Password Based Circuit Breaker

Micro-project's Project Report

Submitted by

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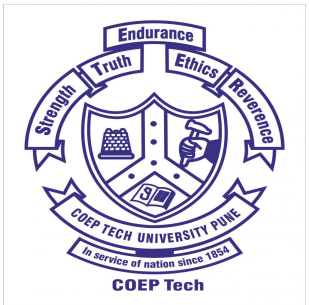

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CERTIFICATE

Certified that this project, titled "Password Based Circuit Breaker" has been successfully completed by

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Abstract

The major problem in the power system is the electrical accidents while repairing the electrical lines due to the lack of communication between the electrical substation and maintenance staff. This project gives a solution to this problem to ensure line man safety. The current lines are to be checked and maintained regularly and this task is not always done by an experienced engineer but by a daily wage worker having very little knowledge of how to operate properly on such a large current. So, the risk to life is very large, especially in rural parts of India. To make sure that no worker should be working risking their life we have come up with a solution of password-based circuit breaker. This circuit is simple to use simply connect it to an electric line and enter the password and the current will no longer flow from the electric line once you are done working simply enter the password again and the current will start to flow again. Also, this circuit does not require any external power supply to woks bur it will derive its working power from the line it's connected to so we don't need to carry any battery with us.

Contents

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Chapter 1

Introduction

1.1 Background

Safety of human life is of a paramount importance. In high current switching system, switch gear protects electrical circuit. "Security is the prime concern in our day to day life. Everyone needs to be securing as much as possible. The electric line man safety system is designed to control a switch gear by using a password for the safety of electric man. Critical electrical accidents to line men are on the rise during electric line repair due to lack of communication and co-ordination between the maintenance staff and electric substation staff. This project offers a resolution that safeguards safety of maintenance line men. The control to turn on or off the line will be maintained by the line man only because this system has an arrangement such that a password is required to operate the circuit breaker on/off .

The password can be entered manually by a keypad matrix. or automatically by a sending a message to the microcontroller circuit include the password. The microcontroller circuit enables remote control of the system. This leads to address the problem of loss of time. Between the two circuits there is a key to switch from manual mode to automatic mode and vice versa. The system also provided protection against over current using the sensors.

1.2 Problem Statement

Nowadays, electrical accidents to the line are increasing, while repairing the electrical lines due to the lack of communication between the electrical sub-station and maintenance staff. This project gives a solution to this problem to ensure line man safety. This

project is arranged in such a way that maintenance staff or line man has to enter the password to ON/OFF the electrical line. The problem of loss of time has also been addressed. So that the line man can be connect or disconnected without coming back to the station. ...

1.3 Objectives

The main objectives of this study are to

- Design of password based circuit breaker circuit.
- Make connection between the main circuit and the over current protection circuit.
- Simulate of controlling password based circuit breaker circuit

Chapter 2

PRINCIPLE OF WORKING

Microcontrollers as name suggests are small controllers. They as single chip computers that are often embedded into other systems to function as processing/controlling unit. Microcontroller – A single chip is used to controlling other devices. Any microcomputer system requires memory for storing the sequence of instructions for making up a pro-gram, parallel port or serial port for communicating with an external system, the timer for controlling purpose like generating time delays, Baud rate for the serial port, apart from the controlling unit called the Central Processing Unit. At present if there is any maintenance work at the distribution the entire line will be turned off which causes inconvenience to the consumers. The proposed system uses a microcontroller of the 8051 family and a rectified power supply. When the proposed system is ON MC A matrix keypad is interfaced to the microcontroller to enter a password. The password entered is displayed in the LCD. The entered password is compared with password stored in the ROM of the microcontroller. If the password entered is correct, then only the line can be turned ON/OFF. A relay is controlled by a relay driver IC, which is interfaced to the microcontroller also it is interfaced with the MC .Whenever there is a maintenance work in the main line ,the line can be disconnected only when the password entered will match with the stored password. The

relay ON/OFF operation will be indicated by the LED's; also it sends a message to the receiver about the line disconnection. As soon as the maintenance work is finished then line man should enter the same password as used to disconnect the line earlier.

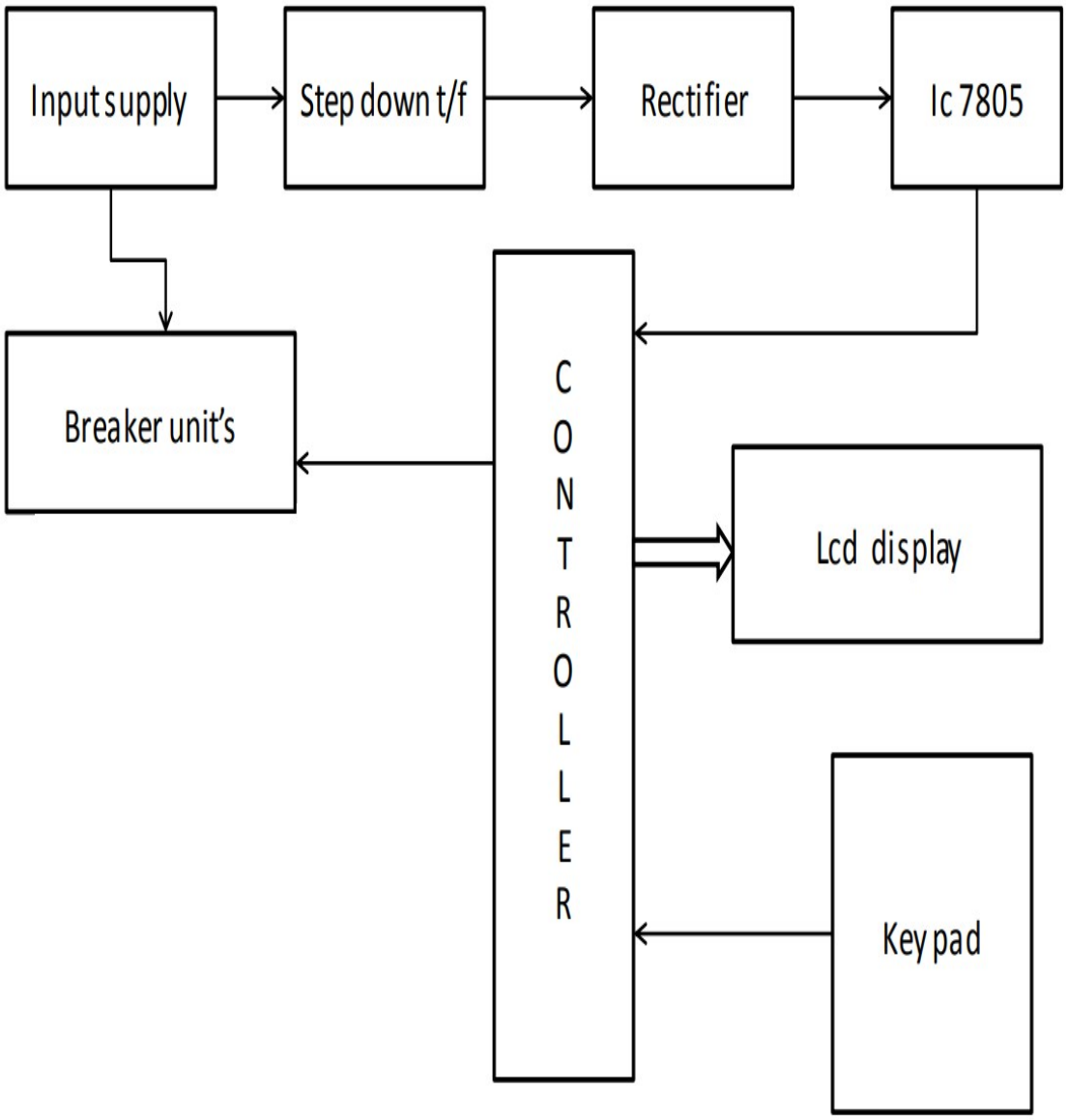


Figure 2.1: Micro-controllers interfacing

Chapter 3

OVERVIEW OF COMPONENTS

Hardware Requirement:

- Microcontroller
- Resistance
- Capacitor
- Diode
- Transistors
- Voltage Regulator
- Crystal Oscillator
- LCD display
- Keypad

3.1 Microcontroller

A microcontroller (sometimes abbreviated uC or MUC) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications

Figure 3.1: 8051 Microcontroller

3.2 RESISTORS

A resistor is a two-terminal electronic component designed to oppose and electric current by producing a voltage drop between its terminals in proportion to the current, that is, in accordance with Ohm's law: V = IR. Resistors are used as part of electrical networks and electronic circuits. They are extremely common place in most electronic equipment. Practical resistors can be made of various compounds and films, as well as resistance wire.

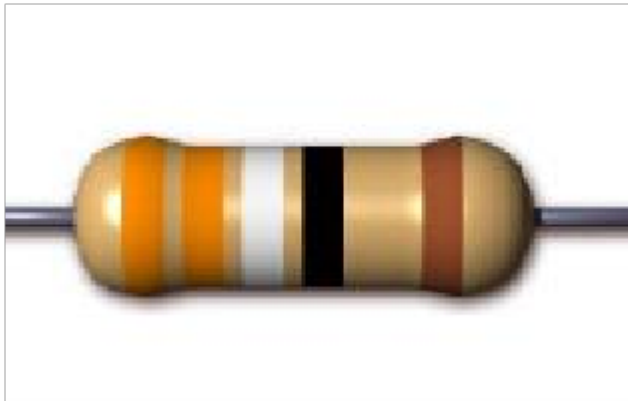


Figure 3.2: Resistor

3.3 CAPACITOR

A capacitor or condenser is a passive electronic component consisting of a pair of conductors separated by a dielectric. When a voltage potential difference exists between the conductors, an electric field is present in the dielectric. This field stores energy and produces a mechanical force between the plates. The effect is greatest between wide, flat, parallel, narrowly separated conductors.

Figure 3.3: Capacitor

3.4 DIODES

Diodes are used to convert AC into DC these are used as half wave rectifier or full wave rectifier. When used in its most common application, for conversion of an alternating current (AC) input into a direct current (DC) output, it is known as a bridge rectifier. A bridge rectifier provides full-wave rectification from a two-wire AC input, resulting in lower cost and weight as compared

to a rectifier with a 3-wire input from a transformer with a center-tapped secondary winding.

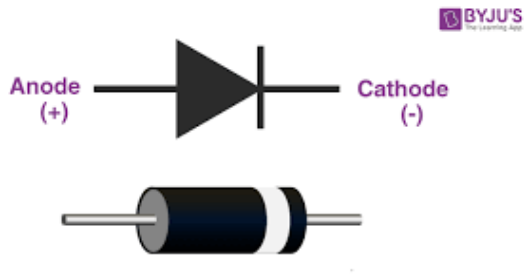


Figure 3.4: Diode

3.5 TRANSISTORS

A transistor is a semiconductor device used to amplify and switch electronic signals and electric power. It is composed of semiconductor material with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits. The transistor is the fundamental building block of modern electronic devices, and is ubiquitous in modern electronic systems.

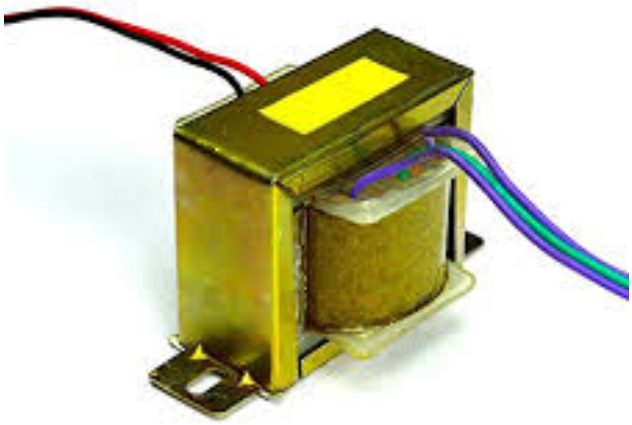


Figure 3.5: Transformer

3.6 VOLTAGE REGULATOR

7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator IC'S. The voltage source in a circuit may have fl voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

Figure 3.6: voltage regulator

3.7 Crystal oscillator

Crystal oscillator is an electronic oscillator circuit that uses mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillator.

Figure 3.7: Enter Caption

3.8 LCD Display

The term liquid crystal is used to describe a substance in a state between liquid and solid but which exhibits the properties of both. Molecules in liquid arrange themselves until they all point in the same specific direction. This arrangement of molecules enables the medium to flow as a liquid. Depending on the temperature and particular nature of a substance, liquid crystals can exist in one of several distinct phases. Liquid crystals in a nematic phase, in which there is no spatial ordering of the molecules, for example, are used in LCD technology. Here this used to display the password entered by us to ON/OFF the circuit breakers.

Figure 3.8: LCD display

3.9 Keypad

HEX keypad is a standard device with 16 keys connected in a 4x4 matrix, giving the characters 0-9 A-F. Interfacing of Hex key pad to Atmega32 is essential while designing embedded system projects which requires character or numeric input or both. For example projects like digital code lock, numeric calculator etc. Here we are using this to enter numeric password for turn ON/OFF the circuit breaker. This can be easily interface with ant kits Microcontroller Development Board. It is a four pin tactile switch and four mounting holes 3.2mm each

Figure 3.9: Key pad

Chapter 4

Methodology

4.1 Working

The project is divided into 3 sections-

1) AC to DC (5V) Converter-The main power line is also used to power the microcontroller. Transformer steps down 220V AC to 5V AC power.Bridge rectifier further makes it unidirectional and capacitor smoothens the ripples. Finally voltage regulator IC provides steady 5V power supply.

2) Password Verified- We enter the password on 4x4 matrix keypad which is verified by 8051 microcontroller and further signal is given to relay. A 16x2 LCD is also present to view password and the verification process.

3) Circuit breaker- Once we enter appropriate password VBE becomes +5V and hence transistor enters saturation region. Thus sufficient potential difference is generated at relay to break the circuit. Alternatively, we can enter the password again to restart power lines.

4.2 Circuit Diagram

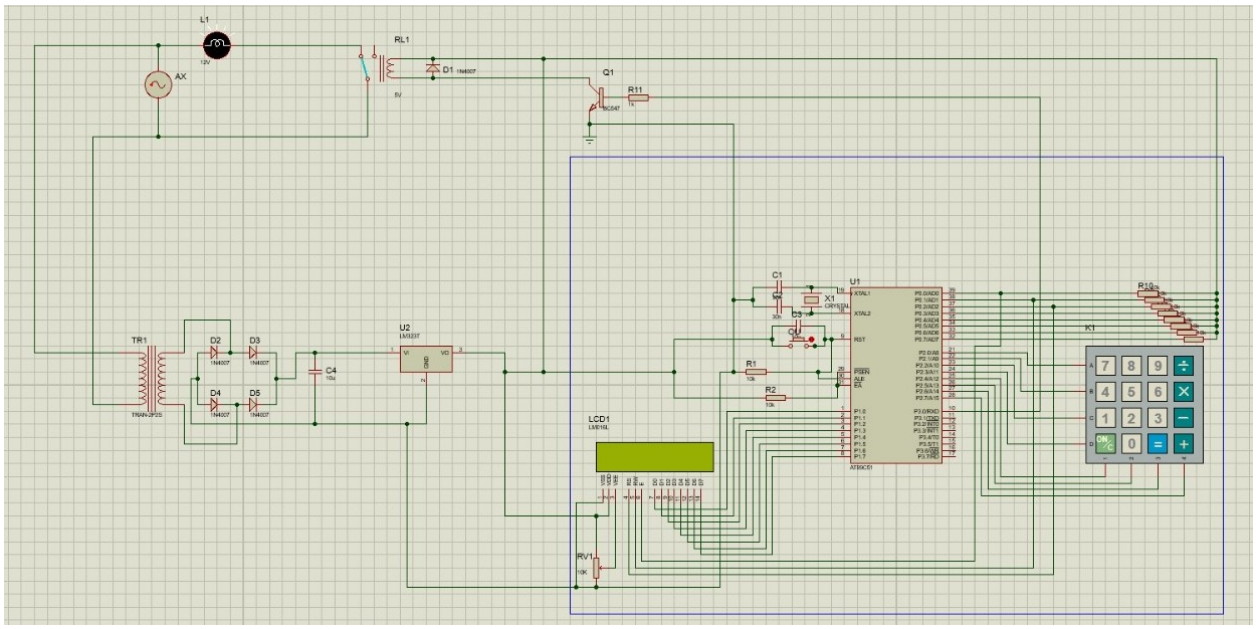


Figure 4.1: Circuit Diagram(source:-Proteus)

4.3 PCB layout

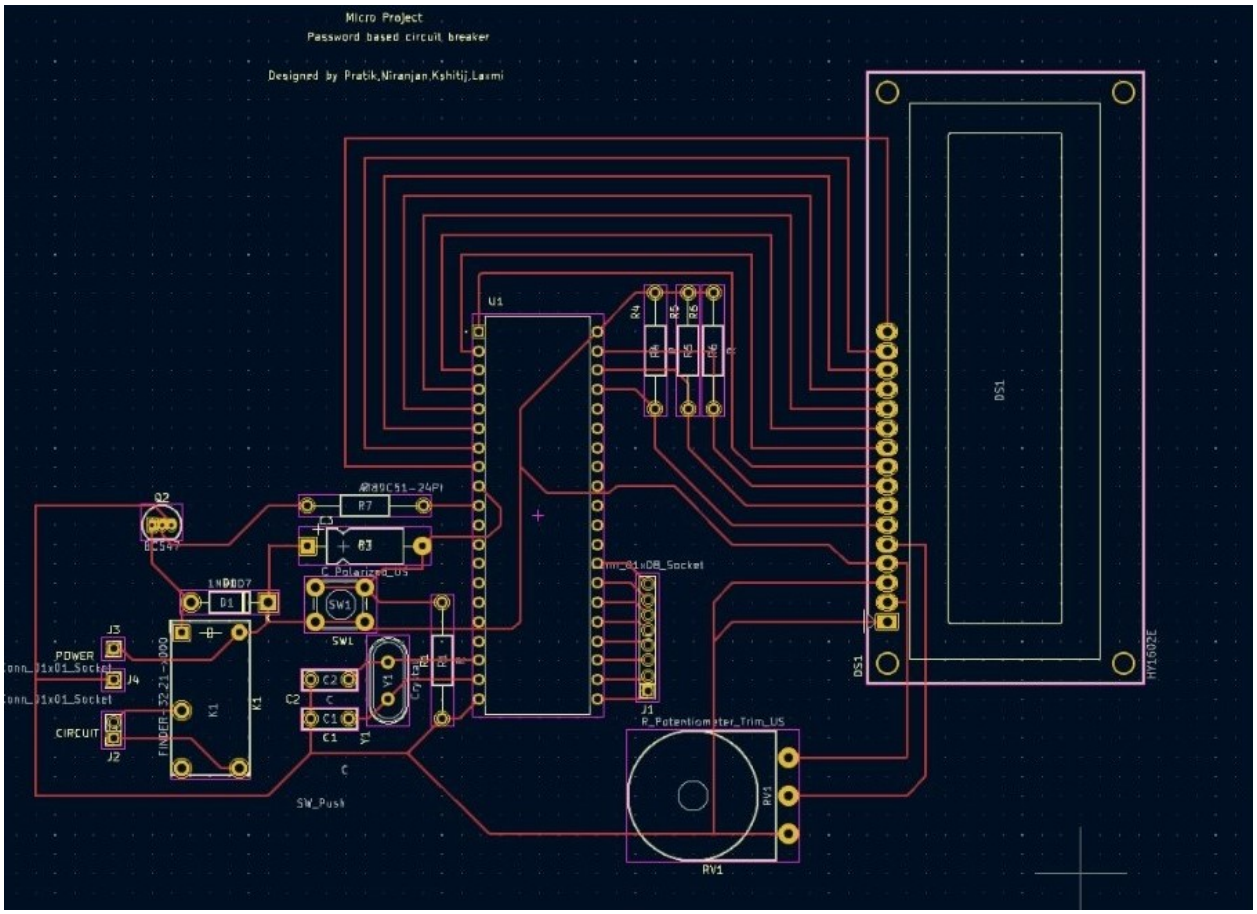


Figure 4.2: PCB design(source:-Kicad)

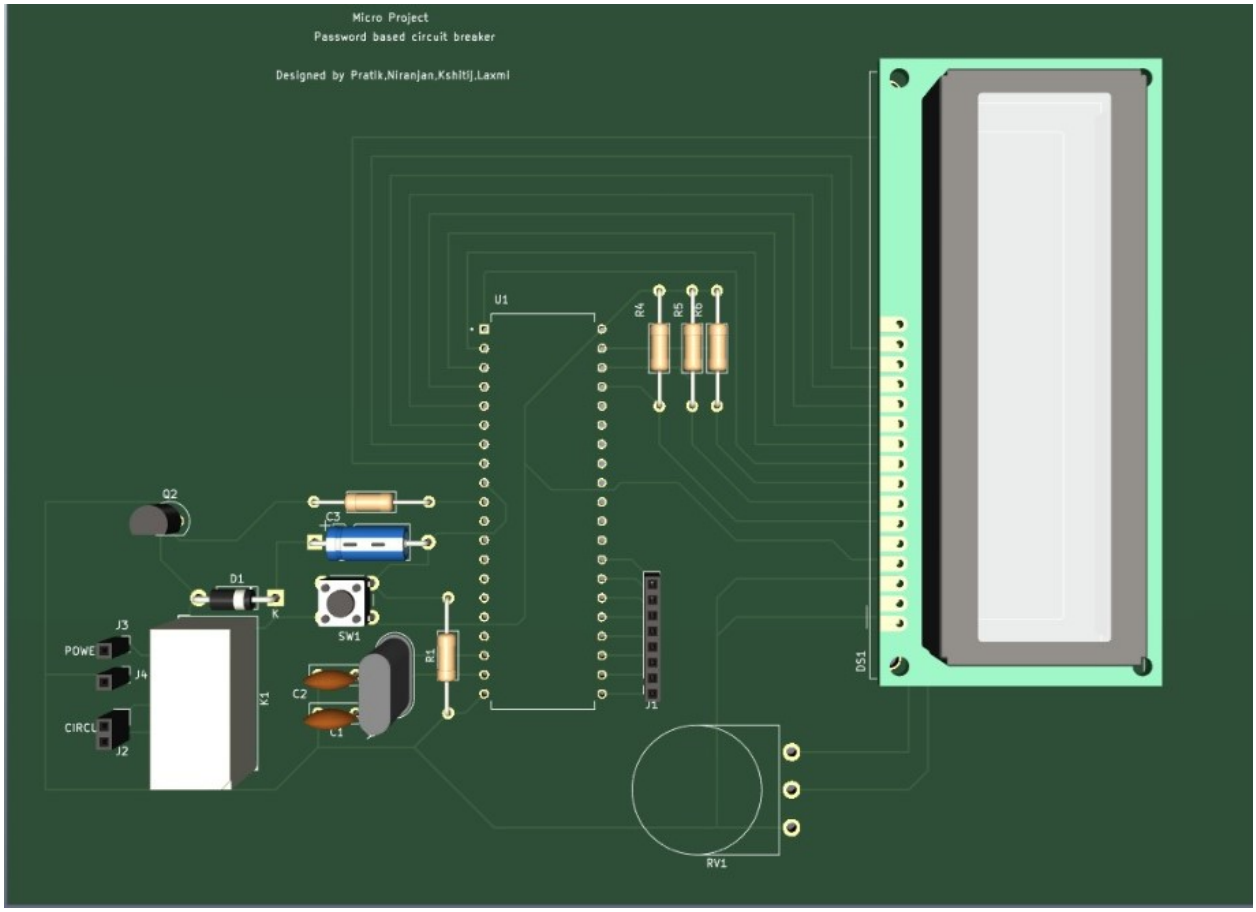


Figure 4.3: 3-d view

4.4 Gerber File

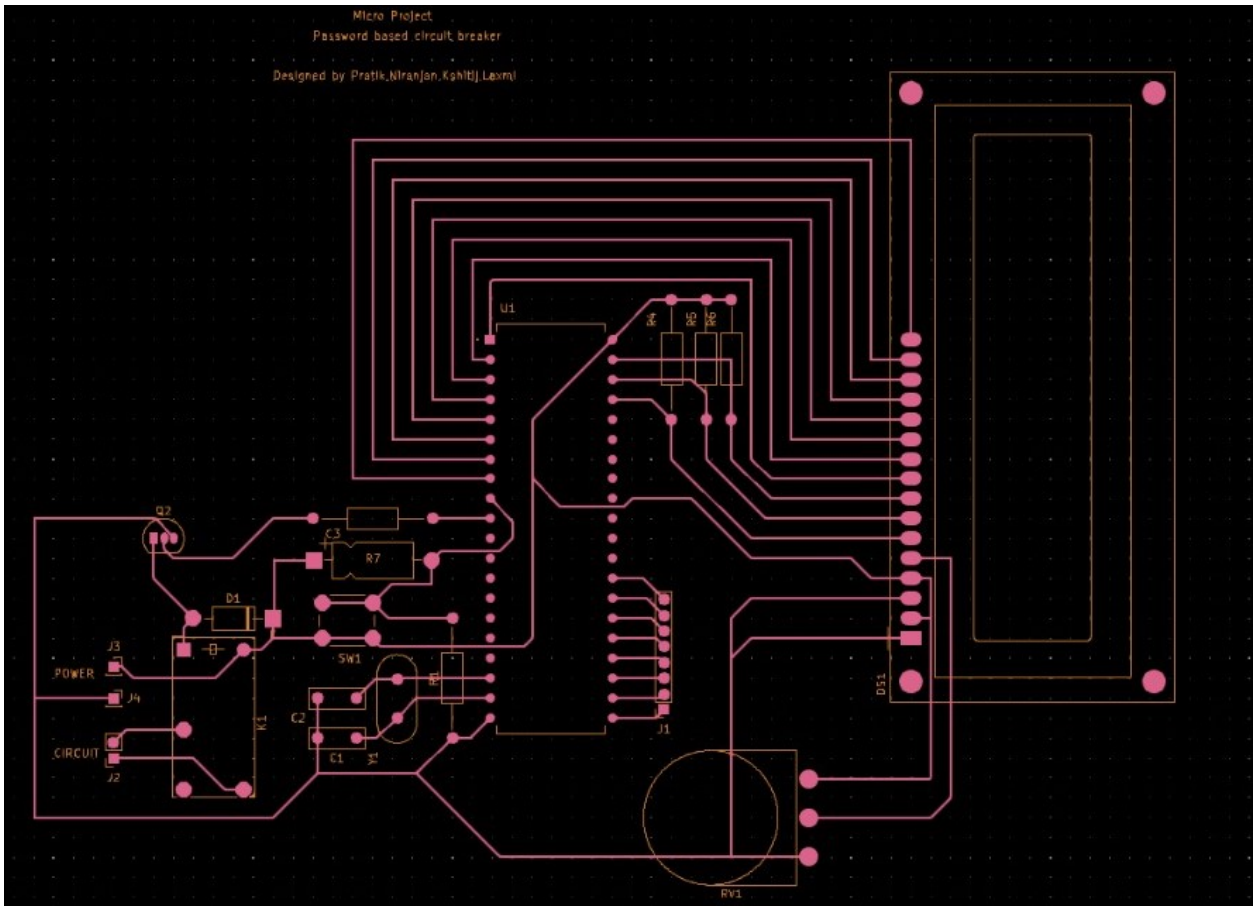


Figure 4.4: Gerber file

4.5 Simulation

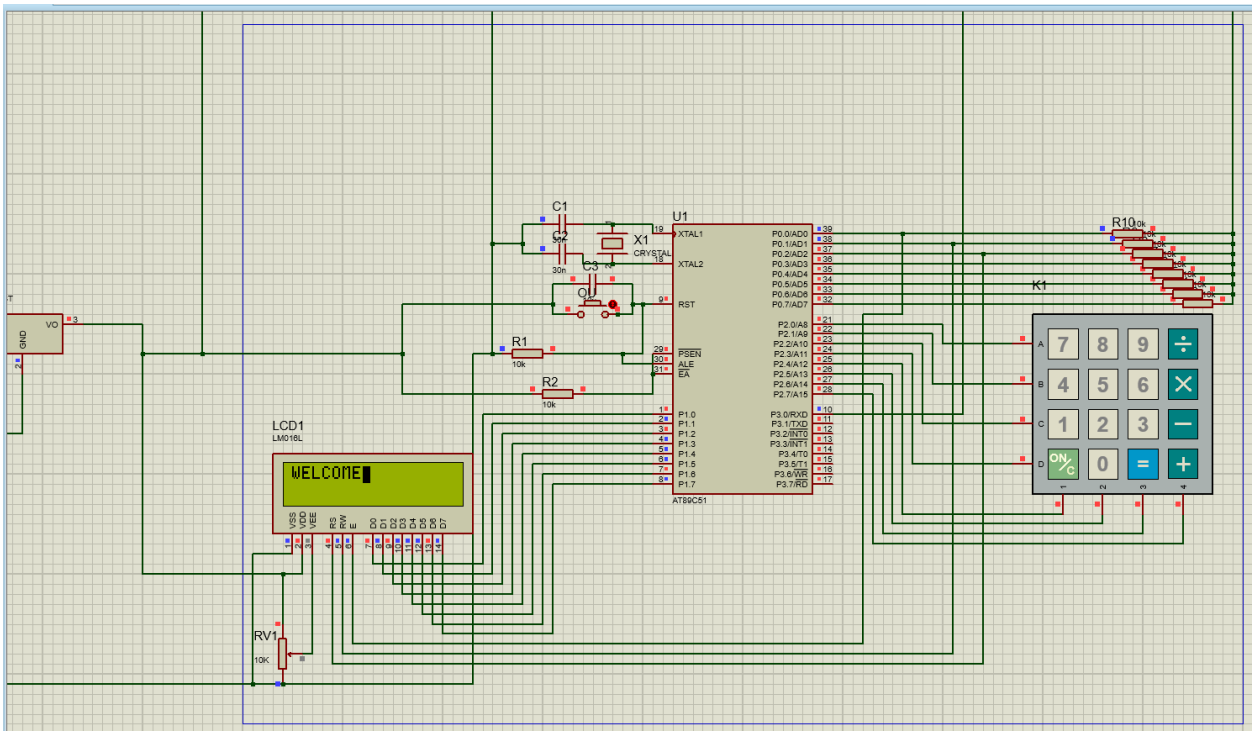


Figure 4.5: Welcome message

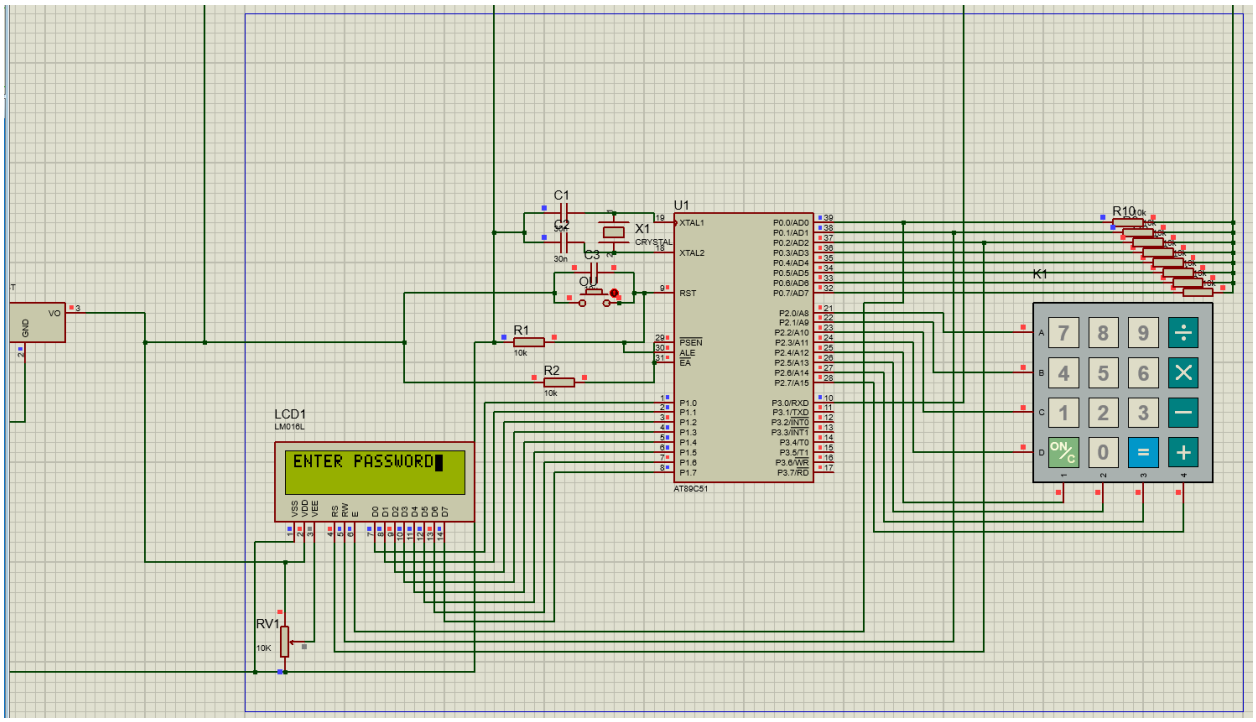


Figure 4.6: Enter password

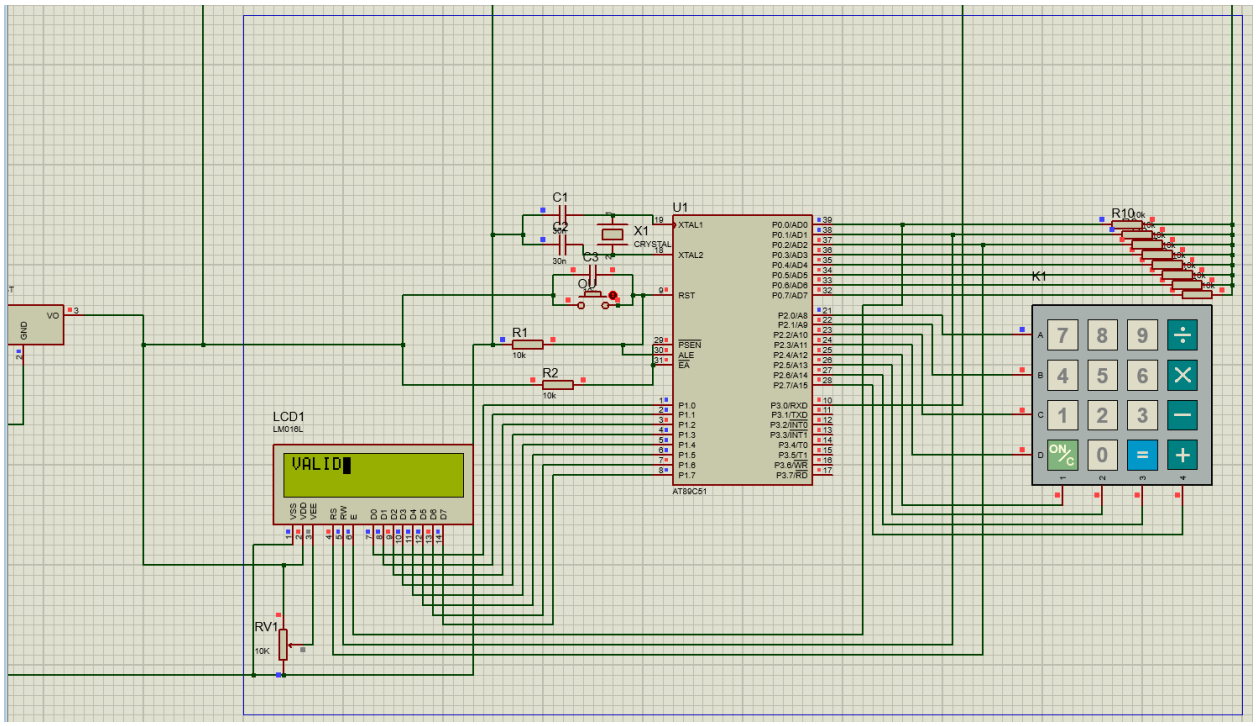


Figure 4.7: If password correct 'valid' is displayed

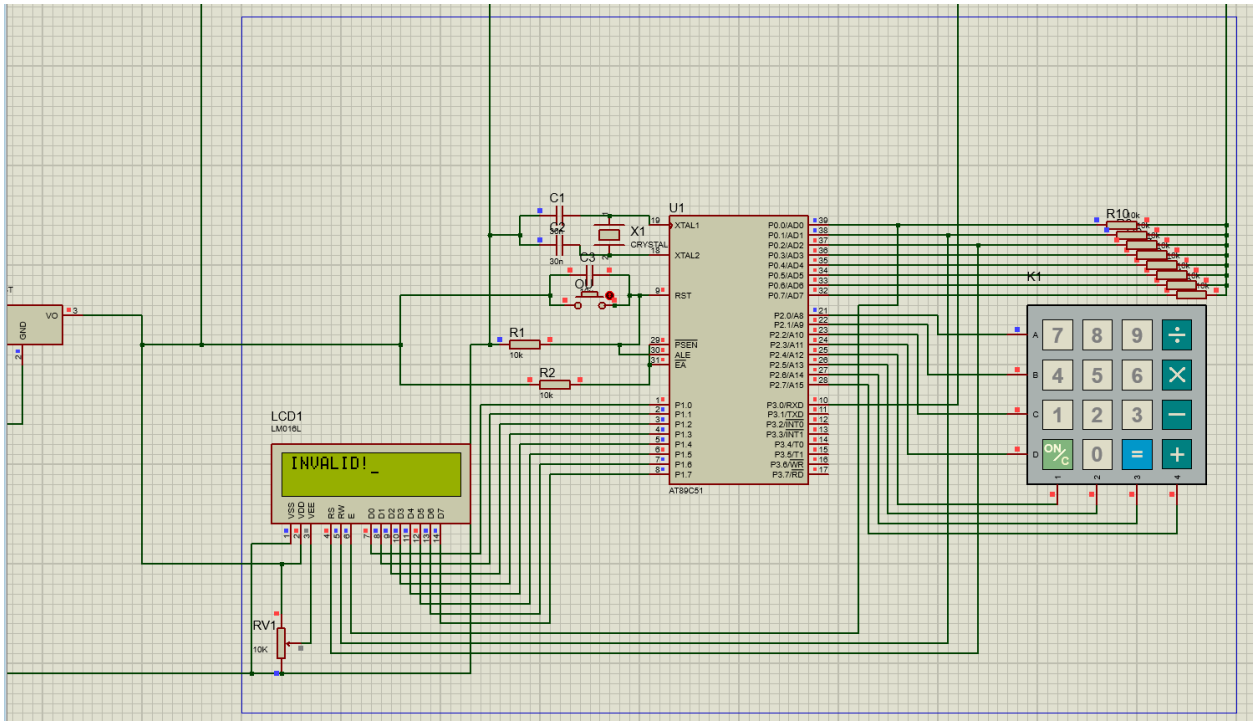
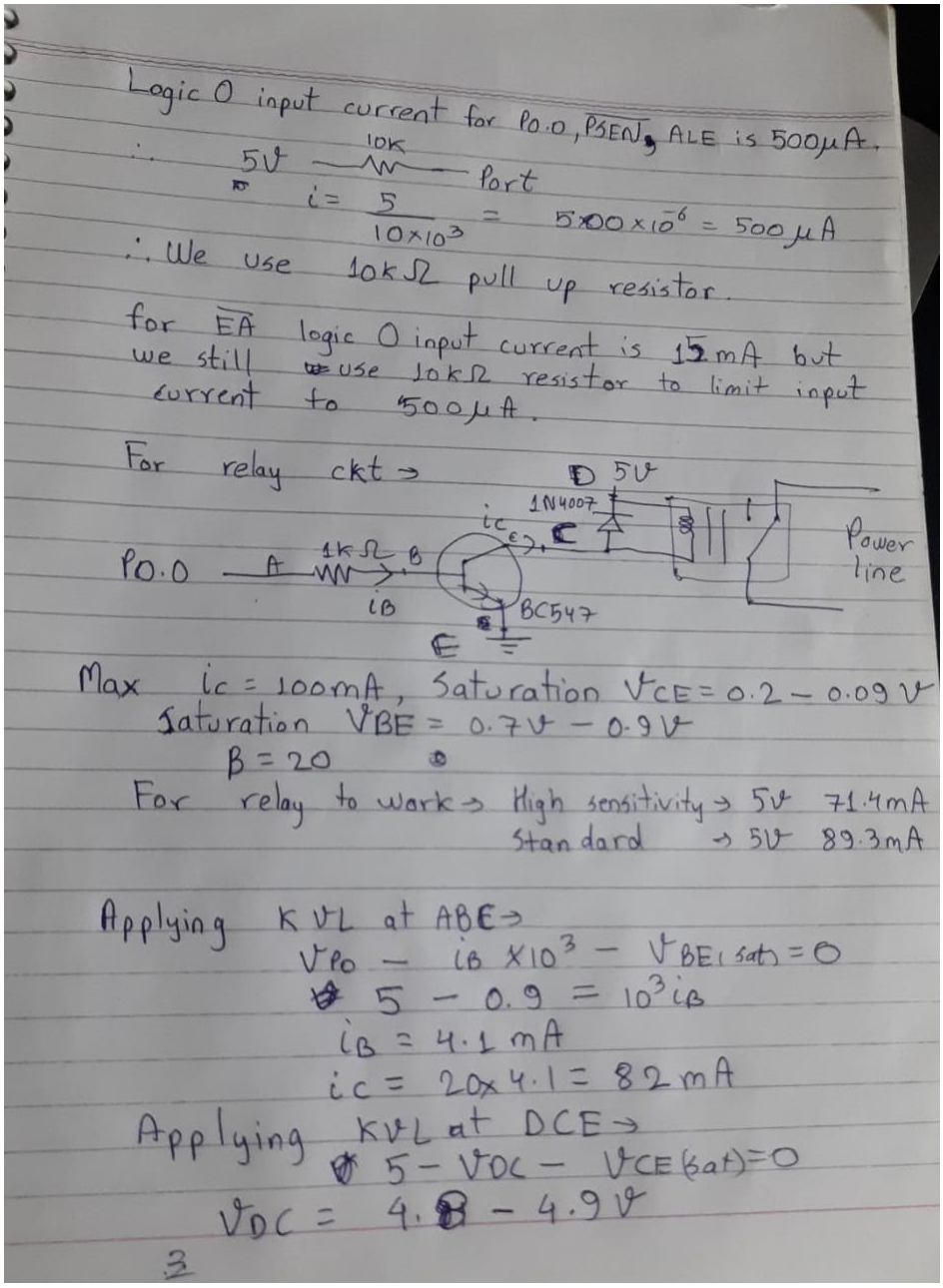
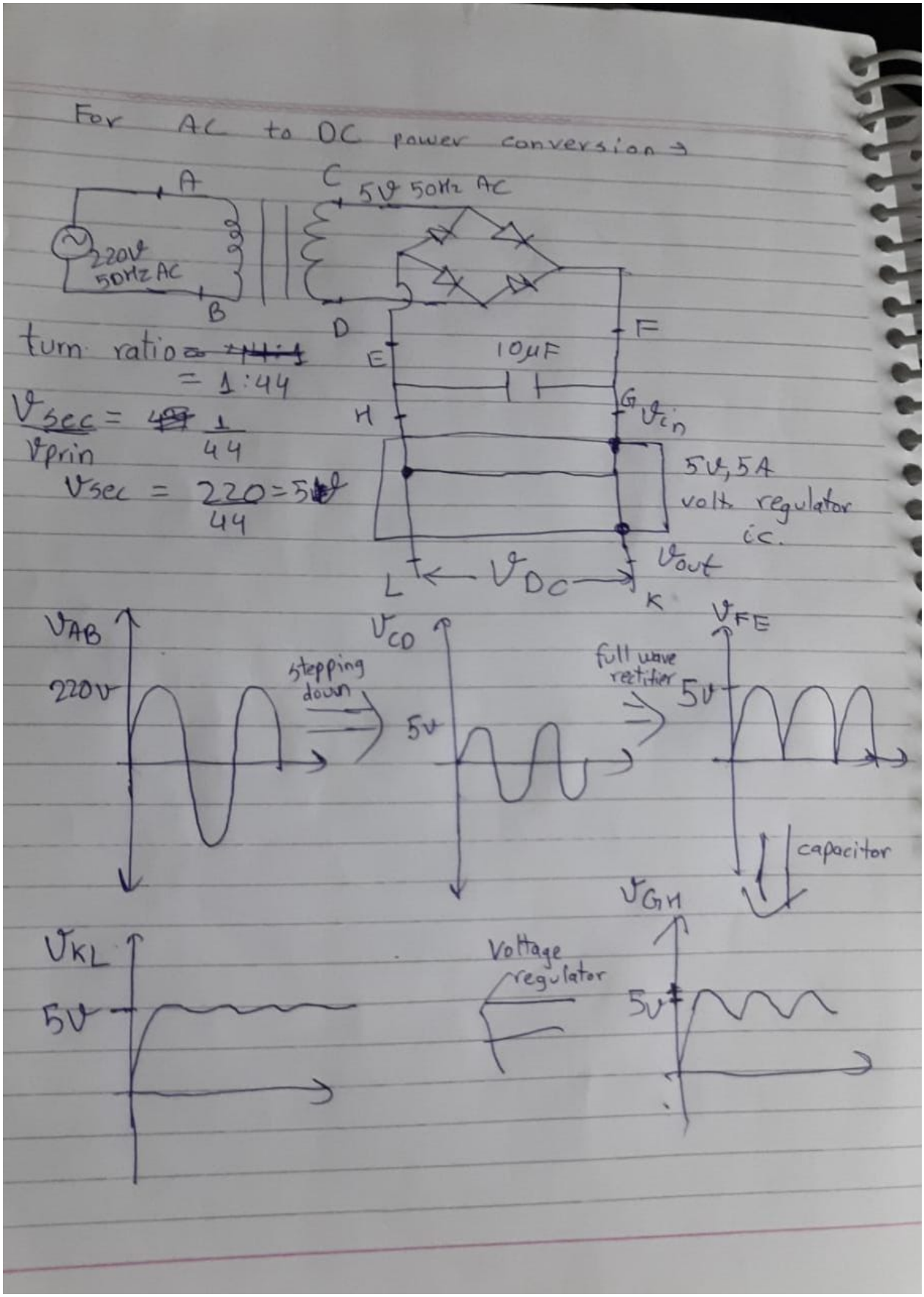


Figure 4.8: If password is wrong 'invalid' is displayed

Chapter 5

Calculations




For AC to DC power conversion →
A
B
C
D
E
F
G
H
220V 50Hz AC
5V 50Hz AC
10μF
turn ratio = 1:44
Vsec/Vprin = 1/44
Vsec = 220/44 = 5V
5V, 5A volt. regulator ic.
Vin
Vout
VDC
L
K
VAB
220V
stepping down
VCD
5V
full wave rectifier
VFE
5V
capacitor
VGH
VKL
5V
Voltage regulator
5V

Chapter 6

Conclusion

In conclusion, the password-based circuit breaker project offers an effective solution for enhancing security and control over electrical systems. By incorporating a password authentication mechanism, the circuit breaker ensures that only authorized individuals can access and control the electrical circuit. This project provides the following key benefits:

6.1 Enhanced Security

The password-based authentication adds an extra layer of security to the electrical circuit, preventing unauthorized access and tampering. It helps protect against potential risks such as unauthorized usage, system damage, or safety hazards.

6.2 Access Control

With the implementation of a password-based system, access to the circuit breaker can be restricted to authorized personnel only. This allows for better control over who can operate and make changes to the electrical system, reducing the chances of accidents or unauthorized modifications.

6.3 User Accountability

By requiring a password for circuit breaker access, the project promotes user accountability. Each individual will have a unique password, making it easier to track and identify any actions performed on the system. This feature can be particularly useful in commercial or industrial settings where multiple individuals may have access to the circuit.

6.4 Flexibility and Convenience

The password-based circuit breaker project offers flexibility by allowing authorized individuals to control the circuit remotely. This remote access feature can be beneficial in situations where immediate action is required, such as emergency shutdowns or maintenance operations.

6.5 Cost-Effective Solution

Implementing a password-based circuit breaker is a cost-effective security measure compared to other sophisticated access control systems. It provides a reliable level of protection without requiring significant financial investment.

Chapter 7

Future Scope and Recommendations

We recommend developing this project so as to make it possible to be connected to SCADA supervision control and data acquisition system, or digital control system DCS to monitor incoming messages in switching case. Besides recording the history of operational time ON/OFF for maintenance purposes.

Develop the system to be able to send message to denotes the CB status as opened, closed, or tripped

Chapter 8

Critical Issues

8.1 Designing the circuit

One challenge was designing a circuit that could effectively integrates the password-based functionality with the circuit breaker system which involved understanding the circuitry of the breaker and ensuring it's compatibility.

8.2 User interfaceing

Creating a user-friendly interface for entering and managing passwords was a significant challenge. We had to design an intuitive interface that allows users to easily input while adhering to the constraints of the circuit breaker system.

8.3 Authentication mechanism

Implementing a mechanism to validate the entered password was a challenge. We had to consider factors such as password length, complexity, and the mechanism to compare the entered password with the stored password.

8.4 Testing and validation

Thoroughly testing the project is crucial to ensure its functionality and security. We had to validate different aspects, such as password input validation, circuit breaker response, and overall system reliability. Developing a comprehensive testing plan and carrying out testing was time-consuming and challenging.

Chapter 9

References

9.1 Website

1. www.microchip.com

2. https://nevonprojects.com/password-based-circuit-breaker-using-8051/

9.2 Books

1. Mazidi, Muhammad Ali - 8051 Microcontroller and Embedded Systems (2013)

2. Kenneth J. Ayala, "The 8051 Micro-controller – Architecture, Programming and Applications", Penram International and Thomson Asia, Second Edition.

Appendix A

Codes

```
1   ORG 0000H
2   EN BIT P0.0
3   RW BIT P0.1
4   RS BIT P0.2
5   OUTPUT BIT P3.0
6   CLR OUTPUT
7   MOV A,#1H
8   LCALL COMMANDWRITE
9   MOV A,#0FH
10  LCALL COMMANDWRITE
11  MOV A,#57H
12  LCALL DATAWRITE
13  MOV A,#45H
14  LCALL DATAWRITE
15  MOV A,#4CH
16  LCALL DATAWRITE
17  MOV A,#43H
18  LCALL DATAWRITE
19  MOV A,#4FH
20  LCALL DATAWRITE
21  MOV A,#4DH
22  LCALL DATAWRITE
23  MOV A,#45H
24  LCALL DATAWRITE
25  LCALL DELAY_2S
26  OPEN1:MOV A,#1H
27  LCALL COMMANDWRITE
28  MOV A,#45H
29  LCALL DATAWRITE
30  MOV A,#4EH
31  LCALL DATAWRITE
32  MOV A,#54H
33  LCALL DATAWRITE
```

```
33  LCALL DATAWRITE
34  MOV A,#45H
35  LCALL DATAWRITE
36  MOV A,#52H
37  LCALL DATAWRITE
38  MOV A,#14H
39  LCALL COMMANDWRITE
40  MOV A,#50H
41  LCALL DATAWRITE
42  MOV A,#41H
43  LCALL DATAWRITE
44  MOV A,#53H
45  LCALL DATAWRITE
46  MOV A,#53H
47  LCALL DATAWRITE
48  MOV A,#57H
49  LCALL DATAWRITE
50  MOV A,#4FH
51  LCALL DATAWRITE
52  MOV A,#52H
53  LCALL DATAWRITE
54  MOV A,#44H
55  LCALL DATAWRITE
56  LCALL DELAY_2S
57  MOV A,#1H
58  LCALL COMMANDWRITE
59  MOV R2,#00H;R6,R7 FOR DELAY,R0
60  OPEN:MOV P2,#0F0H ;
61  MOV A,P2
62  ANL A,#11110000B
63  CJNE A,#11110000B,OPEN
64  KEYPRESSED: LCALL DELAY
65  MOV A,P2
```

```
66  ANL A,#11110000B
67  CJNE A,#11110000B,DEBOUNCE
68  SJMP KEYPRESSED
69  DEBOUNCE: LCALL DELAY
70  MOV A,P2
71  ANL A,#11110000B
72  CJNE A,#11110000B,CHECKROW
73  SJMP KEYPRESSED
74  CHECKROW:LCALL DELAY
75  MOV P2,#11111110B
76  MOV A,P2
77  ANL A,#11110000B
78  CJNE A,#11110000B,ROW1
79  MOV P2,#11111101B
80  MOV A,P2
81  ANL A,#11110000B
82  CJNE A,#11110000B,ROW2
83  MOV P2,#11111011B
84  MOV A,P2
85  ANL A,#11110000B
86  CJNE A,#11110000B,ROW3
87  MOV P2,#11110111B
88  MOV A,P2
89  ANL A,#11110000B
90  CJNE A,#11110000B,ROW4
91  SJMP KEYPRESSED
92  ROW1:MOV R0,#0H
93  SJMP CHECKCOLUMN
94  ROW2:MOV R0,#1H
95  SJMP CHECKCOLUMN
96  ROW3:MOV R0,#2H
97  SJMP CHECKCOLUMN
98  ROW4:MOV R0,#3H
```

```
 90   CJNE A,#11110000B,ROW4
 91   SJMP KEYPRESSED
 92   ROW1:MOV R0,#0H
 93   SJMP CHECKCOLUMN
 94   ROW2:MOV R0,#1H
 95   SJMP CHECKCOLUMN
 96   ROW3:MOV R0,#2H
 97   SJMP CHECKCOLUMN
 98   ROW4:MOV R0,#3H
 99   SJMP CHECKCOLUMN
100   CHECKCOLUMN:MOV R1,#0H
101   RRC A
102   RRC A
103   RRC A
104   RRC A
105   AGAIN:RRC A
106   JNC COLUMNFOUND
107   INC R1
108   SJMP AGAIN
109   COLUMNFOUND:CLR A
110   CJNE R0,#0H,ONE
111   CJNE R1,#0H,FIRST1
112   MOV R3,#31H
113   MOV A,#31H
114   LCALL DATAWRITE
115   LJMP PASSWORDSTORE
116   FIRST1:CJNE R1,#1H,SECOND1
117   MOV R3,#32H
118   MOV A,#32H
119   LCALL DATAWRITE
120   LJMP PASSWORDSTORE
121   SECOND1:CJNE R1,#2H,THIRD1
122   MOV R3,#33H
```

```
122   MOV R3,#33H
123   MOV A,#33H
124   LCALL DATAWRITE
125   LJMP PASSWORDSTORE
126   THIRD1:MOV R3,#41H
127   MOV A,#41H
128   LCALL DATAWRITE
129   LJMP PASSWORDSTORE
130   ONE:CJNE R0,#1H,TWO
131   CJNE R1,#0H,FIRST2
132   MOV R3,#34H
133   MOV A,#34H
134   LCALL DATAWRITE
135   LJMP PASSWORDSTORE
136   FIRST2:CJNE R1,#1H,SECOND2
137   MOV R3,#35H
138   MOV A,#35H
139   LCALL DATAWRITE
140   LJMP PASSWORDSTORE
141   SECOND2:CJNE R1,#2H,THIRD2
142   MOV R3,#36H
143   MOV A,#36H
144   LCALL DATAWRITE
145   LJMP PASSWORDSTORE
146   THIRD2:MOV R3,#42H
147   MOV A,#42H
148   LCALL DATAWRITE
149   LJMP PASSWORDSTORE
150   TWO:CJNE R0,#2H,THREE
151   CJNE R1,#0H,FIRST3
152   MOV R3,#37H
153   MOV A,#37H
154   LCALL DATAWRITE
```

```
155   LJMP PASSWORDSTORE
156   FIRST3:CJNE R1,#1H,SECOND3
157   MOV R3,#38H
158   MOV A,#38H
159   LCALL DATAWRITE
160   LJMP PASSWORDSTORE
161   SECOND3:CJNE R1,#2H,THIRD3
162   MOV R3,#39H
163   MOV A,#39H
164   LCALL DATAWRITE
165   LJMP PASSWORDSTORE
166   THIRD3:MOV R3,#43H
167   LJMP PASSWORDSTORE
168   MOV A,#43H
169   LCALL DATAWRITE
170   THREE:
171   CJNE R1,#0H,FIRST4
172   MOV R3,#2AH
173   MOV A,#2AH
174   LCALL DATAWRITE
175   LJMP PASSWORDSTORE
176   FIRST4:CJNE R1,#1H,SECOND4
177   MOV R3,#30H
178   MOV A,#30H
179   LCALL DATAWRITE
180   LJMP PASSWORDSTORE
181   SECOND4:CJNE R1,#2H,THIRD4
182   MOV R3,#23H
183   MOV A,#23H
184   LCALL DATAWRITE
185   LJMP PASSWORDSTORE
186   THIRD4:MOV R3,#44H
187   MOV A,#44H
```

```
187  MOV A,#44H
188  LCALL DATAWRITE
189  LJMP PASSWORDSTORE
190  PASSWORDSTORE:
191  PUSH 3
192  INC R2
193  CJNE R2,#4,UP
194  SJMP PASSCHECK
195  UP:LJMP OPEN
196  PASSCHECK:
197  MOV P1,#00H
198  LOOP3:POP 4
199  CJNE R2,#4H,L1
200  CJNE R4,#31H,WRONGPASS1
201  DJNZ R2,LOOP3
202  L1:CJNE R2,#3H,L2
203  CJNE R4,#33H,WRONGPASS2
204  DJNZ R2,LOOP3
205  L2:CJNE R2,#2H,L3
206  CJNE R4,#31H,WRONGPASS3
207  DJNZ R2,LOOP3
208  L3:CJNE R2,#1H,L1
209  CJNE R4,#33H,WRONGPASS4
210  SJMP RIGHTPASS
211  WRONGPASS1:POP 4
212  WRONGPASS2:POP 4
213  WRONGPASS3:POP 4
214  WRONGPASS4:MOV R2,#00H
215  MOV R3,#00H
216  MOV R4,#00H
217  MOV A,#1H
218  LCALL COMMANDWRITE
219  MOV A,#49H
```

```
220   LCALL DATAWRITE
221   MOV A,#4EH
222   LCALL DATAWRITE
223   MOV A,#56H
224   LCALL DATAWRITE
225   MOV A,#41H
226   LCALL DATAWRITE
227   MOV A,#4CH
228   LCALL DATAWRITE
229   MOV A,#49H
230   LCALL DATAWRITE
231   MOV A,#44H
232   LCALL DATAWRITE
233   MOV A,#21H
234   LCALL DATAWRITE
235   LCALL DELAY_2S
236   LJMP OPEN1
237   RIGHTPASS:
238   MOV A,#1H
239   LCALL COMMANDWRITE
240   MOV A,#56H
241   LCALL DATAWRITE
242   MOV A,#41H
243   LCALL DATAWRITE
244   MOV A,#4CH
245   LCALL DATAWRITE
246   MOV A,#49H
247   LCALL DATAWRITE
248   MOV A,#44H
249   LCALL DATAWRITE
250   CPL OUTPUT
251   MOV R2,#00H
252   MOV R3,#00H
```

```
252  MOV R3,#00H
253  MOV R4,#00H
254  LCALL DELAY_2S
255  LJMP OPEN1
256  DELAY:MOV R6,#100
257  LOOP1:MOV R7,#99
258  LOOP2:DJNZ R7,LOOP2
259  DJNZ R6,LOOP1
260  RET
261  COMMANDWRITE:LCALL CHECKBUSY
262  CLR RW
263  MOV P1,A
264  LCALL WRITEPULSE
265  RET
266  DATAWRITE: LCALL CHECKBUSY
267  SETB RS
268  CLR RW
269  MOV P1,A
270  LCALL WRITEPULSE
271  RET
272  CHECKBUSY:
273  SETB P1.7
274  SETB RW
275  CLR RS
276  LCALL READPULSE
277  JB P1.7,CHECKBUSY
278  RET
279  READPULSE:
280  CLR EN
281  LCALL DELAY
282  SETB EN
283  RET
284  WRITEPULSE:
```

```
270   LCALL WRITEPULSE
271   RET
272   CHECKBUSY:
273   SETB P1.7
274   SETB RW
275   CLR RS
276   LCALL READPULSE
277   JB P1.7,CHECKBUSY
278   RET
279   READPULSE:
280   CLR EN
281   LCALL DELAY
282   SETB EN
283   RET
284   WRITEPULSE:
285   SETB EN
286   CLR EN
287   RET
288   DELAY_SHORT:
289   LP3:MOV R6,#10
290   LP2:MOV R7,#25
291   LP1:DJNZ R7,LP1
292   DJNZ R6,LP2
293   RET
294   DELAY_2S:
295   MOV B,#100
296   LA3:MOV R6,#100
297   LA2:MOV R7,#99
298   LA1:DJNZ R7,LA1
299   DJNZ R6,LA2
300   DJNZ B,LA3
301   RET
302   END
```