportation.
- In business, sales.
- Security, control.
- Human resources management.
- Health, education.

4. Meaning

Thus, if this topic is successfully implemented, it will bring great significance in both practice and theory.

- The theoretical meaning of the topic:

The entire program and explanation of the topic will become a research document, quick reference, easy to understand, practical for teachers and students, who love Electrical Electronic Circuits and applications, especially in the field of building program on Arduino environment.

- Practical significance of the topic:

With the success of the topic, it will contribute to optimizing the control process, eliminating too high cost of booths, and investment efficiency.

II. ANALYSIS PROJECT AND APPLICATON TO LOCK DOOR

1. About My Application

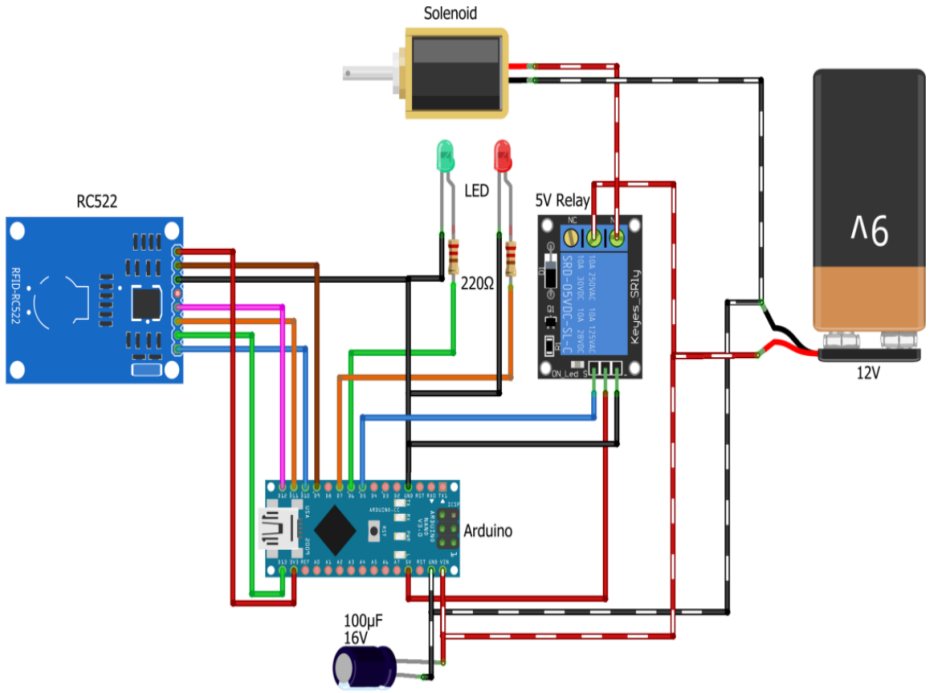
We can apply us project to security aspect so we want to use my knowledge of RFID through using Arduino to program user requirements for security at works as well as at home, hotels, ... by installing electrical lock with electrical relay to activate electric lock and use a master card to scan through equipment that can open door. This job supports high security rooms for jobs that require high quality of security as well as people who have high responsibilities in the group.

2. Components

- Arduino Nano x1
- RFID sensor (MFRC522) x1
- RFID blank card x1
- RFID blue tag x1
- Solenoid lock x1
- Replay module DC5V x1
- Wires
- Breadboard x1
- Battery
- Capacitor 100uF x1
- Resistors 220ohms x2
- Led (red and blue) x2

3. Experimental Procedure

- Drawing circuits



- Real circuits

4. Identity Requirement User and Algorithm

- Initial, the system only saves the number serial of blank card in the memory and the empty value tags, so we need to scan blank card and at the same time we scan RFID tag to add the serial number in tag, thus the serial number in tag is saved in memory.

- When we use RFID tags scan to RFID sensor and the number in memory that matched to the serial in tags, thus it makes relay active to solenoid lock opening and the led blue is light.

- If the serial number in tag that is not added to memory or that is not matched number in memory, so the solenoid lock still closing and the led red is light.

5. Built program

RFID_RC522_MasterCard_MultipleAccess

```
//Author:Trinh Son Lam
//Subject:RFID for system lock
#include <SPI.h>
#include <Wire.h>
#include <MFRC522.h>

#define RST_PIN 9
#define SS_PIN  10

#define STATE_STARTUP       0
#define STATE_STARTING      1
#define STATE_WAITING       2
#define STATE_SCAN_INVALID  3
#define STATE_SCAN_VALID    4
#define STATE_SCAN_MASTER   5
#define STATE_ADDED_CARD    6
#define STATE_REMOVED_CARD  7

#define REDPIN 7
#define GREENPIN 6
#define Relay 5

const int cardArrSize = 10;
const int cardSize    = 4;
byte cardArr[cardArrSize][cardSize];
byte masterCard[cardSize] = {131,35,56,187};   //Change Master Card ID
byte readCard[cardSize];
byte cardsStored = 0;

// Create MFRC522
MFRC522 mfrc522(SS_PIN, RST_PIN);
// Set the LCD I2C address

byte currentState = STATE_STARTUP;
unsigned long LastStateChangeTime;
unsigned long StateWaitTime;

//-------------------------------------------------------------------------
int readCardState()
{
  int index;

  Serial.print("Card Data - ");
  for(index = 0; index < 4; index++)
  {
    readCard[index] = mfrc522.uid.uidByte[index];
    Serial.print(readCard[index]);
    if (index < 3)
    {
      Serial.print(",");
    }
  }
  Serial.println(" ");

  //Check Master Card
  if ((memcmp(readCard, masterCard, 4)) == 0)
  {
    return STATE_SCAN_MASTER;
  }

  if (cardsStored == 0)
  {
    return STATE_SCAN_INVALID;
  }

  for(index = 0; index < cardsStored; index++)
  {
    if ((memcmp(readCard, cardArr[index], 4)) == 0)
    {
      return STATE_SCAN_VALID;
    }
  }

 return STATE_SCAN_INVALID;
}

//-------------------------------------------------------------------------
void addReadCard()
{
  int cardIndex;
  int index;

  if (cardsStored <= 20)
  {
    cardsStored++;
    cardIndex = cardsStored;
    cardIndex--;
  }

  for(index = 0; index < 4; index++)
  {
    cardArr[cardIndex][index] = readCard[index];
  }
```

```
  }
}
//------------------------------------------------------------------------
void removeReadCard()
{
  int cardIndex;
  int index;
  boolean found = false;

  for(cardIndex = 0; cardIndex < cardsStored; cardIndex++)
  {
    if (found == true)
    {
      for(index = 0; index < 4; index++)
      {
        cardArr[cardIndex-1][index] = cardArr[cardIndex][index];
        cardArr[cardIndex][index] = 0;
      }
    }

    if ((memcmp(readCard, cardArr[cardIndex], 4)) == 0)
    {
      found = true;
    }
  }

  if (found == true)
  {
    cardsStored--;
  }
}

//------------------------------------------------------------------------
void updateState(byte aState)
{
  if (aState == currentState)
  {
    return;
  }

  // do state change
  switch (aState)
  {
    case STATE_STARTING:
      StateWaitTime = 1000;
      digitalWrite(REDPIN, HIGH);
      digitalWrite(GREENPIN, LOW);
      break;
case STATE_WAITING:
  StateWaitTime = 0;
  digitalWrite(REDPIN, LOW);
  digitalWrite(GREENPIN, LOW);
  break;
case STATE_SCAN_INVALID:
  if (currentState == STATE_SCAN_MASTER)
  {
    addReadCard();
    aState = STATE_ADDED_CARD;
    StateWaitTime = 2000;
    digitalWrite(REDPIN, LOW);
    digitalWrite(GREENPIN, HIGH);
  }
  else if (currentState == STATE_REMOVED_CARD)
  {
    return;
  }
  else
  {
    StateWaitTime = 2000;
    digitalWrite(REDPIN, HIGH);
    digitalWrite(GREENPIN, LOW);
  }
  break;
case STATE_SCAN_VALID:
  if (currentState == STATE_SCAN_MASTER)
  {
    removeReadCard();
    aState = STATE_REMOVED_CARD;
    StateWaitTime = 2000;
    digitalWrite(REDPIN, LOW);
    digitalWrite(GREENPIN, HIGH);
  }
  else if (currentState == STATE_ADDED_CARD)
  {
    return;
  }
  else
  {
    StateWaitTime = 2000;
    digitalWrite(REDPIN, LOW);
    digitalWrite(GREENPIN, HIGH);
    digitalWrite(Relay,LOW);
    delay(3000);
    digitalWrite(Relay,HIGH);
  }
```

```
      break;
    case STATE_SCAN_MASTER:
      StateWaitTime = 5000;
      digitalWrite(REDPIN, LOW);
      digitalWrite(GREENPIN, HIGH);
      break;
  }
  currentState = aState;
  LastStateChangeTime = millis();
}
void setup()
{
  SPI.begin();           // Init SPI Bus
  mfrc522.PCD_Init();    // Init MFRC522

  LastStateChangeTime = millis();
  updateState(STATE_STARTING);

  pinMode(REDPIN, OUTPUT);
  pinMode(GREENPIN, OUTPUT);
  pinMode(Relay, OUTPUT);
  digitalWrite(Relay,HIGH);
  Serial.begin(9600);
}
void loop()
{
  byte cardState;

  if ((currentState != STATE_WAITING) &&
      (StateWaitTime > 0) &&
      (LastStateChangeTime + StateWaitTime < millis()))
  {
    updateState(STATE_WAITING);
  }

  // Look for new cards
  if ( ! mfrc522.PICC_IsNewCardPresent())
  {
    return;
  }
  // Select one of the cards
  if ( ! mfrc522.PICC_ReadCardSerial())
  {
    return;
  }
  cardState = readCardState();
  updateState(cardState);
```

III. Summaries

1. Result of Project

After a period of implementation, we have completed the system according to the set schedule and requirements. Learn the system carefully and accurately. Analysis clearly:

- The problem sets out.
- Current status of the system and user requirements.
- The functions required of the system.
- Designing the functions of the system to meet the user's requirements

  friendly, easy to use.

- The system to the test successfully.

2. Limitations

The topic is limited in terms of use.

3. Recommendation in the future

In the near future, our team will continue to research, analyze and design the system so that the system can be applied to system lock in companies, manage human resources, security room…

References

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