RFID and Keypad Based Security System Using 8051 Microcontroller

A Mini Project Report

submitted by:

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REPORT ON

RFID and Keypad Based Security System Using 8051 Microcontroller

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ABSTRACT

Radio Frequency Identification (RFID) is one member in the family of Automatic Identification and Data Capture (AIDC) technologies and is a fast and reliable means of identifying any material object. The significant advantage of all types of RFID systems is the non-contact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such as snow, fog, ice, paint, crusted grime, and other visually and environmentally challenging conditions, where barcodes or other optically read technologies would be useless.

This project can provide security for the industries, companies, etc. This security system gives information about the authorized and unauthorized persons. Primarily, the two main components involved in a Radio Frequency Identification system are the Transponder (tags that are attached to the object) and the Interrogator (RFID reader).

In this project, when the card is brought near to the RFID module it reads the data in the card.The data in the card is compared with the data in the program memory and displays authorized or unauthorized message. The door opens for an authorized person, closes for an unauthorized person; it alerts the persons through a buzzer. The RFID module indicates a buzzer whenever it reads the data from the RFID card.

INTRODUCTION

In this project, we will build up an RFID and Keypad based security framework.

This venture is executed by utilizing 8051 microcontroller. RFID Technology is normally utilized in schools, universities, office and stations for different purposes to naturally validate individuals with legitimate RFID labels.

Here we will check the RFID tag, alongside a secret phrase related with the tag, for permissible entry. When an individual puts his RFID tag to RFID Reader, the reader analyses the label's information and sends it to the 8051 microcontroller. The microcontroller compares this information with the pre-characterized information. In case both the information match, the microcontroller requests secret phrase.

On entering the secret word, the microcontroller compares the entered secret key and the predefined secret word. If the secret phrase entered is same as the one already stored, entryway will open. If either the RFID tag or the secret key is invalid, the buzzer rings signalling no access to enter.

8051 Microcontroller:

The microcontroller is one kind of integrated circuit that includes 40-pins with dual inline package or DIP, RAM-128 bytes, ROM-4kb & 16-bit timers–2. Based on the requirement, it includes addressable & programmable 4 – parallel 8-bit ports. In the 8051 microcontroller architecture, the system bus plays a key role to connect all the devices to the central processing unit. This bus includes a data bus- an 8-bit, an address bus-16-bit & bus control signals. Other devices can also be interfaced throughout the system bus like ports, memory, interrupt control, serial interface, the CPU, timers.

There are two buses in 8051 Microcontroller one for the program and another for data. As a result,it has two storage rooms for both programs and data of 64K by 8 sizes. The microcontroller comprises of 8-bit accumulator & an 8-bit processing unit. It also consists of 8 bit B register as majorly functioning blocks and 8051 microcontroller programming is done with embedded C language using Keil software. It also has several other 8 bit and 16-bit registers.

For internal functioning & processing Microcontroller, 8051 comes with integrated built-in RAM. This is prime memory and is employed for storing temporary data. It is an unpredictable memory i.e. its data can get be lost when the power supply to the Microcontroller switched OFF. This microcontroller is very simple to use, affordable less computing power, simple architecture & instruction set.

Features of 8051 Microcontroller:

8-bit CPU through two Registers A & B.

8K Bytes – Internal ROM and it is a flash memory that supports while programming the system.

256 Bytes – Internal RAM where the first RAM with 128 Bytes from 00H to 7FH.

The remaining 128 bytes of the RAM from 80H to FFH include Special Function Registers (SFRs).

These registers control various peripherals such as Serial Port, Timers, all I/O Ports, etc.

Oscillator & CLK Circuit.

Control Registers like PCON, SCON, TMOD, TCON, IE, and IP.

16-bit Timers or Counters -2 like T0 & T1.

Program Counter – 16 bit & DPRT (Data Pointer).

I/O Pins – 32 which are arranged like four ports such as P0, P1, P2 & P3.

Stack Pointer (SP) – 8bit & PSW (Processor Status Word).

Serial Data Tx & Rx for Full-Duplex Operation

RFID Reader:

A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader.

RFID is a technology similar in theory to bar codes. However, the RFID tag does not have to be scanned directly, nor does it require line-of-sight to a reader. The RFID tag it must be within the range of an RFID reader, which ranges from 3 to 300 feet, in order to be read. RFID technology allows several items to be quickly scanned and enables fast identification of a particular product, even when it is surrounded by several other items.

RFID tags have not replaced bar codes because of their cost and the need to individually identify every item.

4x3 Keypad:

A Matrix keypad is the most commonly used input device in many of the application areas like digital circuits, telephone communications, calculators, ATMs, and so on. A matrix keypad consists of a set of push button or switches which are arranged in a matrix format of rows and columns. These keypads are available in configurations like 3×4 and 4×4 based on the application it is implemented for. Internal diagram of this matrix keypad is shown in the below figure.

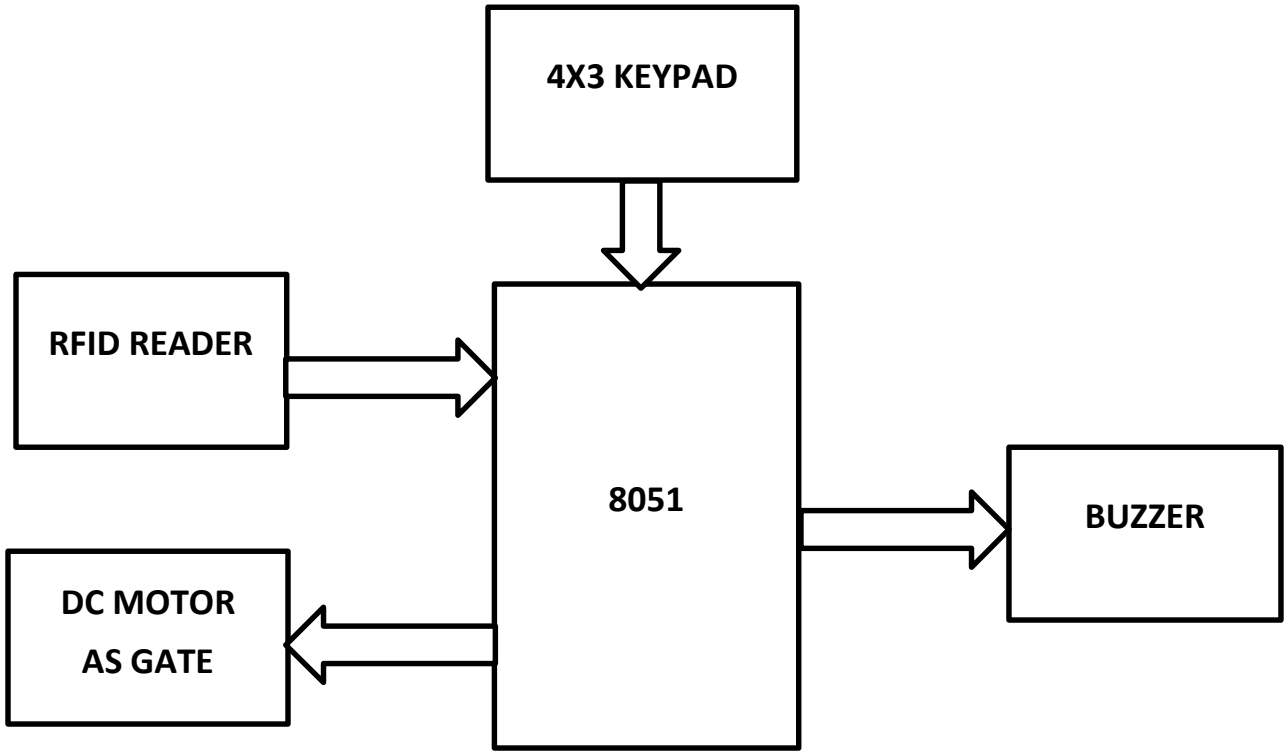
DC Motor:

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current in part of the motor.

Buzzer:

A **buzzer** or **beeper** is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (*piezo* for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

BLOCK DIAGRAM:



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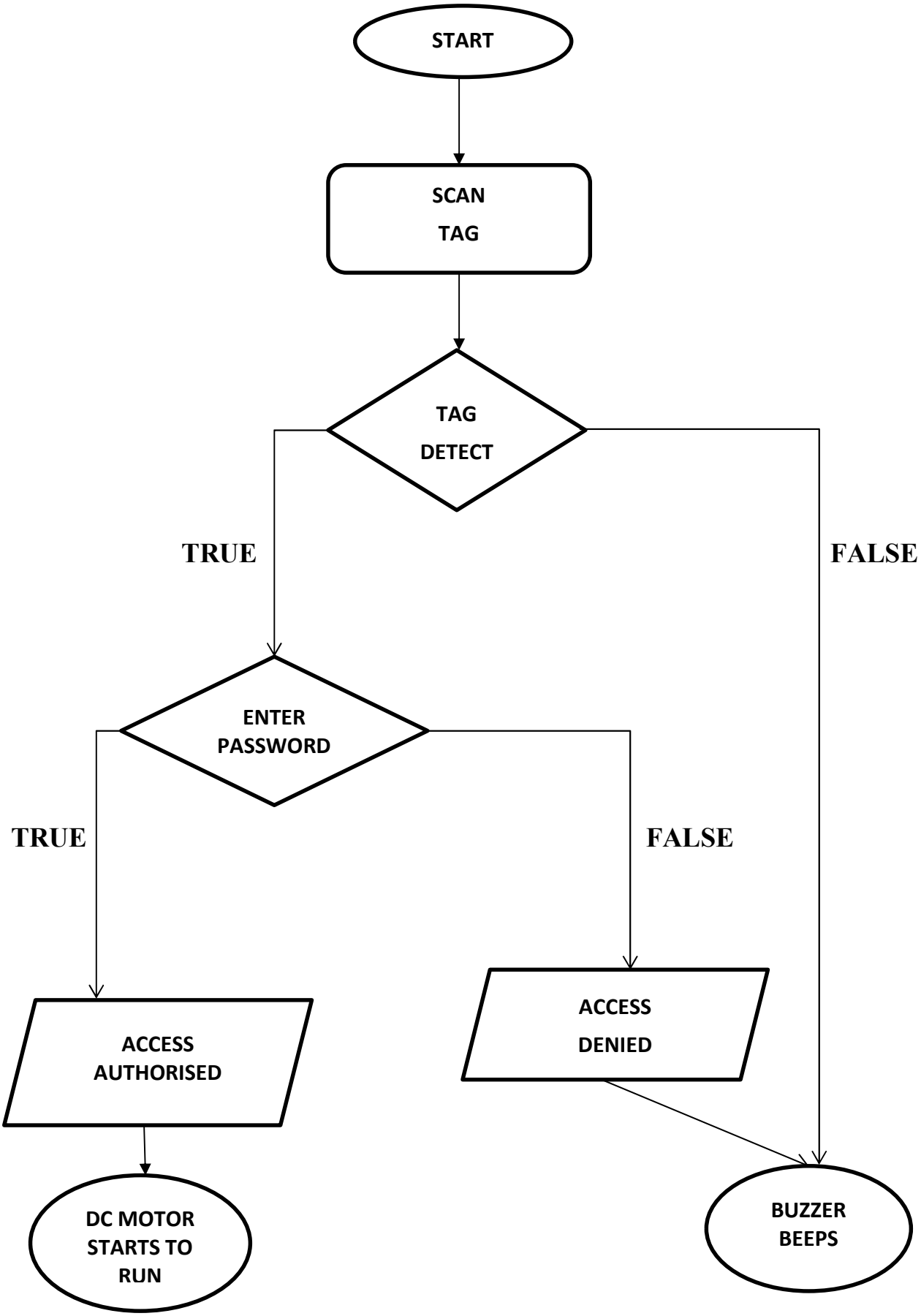
FLOW CHART:


START
SCAN TAG
TAG DETECT
TRUE
FALSE
ENTER PASSWORD
TRUE
FALSE
ACCESS AUTHORISED
ACCESS DENIED
DC MOTOR STARTS TO RUN
BUZZER BEEPS

COMPONENTS USED:

Component	**Specification**
Microcontroller	8051 Series (AT89S52)
RFID Reader	EM-18 Reader module
RFID Tags	Passive Card Type
Programming Board	8051 Series (AT89S52)
Power Supply	12 volts
Buzzer	Active
Keypad	4 X 3 Keypad
DC Motor	L293D,2V
LED	1V
Others	Crystal Oscillator, Capacitors, Resistors, Switches, Connectors, Power cable

SOFTWARE USED:

Keil µVision:

µVision is a window-based software development platform that combines a robust and modern editor with a project manager and make facility tool. It integrates all the tools needed to develop embedded applications including a C/C++ compiler, macro assembler, linker/locator, and a HEX file generator.

The **µVision IDE and Debugger** is the central part of the Keil development toolchain and has numerous features that help the programmer to develop embedded applications quickly and successfully. The Keil tools are easy to use, and are guaranteed to help you achieve your design goals in a timely manner.

Proteus 8 Professional:

Proteus 8 Professional is a software which can be used to draw schematics, PCB layout, code and even simulate the schematic. It also possess 2D CAD drawing feature. It deserves to bear the tagline **"From concept to completion"**.

ISIS is the software used to draw schematics and simulate the circuits in real time.The simulation allows human access during run time, thus providing real time simulation..The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic.

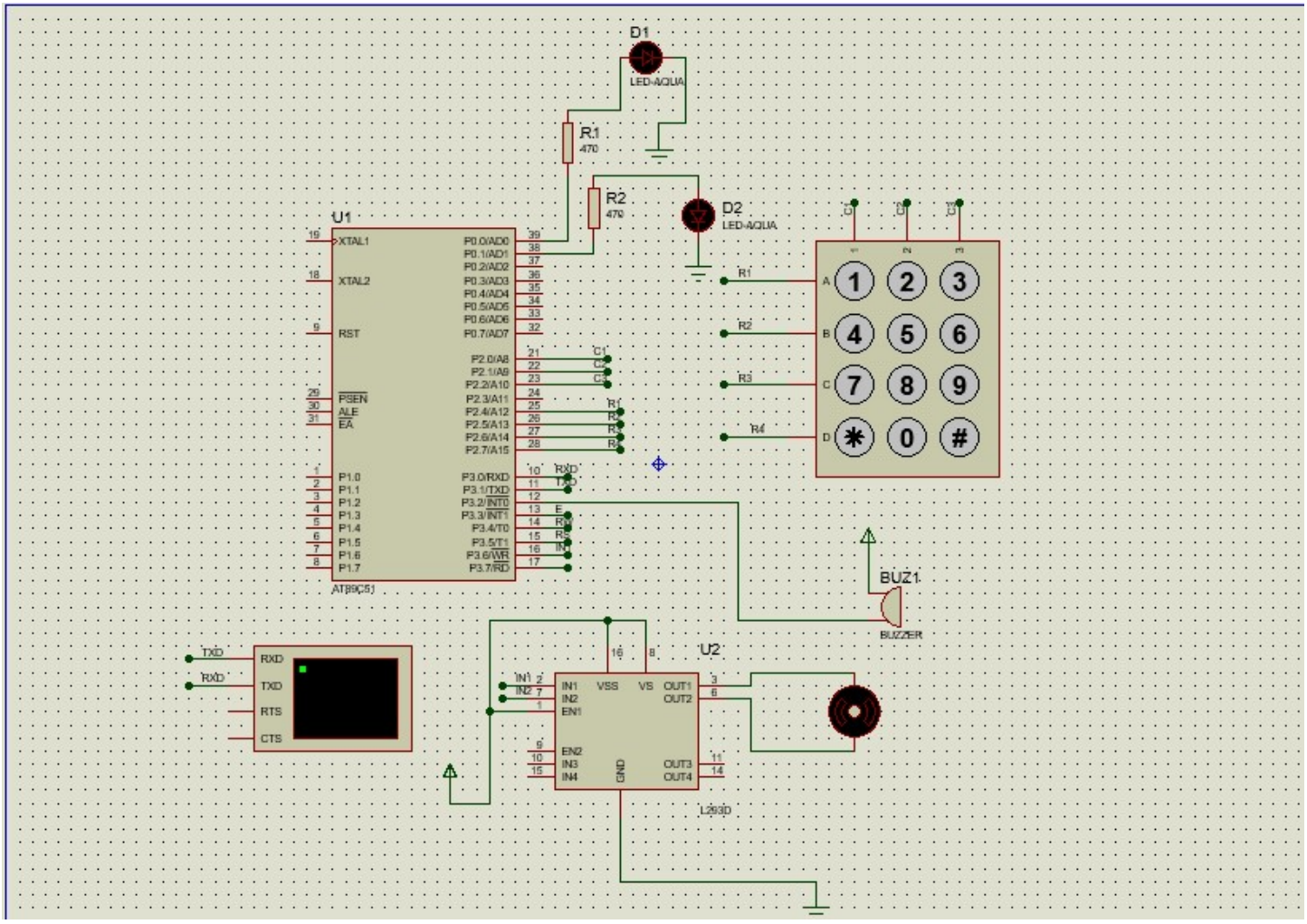
Willar Programmer:

Willar Software is used to dump the code into microcontroller via Programming Board.

We covert the C programming code into HEX file using Keil Software and load into microcontroller.

Connect programmer to USB port. When connecting the hardware to USB the LED will blink in the programmer. It is normal indication for ready to use. Run Willar software from desktop to dump the code into microcontroller.

RESULT AND DISCUSSION:



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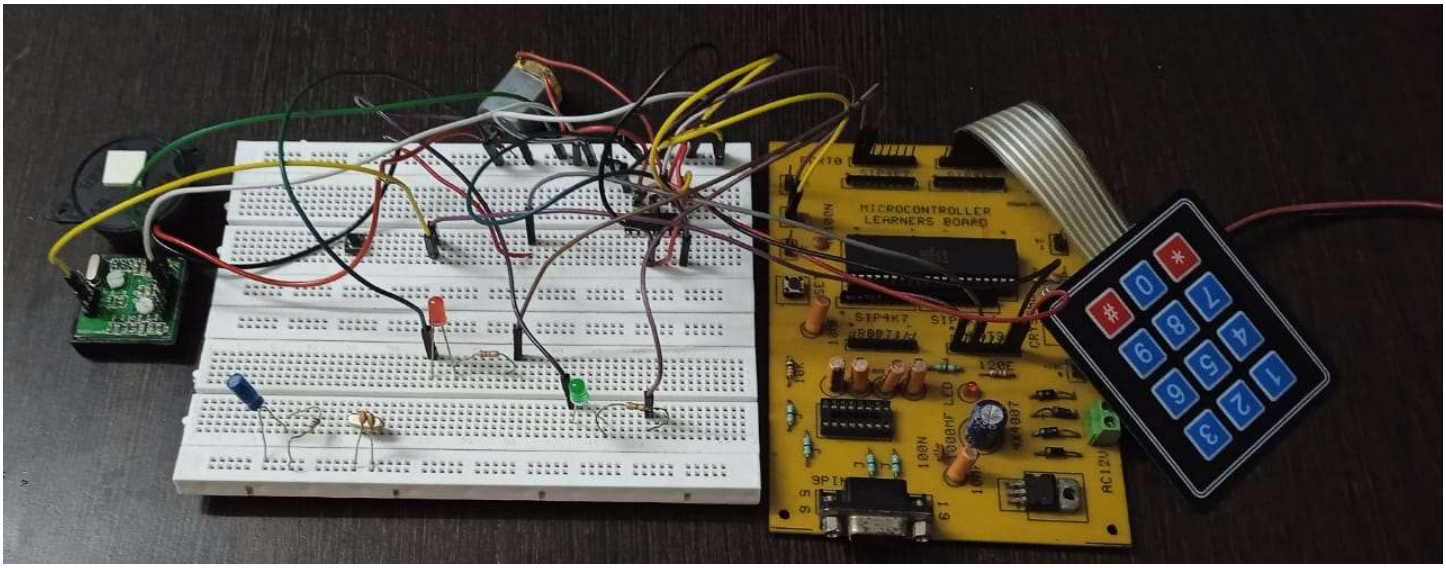
[Proteus Simulation]



Hardware Connection

RFID Based Security System which is able to identify authorized persons and allow only them was successfully developed. The major contribution of this work is managing to write a functional code for micro-controller to communicate with the RFID devices and store authorized person's data. This system should be able to minimize the technical human error during secured gate access. Besides, the system also helps user to use paperless environment and save the time.

User must have RFID tag which contains the personal information of that particular user. A door along with locking system is driven by stepper motor. Stepper motor acts as actuator, which is able to open and close the door in real-time. The RFID Reader detects tag in real-time and ask password to open the door.

In this application, user authentication information is searched on the database first. If the user does not have any previous record registered to the database, the door will not be open thus unauthorized entries will be avoided. In this work we have successfully implemented security system which can be apply to record attendance in class room of institute or can deploy in secured zone so that only authentic person can enter in secure space. Once the user information and password matched with information stored in central database system, then user only can enter within the confined place as the door will open only when the tag information match with the database. The system can be deploy in various secure places within a building.

CONCLUSION:

RFID based security and access control system is more secure and fast responded as compared to the other system like biometric. The advantage of the RFID system is contact-less and works without-line-of-sight. By using programming board it is easy to access and works very quickly while burning the code it is like plug and play device. Users can change the function accordingly by using programming board. It is easier to use and accurate also. Hence this project can be useful for implementation of access control application for tracking system as well as providing the security benefits. This project can improve by raising the range of reader in which the tag read.

RFID is increasingly used with biometric technologies for security. The significant advantage of all types of RFID systems is the non-contact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such as snow, fog, ice, paint. Hence, this project can be very much useful and can be implemented in real time applications for recording the attendance.

FUTURE SCOPE:

By integrating both RFID and microcontroller generates a project with wider boundaries and effective solutions. The system can be improved by increasing the range of reader in which the tag can be read. Further improvement can be done by using a method in which the tag encrypts its ID and then sends to the reader, which will eliminate the capturing of the tag IDs and hence cloning the tags.

It depends upon how original one could be to enhance the use of this project. But for us this project is practical for future uses such as Smart cart can be interfaced with wireless technologies to make it completely portable in the near future. Payment of bills using mobile can be implemented. A low cost RFID scanner can be manufactured and used which can scan multiple tags (products) simultaneously for faster processing and lesser resources. Automatic scanning & availability of products can be introduced. Pay preparation feature will be the latest trend in upcoming years due to the boost in the ecommerce industry.

1. In malls for generating bills without standing in a queue.
2. Gaming zone
3. Environmental problems to control and make nature friendly.
4. Uses in ATM machines

REFERENCES:

1. Parvathy A, Venkat Rohit Raj “rfid based examination hall system”, a paper on IEEE paper.

2. Gynanendra K Verma, Pawan Tripathi, IIIT Allahabad a paper on “A digital security system with door lock system using rfid technology”.

3.https://www.ijser.org/researchpaper/RFID-BASED-SECURITY-SYSTEM-USING-ARDUINO-MODULE

4.https://circuitdigest.com/microcontroller-projects/rfid-based-security-system

5.https://www.electronicshub.org/rfid-security-access-control-system/

APPENDIX :

```
#include <reg52.h>
#include <stdio.h>
#include <string.h>
sbit C1 = P2^0;
sbit C2 = P2^1;
sbit C3 = P2^2;
sbit R1 = P2^4;
sbit R2 = P2^5;
sbit R3 = P2^6;
sbit R4 = P2^7;
sbit motor_pin_1 = P3^6;
sbit motor_pin_2 = P3^7;
sbit buzzer = P3^2;
sbit led1 = P0^0;
sbit led2 = P0^1;
unsigned int i;
unsigned int j;
char count = 0;
char ch;
char input[12];
char pass[4];
void msdelay(unsigned int time){
    for(i=0;i<time;i++)
        for(j=0;j<1275;j++);
```

```
}
void keypad(){
        j = 0;
        while(j < 4){
            msdelay(30);
            C1=C2=C3=1;
            R1=R2=R3=R4=0;
            //column 1
            if(C1==0){
                R1=R2=R3=R4=1;
                C1=C2=C3=0;
                if(R1==0){
                    pass[j++] = '1';
                }
                if(R2==0){
                    pass[j++] = '4';
                }
                if(R3==0){
                    pass[j++] = '7';
                }
                if(R4==0){
                    pass[j++] = '*';
                }
            }
            //column 2
```

```
else if(C2==0){
        R1=R2=R3=R4=1;
        C1=C2=C3=0;
        if(R1==0){
                pass[j++] = '2';
        }
        if(R2==0){
                pass[j++] = '5';
        }
        if(R3==0){
                pass[j++] = '8';
        }
        if(R4==0){
                pass[j++] = '0';
        }
}
//column 3
else if(C3==0){
        R1=R2=R3=R4=1;
        C1=C2=C3=0;
        if(R1==0){
                pass[j++] = '3';
        }
        if(R2==0){
                pass[j++] = '6';
```

```
                        }
                        if(R3==0){
                                pass[j++] = '9';
                        }
                        if(R4==0){
                                pass[j++] = '#';
                        }
                }
        }
}
void uart_init(){
        TMOD=0x20;//timer 1 , mode 2 , auto reload
        SCON=0x50;//8bit data , 1 stop bit , REN enabled
        TH1=0xfd;//timer value for 9600 bits per second(bps
        TR1=1;//start the timer
}
void led_init(){
                led1 = 0;
                led2 = 0;
                msdelay(20);
                led1 = 1;
                led2 = 1;
                msdelay(20);
                led1 = 0;
                led2 = 0;
```

```
}
void motor_rotate(){
        motor_pin_1 = 1;
        motor_pin_2 = 0; //Rotates Motor Anit Clockwise
        msdelay(300);
        motor_pin_1 = 1;
        motor_pin_2 = 1; //Stops Motor
        msdelay(200);
        motor_pin_1 = 0;
        motor_pin_2 = 1; //Rotates Motor Clockwise
        msdelay(300);
        motor_pin_1 = 0;
        motor_pin_2 = 0; //Stops Motor
        msdelay(200);
}
void accept(){
                led1 = 0;
                msdelay(20);
                led1 = 1;
                msdelay(100);
                led1 = 0;
                motor_rotate();
}

void wrong(){
```

```
                buzzer = 0;
                led2 = 0;
                msdelay(20);
                led2 = 1;
                msdelay(100);
                led2 = 0;
                msdelay(1800);
                buzzer = 1;
}
char rxdata(){
        while(RI==0);   //wait till RI becomes HIGH
        RI=0;           //make RI low
        ch=SBUF;      //copy received data
        return ch;      //return the received data to main function.
}
void main()
{
                buzzer = 1;
                uart_init();
                led_init();
                while(1){
                        while(count < 12){
                                input[count++] = 0;
                        }
                        count = 0;
```

```
while(count < 12){
        input[count++] = rxdata();
}
if(strncmp(input,"0800A36477B8",12) == 0){
    led1 = 0;
    msdelay(20);
    led1 = 1;
    msdelay(100);
    led1 = 0;
    keypad();
    if(strncmp(pass,"1024",4) == 0){
        accept();
    }else{
        wrong();
    }
}else if(strncmp(input,"0800A2B46876",12) == 0){
    led1 = 0;
    msdelay(20);
    led1 = 1;
    msdelay(100);
    led1 = 0;
    keypad();
    if(strncmp(pass,"1729",4) == 0){
        accept();
    }else{
```

```
                wrong();
            }
        }else if(strncmp(input,"08009BF491F6",12) == 0){
            led1 = 0;
            msdelay(20);
            led1 = 1;
            msdelay(100);
            led1 = 0;
            keypad();
            if(strncmp(pass,"2048",4) == 0){
                accept();
            }else{
                wrong();
            }
        }else{
            wrong();
        }
    }
}
```