

# Password Based Circuit Breaker

## MCA T2 Project Report

*Submitted by*

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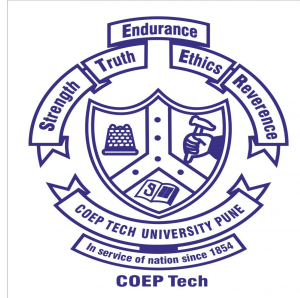
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## **Abstract**

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 work but 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

	<b>i</b>
<b>List of Figures</b>	<b>ii</b>
	<b>ii</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Background . . . . .	1
1.2 Problem Statement . . . . .	2
1.3 Objectives . . . . .	2
<b>2 PRINCIPLE OF WORKING</b>	<b>3</b>
<b>3 OVERVIEW OF COMPONENTS</b>	<b>5</b>
3.1 Microcontroller . . . . .	6
3.2 RESISTORS . . . . .	6
3.3 CAPACITOR . . . . .	7
3.4 DIODES . . . . .	7
3.5 TRANSISTORS . . . . .	8
3.6 VOLTAGE REGULATOR . . . . .	9
3.7 Crystal oscillator . . . . .	10
3.8 LCD Display . . . . .	11
3.9 Keypad . . . . .	12

<b>4</b>	<b>Methodology</b>	<b>13</b>
4.1	Working . . . . .	13
4.2	Circuit Diagram . . . . .	14
4.3	Simulation . . . . .	15
<b>5</b>	<b>Conclusion</b>	<b>18</b>
5.1	Enhanced Security . . . . .	18
5.2	Access Control . . . . .	18
5.3	User Accountability . . . . .	19
5.4	Flexibility and Convenience . . . . .	19
5.5	Cost-Effective Solution . . . . .	19
<b>6</b>	<b>Future Scope and Recommendations</b>	<b>20</b>
<b>7</b>	<b>References</b>	<b>21</b>
7.1	Website . . . . .	21
7.2	Books . . . . .	21
<b>A</b>	<b>Codes</b>	<b>22</b>

# List of Figures

2.1	Microcontrollers interfacing . . . . .	4
3.1	8051 Microcontroller . . . . .	6
3.2	Resistor . . . . .	7
3.3	Capacitor . . . . .	7
3.4	Diode . . . . .	8
3.5	Transformer . . . . .	9
3.6	voltage regulator . . . . .	10
3.7	Enter Caption . . . . .	10
3.8	LCD display . . . . .	11
3.9	Key pad . . . . .	12
4.1	Circuit Diagram(source:-Proteus) . . . . .	14
4.2	Welcome message . . . . .	15
4.3	Enter password . . . . .	16
4.4	If password correct 'valid' is displayed . . . . .	16
4.5	If password is wrong 'invalid' is dipalyed . . . . .	17

# 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 substation 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.

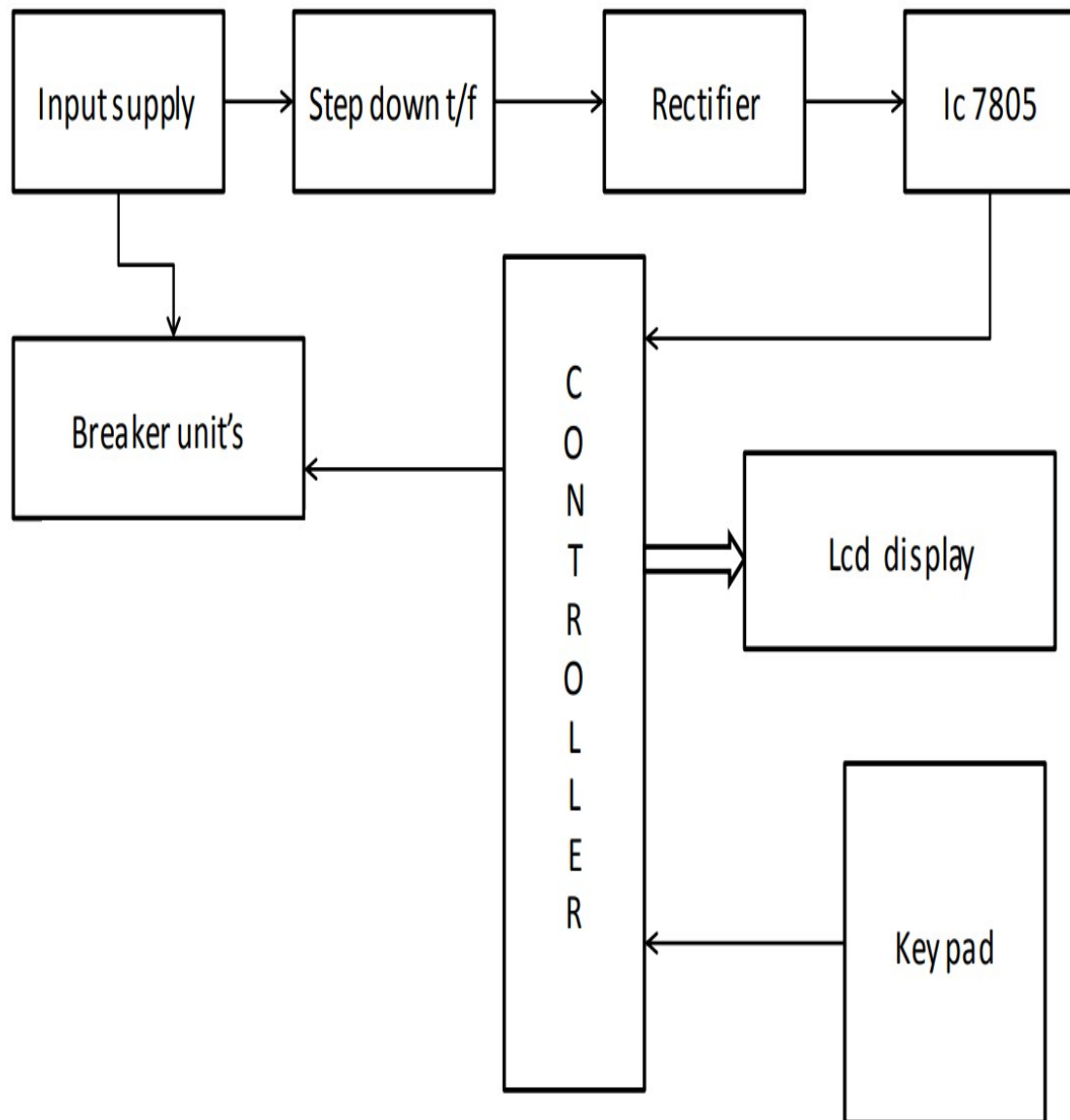


Figure 2.1: Microcontrollers interfacing

# 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.

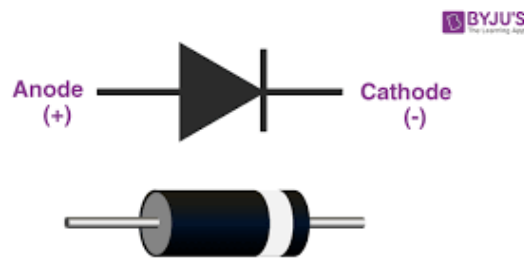


Figure 3.4: Diode

## 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.

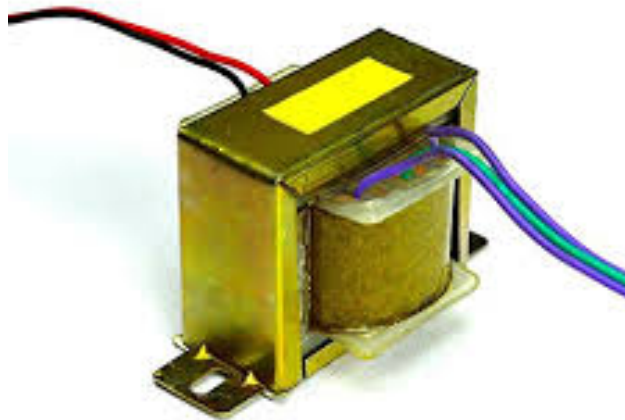


Figure 3.5: Transformer

## 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.

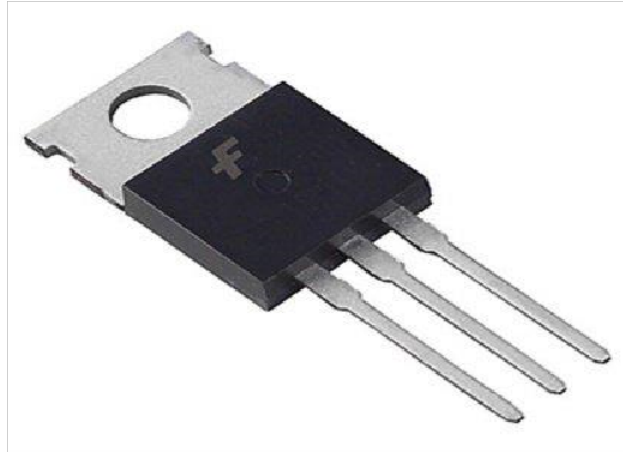


Figure 3.6: voltage regulator

### 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 Verifier- 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

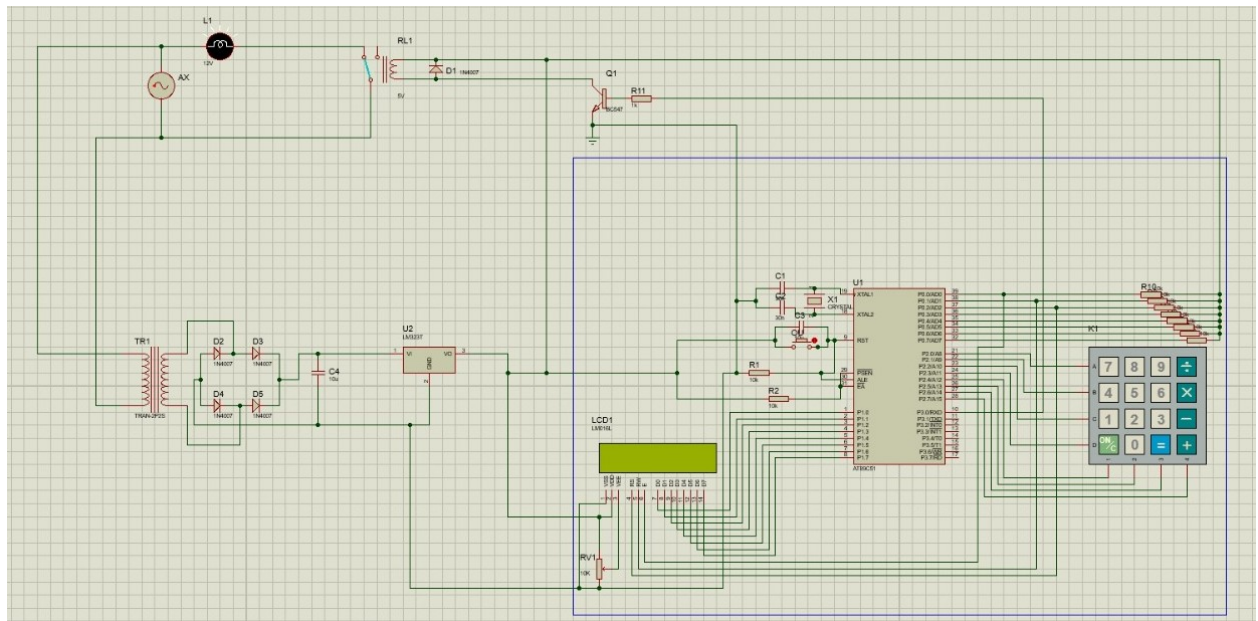


Figure 4.1: Circuit Diagram(source:-Proteus)

## 4.3 Simulation

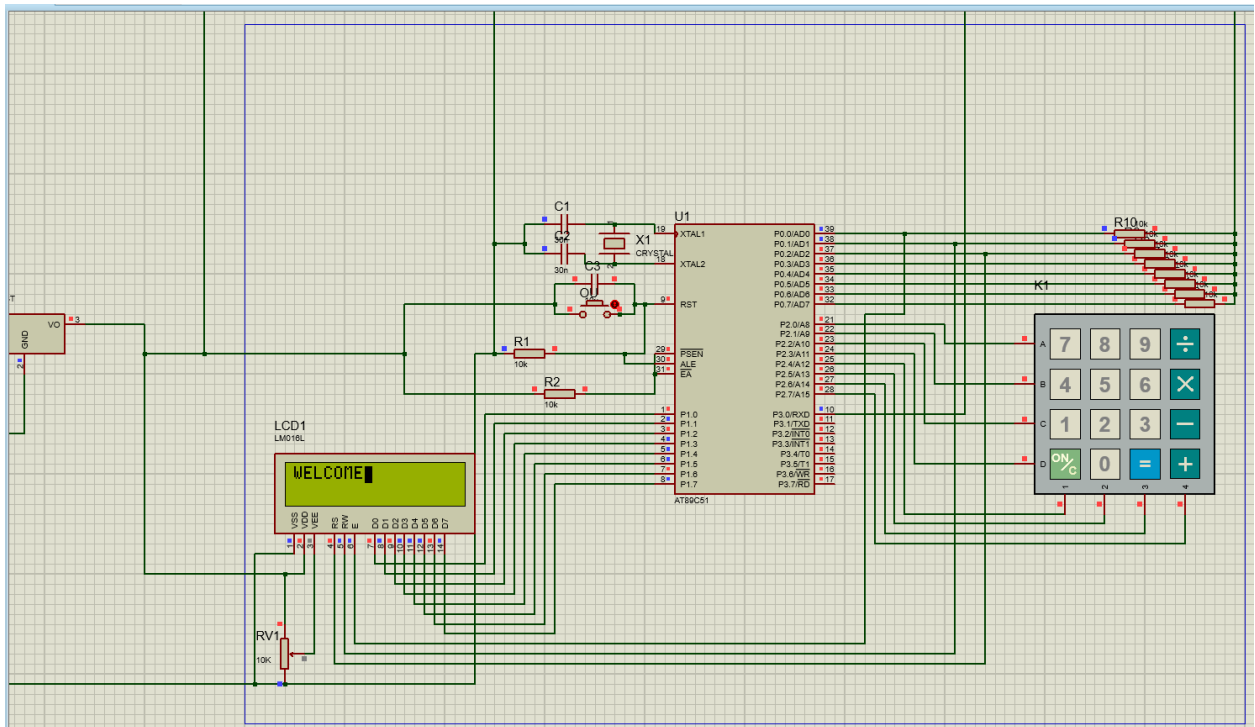


Figure 4.2: Welcome message

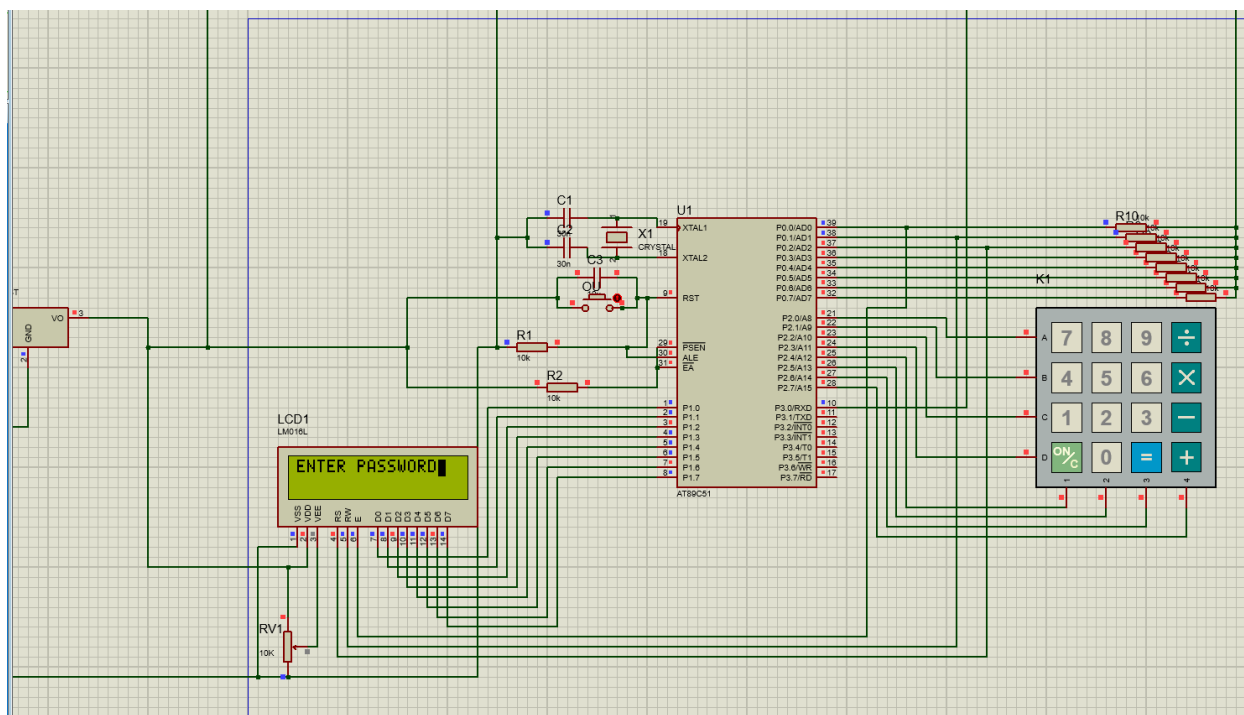


Figure 4.3: Enter password

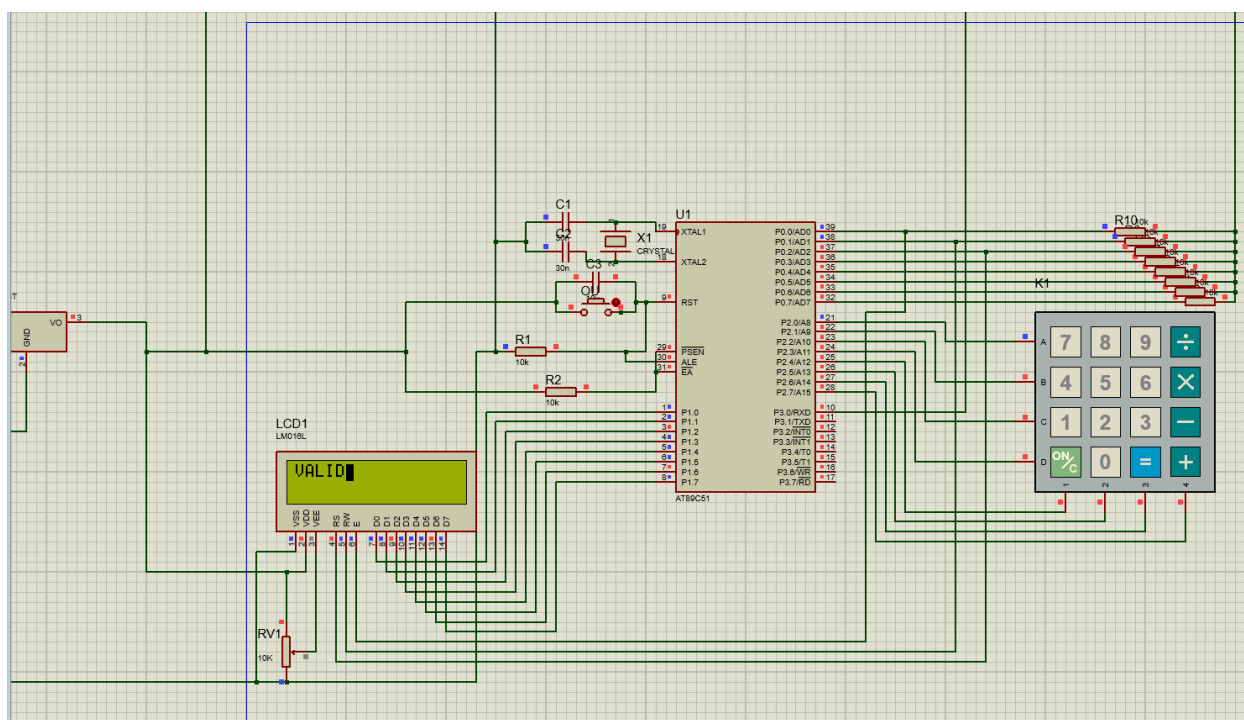


Figure 4.4: If password correct 'valid' is displayed

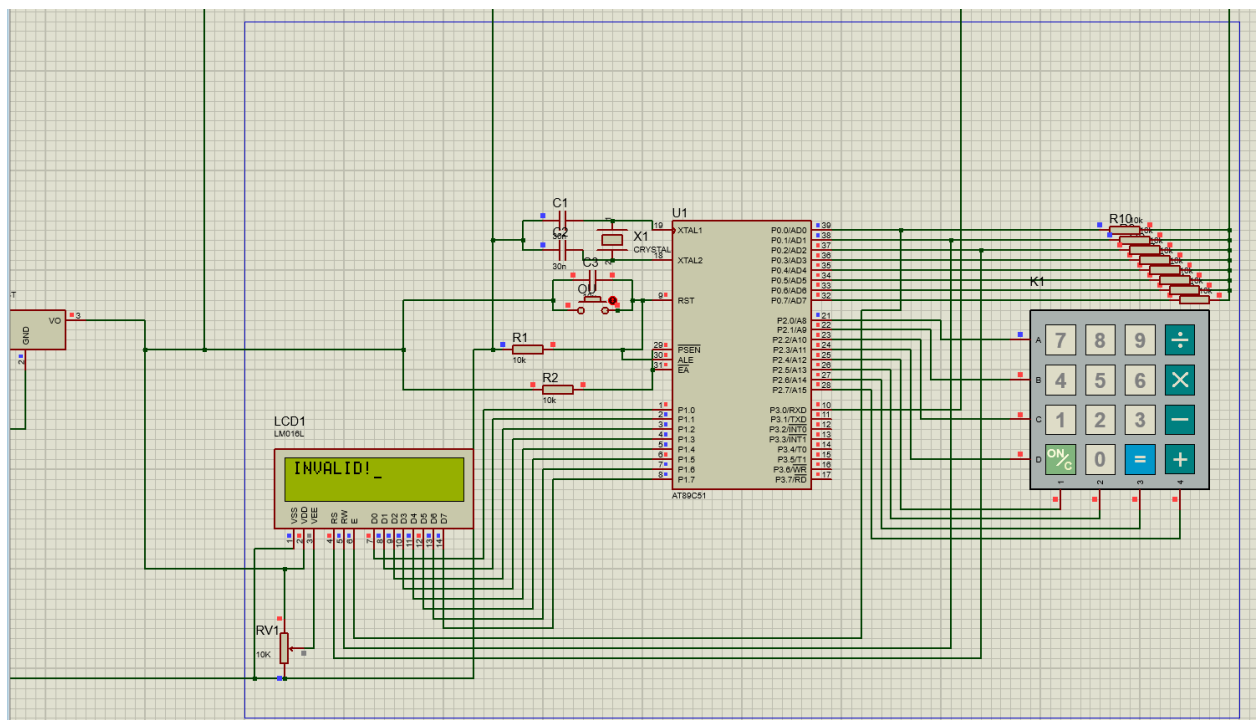


Figure 4.5: If password is wrong 'invalid' is displayed

# Chapter 5

## 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:

### 5.1 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.

### 5.2 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.



### **5.3 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.

### **5.4 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.

### **5.5 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 6

### 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 7

## References

### 7.1 Website

1. [www.microchip.com](http://www.microchip.com)
2. <https://nevonprojects.com/password-based-circuit-breaker-using-8051/>

### 7.2 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

source:keil uvision

```
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  ---

```

```

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 -----

```

```

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

```