SAVITRIBAI PHULE PUNE UNIVERSITY

A

Mini Project & Seminar Report

On

"Automated Door Locking System using PIC Microcontroller"

Submitted by

SUMEET SHIRPURKAR T120323101

AMIT VITEKAR T120323112

ROHIT JADHAV T120323050

Guided by

Prof. P. B. Chopade

Department of Electronics & Telecommunication

Modern Education Society's

College of Engineering, Pune-01

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SAVITRIBAI PHULE PUNE UNIVERSITY

Modern Education Society's College of Engineering, Pune-01

Dept. of Electronics & Telecommunication

CERTIFICATE

This is to certify that the Mini-project & seminar entitled "Automated Door Locking system using Microcontroller" has been carried by

SUMEET SHIRPURKAR T120323101

AMIT VITEKAR T120323112

ROHIT JADHAV T120323050

as a partial fulfilment for the Bachelor of Engineering degree in Electronics & Telecommunication of Savitribai Phule Pune University during the academic year 2016-2017.

Project Guide

Prof P. B. Chopade

Head of Department

Prof P. B. Chopade

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Last but not the least, our sincere thanks to all of our friends who have patiently extended all sorts of help in this project.

SUMEET SHIRPURKAR

AMIT VITEKAR

ROHIT JADHAV

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ABSTRACT

Security is a prime concern in our day-today life. Everyone wants to be as much secure as possible. An access control for doors forms a vital link in a security chain. The microcontroller based Door locker is an access control system that allows only authorized persons to access a restricted area. The system is fully controlled by the 8 bit microcontroller PIC16FXXX which has a --Kbytes of ROM for the program memory. The password is stored in the EPROM so that we can change it at any time. The system has a Keypad by which the password can be entered through it. When they entered password equals with the password stored in the memory then the relay gets on and so that the door is opened. If we entered a wrong password, then the Alarm is switched on. When we go inside and come back then the microcontroller will sense the person using the Laser light, the microcontroller will automatically open the door for you.

1. INTRODUCTION

“Password Based Door Security System using Microcontroller” is used in the places where we need more security. It can also be used to secure lockers and other protective doors.

The system comprises a number keypad which is connected to the PIC16FXXX. This is one of the popular Microcontrollers. It has only -- pins and there are – input/output lines. The microcontroller has a program memory of --Kilobytes. The microcontroller continuously monitor the keypad and if somebody enters the password it will check the entered password with the password, which was stored in the memory and if it they are same then the microcontroller will switch on the corresponding device. Which will lead to access through the door.

2. PROJECT DESCRIPTION

2.1 BLOCK DIAGRAM

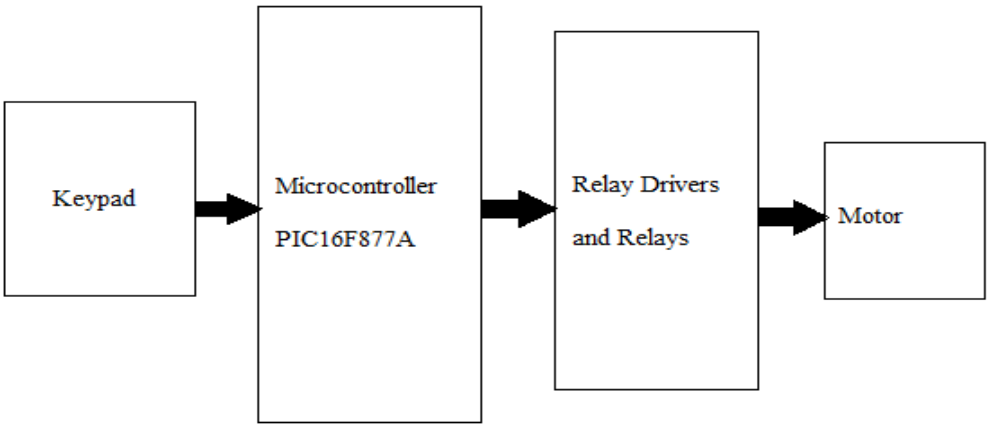

Fig A

2.2 BLOCK DIAGRAM EXPLANATION

A. PIC16F877A's PIN-OUT.

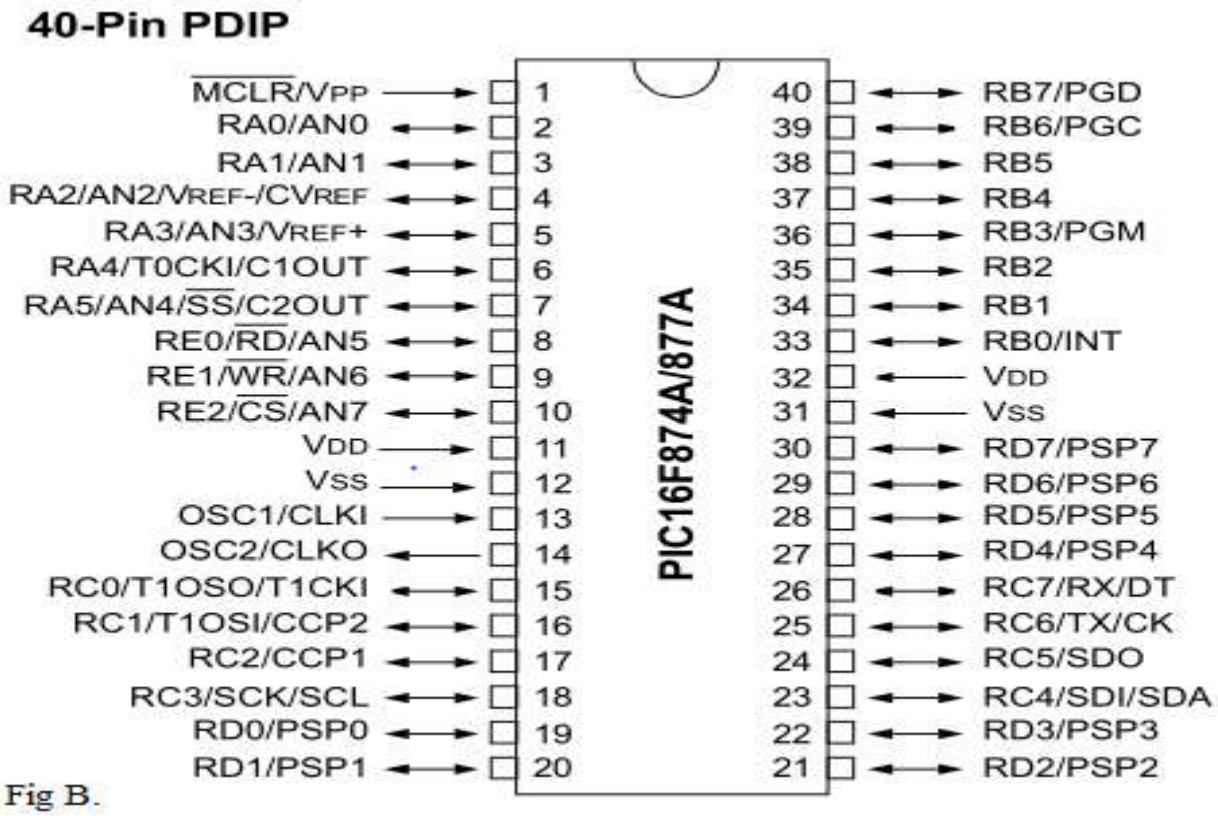

Fig B.

PIC16F877A is available in 40-pin and 44-pin packages. All devices in the PIC16F87XA family share common architecture with the following differences:

- The 28-pin devices have three I/O ports, while the 40/44-pin devices have five
- The 28-pin devices have fourteen interrupts, while the 40/44-pin devices have Fifteen.
- The 28-pin devices have five A/D input channels, while the 40/44-pin devices have eight.
- The Parallel Slave Port is implemented only on the 40/44-pin devices.

B. Memory Organization

- There are three memory blocks in PIC16F877A.
- The program memory and data memory have separate buses so that concurrent access can occur.
- The PIC16F877A has an 8K words x 14 bits of Flash program memory, Accessing a location above the physically implemented address will cause a wraparound.
- The data memory is partitioned into multiple banks which contain the General-Purpose Registers and the Special Function Registers.
  Bits RP1 (Status<6>) and RP0 (Status<5>) are the bank select bits.

C. Timers/Counters

1. TIMER0 MODULE

- The Timer0 module timer/counter has the following features:
  • 8-bit timer/counter

• Readable and writable

• 8-bit software programmable prescalar.

• Internal or external clock select

• Interrupt on overflow from FFh to 00h

• Edge select for external clock

- Timer mode is selected by clearing bit T0CS. In Timer mode, the Timer0 module will increment every instruction cycle (without prescaler).
- If the TMR0 register is written, the incre-ment is inhibited for the following two instruction cycles. The user can work around this by writing an adjusted value to the TMR0 register.

2. TIMER1 MODULE

- The Timer1 module is a 16-bit timer/counter consisting of two 8-bit registers (TMR1H and TMR1L) which are readable and writable. The TMR1 register pair (TMR1H:TMR1L) increments from 0000h to FFFFh and rolls over to 0000h. The TMR1 interrupt, if enabled, is generated on overflow which is latched in interrupt flag bit, TMR1IF (PIR1<0>). This interrupt can be enabled/disabled by setting/clearing TMR1 interrupt enable bit, TMR1IE (PIE1<0>).

Timer1 can operate in one of two modes:

• As a Timer

• As a Counter

3. TIMER2 MODULE

- Timer2 is an 8-bit timer with a prescaler and a postscaler. It can be used as the PWM time base for the PWM mode of the CCP module(s). The TMR2 register is readable and writable and is cleared on any device Reset.

- The Timer2 module has an 8-bit period register, PR2. Timer2 increments from 00h until it matches PR2 and then resets to 00h on the next increment cycle. PR2 is a readable and writable register. The PR2 register is initialized to FFh upon Reset.

D. PIN CONFIGURATIONS OF PIC16F877A.

PIN 1: MCLR
The first pin is the master clear pin of this IC. It resets the microcontroller and is active low, meaning that it should constantly be given a voltage of 5V and if 0 V are given then the controller is reset. Resetting the controller will bring it back to the first line of the program that has been burned into the IC.

PIN 2: RA0/AN0
PORTA consists of 6 pins, from pin 2 to pin 7, all of these are bidirectional input/output pins. Pin 2 is the first pin of this port. This pin can also be used as an analog pin AN0.

PIN 3: RA1/AN1
This can be the analog input 1.

PIN 4: RA2/AN2/Vref-
It can also act as the analog input2. Or negative analog reference voltage can be given to it.

PIN 5: RA3/AN3/Vref+
It can act as the analog input 3. Or can act as the analog positive reference voltage.

PIN 6: RA0/T0CKI
To timer0 this pin can act as the clock input pin, the type of output is open drain.

PIN 7: RA5/SS/AN4
This can be the analog input 4. There is synchronous serial port in the controller also and this pin can be used as the slave select for that port.

PIN 8: RE0/RD/AN5
PORTE starts from pin 8 to pin 10 and this is also a bidirectional input output port. It can be the analog input 5 or for parallel slave port it can act as a 'read control' pin which will be active low.

PIN 9: RE1/WR/AN6
It can be the analog input 6. And for the parallel slave port it can act as the 'write control' which will be active low.

PIN 10: RE2/CS/A7
It can be the analog input 7, or for the parallel slave port it can act as the 'control select' which will also be active low just like read and write control pins.

PIN 11 and 32: VDD
These two pins are the positive supply for the input/output and logic pins. Both of them should be connected to 5V.

PIN 12 and 31: VSS
These pins are the ground reference for input/output and logic pins. They should be connected to 0 potential.

PIN 13: OSC1/CLKIN
This is the oscillator input or the external clock input pin.

PIN 14: OSC2/CLKOUT
This is the oscillator output pin. A crystal resonator is connected between pin 13 and 14 to provide external clock to the microcontroller. ¼ of the frequency of OSC1 is outputted by OSC2 in case of RC mode. This indicates the instruction cycle rate.

PIN 15: RC0/T1OCO/T1CKI
PORTC consists of 8 pins. It is also a bidirectional input output port. Of them, pin 15 is the first. It can be the clock input of timer 1 or the oscillator output of timer 2.

PIN 16: RC1/T1OSI/CCP2
It can be the oscillator input of timer 1 or the capture 2 input/compare 2 output/ PWM 2 output.

PIN 17: RC2/CCP1
It can be the capture 1 input/ compare 1 output/ PWM 1 output.

PIN 18: RC3/SCK/SCL
It can be the output for SPI or I2C modes and can be the input/output for synchronous serial clock.

PIN 23: RC4/SDI/SDA
It can be the SPI data in pin. Or in I2C mode it can be data input/output pin.

PIN 24: RC5/SDO
It can be the data out of SPI in the SPI mode.

PIN 25: RC6/TX/CK
It can be the synchronous clock or USART Asynchronous transmit pin.

PIN 26: RC7/RX/DT
It can be the synchronous data pin or the USART receive pin.

PIN 19,20,21,22,27,28,29,30:
All of these pins belong to PORTD which is again a bidirectional input and output port. When the microprocessor bus is to be interfaced, it can act as the parallel slave port.

PIN 33-40: PORT B
All these pins belong to PORTB. Out of which RB0 can be used as the external interrupt pin and RB6 and RB7 can be used as in-circuit debugger pins.

3. CIRCUIT DIAGRAM

3 .1 MAIN CIRCUIT DIAGRAM

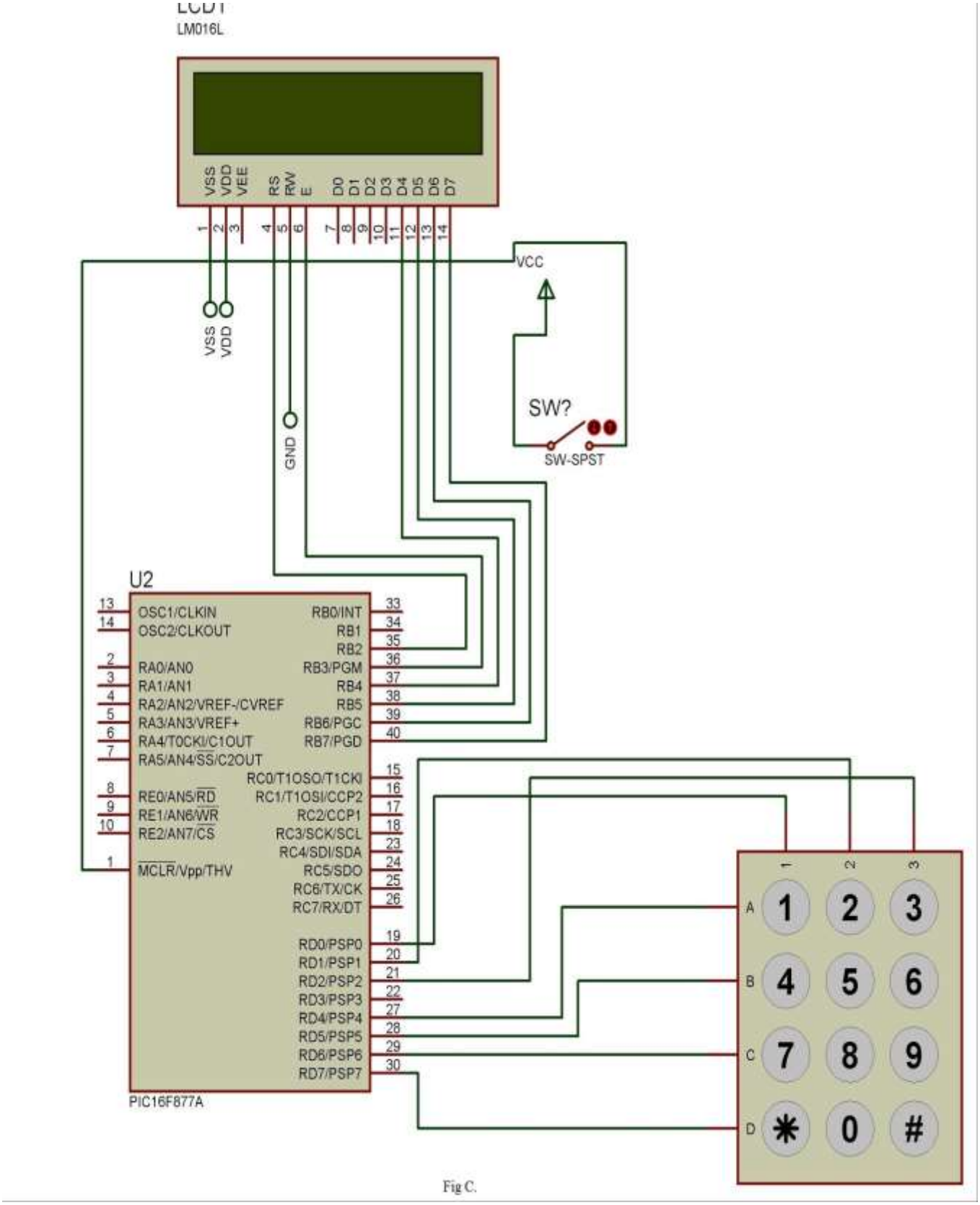

Fig C.

3.2 POWER SUPPLY DIAGRAM

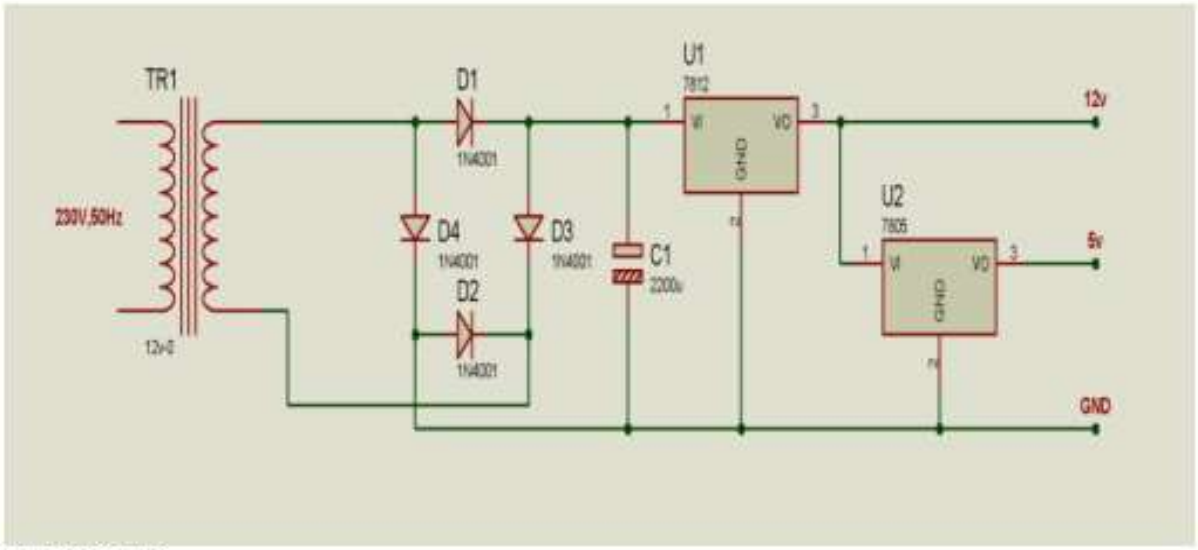

FIGURE: D

3.3. CIRCUIT DIAGRAM EXPLANATION

The Main Part of the above Circuit diagrams is the Microcontroller PIC16FXXX. The Keypad was the input device and it was connected in a matrix format so that the numbers of ports needed are reduced. The Microcontroller reads a four-digit password through the Keypad. Then the Microcontroller compares the four-digit password with the number, which is pre-programmed and if it is equal then the Microcontroller will switch on the motor for the door and if we enter the wrong password for more than three times then an alarm will be switched on until a right password was pressed through the Keypad. The Password was stored in the EEPROM and the password can be changed at any time using the same keypad. The power supply section is the important one. It should deliver constant output regulated power supply for successful working of the project. A 0-12V/500 mA transformer is used for our purpose the primary of this transformer is connected in to main

supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes convert from 12V AC to 12V DC voltage. Which is further regulated to +5v, by using IC 7805.

4. FLOWCHART

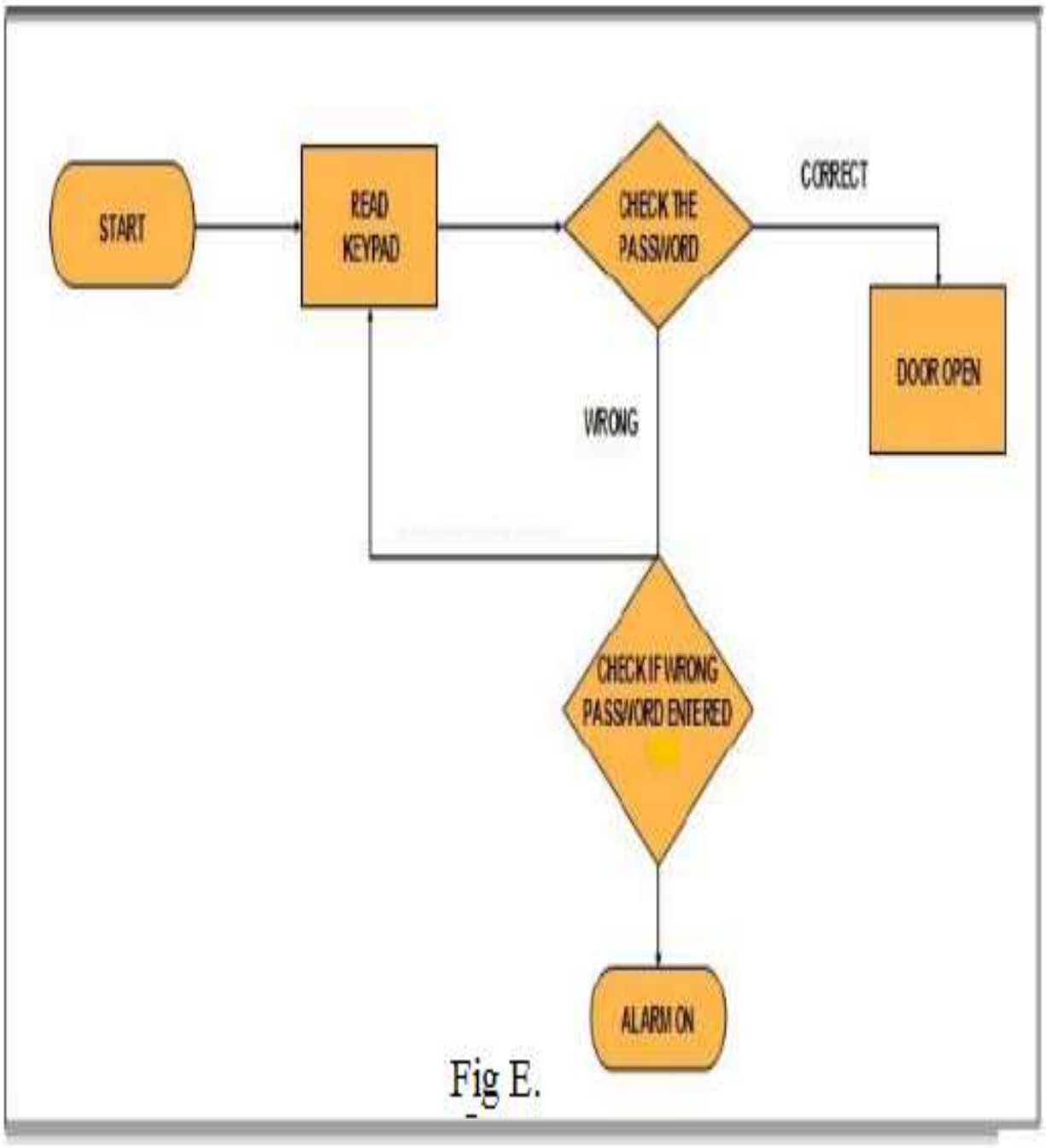

Fig E.

5. ALGORITHM

1. START

2. initialise lcd, keypad

3. clear lcd

4. print “Enter the Password” on lcd

5. get 5 char long password using matrix key pad

6. if input = “5678” then

6.1 print “Access Granted”

6.1.1 else

6.1.2 print “Access Denied” on lcd and then sound alarm on.

7. STOP

6. PROGRAM

```
#include <xc.h>
#include"delay.h"
#include"lcd_4bit.h"
#include"keypad.h"
#pragma config CP=0FF
#pragma config DEBUG=0FF
#pragma config CPD=0FF
#pragma config LVP=0FF
#pragma config BOREN=0FF
#pragma config FOSC=HS
#pragma config WDTE=OFF

void main(void)
{
    TRISDbits.TRISD5=0; //relay door open
    TRISDbits.TRISD7=0; //relay door close
    TRISCbits.TRISC6=0; //buzzer


    PORTDbits.RD5=0;
    PORTDbits.RD6=0;
    PORTCbits.RC6=0;
```

```
    char Key = 'n';                 // Variable to store pressed key value
    unsigned int pos=0xC0;
    unsigned int passcount=0,lencount=0;
    char password[5];
      InitKeypad();
      lcd_init();
    DisplayMsg(1,1," Password Based ",16);
    DisplayMsg(2,1,"   Door Lock    ",16);
    delay(500);

    clear();
    DisplayMsg(1,1,"Enter Password  ",16);
      delay(100);
    pos=0xC0;

      while(1)
  {

          Key = GetKey();
        if(Key>='0' && Key<='9' && lencount<4)
        {
          Command(pos);
          Display(Key);
          pos++;
```

```
    password[passcount]=Key;
    passcount++;
    lencount++;

}
else{
    if(lencount>=4)
    {
 if(password[0]=='5' && password[1]=='6'&&  password[2]=='7'
 && password[3]=='8')
       {
          clear();
          DisplayMsg(1,1,"Access Granted  ",16);
          delay(100);
          PORTDbits.RD5=1;
          delay(1000);
          PORTDbits.RD5=0;
          delay(2500);
          PORTDbits.RD7=1;
          delay(1000);
          PORTDbits.RD7=0;

          clear();
          DisplayMsg(1,1,"Enter Password  ",16);
```

```
                pos=0xc0;
            }
            else{
                clear();
                DisplayMsg(1,1,"Access Denied   ",16);
                delay(100);
                PORTCbits.RC6=1;
                delay(1000);
                PORTCbits.RC6=0;
                clear();
                DisplayMsg(1,1,"Enter Password  ",16);
                pos=0xc0;
            }
            lencount=0;
             passcount=0;
            pos=0xc0;
        }


    }
}

}
```

7. COMPONENTS DETAILS

7.1. Resistor:

Resistor is a component that resists the flow of direct or alternating Electric circuit. Resistors can limit or divide the current, reduce the voltage, protect an electric circuit, or provide large amounts of heat or light. An electric current is the movement of charged particles called electrons from one region to another. Resistors are usually placed in electric circuits. Physicists explain the flow of current through a material, such as a resistor, by comparing it to water flowing through a pipe. Resistors are designed to have a specific value of resistance. Resistors used in electric circuits are cylindrical. They are often colour coded by three or four colour bands that indicate the specific value of resistance. Resistors obey ohm's law, which states that the current density is directly proportional to the electric field when the temperature is constant.

7.2 Capacitor:

Capacitor or electric condenser is a device for storing an electric charge. The simplest form of capacitor consists of two metal plates separated by a non touching layer called the dielectric. When one plate is charged with electricity from a direct current or electrostatic source, the other plate has induced in it a charge of the opposite sign; that is, positive if the original charge is negative and negative if the original charge is positive. The electrical size of the capacitor is its capacitance. Capacitors are limited in the amount of electric

charge they can absorb; they can conduct direct current for only instances but function well as conductors in alternating current circuits. Fixed capacity and variable capacity capacitors are used in conjunction with coils as resonant circuits in radios and other electronic equipment. Capacitors are produced in a wide variety of forms. Air, Mica, Ceramics, Paper, Oil, and Vacuums are used as dielectrics depending on the purpose for which the device is intended.

7.3 Transistor:

Transistor is a device which transforms current flow from low resistance path to high resistance path. It is capable of performing many functions of the vacuum tube in electronic circuits, the transistor is the solid-state device consisting of a tiny piece of semiconducting material, usually germanium or silicon, to which three or more electrical connections are made. N-type and P-type Transistor: A germanium or silicon crystal, containing donor impurity atoms is called a negative or n-type semiconductor to indicate the presence of excess negatively charged electrons. The use of an acceptor impurity produces a positive, or p-type semiconductor so called because of the presence of positively charged holes. When an electrical voltage is applied, the n-p junction acts as a rectifier, permitting current to flow in only one direction. If the p-type region is connected to the positive terminal of the battery and the n-type to the negative terminal, a large current flow through the material across the junction.

7.4 Diode:

Diode is an electronic device that allows the passage of current in only one

direction. The first such devices were vacuum -tube diodes, consisting of an evacuated glass or steel envelope containing two electrodes – a cathode and an anode. The diodes commonly used in electronic circuits are semiconductor diodes. There are different diodes used in electronic circuits such as Junction diode, Zener diode, Photo diodes, and tunnel diode. Junction diodes consist of junction of two different kinds of semiconductor material. The Zener diode is a special junction type diode, using silicon, in which the voltage across the junction is independent of the current through the junction.

7.5 Integrated circuits

Regulator IC (LM 7805):

The LM7805 monolithic 3-terminal positive voltage regulators employ internal current-limiting, thermal shutdown and safe-area compensation, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 1.0A output 43 current. They are intended as fixed voltage regulators in a wide range of applications including local (on-card) regulation for elimination of noise and distribution problems associated with single-point regulation. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents. Considerable effort was expended to make the entire series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply.

7.6 BC 547

BC547 is an NPN bi-polar junction transistor. A transistor, stands for transfer of resistance, is commonly used to amplify current. A small current at its base controls a larger current at collector & emitter terminals.

BC547 is mainly used for amplification and switching purposes. It has a maximum current gain of 800. Its equivalent transistors are BC548 and BC549.

The transistor terminals require a fixed DC voltage to operate in the desired region of its characteristic curves. This is known as the biasing. For amplification applications, the transistor is biased such that it is partly on for all input conditions. The input signal at base is amplified and taken at the emitter. BC547 is used in common emitter configuration for amplifiers. The voltage divider is the commonly used biasing mode. For switching applications, transistor is biased so that it remains fully on if there is a signal at its base. In the absence of base signal, it gets completely off.

7.7 RELAY

8. PCB FABRICATION

The first step of assembling is to produce a printed circuit board. The fabrication of the program counter plays a crucial role in the electronic field. The success of the circuit is also dependent on the PCB. As far as the cost is concerned, more than 25% of the total cost is for the PCB design and fabrication. The board is designed using a personal computer. The layout is drawn using the software “Pro CAD”. The layout is printed in a “buffer sheet” using a laser procedure. First, a negative screen of the layout is prepared with the help of a professional screen printer. Then the copper clad sheet is kept under this screen. The screen printing ink is poured on the screen and brushed through the top of the screen. The printed board is kept under shade for few hours till the ink becomes dry. The etching medium is prepared with the un-hydrous ferric chloride water. The printed board is kept in this solution till the exposed copper dissolves in the solution fully. After that the board is taken out and rinsed in flowing water under a tap. The ink is removed with solder in order to prevent oxidation. Another screen, which contains component side layout, is prepared and the same is printed on the component side of the board. A paper epoxy laminate is used as the board. Both the component and the track layout of the peripheral PCB is given at the end of this report.

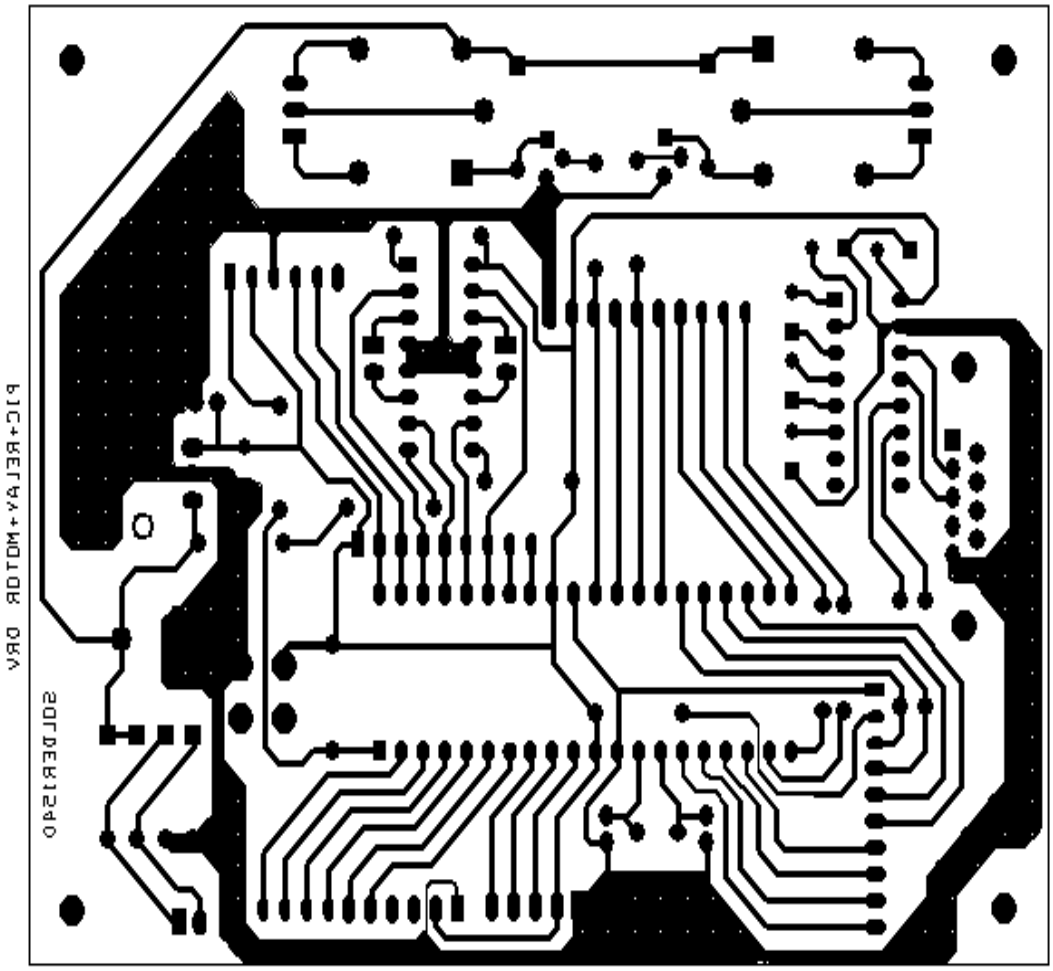

Fig F.

COMPONENT LAYOUT

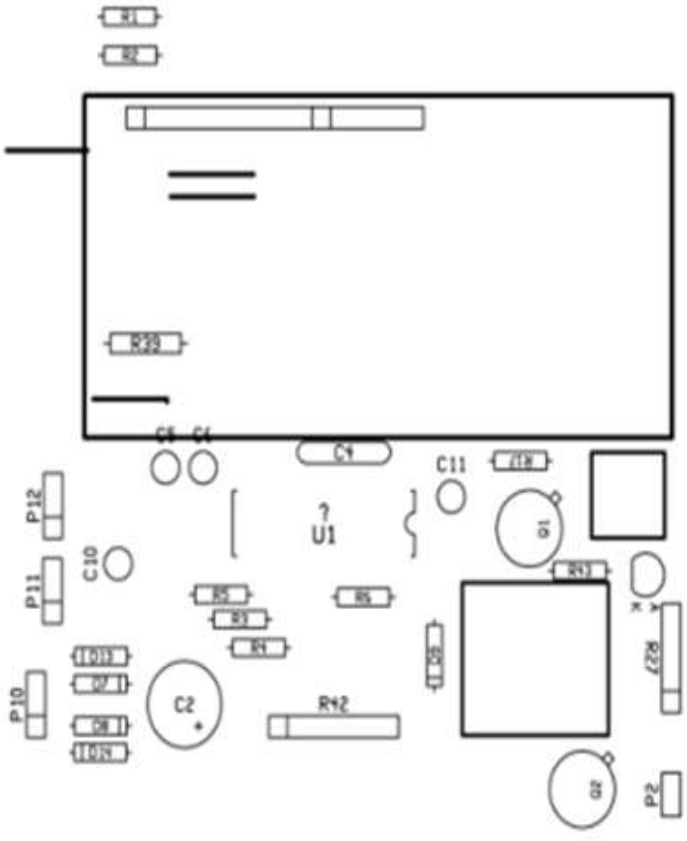

Fig G.

9. APPLICATIONS

This project is meant for security systems whose access is only for respected authorities. Using a microcontroller, the password entered is checked with the stored password and then does the corresponding operations. Here we use a 5 digit password for better secrecy.

1. For security purpose
2. For locking purpose

ADVANTAGES AND DISADVANTAGES

1. ADVANTAGES

One of the main advantages of an automated door lock system is not needing to carry a key. You'll no longer need to worry about losing your key or fidgeting at the door to get it open.

It also means that you won't need to store a spare key somewhere on your property, as many homeowners currently do. Because most criminals are used to looking around to find a spare key, eliminating the need for one will help make your home safer.

Another advantage of automated door lock system is that you can provide entry to your home for others at your discretion. You will not need to make copies of a key or leave keys for dog walkers, housekeepers, or house guests to get in to your home. Rather, you'll simply need to tell those people the proper code in order to gain access.

2. DISADVANTAGES

While keyless door lock systems are generally safe and designed to alert police or other authorities if incorrect codes are entered too many times, it is nonetheless possible that an intruder may be able to gain access to your home through this system by guessing or hacking the code.

Just as you can forget your keys and be locked out of your home, you can also forget the passcode to access your keyless entry system and be locked out. While it is safer to use a completely random code and avoid obvious choices like birth dates or simple, repetitive numbers, this can pose a problem if you have a difficult time remembering things.

One final disadvantage of keyless door locks is that electrically-powered systems may not function properly in the case of a power failure. This can leave your door completely locked throughout the failure, or it may result in the door not locking properly and remaining open. Fortunately, most systems have battery backup systems as a fail-safe.

LIMITATIONS

1. Difficult to implement
2. Source code is comparatively complex

CONCLUSION

Our electronic door lock performed as expected. We were able to implement all the functions specified in our proposal. The biggest hurdle we had to overcome with this project was interfacing the micro controller with the hardware components. We feel that this electronic door lock is very marketable because it

is easy to use, comparatively inexpensive due to low power consumption, and highly reliable. This door lock is therefore particularly useful in applications such as hotel room door locks, residential housing, and even office buildings.

FUTURE SCOPE

1. Electrical devices such as Lights, Computer etc. can be controlled by using separate passwords.
2. The system can be easily connected to the personal computer for further control.
3. Other than the speaker sounds, all the lights are made to turned on if password entered is wrong for three times and also a hidden camera is used to record the faces who trespassed.
4. We can use this system as an attendance register for the students to enter a class room with their respective password.

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