Password Based Circuit Breaker

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Password Based Circuit Breaker

Report submitted to the
SRM University - AP, Andhra Pradesh
For the award of the degree

of

Bachelor of Technology

by

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Under the guidance of

Dr. Sreenivasulu Tupakula

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SRM UNIVERSITY - AP, ANDHRA PRADESH
MAY 2021

CERTIFICATE OF APPROVAL

Certified that the project report entitled **Password Based Circuit Breaker**, submitted by

1. Mattam Chiranjeevi (AP17110020018)

2. Teluguntla Naga Bala Revanth (AP17110020044)

to the SRM University - AP, Andhra Pradesh, for the award of the degree Bachelor of Technology has been accepted by the examiners and that the student(s) has (have) successfully completed the viva-voce examination held today.

(Examiner)   (Examiner)

(Examiner)   (Examiner)

(Supervisor)   Head of the Department,

                                                              Department of ECE

Date:

Place:

CERTIFICATE

This is to certify that the report entitled **Password Based Circuit Breaker**, submitted by

1. Mattam Chiranjeevi (AP17110020018)
2. Teluguntla Naga Bala Revanth (AP17110020044)

to SRM University - AP, Andhra Pradesh, is a record of bona fide work carried out under my supervision and is worthy of consideration for the award of the degree of Bachelor of Technology of the Institute.

Dr. Sreenivasulu Tupakula
(Supervisor)

Date:

Place:

Contents

List of Abbreviations

S.No	Abbreviation	Full Form
1	LCD	Liquid Crystal Display
2	KB	Kilobyte
3	RAM	Read Only Memory
4	ROM	Random Access Memory
5	IC	Integrated Circuit
6	AC	Alternating Current
7	DC	Direct Current
8	EN	Enable
9	RS	Register Select
10	R/W	Read Write
11	NC	Normally Closed
12	NO	Normally Open
13	SMS	Special Function Registers

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S.No	Algorithm
1	Algorithm 1 for Password Based Circuit Breaker

Abstract

Abstract:

   Password Based Circuit Breaker may be a design to guard a circuit from damage which is caused by over load or short. Many fatal electrical accidents are happening thanks to miscommunication between service staff and therefore the electric substation staff. To avoid these accidents, we are implementing a password based circuit breaker that to control the panel doors and circuit breaker by using a password for the safety.

The project is meant during which only authorized person can operate with the assistance of Password. If the given password is correct then the breaker on/off and door open/close feature is enabled for lineman to require up repair.

This system is fully controlled by 8-bit microcontroller from 8051 families which has an 8KB of ROM for program memory. A matrix keypad is employed to enter the password and relay driver IC wont to switch on/off the hundreds through relays.

Keywords: Microcontroller, Relay, Relay Driver, LCD Display, Matrix Keypad.

INTRODUCTION

This project is meant to regulate a breaker with help of a password only. Fatal electrical accidents happening due to the line man are increase during the electrical line repair due to the lack of communication and miscommunication between maintenance staff and the electric substation staff. This project provides an answer, which may make sure the safety of the upkeep staff e.g. line man.

Here, it mainly focuses on safety of the lineman while working, so they do not feel the sudden electric shocks. As he has to deal with live wires very often, the chances of critical accidents are already very high. However, with the right amount of coordination among lineman and substation, a lot of these accidents can be avoided.

If the entered password is correct then the breaker ON/OFF and door OPEN/CLOSE feature is enabled for the lineman to need up repair. So, this project is designed to operate the system by only authorized person to avoid such accidents.

Now if there are any fault in electrical line then the line man will slow down the power supply to the line by entering password and comfortably repair the electrical line, and after coming to the substation line man turn on the availability to the actual line by entering the password.

1.1 Motivation

Design and implementation of a circuit breaker that based on a password contains of a LCD screen, matrix keypad and a relay, also by exploring and making use of a program of circuit breaker password written on Keil software and also a practical circuit in normal and after detach condition. With cost efficient components and most favourable results.

1.2 A Layout of the Report

The report is structured in the following way:

- Chapter 1 contains Introduction

  1.1 Motivation

  1.2 A Layout of the Report

  1.3 Circuit Breaker

  1.4 Methodology

- Chapter 2 contains Literature Survey and Components

  2.1 Components Explained

  2.2 Principle of Operation

  2.3 Block Diagram

What is Circuit Breaker:

A breaker could also be a switching device which can be functioned manually also as routinely for canopy and control of electrical power grid, because the modern power system deals with huge currents, the special concentration should tend during designing of a breaker to secure interruption of the arc generated during the working of the breaker.

Password based breaker gives solution to make sure lineman security. during this project, the control (on/off) of the electrical lines lies with lineman. This project is about in such how that preservation staff or lineman possesses to enter the password to on/off the electrical line.

Methodology:

Programs are written by using keil software and the program is loaded to the Arduino. And now connections as per the circuit diagram. And make sure that no common connection between AC and DC supplies. Apply the power supply to the circuit and LCD display then works then it asks to enter the password.

Step1: Designing the circuit
Step2: Entering the code in keil software
Step3: Software Implementation
Step4: Entering the password
Step5: Implementation Results

LITERATURE SURVEY

The system is fully controlled by the 8-bit microcontroller from 8051 families which has an 8KB of ROM for the program memory. A matrix keypad interfaced to the microcontroller to enter the password, while a relay driver IC is employed to modify ON / OFF the hundreds through relays. the entire circuit is made with on board power supply. the facility supply consists of a step down transformer 230/12V, which steps down the voltage to 12V AC. this is often converted to DC employing a Bridge rectifier. The ripples are removed employing a capacitive filter and it's then regulated to +5V employing a transformer which is required for the operation of the microcontroller and other components.

The project aimed toward providing the answer that ensures the security of service staff. Here, as soon the lineman detects the fault within the electric line, an SMS are going to be sent to the substation staff, who would cut the road and switch it on when the fault is being resolved, thus reducing the probabilities of accidents and saves the facility also.

Components Required:

1. 8051 Microcontroller (AT89C51)
2. 8051 Programming Board (Programmer)
3. 4 x 4 Matrix Keypad
4. 4 – Channel Relay Module
5. LCD Display
6. Resistor
7. Capacitor
8. Transistor
9. DC Generator
10. 4 Light Bulbs
11. Power Supply
12. Connecting Wires

Components Explanation:

1. 8051 microcontroller (AT89C51):

The AT89C51 comes from the 8051 family of Atmel Microcontrollers. It is an 8-bit CMOS microcontroller with 8KB in system programmable Flash memory and 256 bytes of RAM. The Microcontroller also has an Operating mode, Idle Mode and Power down mode which makes it suitable for battery operated applications. The Atmel AT89C51 is a powerful microcontroller which provides highly-flexible and cost-effective solution to many embedded control applications
CPU: 8-bit 8051 family

RAM (bytes): 256, Memory:8KB
Pin Count: 40
Max CPU Speed (MHz): 33MHz
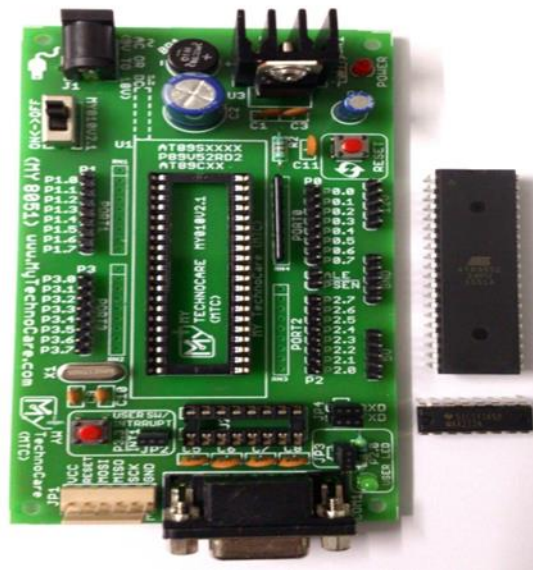
- **8051 microcontroller (AT89C51)**

2. 4x4 matrix keypad:

HEX keypad is a standard device with 16 keys connected in a 4x4 matrix, giving numbers are 0-9 A-F. The Hex keypad to Atmega32 is important while designing embedded system projects which needs character or numerical input or both. For example, projects like digital code lock, numerical calculator etc. where we are using to enter numeric password for turn ON/OFF the breaker. This can be easily interfering with ant kits Microcontroller Development Board. It is a four pin tactile switch and 4 mounting holes 3.2mm each.
Row R1 R2 R3 R4 – 0000
Column C1 C2 C3 C4 - 1111
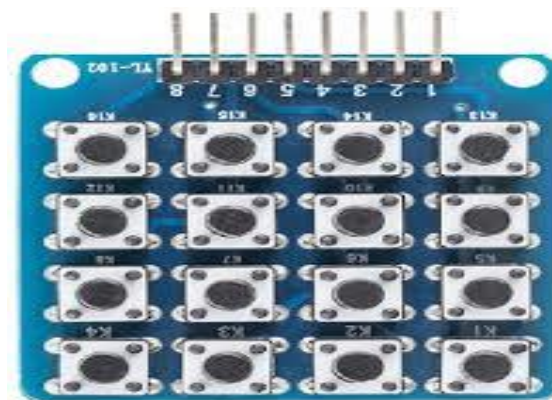
- **4x4 matrix keypad**

3. 16 X 2 LCD Display:

LCDs mostly connected to the microcontroller are 16X2 displays and having 16 Characters per lines by 2 lines respectively it having 1+6 pins for interfacing and signaling and VCCS and GNDS. Three control lines are EN, RS, and R/W EN=Enable, RS=Register select, R/W: Read/Write. The controller chip which receives data from an external source and direct communication with the LCD.

- **16 X 2 LCD Display**

4. Relay Module:

A relay is the electrically operated switch. Many relays use as electromagnetic to mechanical operator switch, but other operating principals are also used, such are solid state relay. Relays are used where it's necessary to regulate the circuit by a coffee power signal or where several circuits must be controlled by one signal. The first relay was utilized in long distance telegraph circuit as amplifiers. The repetitive signal coming in from one circuit and it is re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

- **Relay Module**

5. Power Supply:

Microcontroller requires +5V supply for its working. This is derived from 9V transformer. 9V transformer is connected to diode rectifier circuit, after converting AC to DC by using rectifier is 9V dc is regulated to +5V by using transformer 7805.This +5Vsupply is applied to microcontroller.

6. Resistors:

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

R = 330 ohm

7. Capacitor:

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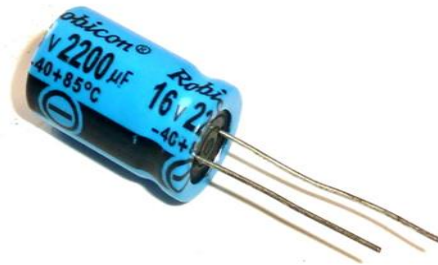
- Capacitor

8. Diodes:

Diodes are wont to convert AC into DC these are used as half wave rectifier or full wave rectifier. When utilized in its commonest application, for conversion of an AC (AC) input into an immediate current (DC) output, it's referred to as a bridge rectifier. A bridge rectifier provides full-wave rectification from a two-wire AC input, resulting in a lower cost and weighted as compared to a rectifier with the 3-wire input from a transformer with a center-tapped secondary winding.

9. Transistors:

A transistor may be a semiconductor unit wont to amplify and switch electronic signals and electrical power. It is composed of semiconductor material with a minimum of three terminals for connection to an external circuit. A voltage or current applied to a minimum of one pair of the transistor's terminals changes this through another pair of terminals. Because the controlled (output) power are often above the controlling the input power and a transistor can amplify a sign. Some transistors are packaged individually, but more are found embedded in integrated circuits. The transistor is that the fundamental building block of recent electronic devices, and is ubiquitous in modern electronic systems.

10. Voltage Regulator:

7805 is a voltage regulator integrated circuit. It is a member of7805 series of fixed linear voltage regulator IC'S. The voltage source in a circuit may have flow voltage output. The transformer IC maintains the output voltage at a continuing value. The xx in 78xx indicates the fixed output voltage it's designed to supply. 7805 provides +5V regulated power supply. Capacitors of suitable values are often connected at input and output pins depending upon the respective voltage levels.

11. Rectifier:

A rectifier is a device that converts AC (AC), which periodically reverses direction, to DC (DC), current that flows in just one direction, a process referred to as rectification.

Principle of Operation:

The main component within the circuit is 8051 microcontrollers. In this project 4×4 keypad is employed to enter the password. The password which is entered compared with the defined password. If the entered password is correct, then the corresponding electrical line is turned will ON or OFF. In this project, a separate password is provided to each electrical line. Activation and deactivation of the road (circuit breaker) is indicated by the load (Light Bulbs).

Block Diagram:
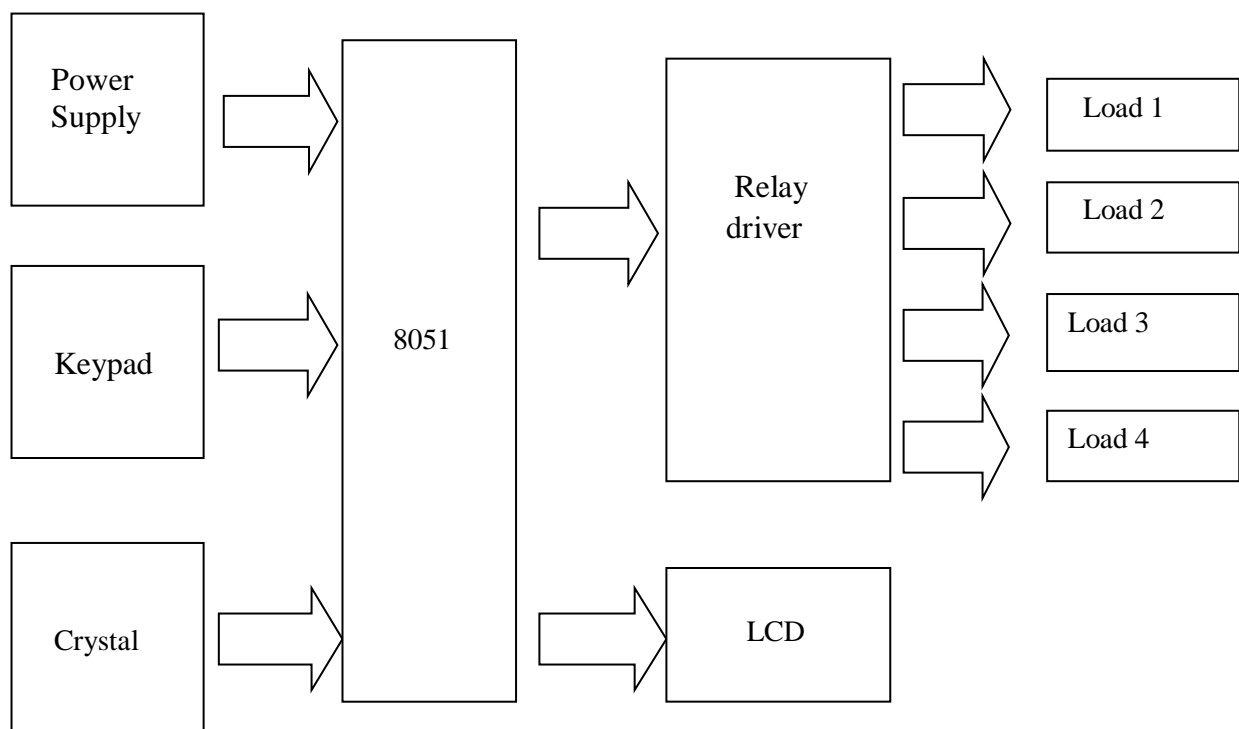
1. 8051 Microcontroller:

The AT89C51microcontroller is employed as central processing unit of our project. Microcontroller may be a single chip that contents the Processor, ROM, EPROM, EEPROM, RAM, clock and I/O ports. ATMEGA16A is a 8 bit microcontroller with 16kbytes.

2. LCD Display:

1) LCD is mostly connected with the microcontrollers are 16x2 and 20x2 displays.
2) Meaning with 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.
3) LCD having 16 pins for interfacing and signaling and VCCS and GNDS.
4) There are three control lines like EN, RS, and RW etc.
5) EN=Enable which is used to tell that from the LCD to sending data.
6) RS=Register Select (When RS is High (1), then data being sent is text data) (When RS is Low (0), then data is treated as a command)
7) R/W=Read/Write (When RW is low (0), then the info Read the data) (When RW is High (1), then the info writes the data).

3. Matrix Keypad:

      A keypad could also be a group of buttons arranged during a block or "pad" which usually bear digits, symbols and typically a whole set of alphabetical letters. If it mostly contains numbers, then it also can be called a numeric keypad. In order to detect which key's pressed from the matrix, the row lines are to be made low one by one and skim the columns. Assume that if Row1 is formed low, then read the columns. If any of the key in row1 is pressed then correspondingly the column 1will give low that's if second key's pressed in Row1, then column2 will give low.

4x4 Matrix Keypad

4. Relay:

      Relay is an electromagnetic switch it used to control the electrical device. Copper core magnetic fluxes play the most role here. The relay's switch connections are labelled COM, NC and NO:COM = Common, it's the moving a part of the itch. NC = Normally Closed, which the relay coil is off when the COM is connected to the NC. NO = Normally Open, which the relay coil is on when the COM is connected to the NO.
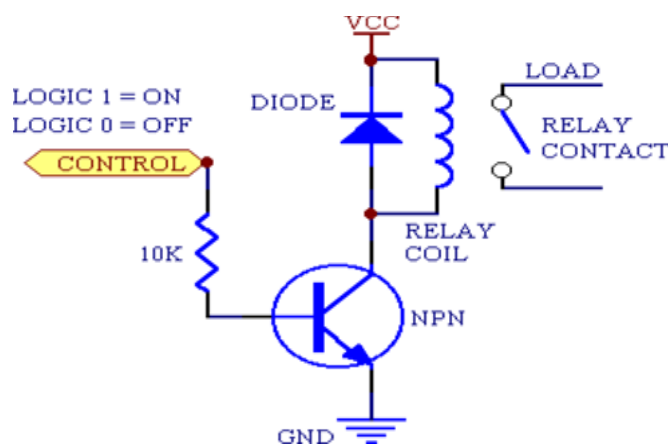
- Circuit diagram of Relay

5. Power Supply:

      Microcontroller requires +5V supply for working. This is derived from 9V transformer and when the 9V transformer is connected to the diode rectifier circuit, while after converting AC to DC by using rectifier is 9V dc is regulated to +5V by using transformer 7805.This +5V supply is applied to microcontroller.

C H A P T E R   **3**

HARDWARE AND SOFTWARE IMPLEMENTATION

Designing of a Password based Circuit Breaker Circuit:

1. The circuit consists of components are 8051 microcontroller (AT89C52), 4×4 Matrix Keypad, 16 x 2 LCD Display, 4 – Channel Relay Module and Four Loads.

2. LCD pins are connected to PORT1 and the control pins like RS, RW and EN pins are connected to P3.0, GND and P3.1 respectively. Here, the LCD is employed to display the knowledge associated with the load.

3. Keypad is connected to PORT2 to the microcontroller. The four Row Pins of Keypad are connected to P2.0 to P2.3 and the four Column Pins are connected to P2.4 to P2.7. Using this keypad, we have to enter the password.

4. Four Lamps which are acting as Electrical Lines are connected to P0.0 to P0.3 throughout the 4 – Channel Relay Module and these are used to indicate the circuit breaker state whether the Light ON – Line Active or Light OFF – Line Not Active.

5. If Relay Module is not used, then you can use 4 BC547 NPN Transistors with current limiting to base Resistor in order to drive the relays. Relay is electromagnetic switch, used to control the electrical devices.
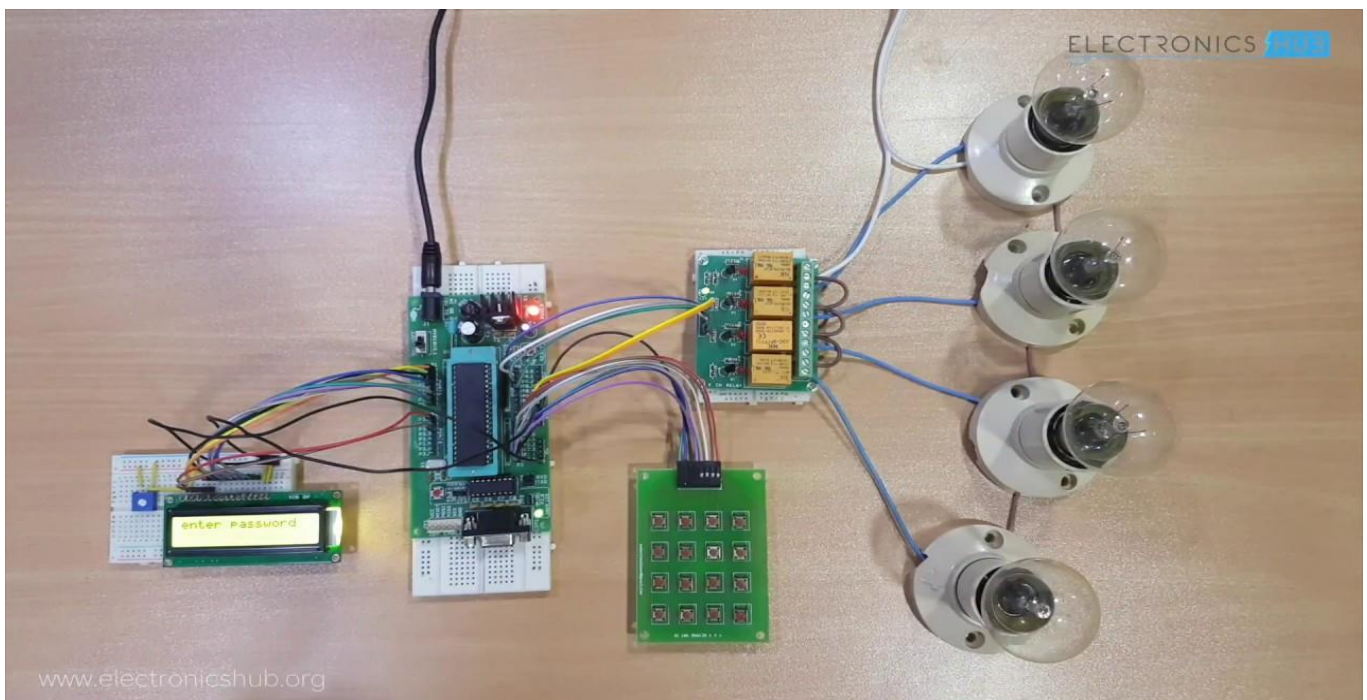
Hardware Implementations:

1. EEPROM:

EEPROM stands for Electrically Erasable Programmable Read Only Memory and may be a sort of on volatile memory utilized in computers and other electronic devices to store small amounts of knowledge that must be saved when power is removed, e.g., calibration tables or device configuration. When larger amounts of static data are to be stored (such as in USB flash drives) a selected sort of EEPROM like non-volatile storage is more economical than traditional EEPROM devices. EEPROMs are organized as of arrays for the floating gate transistors.

2. LCD Display:

LCD from the name "Liquid Crystal" itself. It is actually a mixture of two states of matter – the solid and therefore the liquid. They have both the properties of solids and liquids and maintain their respective states with respect to another for ease of interaction with the user, this system uses an electronic display module. Here a 16x2 LCD is used. This means in 2 lines it's possible to display 16 characters per line. A 5x8 pixel matrix is employed for display one character. Two registers are related to an LCD, like data and command. These modules are preferred since it's easily programmable. For providing visual assistance to the lineman this is often often unavoidable.

3. Matrix Keypad:

A keypad is one among the foremost commonly used input devices in microprocessor applications where in a standard keypad it is wired as an X-Y switch matrix, normally-open connect a row to a column when pressed.

Hardware Implementation

Working Principle:

1. The power is distributed over 2 sections. First one supply unit and second one is Breaker unit. Supply unit is converted to 5v and is given to microcontroller.

2. Now both the AC and DC supplies are switched on. Relay output pins gets 230V, in order that they shouldn't be touched.

3. LCD displays "enter password". Enter the password with the assistance of keypad, you'll see '*' for every digit. Now if the password is correct then the circuit breaker changes and displays status line on the LCD screen, where If password is wrong, then it displays "access denied".

4. Since this is a user changeable one, to change the password click on '*', '#'. It will display 'enter password and 'new password'. Now any password of will can be entered.

5. After that it displays 'confirm password' i.e., the new entered password is going to be stored and the person can change the status of circuit breaker only by this new password.

6. First of all the password is present by programming, when we entered by the keypad if it is matched by the present password then the microcontroller sends the signal trip the password based relay and again when maintenance is done, password to be entered and if it is matched with the present password, signal is sent by microcontroller and relay ON otherwise it is OFF.

7. During maintenance maintainer may met fatal accident. So, for cover of maintainer, relay is operated by password this is often through with the assistance of microcontroller.

8. Only authorized person can operate with the help of the password.

9. Now if there is any fault in electrical line the system will send an SMS to the substation staff, then line man will switch off the power supply to the line by entering password, who would switch off the line and turn it on when the fault is being resolved, thus reducing the chances of accidents and saves the power as well. The proposed system is fully operated with the help of microcontroller.

## Software Implementations:

Keil compiler:
Keil software is the first C compiler implemented and designed from the ground-up specifically for the 8051 microcontroller. Keil Software provides a broad range of development tools like ANSI C Compiler, Macro Assemblers, Debuggers and Simulators, linkers, IDE, library managers, Real-time operating systems and evaluation boards for Intel 8051, IntelMCS-251, ARM and XC16xC16x ST10 families.

Languages Used:

Embedded C Language:
An embedded system is an application that contains a minimum of one programmable computer (typically within the sort of a microcontroller and microprocessor or digital signal processor chip) and which is employed by individuals who are, within the main, unaware that the system is computer based.

Circuit Diagram of Password Based Circuit Breaker:
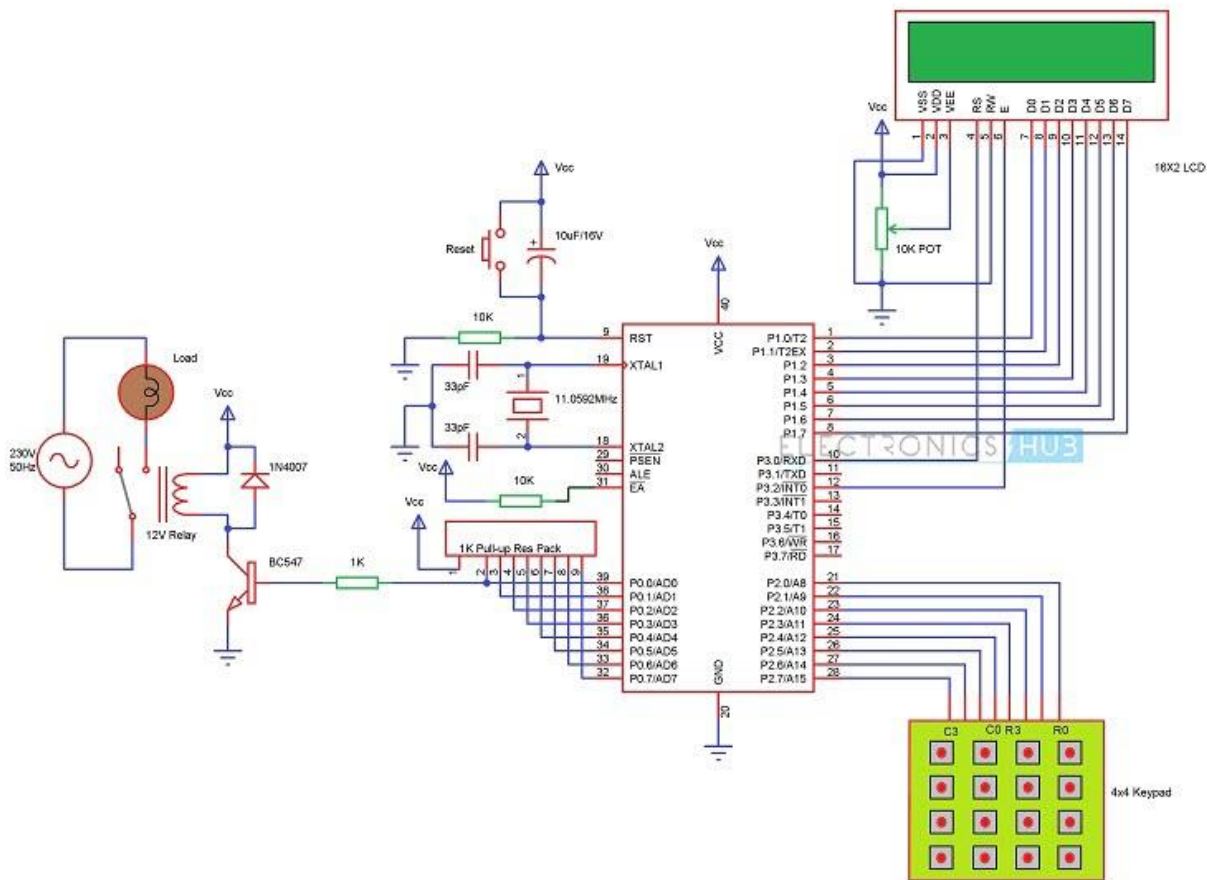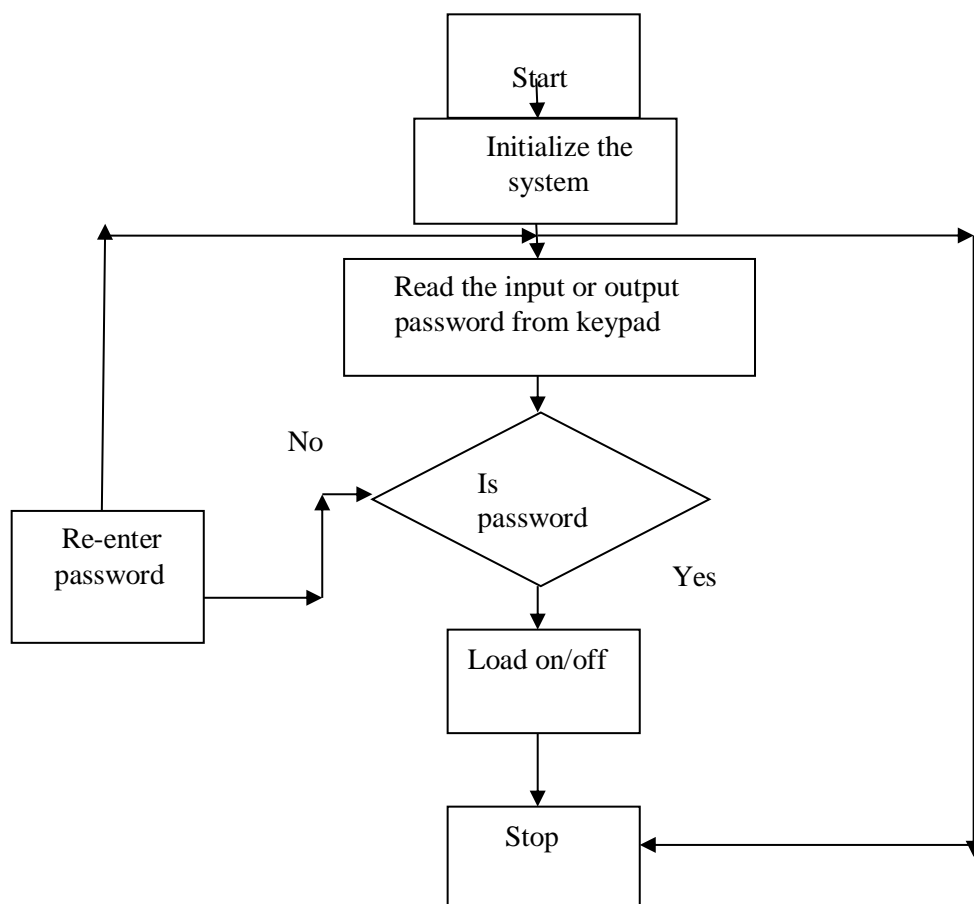

- Circuit Diagram of Password Based Circuit Breaker

Operation of Password Based Circuit Breaker in Keil Software:

1. Write the program to the Password based Circuit Breaker in Keil software and create a hex file.

2. The program burns in the controller with help of 8051 Programming Board and Willar Software.

3. Give the connections as shown in the circuit diagram.

4. While giving the connections, confirm that there's no common connection between AC and DC supplies

5. Use 5V power supply circuit to supply regulated 5V DC to the controller.

6. turn on the both AC and DC supplies.

7. Now relay output pins gets 230V. So, do not touch the load connected pins.

8. LCD displays "enter password".

9. Enter the password with help of keypad.

10. If the password is correct, then the breaker changes its state i.e. if it's already ON, now it becomes OFF and if it's already OFF, now it becomes ON and displays load status on LCD.

11. If the password is wrong, then the LCD displays "wrong password".

12. After a while, the microcontroller asks to enter password by displaying "enter password".

RESULTS

Flow Chart:

 It shows the display of each step and describe how to follow the steps in a correct way until it provides the output.

```
                          ┌──────────────┐
                          │    Start     │
                          └──────┬───────┘
                          ┌──────▼───────┐
                          │ Initialize the│
                          │    system    │
                          └──────┬───────┘
          ┌──────────────────────┼────────────────────────┐
          │                ┌──────▼──────────┐             │
          │                │ Read the input or output │    │
          │                │ password from keypad     │    │
          │                └──────┬──────────┘             │
          │    No           ┌─────▼─────┐                  │
  ┌───────────────┐         │    Is     │                  │
  │  Re-enter     │◄────────│ password  │   Yes            │
  │  password     │         └─────┬─────┘                  │
  └───────────────┘          ┌────▼─────┐                  │
                             │ Load on/off│                 │
                             └────┬─────┘                  │
                             ┌────▼─────┐                  │
                             │   Stop   │◄─────────────────┘
                             └──────────┘
```

Algorithm1 for Password Based Circuit Breaker:

1. Initially it declares the PORT1 to LCD data pins and its control pins RS and E to P3.0 and P3.2 and P3.7 respectively and also declare PORT2 to the keypad and use P0.0, P0.1, P0.2 and P0.3 to loads.
2. Initially display "enter password" on the LCD.
3. Now read the five-digit password from the user.
4. Compare the entered password with stored password.
5. If the password matches, correct then ON or OFF the actual load and display line or load status on LCD.
6. If the password is incorrect or not matched, then its displays "wrong password" on the LCD.
7. After delay, it again asks to enter password so it can have performed several times.

Advantages:

1) Avoids electrical accidents to line man
2) It improve the road man safety
3) Project is straightforward and straightforward
4) Uses commonly available components
5) Most useful to work within the public areas

Applications:

• It's utilized in electrical substations to make sure line man safety.
• Password based breaker is employed in buildings and houses.
• It is set for saving power in hotels and shopping malls.
• It also can be used as Password based Load system or Password Based electrical appliance control.

Results:

Hardware Implementations Results:
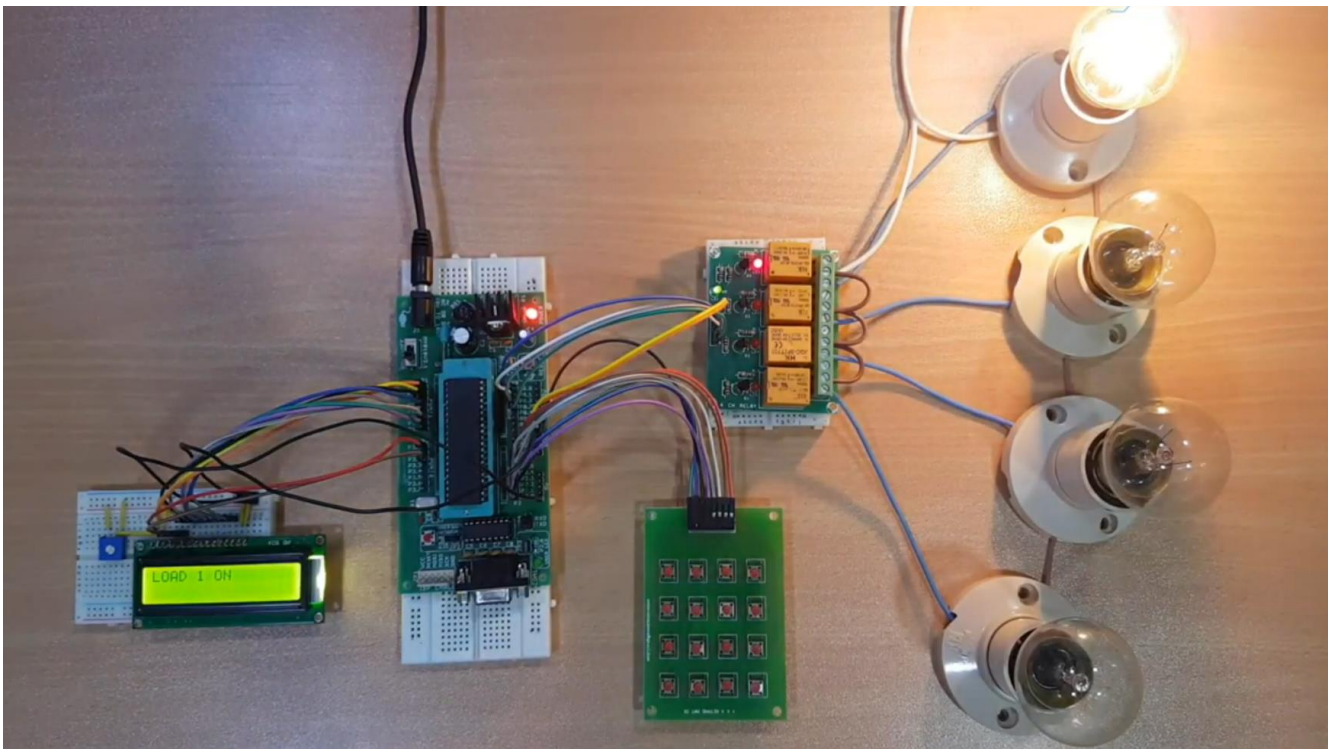
Fig 1. Load 1 is ON

By turning the load 1, by giving proper input through keypad. If the password is correct then the corresponding load will turn on by displaying the current status i.e. Load 1 is ON of the load on LCD.
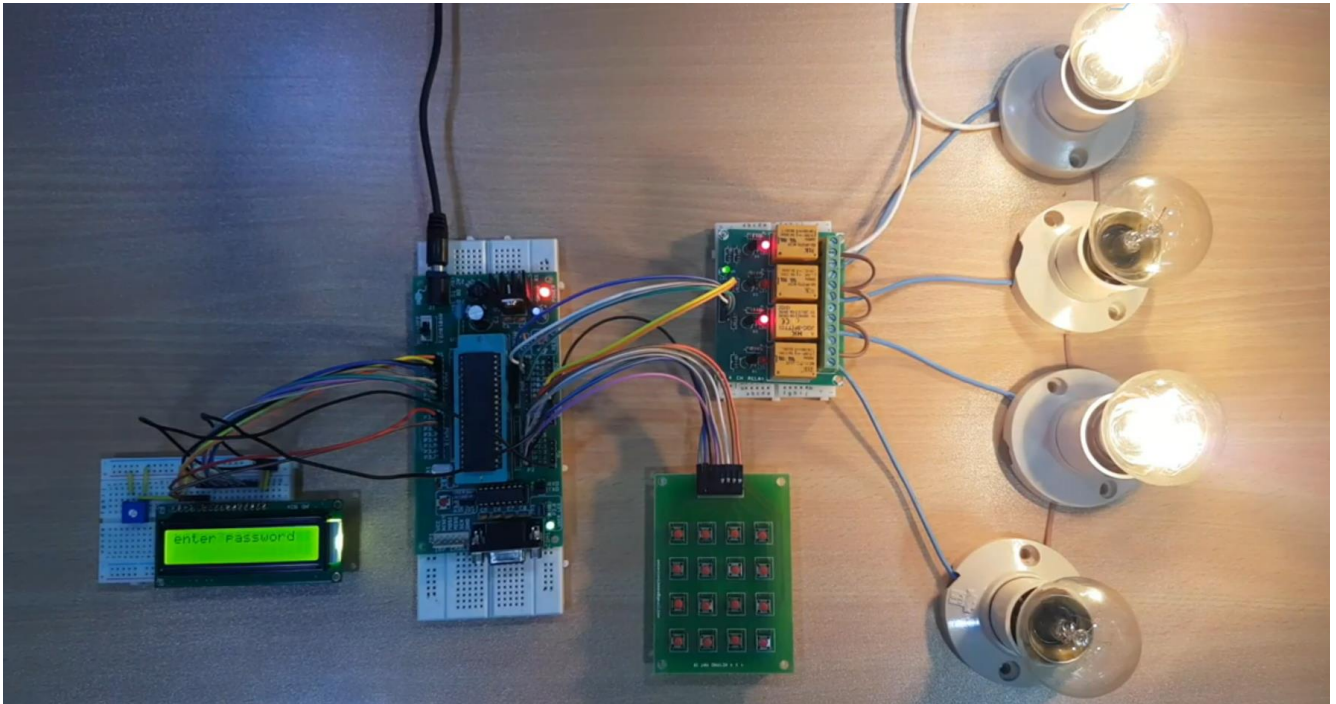
Fig 2. Load 1 and 3 is ON

By turning the load 1 and load 3, by giving proper input through keypad. If the password is correct given to the load 1 and 3 then the corresponding loads will turn on by passing the current flow same in Load 1 and Load 3 by displaying the current status i.e. Load 1 and Load 3 is ON of the load on LCD.
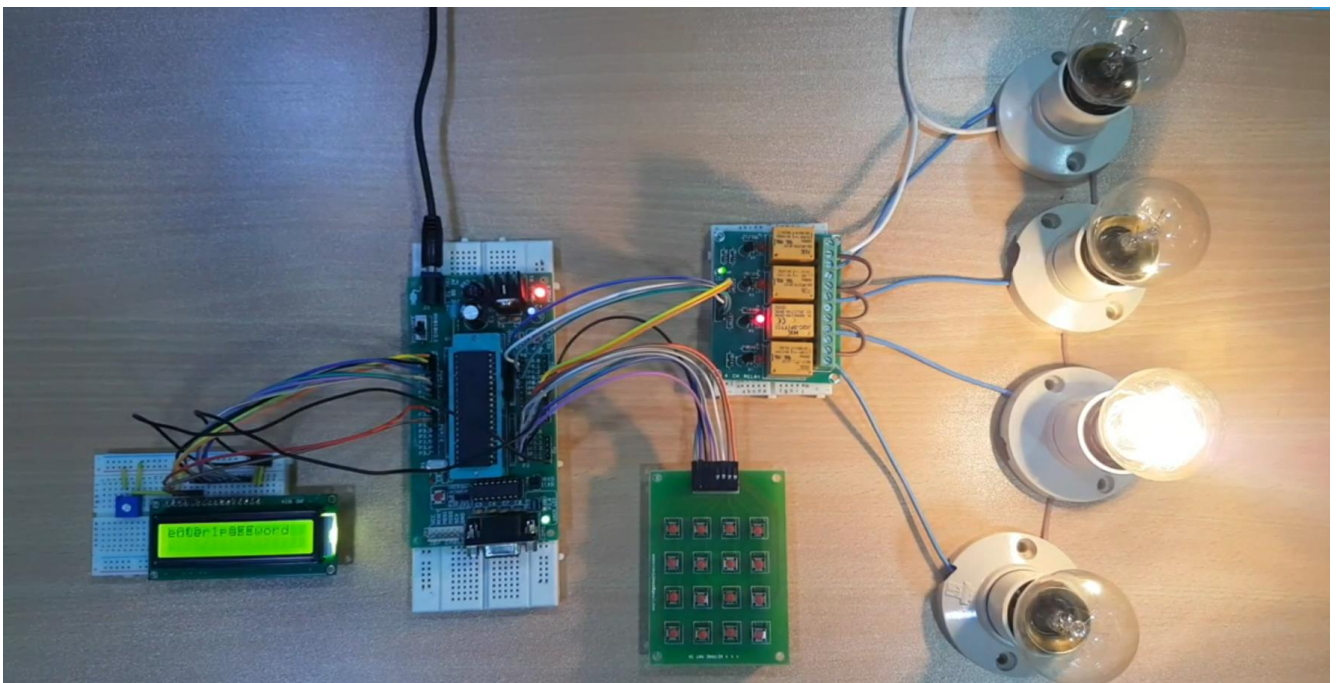

Fig 3. Load 1 OFF and Load 3 is ON

By turning the load 3, by giving proper input through keypad. If the password is correct then the corresponding load will turn on by displaying the current status i.e. Load 3 is ON of the load on LCD.
To turn off the load 1, retype its password on keypad so it turns off and the correspondence bulb stops glowing. Similar to the load 3, retype the password on keypad so it turns off and the correspondence bulb stops glowing.
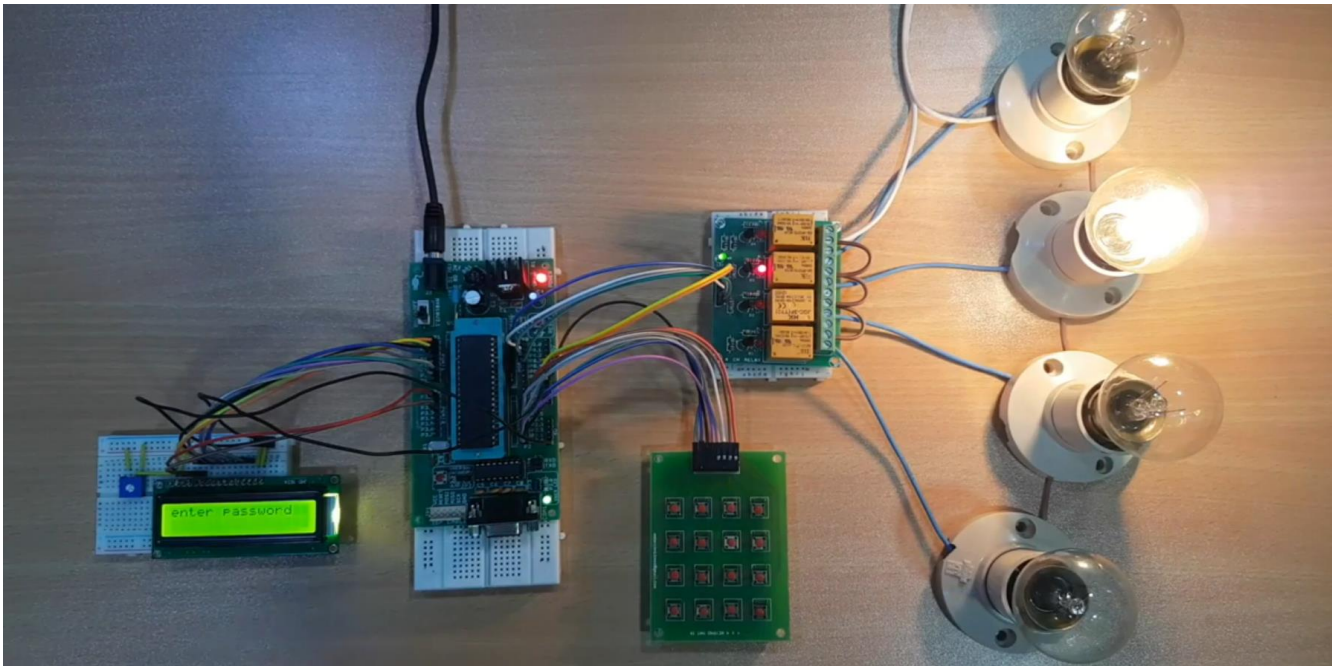
Fig4. Load 2 is ON

Similarly, by turning the load 2, by giving proper input through keypad. If the password is correct then the corresponding load will turn on by displaying the current status i.e. Load 2 is ON of the load on LCD.
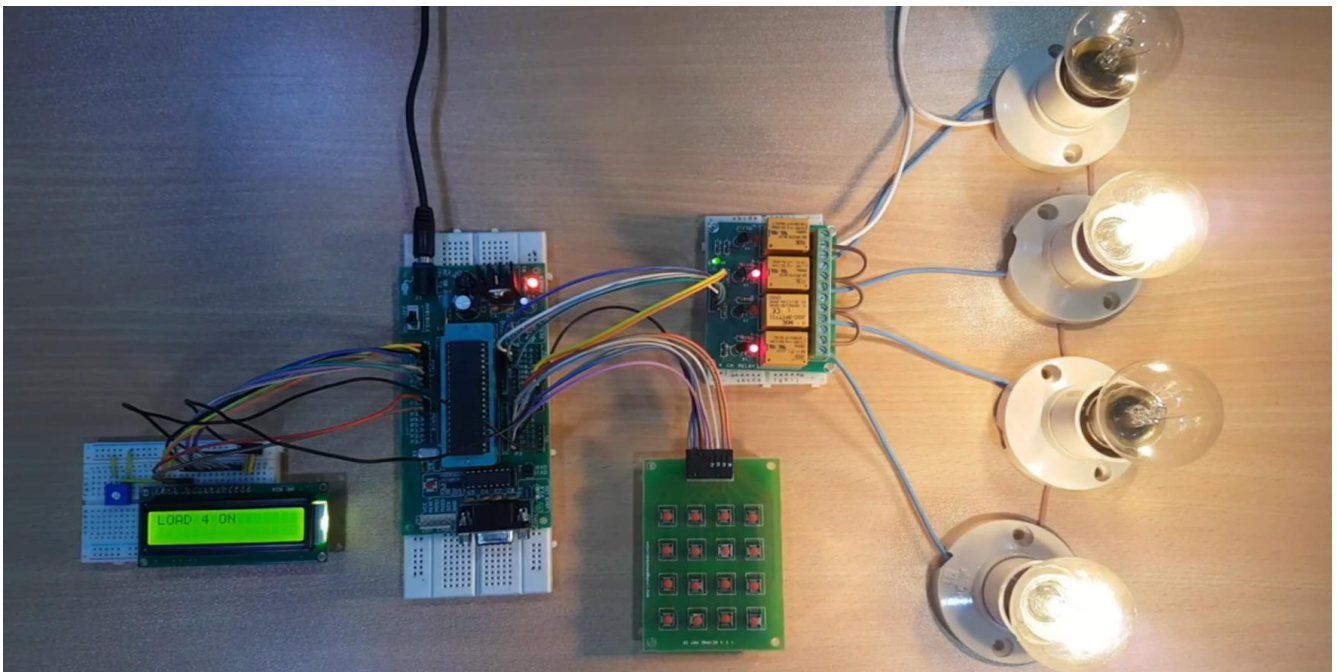

Fig 5. Load 2 and 4 is ON

By turning the load 2 and load 4, by giving proper input through keypad. If the password is correct given to the load 2 and 4 then the corresponding loads will turn on by passing the current flow same in Load 2 and Load 4 by displaying the current status i.e. Load 2 and Load 4 is ON of the load on LCD.
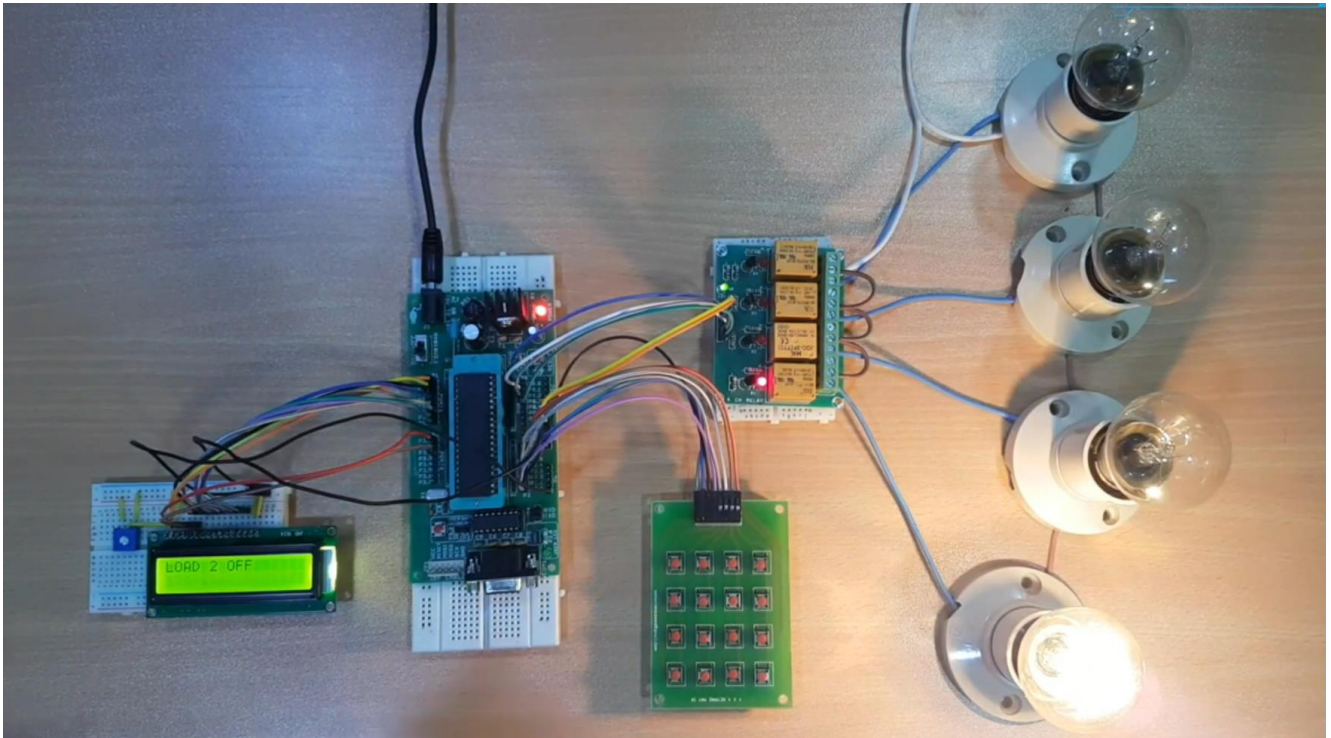
Fig 6. Load 2 is OFF and Load 4 is ON

By turning the load 4, by giving proper input through keypad. If the password is correct then the corresponding load will turn on by displaying the current status i.e. Load 4 is ON of the load on LCD.
To turn off the load 2, retype its password on keypad so it turns off and the correspondence bulb stops glowing. Similar to the load 4, retype the password on keypad so it turns off and the correspondence bulb stops glowing.

Software Implementation Results:

1. By using Keil Software to define the code and processing the code until it gives 0 ERRORS and 0 WARNINGS. Then create a HEX.file for stimulating the circuit in Proteus Software.
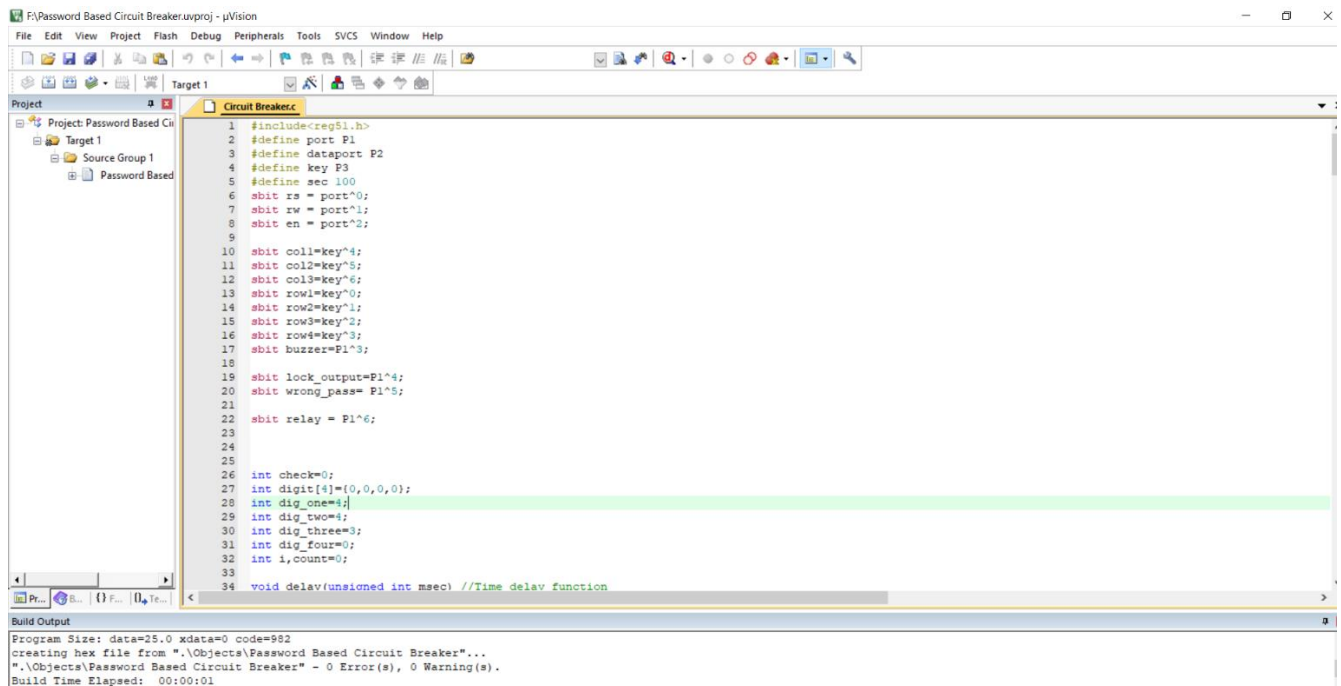

Fig 7. Keil Software

2. Proteus Version 8.6, where we need to draw the circuit diagram by searching and selecting the certain components which needed for the Password Based Circuit Breaker.

3. Next, the HEX.file need to upload in following AT89C51 Microcontroller and then click ok to run the program.
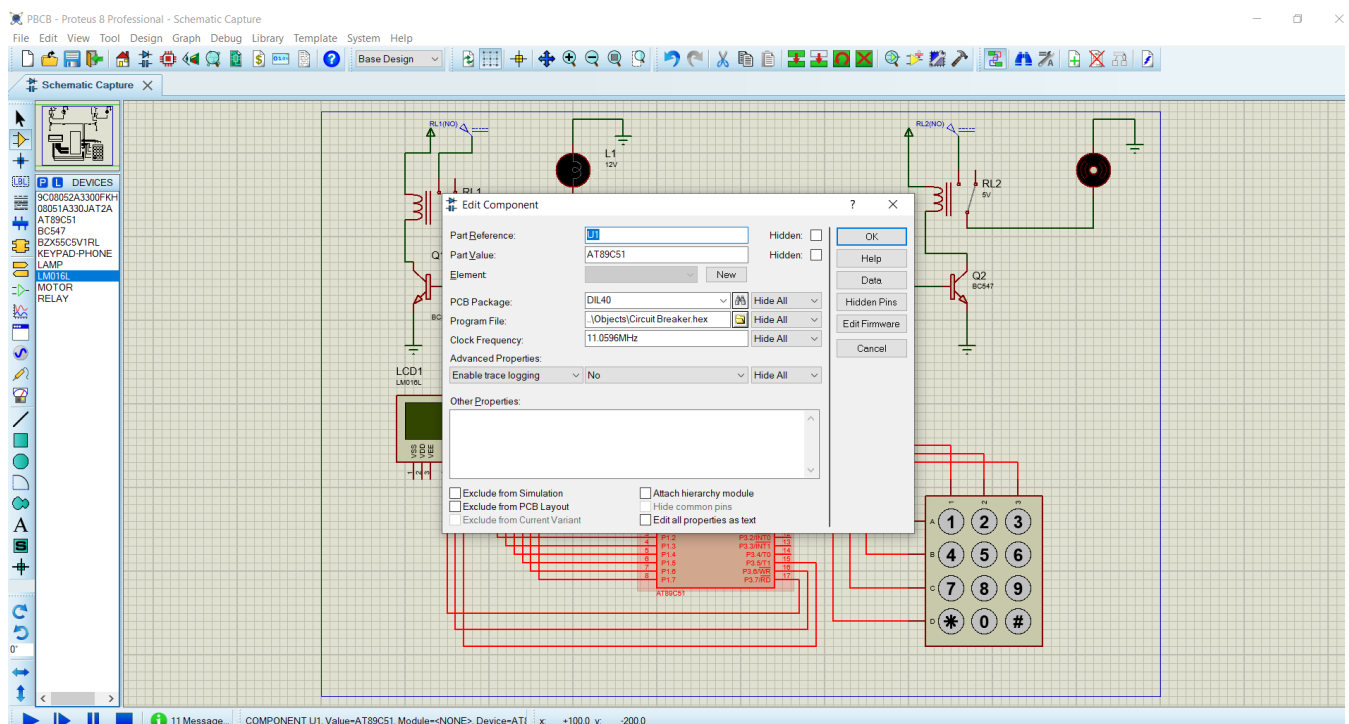

Fig 8. Uploading HEX.file in Proteus Software

4. The Keypad shows enter password and the motor will ON and the Relay RL2 opens and RL1 closes.

5. After running the program, the keypad shows to enter password, then type the correct password in the keypad.

6. After entering the correct password, the motor runs and relay module RL1 opens and RL2 closes then the motor will rotate and gives the light in the lamp which shows that given password is correct otherwise it is incorrect.

Fig 9. Stimulation in Proteus Software

CONCLUSION

Conclusion:

Circuit breaker can work on one given known password. The password to work are often changed and system are often operated efficiently with the changed password. No other person can reclose the breaker once the changed password is given into system aside from the one that had changed it. It gives no scope of password stealing. it's effective in providing safety to the working staff. it's economical and It are often easily installed.

Future Scope:

• Development in electric power transmission requires the utilization of circuit breakers with increasing breaking capacity.

• It also can be interfaced with a GSM modem for remotely controlling the electronic breaker via SMS.

Code for Password Based Circuit Breaker in C Language:

```c
#include<reg51.h>
#define port P1
#define dataport P2
#define key P3
#define sec 100
sbit rs = port^0;
sbit rw = port^1;
sbit en = port^2;

sbit col1=key^4;
sbit col2=key^5;
sbit col3=key^6;
sbit row1=key^0;
sbit row2=key^1;
sbit row3=key^2;
sbit row4=key^3;
sbit buzzer=P1^3;

sbit lock_output=P1^4;
sbit wrong_pass= P1^5;

sbit relay = P1^6;

int check=0;
int digit[4]={0,0,0,0};
int dig_one=4;
int dig_two=4;
int dig_three=3;
int dig_four=0;
int i,count=0;

void delay(unsigned int msec) //Time delay function
{
int i,j ;
for(i=0;i<msec;i++)
  for(j=0;j<1275;j++);
}

void lcd_cmd(unsigned char item) //Function to send command to LCD
{
```

```c
dataport = item;
rs= 0;
rw=0;
en=1;
delay(1);
en=0;
return;
}

void lcd_data(unsigned char item) // Function to send data to LCD
{
dataport = item;
rs= 1;
rw=0;
en=1;
delay(1);
en=0;
return;
}

void lcd_data_string(unsigned char *str)  // Function to send string to LCD
{
int i=0;
while(str[i]!='\0')
{
  lcd_data(str[i]);
  i++;
  //delay(10);
}
return;
}

void lcd(unsigned char str[10])  // Function to send string to LCD
{
lcd_cmd(0x38);
lcd_cmd(0x0e);
lcd_data_string(str);
}

void ans()
{
if(check>3)
{
  lcd_cmd(0x01);
  lcd_cmd(0x82);
  lcd_data_string(" LOCK OPEN");
  lock_output=1;
  wrong_pass=0;
  relay=~relay;
```

```
}
else
{
  lcd_cmd(0x01);
  lcd_cmd(0x81);
  lcd_data_string("WRONG PASSWORD");
  lock_output=0;
  wrong_pass=1;

  count++;
  delay(750);
}
}

void code_check() // Function to check password
{
if(i<=3 )
{
  switch((i+1))
  {
   case 1: {
     if(dig_one==digit[0])
     {
      check=check+1;
     }
     break;
    }

   case 2: {
     if(dig_two==digit[1])
     {
      check=check+1;
     }
     break;
    }

   case 3: {
     if(dig_three==digit[2])
     {
      check=check+1;
     }
     break;
    }

   case 4: {
     if(dig_four==digit[3])
     {
      check=check+1;
     }
```

```
 break;
    }
  }
}
if(i==3)
{
  ans();
}
}

void display(int a) //Display function
{
switch(a)
{
  case 1:{
    lcd_data('1');
    delay(30);
    digit[i]=1;
    code_check();
    break;
    }
  case 2:{
    lcd_data('2');
    delay(30);
    digit[i]=2;
    code_check();
    break;
    }
  case 3:{
    lcd_data('3');
    delay(30);
    digit[i]=3;
    code_check();
    break;
    }
  case 4:{
    lcd_data('4');
    delay(30);
    digit[i]=4;
    code_check();
    break;
    }
  case 5:{
    lcd_data('5');
    delay(30);
    digit[i]=5;
    code_check();
    break;
    }
```

```c
    case 6:{
      lcd_data('6');
      delay(30);
      digit[i]=6;
      code_check();
      break;
      }
    case 7:{
      lcd_data('7');
      delay(30);
      digit[i]=7;
      code_check();
      break;
      }
    case 8:{
      lcd_data('8');
      delay(30);
      digit[i]=8;
      code_check();
      break;
      }
    case 9:{
      lcd_data('9');
      delay(30);
      digit[i]=9;
      code_check();
      break;
      }
    case 0:{
      lcd_data('0');
      delay(30);
      digit[i]=0;
      code_check();
      break;
      }
}
}

void check_col1()
{
row1=row2=row3=row4=1;
row1=0;
if(col1==0)
display(1);
row1=1;
row2=0;
```

```
if(col1==0)
display(4);
row2=1;
row3=0;
if(col1==0)
display(7);
row3=1;
row4=0;
if(col1==0)
{
  row4=1;
}
}

void check_col2()
{
row1=row2=row3=row4=1;
row1=0;
if(col2==0)
display(2);
row1=1;
row2=0;
if(col2==0)
display(5);
row2=1;
row3=0;
if(col2==0)
display(8);
row3=1;
row4=0;
if(col2==0)
display(0);
row4=1;
}

void check_col3()
{
row1=row2=row3=row4=1;
row1=0;
if(col3==0)
display(3);
row1=1;
row2=0;
if(col3==0)
display(6);
row2=1;
row3=0;
```

```
if(col3==0)
display(9);
row3=1;
row4=0;
if(col3==0)
{
  row4=1;
}
}

void main()
{

 lock_output=wrong_pass      =0;
 buzzer=1;
 lcd_cmd(0x01);
col1=col2=col3=1;
relay=0;
lcd_cmd(0x38);
lcd_cmd(0x0C);
lcd_cmd(0x83);
lcd("WELCOME");
delay(500);

while(1)
{
 lcd_cmd(0x01);  //Clear LCD screen
 lock_output=0;

 wrong_pass=0;
 lcd_cmd(0x81);   // Set cursor on position first of first line
 lcd("ENTER PASSWORD");
 check=0;
 row1=row2=row3=row4=0;
 while(col1==1 && col2==1 && col3==1);
 for(i=0;i<4;i++)
 {
  delay(100);
  lcd_cmd(0xc4+i);
  row1=row2=row3=row4=0;
  while(col1==1 && col2==1 && col3==1);
  row1=row2=row3=row4=0;
  if(col1==0)
  check_col1();
  else
   if(col2==0)
   check_col2();
   else
```

```c
    if(col3==0)
    check_col3();
   if(count==4)
   {
  lcd_cmd(0x01);
  lcd_cmd(0x86);
  lcd("SORRY");
  lcd_cmd(0xc1);
  lcd("NO MORE TRIALS");
  buzzer=0;
  while(1);
   }
 }
}
}
```

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