DANANG UNIVERSITY
UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF MECHANICAL ENGINEERING

PROJECT BASE LEARNING 4

DESIGN DEVICE FOR APPLICATION OF MICROCONTROLLER AND SENSOR

GROUP: 19.06A

TOPIC:
AUTOMATIC DOOR SYSTEM

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Class : 19CDTCLC1

DANANG, JUNE 2022

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INTRODUCTION

Our country is currently in a period of renewal, in the period of industrialization and modernization, along with the development of information technology, the mechatronic engineering industry is developing to new heights. Mechatronics is one of the important industries in the process of industrialization and modernization, especially contributing to the liberation of human labor and more precisely human.

Currently, the industrial revolution 4.0 has changed the way people work and connect with each other, having a strong impact on the field of mechatronics. Automated lines, auto-driving cars, robots... are the development directions of mechatronic engineering technology. The Project Based Learning 4 – Application Microcontroller And Sensor is important subject in mechatronic engineering industry, the subject trains students with many skills and abilities apply learned theories to solve real-world requirements such as: How to control systems from Microcontroller (PIC 16F877A), Can applications sensors to gather information about some state or process, solve problems that people can't do, support and service people optimaly…, both meet the technical criteria and ensure economic spending.

This is the first reality subject project that students learn so the design process and circuit making skills are still new and hesitate. Therefor, the errors can be evade this problem, Thanks for the teacher in the past time dedicated guide student to complete this project.

Sincerely thanks!

Danang, June, 21th, 2022

Signature

Le Minh Nhat Nguyen Ngoc Khoi

CHAPTER 1
INTRODUCTION OVERVIEW

1.1 Concept Automatic door system

- Automatic door is a door line installed by an automation system that helps the door open and close completely automatically without using human force.

- This is an automatic opening/closing device based on a combination of power source and motor system, intelligent processor capable of independent operation, making it easy for people to move back and forth. much easier and more convenient.

- With increasingly developing technology, innovation has produced many types of advanced automatic doors, diverse features, the most intelligent to suit the needs of today's consumers. And most of them are widely installed in large projects such as: Restaurants, hotels, hospitals, amusement parks, shopping malls, banks, companies, enterprises.. As well as practical applications. into a number of other areas.

1.2 Characteristics in automatic door

- Directly adjust the opening and closing speed according to the user's wishes.
- Time to automatically close the window is fast, minimizing congestion.
- Space saving installation, very convenient for users.
- Create an ideal workspace environment inside.
- Helps save maximum power consumption.
- Connects with other smart devices such as phones, fingerprints, magnetic cards
- Direct integration with sensors => Helps the door automatically detect obstacles from afar, change direction or stop to ensure absolute safety for people.
- Beautiful design, delicate, luxurious, modern class. Quick and easy to install
- Installing automatic glass doors is very suitable for the elderly, children, disabled people who have to use wheelchairs when going through the door.

1.3 Applications and benefits of automatic doors

- Depending on the needs as well as the environment and space, the corresponding automatic doors can be used.
- Wide applicability:
  + Can be used in many different environments and spaces such as hospitals, supermarkets, commercial centers, banks...
  + Fit with today's modern life, developed technology, automatic devices are increasingly used.

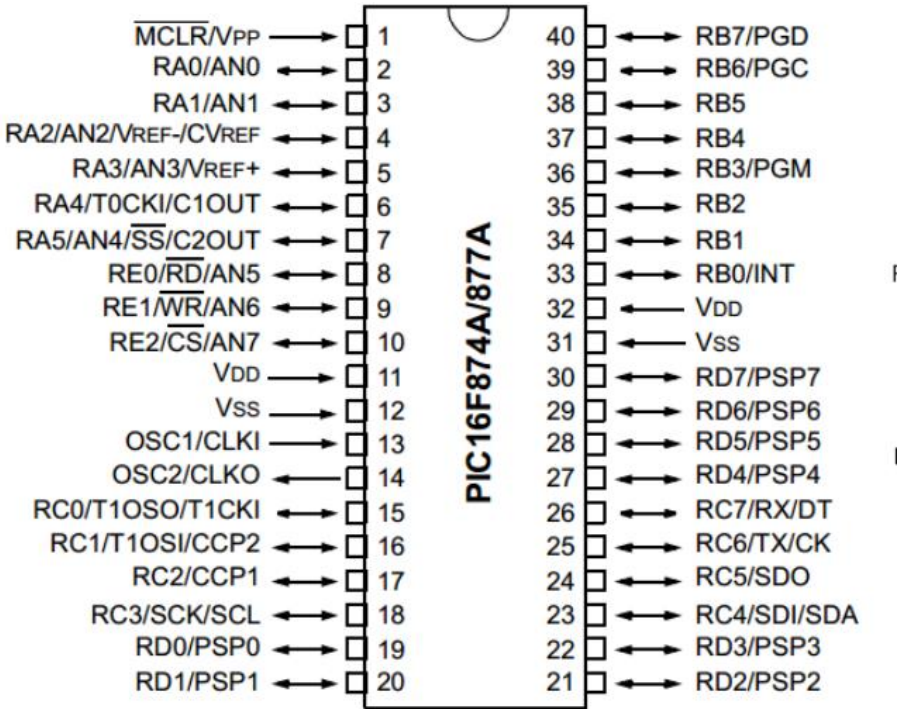
+ Can be applied well in environments with the elderly, children or people with disabilities.

+ Flexible use with many different door materials, in addition to glass, aluminum, wooden, iron, panel doors can all be used.

CHAPTER 2
INTRODUCTION ELECTRONIC COMPONENTS IN ELECTRICAL CIRCUITS

2.1 Introduction microcontroller PIC16F877A

- PIC16F877A has 14-bit instructions and 40-PIN



- Belong to PIC16Fxxx family with instruction set has 35 instructions
- The execution time is the same for almost all instructions, and lasts 4 clock cycles which is stabilized by a quartz crystal. It can operate up to **20MHz frequency**
- Flash program memory with capacity of 8K × 14 bit.
- RAM Memory size of 368 byte.
- Supply power: 5 VDC
- EEPROM Memory:
    + Size of 256 byte
    + Can be read and written up to 1.000.000 times

+ Data can be stored up to 40 years

- 5 I/O ports with 33 pins, namely A, B, C, D, E
- SLEEP mode for saving power usage
- 10-bit Analog-to-Digital Module have 8 input channels
- Have 2 Analog Comparators

Peripheral Characteristics

✓ 3 Timer Modules

- Timer 0: Timer/counter 8 bit, Prescale
- Timer 1: Timer/counter 16 bit, Prescale, can work in SLEEP mode with internal/external clock
- Timer 2: Timer/counter 8 bit, Prescaler and Postscaler

✓ 2 CCP Modules (Capture/Compare/PWM)

- 16-bit Capture register
- 16-bit Compare register
- 10-bit PWM

2.2 LCD 16x2

- A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers, 16x2 LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability, programmer friendly and available educational resources.

- LCD has many advantages over other display formats, it has the ability to display diverse characters, intuitive, easy to put into application circuit

- Shape and size

- There are many types of LCD are different shapes and sizes. This image (1.2.1) is type of LCD in common

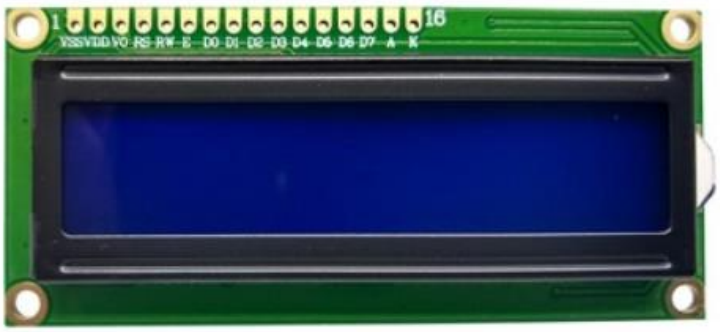


Image 2.2.1: LCD in common

- When manufacturing lcd, the manufacturer has integrated microchip inside the shell and put the necessary communication pins. These pins are numbered and named as image below (1.2.2).

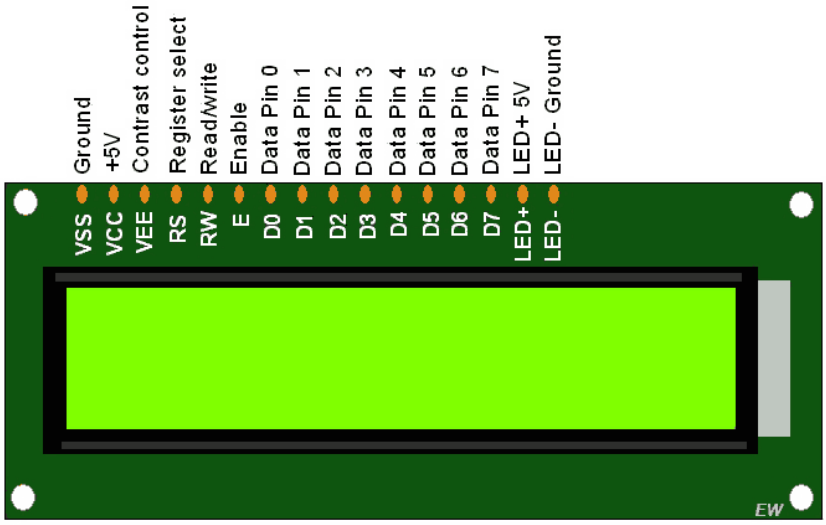


Image 1.2.2: Pins and names of LCD

- Function of the PIN from LCD

STT	Name	Describe
1	VSS(GNG)	0V
2	VDD(Vcc)	+5VDC
3	VEE	0 ÷ VDD
4	RS	RS = 0: Command mode (data in D0 – D7 is Command) RS = 1: Data mode (data in D0 – D7 is Data)
5	R/W	R/W = 0: Write data (from microcontroller to LCD) R/W = 1: Read data (from LCD to microcontroller)
6	E	E = 0: Disable LCD E = 1: Ennable LCD E transfer signal 1 to 0 : Begin process read/write LCD
7	D0	Data bit 0
8	D1	Data bit 1
9	D2	Data bit 2
10	D3	Data bit 3
11	D4	Data bit 4
12	D5	Data bit 5

13	D6	Data bit 6
14	D7	Data bit 7
15	A	Led Positve
16	K	Led Negative

2.3 Matrix Keypab 3x4:

- A matrix keypab is a device used to input data or signals, it is a combination of single buttons arranged in rows and columns, matrix keypab allows the user to enter numbers, symbols or characters into the controller, The number of buttons can be changed flexibly depending on the needs of the user and is usually installed on specialized equipment.

- The image below (1.3.1) is used for this project.

Image 2.3.1: Matrix keypab

2.4 Module RFID

- RFID (Radio Frequency Identification Detection) below image (1.4.1) is the technology of object recognition by radio waves. Is an automatic identification method based on remote data storage, using RFID Card device and an RFID Reader.

Image 2.4.1: RFID

2.5 IR Sensor (Infrared Sensor)

- IR Sensor **(**1.5.1) is an electronic device, emitted to sense some aspect of its surroundings. IR sensors can measure the heat of an object as well as detect motion. These types of sensors only measure infrared radiation, not emissions, so it is called a passive infrared sensor. Normally, in the infrared spectrum, all objects radiate some form of thermal radiation.

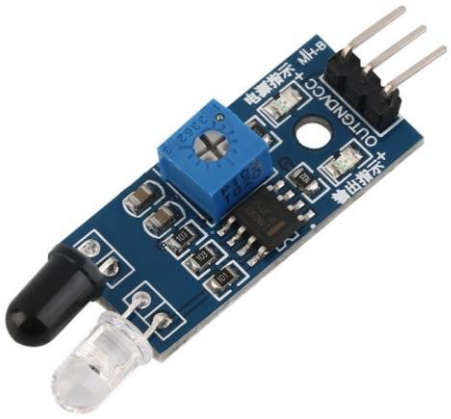


Image 2.5.1: IR Sensor

- This sensor is used to detect objects such as people and objects that prevent the door from opening and closing to prevention overload, protect for human.

2.6 DC Motor

- A DC motor (1.6.1) or direct current motor is an electrical machine that transforms electrical energy into mechanical energy by creating a magnetic field that is powered by direct current. When a DC motor is powered, a magnetic field is created in its stator. The field attracts and repels magnets on the rotor; this causes the rotor to rotate. To keep the rotor continually rotating, the commutator that is attached to brushes connected to the power source supply current to the motors wire windings.

Image 2.6.1: DC Motor

- However, we can't connect wire of DC Motor to microcontroller, we need a device intermediary to control the Motor can spin faster, slowly, clockwise or counter-clockwise, This device is module L298 (1.6.2)

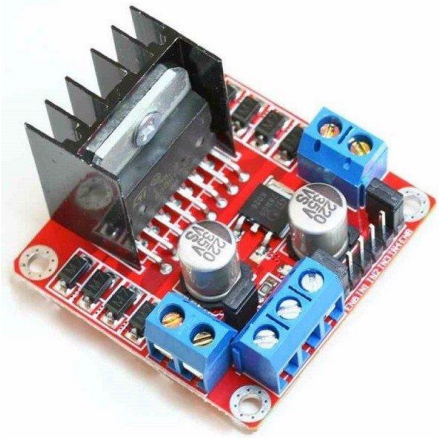


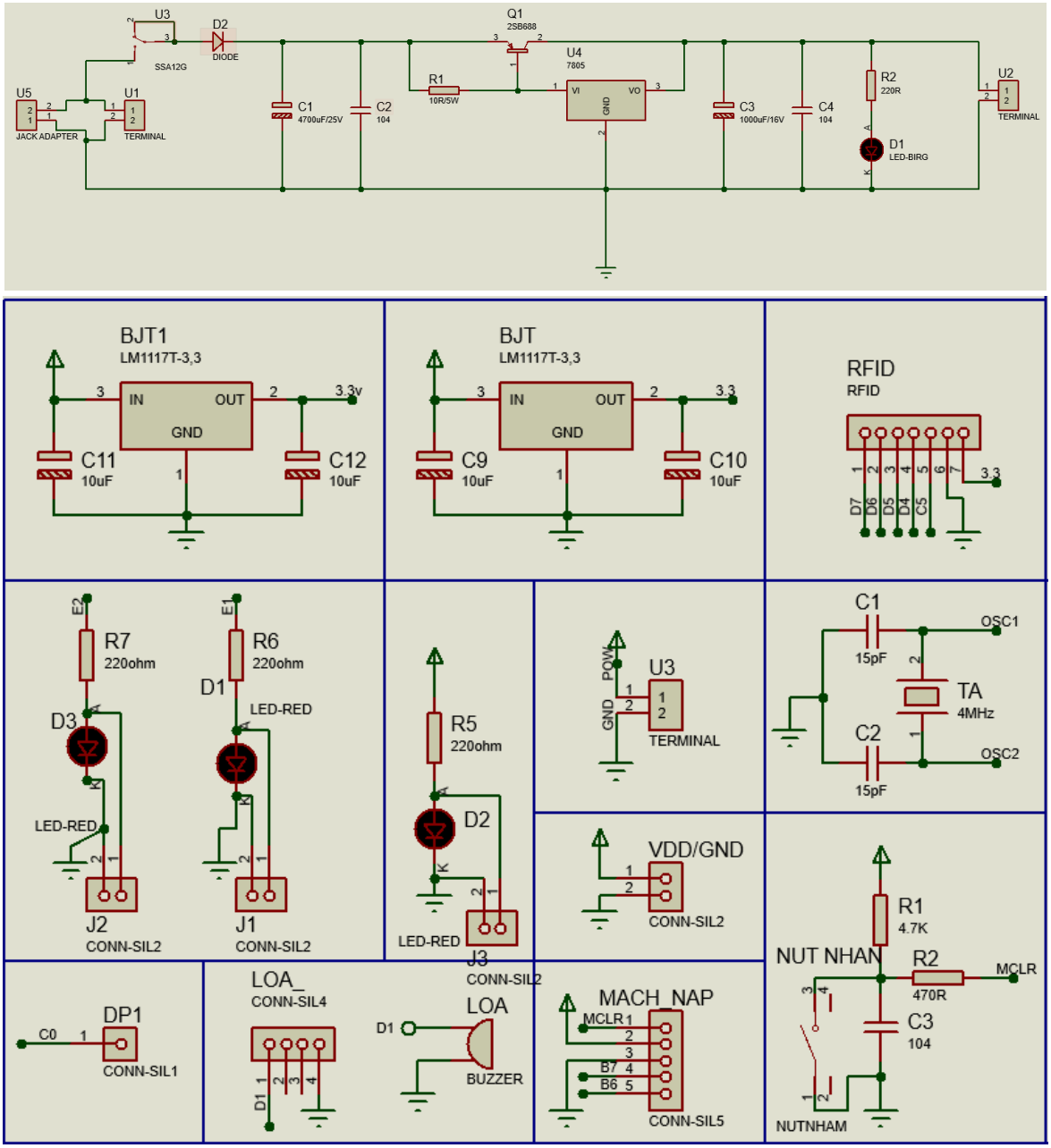
Image 2.6.2: Module L298

- Module control motor L298 in Capable of driving 2 DC motors, 2A max current per motor, integrated circuit protection diode and power IC 7805 to supply 5VDC power to other modules, with reversing motor function, It is a high voltage, high current dual fullbridge driver designed to accept standard TTL logic levels and drive, inductive loads such as relays, solenoids, DC and stepping motors

- Two enable inputs are provided to enable or disable the device independently of the input signals

CHAPTER 3
PRINCIPLE SIMULATION AND PRINTED CIRCUIT

3.1 Circuit principle:



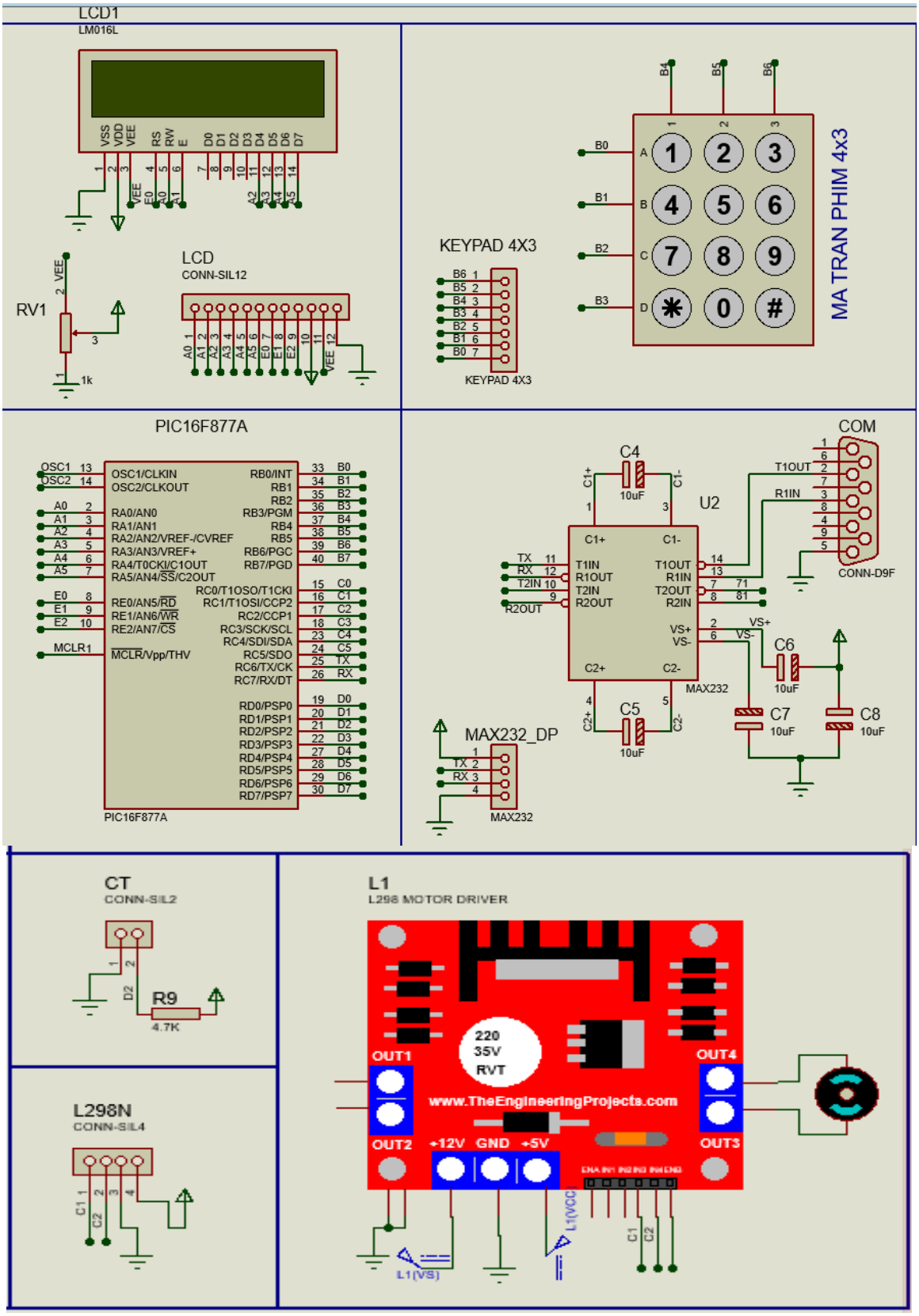


Image 3.1: Diagram circuit in software Proteus

- This Circuit principle, pins of the microcontroller are connected to the following electronic components in turn:

+ Pins data of LCD (Data 4 – 7) connected to Port A, A0 and A1 connected PIN RW, E. E0 connected RS LCD

+ Pins of matrix keypab connected to Port B

+ Pins of RFID connected to Port D (D4-D7), and use 1 Pin connect C5

+ L298 connected to Port C (C1-C2)

And some pins are connected to the integrated circuits for the microcontroller…

3.2 Printed circuit:

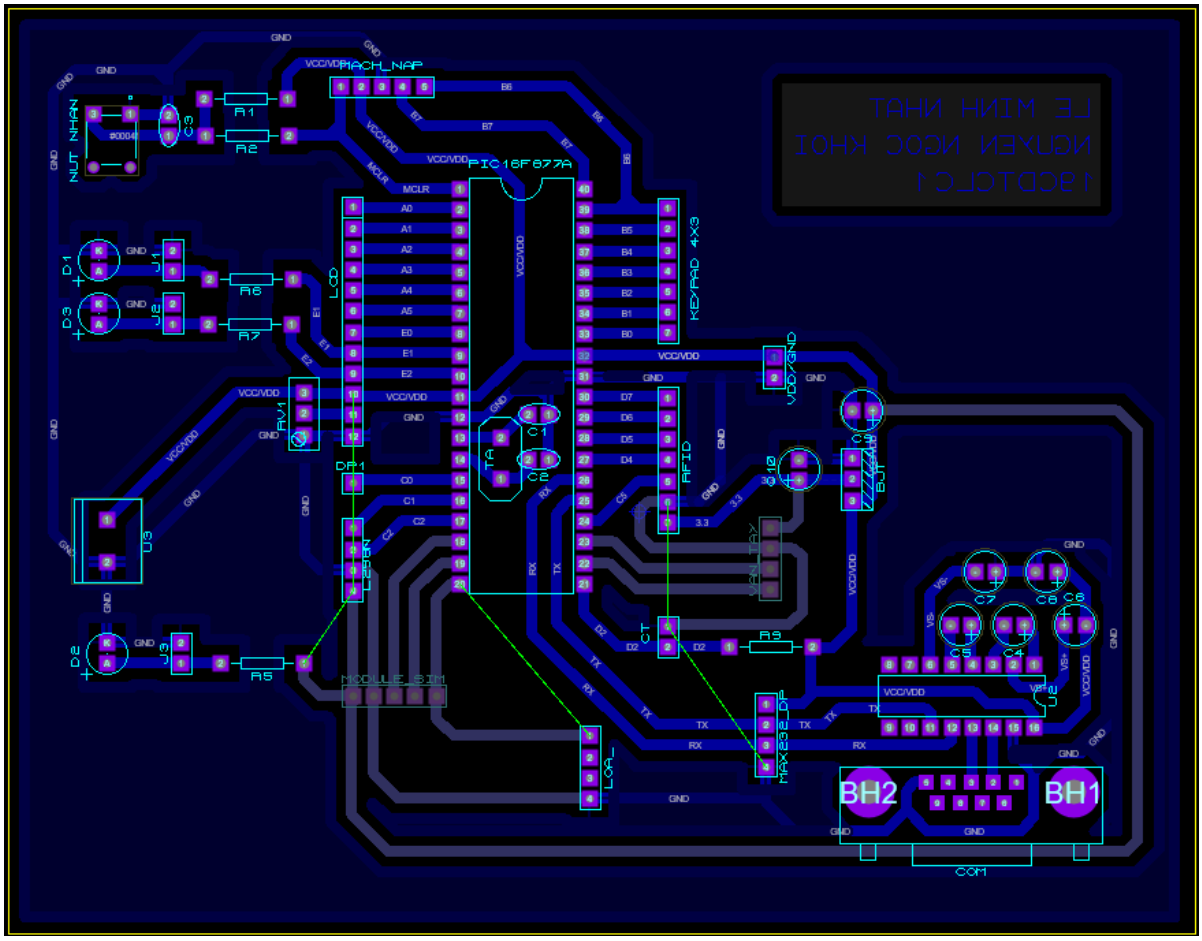


Image 3.2.1: Main circuit

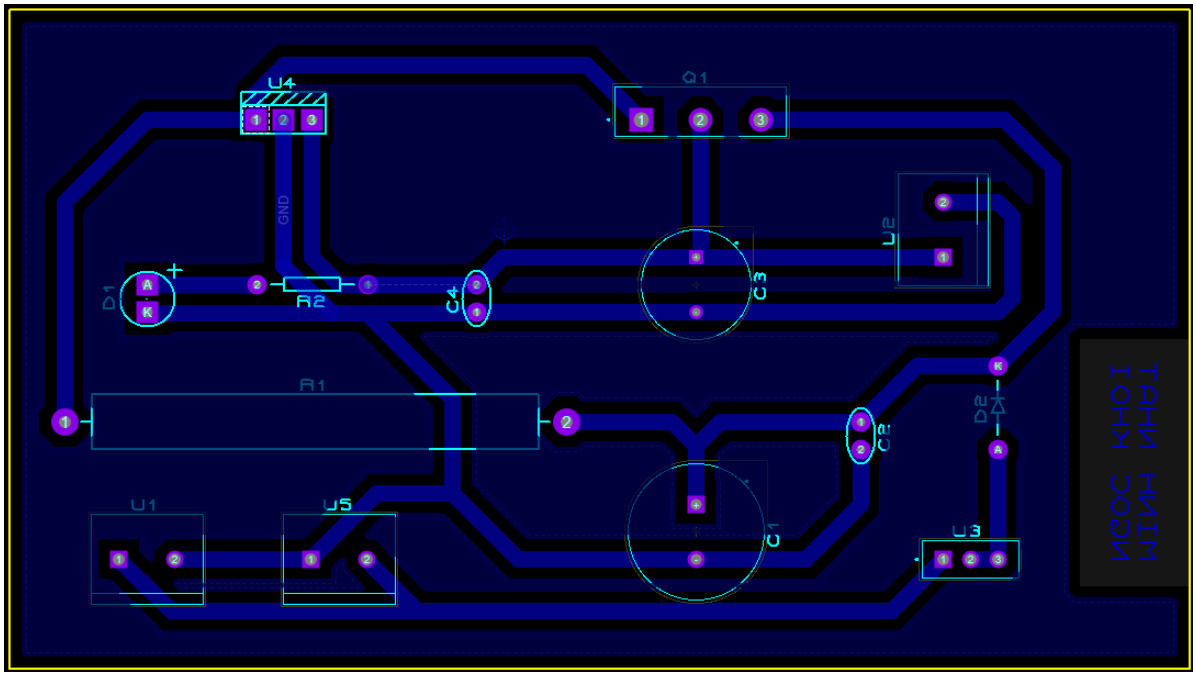


Image 3.2.2: Source circuit

3.3 Simulation Circuit:

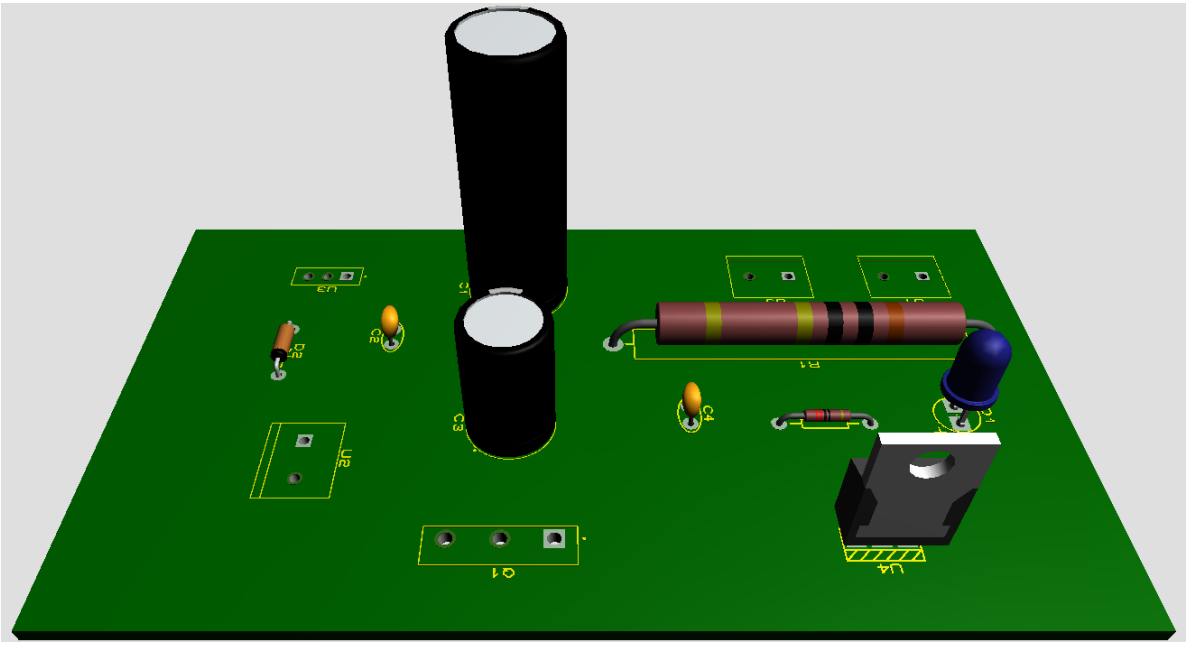


Image 3.3.1: Simulation source circuit

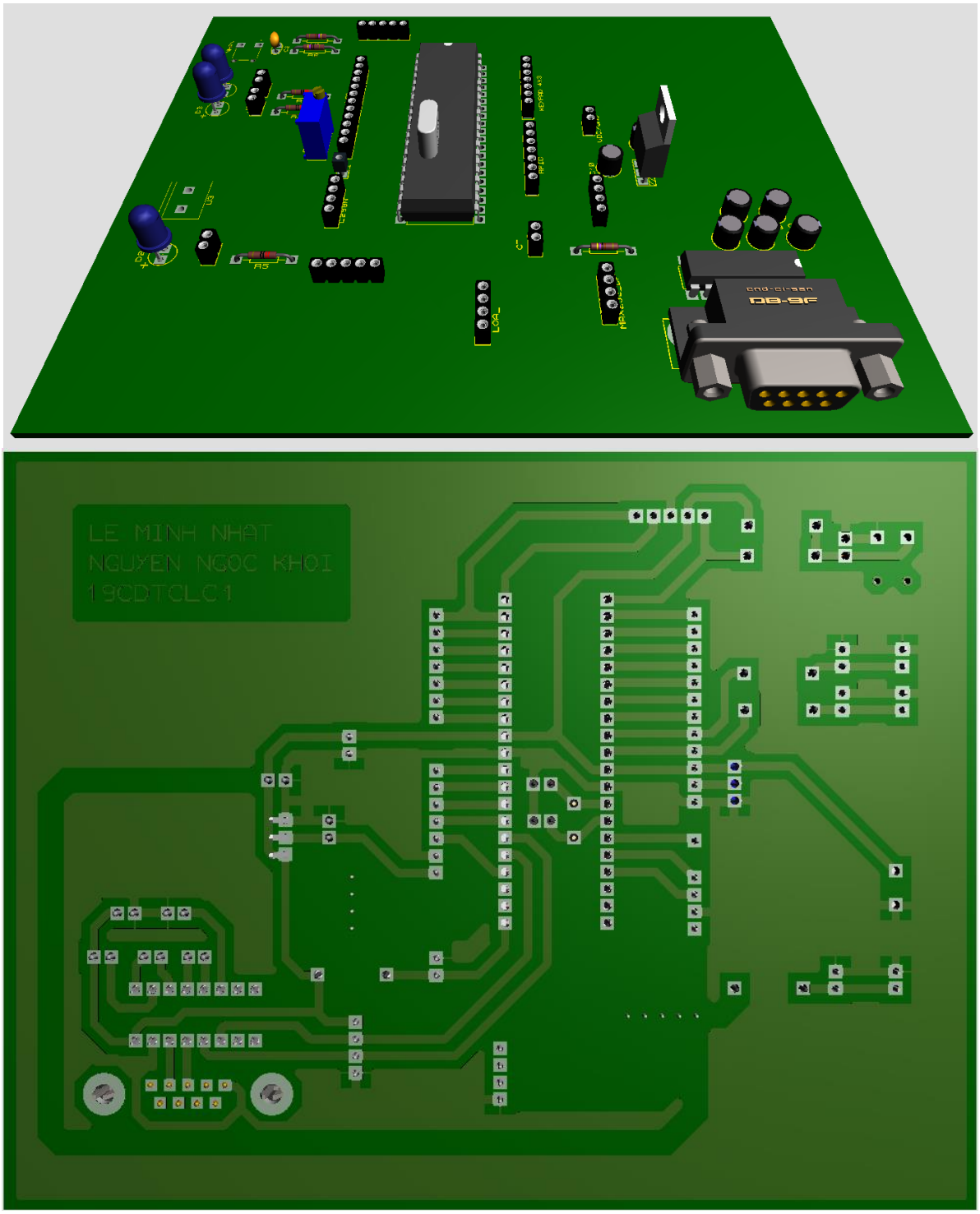


Image 3.3.2: Simulation main circuit

3.4 Actual Circuit

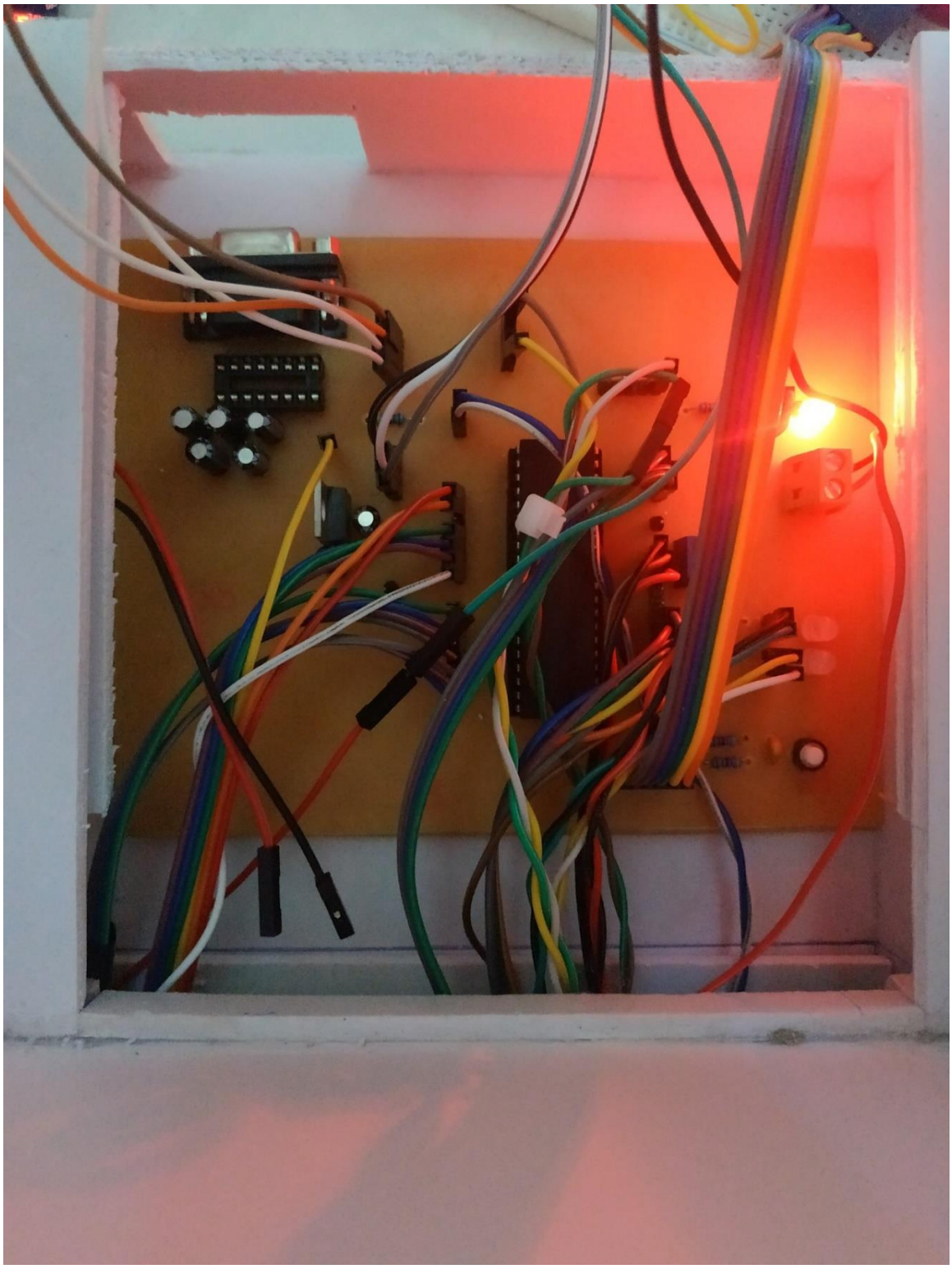


Image 3.4.1: Reality source circuit

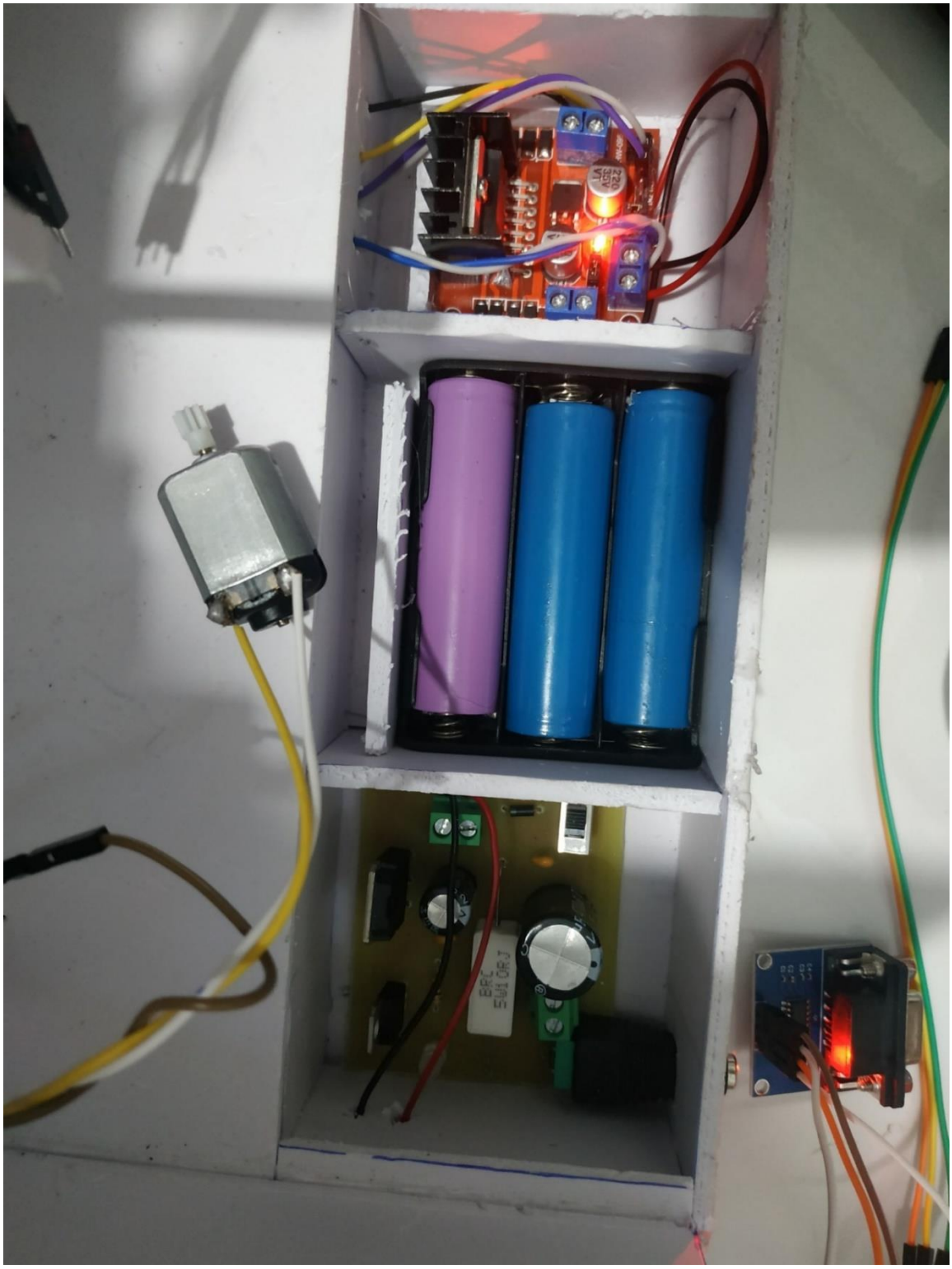


Image 3.4.2: Reality source circuit

Image 3.4.3: Decor systems

Image 3.4.4: Test paradigm

CHAPTER 4
ALGORITHM FLOWCHART, CODE CCS AND WINDOWFORM FOR C# TO MICROCONTROLLER

4.1 Algorithm flowchart

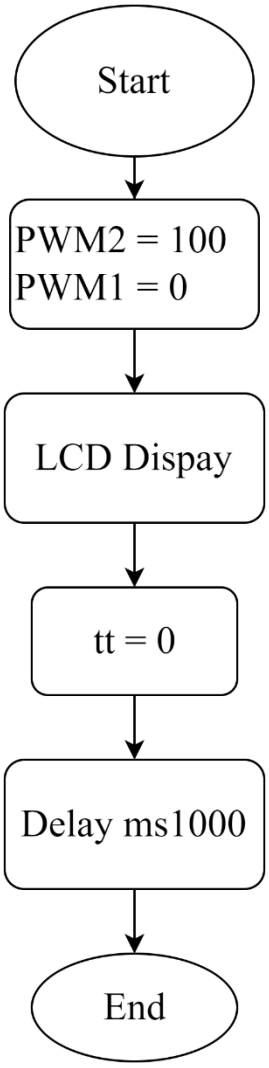


Image 4.1.1:
Algorithm flowchart void motor()

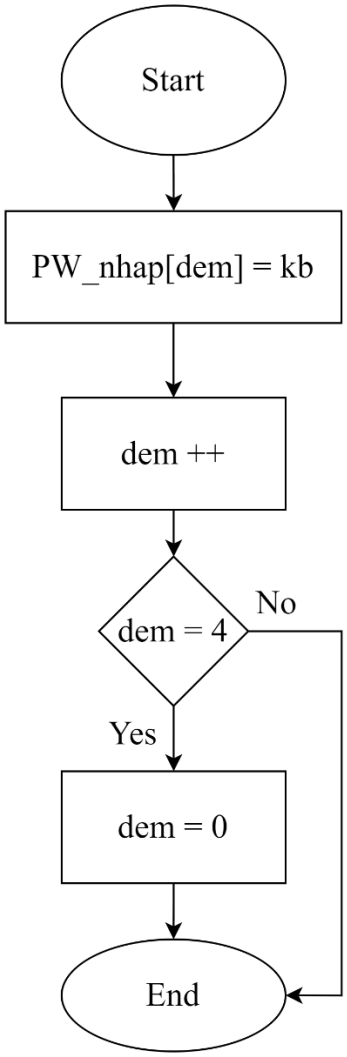


Image 4.1.2:
Algorithm flowchart void gan_phim()

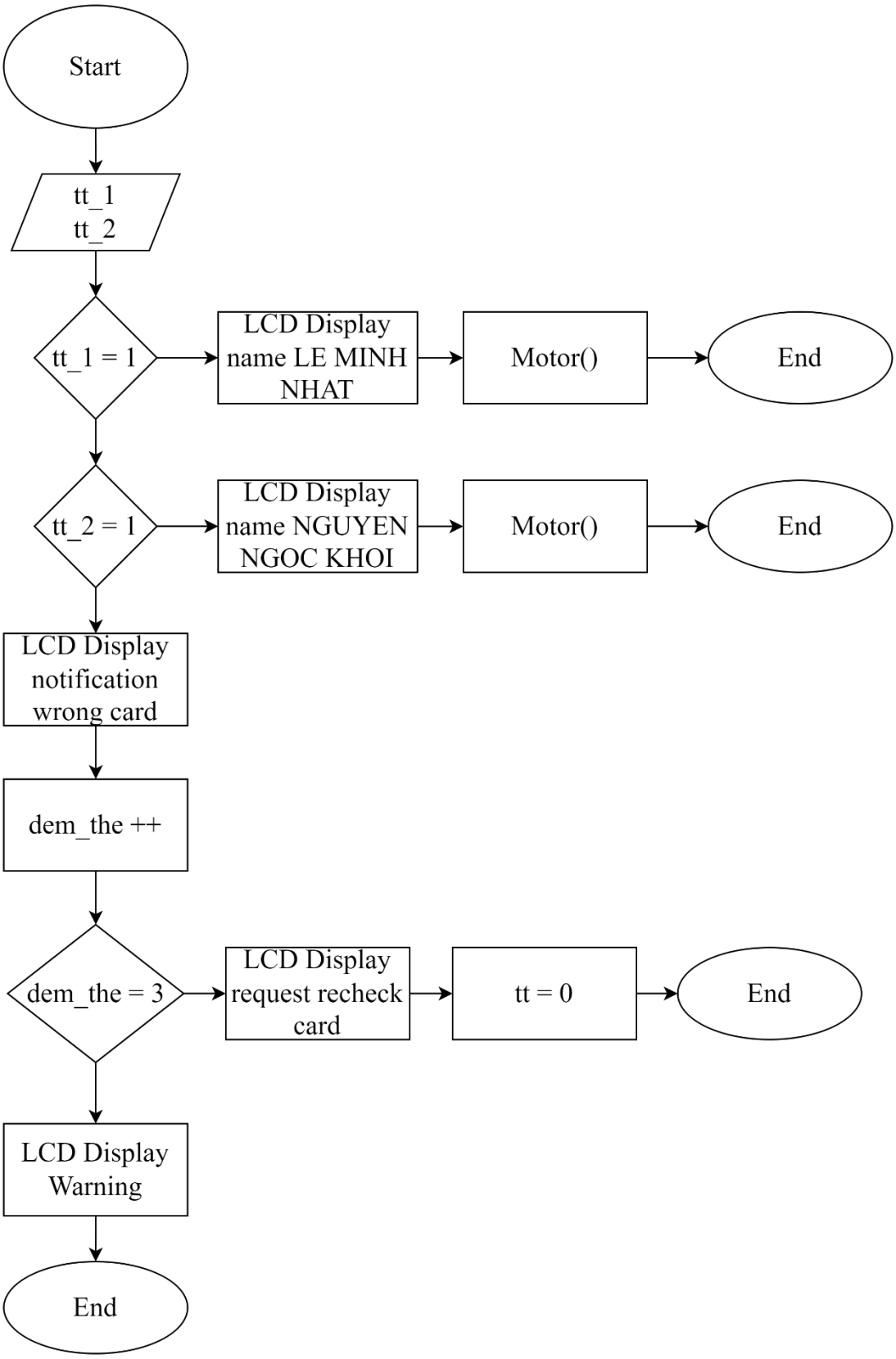


Image 4.1.3: Algorithm flowchart void nap_the()

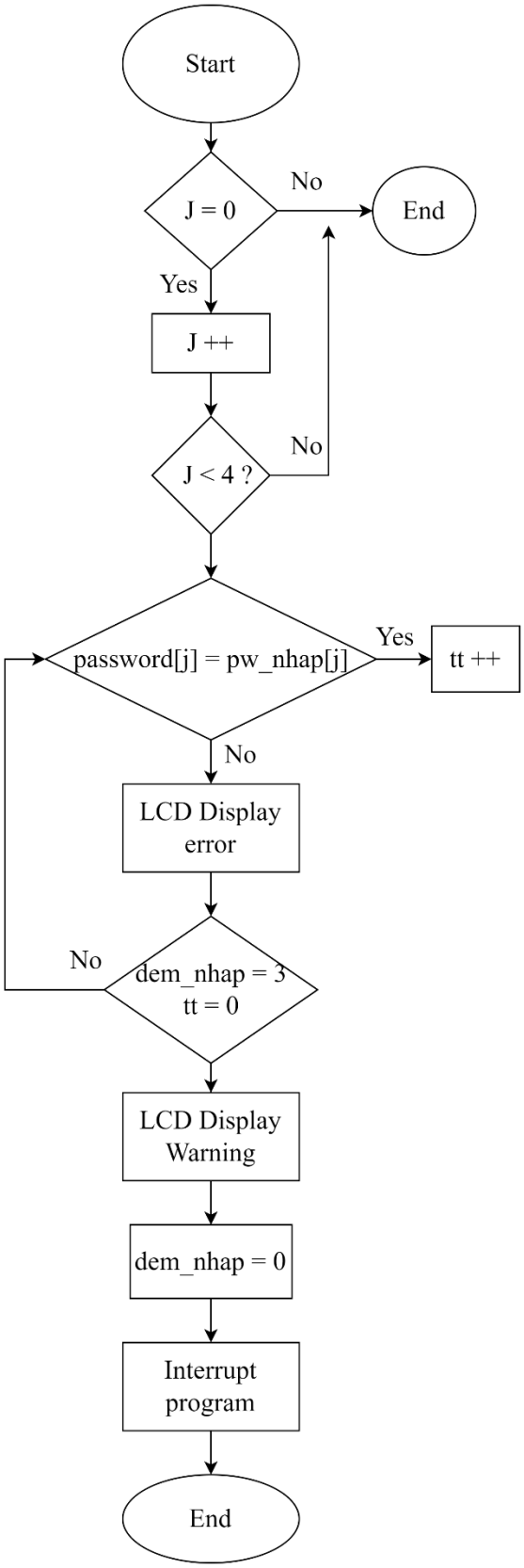


Image 4.1.4: Algorithm flowchart void chess_pass()

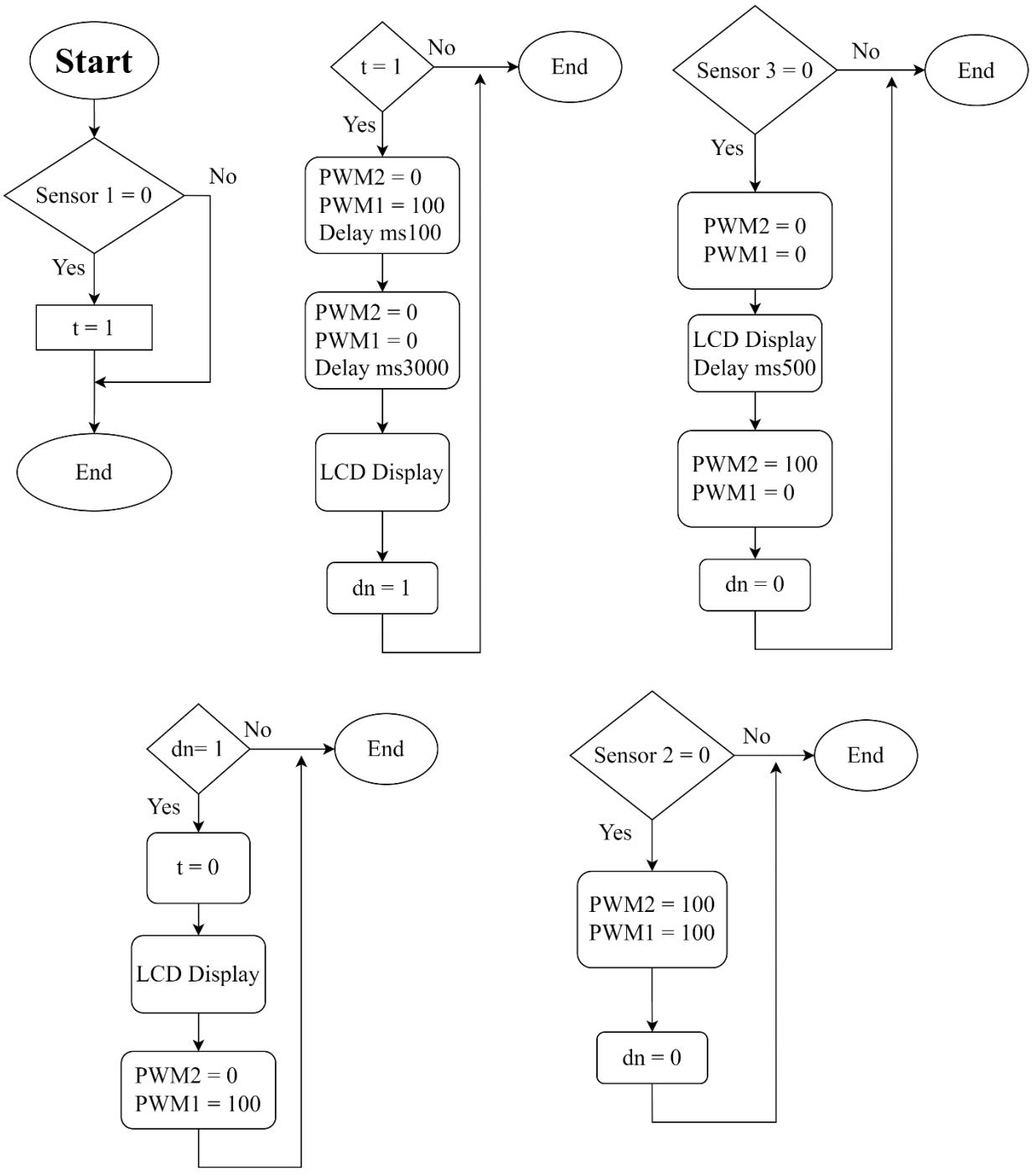


Image 4.1.5: Algorithm flowchart void cam_bien()

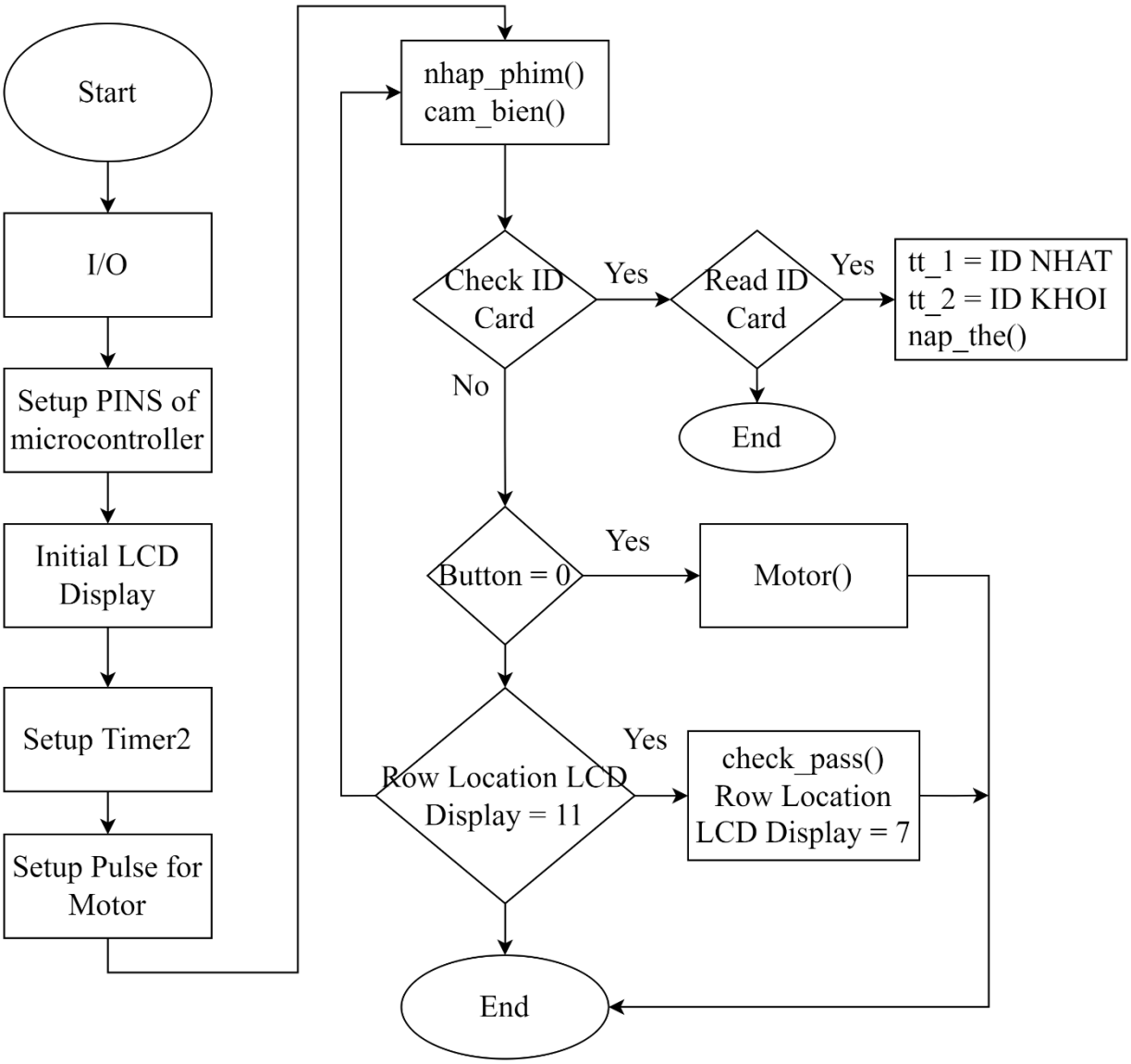


Image 4.1.6: Algorithm flowchart void Main()

4.2 Code CCS programing for microcontroller

- To load the code for mircrocontroller PIC16F877A, we use the software Pickit 3 and use charging circuit Pickit to load the code

- This is the whole program for automatic door lock working

File.c

```
#include <BAO_VE.h>
#include<lcd.c>
#include<Built_in.h>
char DATA_NHAT[5] = { 0x41,0xB1,0xA2,0x1A,0x48 };
char DATA_KHOI[5] = { 0XE1,0XC2,0X4A,0X20,0X49 };
int1 THE = 0;
```

```
char tt_1, tt_2;
int8 dem_the = 0;
int password[4]={3,5,7,8};
int pw_nhap[4]={0,0,0,0};
int tt=0;
int b=7, kp = 0, dem = 0, dem_nhap = 0;
int8 dn=0, t=0;
char c;//C#
int1 QUET_THE(char Data[], char UID[])
{
   for(int i = 0; i < 5; i++)
   {
      if(UID[i]== Data[i])
      {
         THE=1;
      }
      else
      {
         THE=0;
         //break;
      }
   }
return THE;
}
void bipbip(int8 hoi,int8 tieng)
{
int8 i, j;
   for(i = 0; i < hoi; i ++){
      for(j = 0; j < tieng; j ++){
         output_high(pin_d1);
         delay_ms(200);
      }
      output_low(pin_d1);
      delay_ms(20);
   }
}
void led_dung(int8 hoi,int8 tieng)
{
int8 i, j;
   for(i = 0; i < hoi; i ++){
      for(j = 0; j < tieng; j ++){
       output_high(pin_e2);
       output_high(pin_d1);
       delay_ms(200);
      }
      output_low(pin_e2);
      output_low(pin_d1);
      delay_ms(20);
   }
}
```

```
void led_sai(int8 hoi,int8 tieng)
{
int8 i, j;
   for(i = 0; i < hoi; i ++){
      for(j = 0; j < tieng; j ++){
         output_high(pin_e1);
         output_high(pin_d1);
         delay_ms(200);
      }
      output_low(pin_e1);
      output_low(pin_d1);
      delay_ms(20);
   }
}
void tieu_de()
{
   lcd_putc('\f');
   lcd_gotoxy(4,1);
   lcd_putc(" PASS/RFID ");
   lcd_gotoxy(7,2);
   lcd_putc("____");
}
void gioi_thieu()
{
   lcd_putc('\f');
   led1(1);
   led2(1);
   delay_ms(500);
   led1(0);
   led2(0);
   lcd_gotoxy(4,1);
   lcd_putc("DO AN PBL4");
   delay_ms(700);
   lcd_gotoxy(4,2);
   lcd_putc("19CDTCLC1");
   delay_ms(1000);
   lcd_putc('\f');
   delay_ms(500);
   lcd_gotoxy(3,1);
   lcd_putc("He Thong Khoa");
   lcd_gotoxy(4,2);
   lcd_putc("Cua Tu Dong");
   delay_ms(1000);
   lcd_putc('\f');
   delay_ms(500);
   lcd_gotoxy(3,1);
   lcd_putc("LE MINH NHAT");
   delay_ms(700);
   lcd_gotoxy(1,2);
   lcd_putc("NGUYEN NGOC KHOI");
```

```
   delay_ms(1000);
}
void motor()
{
   set_pwm2_duty(100);
   set_pwm1_duty(0);
   lcd_putc('\f');
   led_dung(0,1);
   lcd_gotoxy(1,1);
   lcd_putc("Dang Mo Cua");
   tt=0;
   b=7;
   delay_ms(1000);
}
void nap_the()
{
   if(tt_1 == 1)
      {
         led_dung(1,1);
         lcd_gotoxy(6,2);
         lcd_putc("SUCCESS");
         delay_ms(1000);
         lcd_putc('\f');
         lcd_gotoxy(2,1);
         lcd_putc(" LE MINH NHAT ");
         delay_ms(1000);
         lcd_gotoxy(5,2);
         lcd_putc("WELCOME");
         delay_ms(1000);
         lcd_putc('\f');
         motor();
      }
   else if(tt_2==1) // ko có else thí chay xong tt_1 se chuyen sang else ko
hop le
      {
         lcd_gotoxy(6,2);
         printf(LCD_PUTC, "SUCCESS");
         led_dung(1,1);
         delay_ms(1000);
         lcd_putc('\f');
         lcd_gotoxy(1,1);
         lcd_putc("NGUYEN NGOC KHOI");
         delay_ms(1000);
         lcd_gotoxy(5,2);
         lcd_putc("WELCOME");
         delay_ms(1000);
         lcd_putc('\f');
         motor();
      }
   else
```

```
      {
         led_sai(2,1);
         lcd_gotoxy(1,1);
         lcd_putc("\fTHE KHONG HOP LE");
         delay_ms(700);
         dem_the++;
         if(dem_the==3)
            {
               delay_ms(700);
               lcd_gotoxy(1,1);
               lcd_putc("\f QUA SO LAN NHAP");
               lcd_gotoxy(4,2);
               lcd_putc("WARNING!!!");
               led_sai(3,2);
               delay_ms(1000);
               dem_the = 0;
               lcd_putc('\f');
               tieu_de();
            }
         lcd_gotoxy(1,2);
         lcd_putc("VUI LONG THU LAI");
         delay_ms(1000);
         tt=0;
         b=7;
         lcd_putc('\f');
         tieu_de();
      }
}
void gan_phim()
{
   pw_nhap[dem] = kp;
   dem++;
   if(dem == 4)
   {
      dem=0;
   }
}
void quet(int8 k){
   switch(k){
      case 1:
      {
         output_low(C1);
         output_high(C2);
         output_high(C3);
         break;
      }
      case 2:
      {
         output_low(C2);
         output_high(C1);
```

```
            output_high(C3);
            break;
         }
         case 3:
         {
            output_low(C3);
            output_high(C2);
            output_high(C1);
            break;
         }
      }
}
void nhap_phim(){
int8 i,a=0,x,y,z,t;
   for(i=1;i<5;i++){
      switch(i)
      {
         case 1:
         {
         quet(1);
         if(input(R1)==0)
         {
            lcd_gotoxy(b,2);
            printf(lcd_putc,"*");//1
            b++;
            a=1;
            kp=1;
            gan_phim();
         }
         else if(input(R2)==0)
         {
            lcd_gotoxy(b,2);
            printf(lcd_putc,"*");//4
            b++;
            a=1;
            kp=4;
            gan_phim();
         }
         else if(input(R3)==0)
         {
            lcd_gotoxy(b,2);
            printf(lcd_putc,"*");//7
            b++;
            a=1;
            kp=7;
            gan_phim();
         }
         else if(input(R4)==0)//*
         {
            a=1;
```

```
   kp=0;
}
break;
}
case 2:
{
   quet(2);
   if(input(R1)==0)
{
   lcd_gotoxy(b,2);
   printf(lcd_putc,"*"); //2
   b++;
   a=1;
   kp=2;
   gan_phim();
}
else if(input(R2)==0)
{
   lcd_gotoxy(b,2);
   printf(lcd_putc,"*");//5
   b++;
   a=1;
   kp=5;
   gan_phim();
}
else if(input(R3)==0)
{
   lcd_gotoxy(b,2);
   printf(lcd_putc,"*");//8
   b++;
   a=1;
   kp=8;
   gan_phim();
}
else if(input(R4)==0)//0
{
   lcd_gotoxy(b,2);
   printf(lcd_putc,"*");//0
   b++;
   a=1;
   kp=0;
   gan_phim();
}
break;
}
case 3:{
   quet(3);
   if(input(R1)==0)
{
   lcd_gotoxy(b,2);
```

```
            printf(lcd_putc,"*");//3
            b++;
            a=1;
            kp=3;
            gan_phim();
         }
         else if(input(R2)==0)
         {
            lcd_gotoxy(b,2);
            printf(lcd_putc,"*");//6
            b++;
            a=1;
            kp=6;
            gan_phim();
         }
         else if(input(R3)==0)
         {
            lcd_gotoxy(b,2);
            printf(lcd_putc,"*");//9
            b++;
            a=1;
            kp=9;
            gan_phim();
         }
         else if(input(R4)==0)//#
         {
            a=1;
            kp=0;
         }
         break;
         }
      }
      do {
         x=input(R1);
         y=input(R2);
         z=input(R3);
         t=input(R4);
         if(a==1)
         {
            a=0;
         }
      }
      while(x==0||y==0||z==0||t==0);
      }
}
void check_pass(){
   for(int j=0;j<4;j++)
   {
      if(password[j] == pw_nhap[j])
      {
```

```
            tt++;
        }
        else
        {
            lcd_gotoxy(7,2);
            lcd_putc("ERROR");
            led_sai(2,1);
            dem_nhap++;
            tt=0;
            if(dem_nhap==3)
            {
                delay_ms(500);
                lcd_gotoxy(1,1);
                lcd_putc("\f QUA SO LAN NHAP");
                lcd_gotoxy(4,2);
                lcd_putc("WARNING!!!");
                delay_ms(50);
                led_sai(3,1);
                dem_nhap = 0;
                delay_ms(1000);
            }
            delay_ms(1000);
            tieu_de();
            break;// ko co se error lien tuc
        }
    }
    if (tt>=3){
        lcd_gotoxy(6,2);
        lcd_putc("SUCCESS");
        led_dung(1,1);
        delay_ms(1000);
        dem_the = 0;
        dem_nhap = 0;
        motor();
    }
}
void cam_bien()
{
    if(CB1==0)
    {
        t=1;
    }
    if(t==1)
    {
        set_pwm2_duty(0);
        set_pwm1_duty(100);
        delay_ms(200);
        set_pwm2_duty(0);
        set_pwm1_duty(0);
        lcd_putc('\f');
```

```
      lcd_gotoxy(1,1);
      lcd_putc("Xin Moi Vao");
      delay_ms(3000);
      dn=1;
   }
   if(dn==1){
      t=0;
      //dn=1;
      lcd_putc('\f');
      lcd_gotoxy(1,1);
      lcd_putc("Dang Dong Cua");
      delay_ms(200);
      set_pwm2_duty(0);
      set_pwm1_duty(100);
      if(CB3==0){
         set_pwm2_duty(0);
         set_pwm1_duty(0);
         bipbip(2,1);
         lcd_putc('\f');
         lcd_gotoxy(1,1);
         lcd_putc("Co vat can");
         lcd_gotoxy(1,2);
         lcd_putc("Dang Mo Cua");
         delay_ms(500);
         set_pwm2_duty(100);
         set_pwm1_duty(0);
         dn=0;
      }
      if(CB2==0){
         delay_ms(200);
         set_pwm1_duty(100);
         set_pwm2_duty(100);
         dn=0;
         tieu_de();
      }
   }
}
void main()
{
   char size;
   char i;
   lcd_init();
   MFRC522_Init();
   port_b_pullups(1);
   char UID[5];
   unsigned int TagType;
   setup_timer_2(T2_DIV_BY_1,255,1);
   setup_ccp2(CCP_PWM);
   setup_ccp1(CCP_PWM);
   //gioi_thieu();
```

```
   tieu_de();
   while(TRUE)
   {
   nhap_phim();
   cam_bien();
   if (MFRC522_isCard (&TagType)) //Kiem tra the
      {
         if (MFRC522_ReadCardSerial (&UID)) //doc id the
            {
               tt_1 = QUET_THE(DATA_NHAT,UID);
               tt_2 = QUET_THE(DATA_KHOI,UID);
               nap_the();
          for (i = 0; i < 5; i++)
          {
            printf("%X",UID[i]);
          }
            size = MFRC522_SelectTag (&UID);
          }
         //MFRC522_Halt(); //Ngu dong loi success xong chay luon ham loi
      }
   if(input(PIN_D2)==0)
      {
         led_dung(1,1);
         motor();
      }
   if(b==11)
      {
         check_pass();
         b=7;
      }
   if (kbhit())
      {
         c = getch();
         if (c=='1')
         {
            led_dung(1,1);
            motor();
         }
      }
   }
}
```

File.h

```
#include <16F877A.h>
#device ADC=16

#FUSES NOWDT                    //No Watch Dog Timer
#FUSES NOBROWNOUT               //No brownout reset
```

```
#FUSES NOLVP                    //No low voltage prgming, B3(PIC16) or
B5(PIC18) used for I/O

#use delay(crystal=4MHz)
#use RS232(baud=9600, xmit=PIN_C6, rcv=PIN_C7)
//LED
#define led1(x) output_bit(PIN_E2,x);//xanh
#define led2(x) output_bit(PIN_E1,x);//cam
// LCD
#define LCD_RS_PIN      PIN_E0
#define LCD_RW_PIN      PIN_A0
#define LCD_ENABLE_PIN  PIN_A1
#define LCD_DATA4       PIN_A2
#define LCD_DATA5       PIN_A3
#define LCD_DATA6       PIN_A4
#define LCD_DATA7       PIN_A5
// RFID
#define MFRC522_CS  PIN_D7 //SDA //B4//
#define MFRC522_SCK PIN_D6 //SCK //B3//
#define MFRC522_SI  PIN_D5 //MOSI//B2//
#define MFRC522_SO  PIN_D4 //MISO//B1//
#define MFRC522_RST PIN_C5  //RST //B0//
// Nut nhan
#define  CT    PIN_D2
// Cam bien vat can
#define  CB1   input(PIN_C4)
#define  CB2   input(PIN_C3)
#define  CB3   input(PIN_D0)
// KEYPAD
#define     R1      PIN_B0
#define     R2      PIN_B1
#define     R3      PIN_B2
#define     R4      PIN_B3
#define     C1      PIN_B4
#define     C2      PIN_B5
#define     C3      PIN_B6
```

4.3 Window form for c# in Visual Studio.

- To comunication Computer with PIC16F877A, we use the COM Port to transmit data from Computer and microcontroller.
- The COM Port is use with Driver MAX232 to transmit data
- MAX232 connected to PINS RC7 and RC6 (Rx and Tx) of PIC16F877A

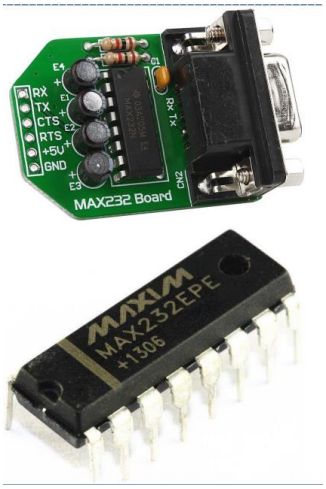


Image 4.3.1: COM Port and MAX232

- In Visual Studio, declare command to transmit data in C# is Serial Port
- This is the WindowForm to control microcontroller from COM Port

Image 4.3.2: WindowForm to control microcontroller

4.4 Code C# in Visual Studio

- We use the Window class in Window form:

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;
using System.IO;
using System.IO.Ports;
using AForge.Video;
using System.Drawing.Imaging;
using System.Threading;
```

4.4.1: Connect COM Port.

```
private void Form1_Load_1(object sender, EventArgs e)
        {
            string[] ports = SerialPort.GetPortNames();
            foreach(string port in ports)
            {
                comboBox_COMPort.Items.Add(port);
            }
        }
private void comboBox_COMPort_SelectedIndexChanged(object sender, EventArgs e)
        {
            serialPort1.PortName = comboBox_COMPort.Text;
        }
private void btn_connect_Click(object sender, EventArgs e)
        {
            if(comboBox_COMPort.Text == "")
            {
                MessageBox.Show("Hãy chọn cổng COM.", "Thông Báo",
MessageBoxButtons.OK, MessageBoxIcon.Information);
            }
            else
            {
                try
                {
                    if (serialPort1.IsOpen)
                    {
                        MessageBox.Show("Cổng COM đã kết nối.", "Thông Báo",
MessageBoxButtons.OK, MessageBoxIcon.Information);
                    }
                    else
                    {
                        serialPort1.Open();
                        timer1.Start();
                        textBox2.BackColor = Color.Lime;
```

```
                    textBox2.Text = "Connected";
                    comboBox_COMPort.Enabled = false;
                }
            }
            catch(Exception)
            {
                MessageBox.Show("Cổng COM này đã được sử dụng cho thiết bị
khác.", "Thông Báo", MessageBoxButtons.OK, MessageBoxIcon.Information);
            }
        }
    }
```

4.4.2: Connect Camera with Smart phone.

```
public partial class Form1 : Form
    {
        MJPEGStream stream;
        public Form1()
        {
            InitializeComponent();
            stream = new MJPEGStream("http://192.168.43.60:4747/video?");
            stream.NewFrame += stream_NewFrame;

        }
private void stream_NewFrame(object sender, NewFrameEventArgs eventArgs)
{
      Bitmap bmp = (Bitmap)eventArgs.Frame.Clone();
        ptb_camera.Image=bmp;

}
private void btn_batcam_Click(object sender, EventArgs e)
        {
            stream.Start();

        }
private void btn_tatcam_Click(object sender, EventArgs e)
        {
            stream.Stop();

        }
```

4.4.3: Display ID Card in Window form

```
private void timer1_Tick(object sender, EventArgs e)
        {
            String temp = serialPort1.ReadExisting().ToString();
            if (!String.IsNullOrEmpty(temp)) txt_id.Text = temp;

        }
```

4.4.4: Open the door from Uart

```
private void btn_open_Click(object sender, EventArgs e)
        {
            serialPort1.Write("1");
        }
```

- In CCS for C, we add the code to receive data from computer to Microcontroller PIC to execute command open the door.

```
char c;

void main()

while(TRUE)

if (kbhit())
      {
         c = getch();
         if (c=='1')
         {
            led_dung(1,1);
            motor();
         }
     }
```