Password Operated Circuit Breaker for the Protection of Lineman from High Voltage Line Supply

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Abstract **- This proposed system mainly designed for the safety of the lineman while working on the line or load, so they do not get the sudden electric shocks. As the lineman work is to deal with live wires every day so the probability of critical accidents is already very high risk. So it was need to provide a safely system of protection to avoid the accidents that may occurs in case of miss coordination between the lineman and station or control staff.**

This proposed system is designed to give a security system as well as it is switching off the meanly line with entering a password with a help of 4x4 matrix keypad and here we got the safety system to work on it.

When the lineman staff get finished their work on after that they can activate the line by using simple method which is entering the same password that added before using keypad on station here we have a very important feature that will support the system during operation is known as gain time.

Index Terms **- Arduino Uno, 4x4 matrix keypad, relay board, 16x2 LCD Display.**

I.INTRODUCTION

In previous years, the problem of lack coordination between the electric power station and the maintenance team that in switch off the circuit breakers during the line men on their work or has not finished yet removing or clearing faults, causing a high damage including injury the team of maintenance with an electric shocks may lead to death or combustion at least, also include damages to the equipment's that use.

So there must be a way to secure and gives a protection to the line man or the maintenance team by not returning the circuit breaker while the maintenance team on a work and that by the line man himself and this insurance is in the form of a password entered by a keypad located in the station.

1.2 Problem Statement

To give an environment to the line man about no one can return the line unless he get finished his work we made a circuit breaker based with password to achieve a safely system to the team that work on maintenance whatever it is.

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit.

Its basic function is to detect a fault condition and interrupt current flow. Unlike a fuse, which operates once and then must be reset (either manually or automatically) to resume normal operation. When operate manually we see fatal electrical accidents to the line man are increasing during the electric line repair due to the lack of communication and coordination between the maintenance staff and the electric substation staff.

1.3 Objectives

The main objectives of this study are to:

- Design of Password Based Circuit Breaker circuit.
- Implementation of Password Based Circuit Breaker circuit.
- Simulate of controlling Password Based Circuit Breaker circuit.

II. LITREATURE REVIEW

There are two major divisions in control theory, namely, classical and modern, which have direct

implications over the control engineering applications. The scope of classical control theory is limited to single-input and single-output (SISO) system design, except when analyzing for disturbance rejection using a second input.

The system analysis is carried out in the time domain using differential equations, in the complex-s domain with the Laplace transform, or in the frequency domain by transforming from the complex-s domain. Many systems may be assumed to have a second order and single variable system response in the time domain. A controller designed using classical theory often requires on-site tuning due to incorrect design approximations. Yet, due to the easier physical implementation of classical controller designs as compared to systems designed using modern control theory, these controllers are preferred in most industrial applications.

The most common controllers designed using classical control theory is Proportional Integral-Derivative controllers (PID). A less common implementation may include either or both a Lead and Lag filter. The ultimate end goal is to meet requirements set typically provided in the time-domain called the Step response, or at times in the frequency domain called the Open-Loop response. The Step response characteristics applied in a specification are typically percent overshoot, settling time, etc. The Open-Loop response characteristics applied in a specification are typically Gain and Phase margin and bandwidth. These characteristics may be evaluated through simulation including a dynamic model of the system under control coupled with the compensation model. In contrast, modern control theory is carried out in the state space and can deal with multiple- input and multiple-output (MIMO) systems. This overcomes the limitations of classical control theory in more sophisticated design problems, such as fighter aircraft control, with the limitation that no frequency domain analysis is possible.

III. METHODOLOGY

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit.

Its basic function is to detect a fault condition and interrupt current flow. Unlike a fuse, which operates once and then must be reset (either manually or automatically) to resume normal operation. When operate manually we see fatal electrical accidents to the line man are increasing during the electric line repair due to the lack of communication and coordination between the maintenance staff and the electric substation staff.

This system includes the power supply unit 4x4 matrix keypad Arduino UNO 5v relay circuit 16x2 LCD display and the load. This circuit will work on 5v power supply as specific key matrix is pressed it will activate the circuit and after the activation of the circuit the i.e. arduino UNO will provide the signal to the relay board so that relay circuit will deactivate the load which is present across the relay load in this the work is done in this project.

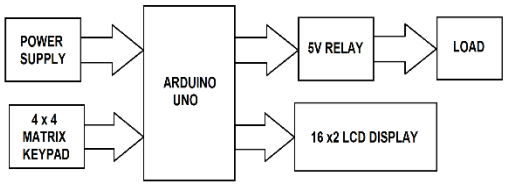


Figure 1: Block diagram of the proposed system

IV. COMPONENTS USED

A. Arduino:

Arduino is a small microcontroller board shown in figure 2 with a USB plug to connect to your computer and a number of connection sockets that can be wired up to external electronics, such as motors, relays, light sensors, laser diodes, loudspeakers, microphones, etc. Arduino can either be powered through the USB connection from the computer or from a 9V battery, Arduino can be controlled from the computer or programmed by the computer and then disconnected and allowed to work independently [2].

Figure 2: Arduino board

B. Relay interfacing with arduino:

It is electromechanical device shown in figure (2). It contains a solenoid coil and some kind of mechanical assembly. When a coil is magnetized by apply its operating voltage it get magnetizing and changes the position of a switch. And the connected device will be ON or OFF depending on the connection.

A relay is used to switch ON and OFF the AC appliances. It also provides an isolation between arduino that running at 5V and AC appliances running at 220V AC. It has COM (common), NC (normally close) and NO (normally open) terminal.

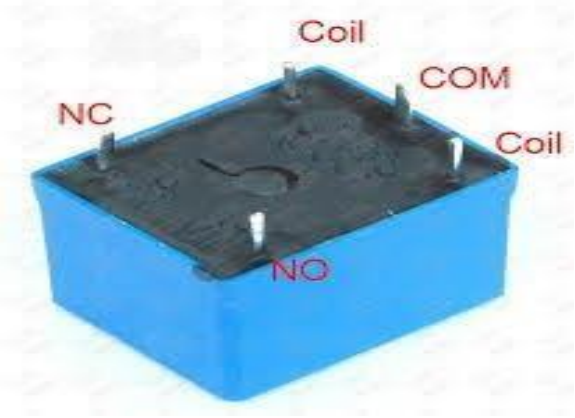


Figure 2: Relay point

C. Setting up the LCD:

A parallel LCD screen these are extremely common and come in all kinds of shapes and sizes. The most common is a 16×2 character display with a single row of 16 pins (14 if it does not have a backlight). In this topic, we use a 16-pin LCD display that can show a total of 32 characters (16 columns and 2 rows).

If your display didn't come with a 16-pin header already soldered on, you need to solder one on so that you can easily install it in your breadboard. With the header successfully soldered on, your LCD should look like the one shown in Figure 3

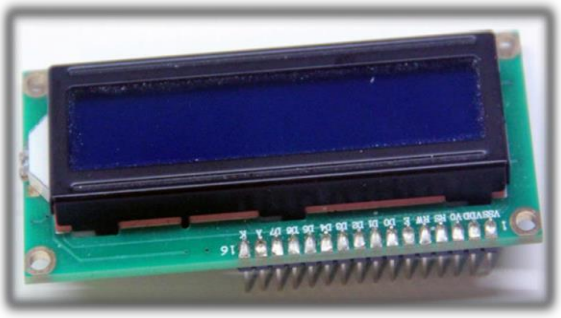


Figure 3: LCD with headers soldered on

D. Interface the keypad to Arduino:

A keypad is one of the most commonly used input devices in microprocessor applications shown in figure (4). In a standard keypad wired as an X-Y switch matrix, normally-open connect a row to a column when pressed.

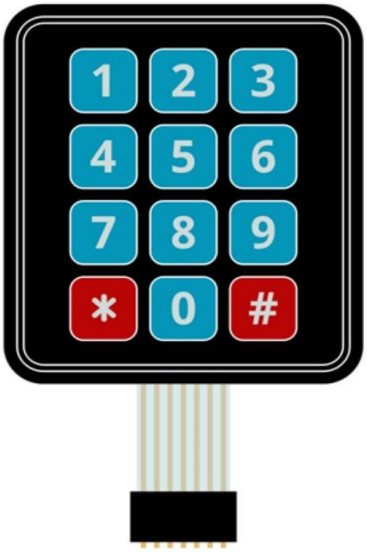
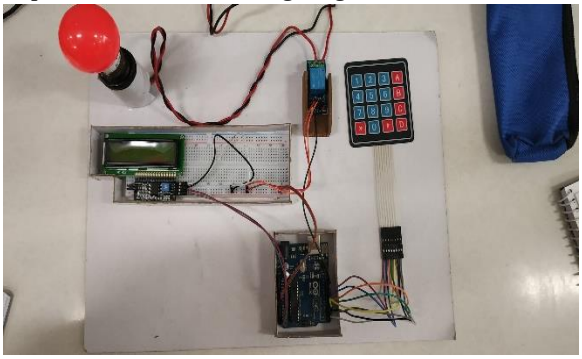


Figure 4: 3×4 Hex keypad

V. SYSTEM IMPLEMENTATION AND TESTING

In the following diagram shows the actual system implementation or working diagram.



Program of the system is as follows,

```
#include <Keypad.h>
#include<LiquidCrystal.h>
#include<EEPROM.h>
#include <SoftwareSerial.h>
SoftwareSerial mySerial(2,3);
LiquidCrystal lcd(11,9,8,7,6,5);
char password[4];
char pass[4],pass1[4];
```

```
int i=0;
char customKey=0;
const byte ROWS = 4; //four rows const byte COLS = 3; //three columns char hexaKeys[ROWS][COLS] = {
{'1','2','3'},
{'4','5','6'},
{'7','8','9'},
{'*','0','#'}
};
byte rowPins[ROWS] = {4,A5,A4,A3}; // the row pinouts of the keypad byte colPins[COLS] = {A2,A1,A0}; // the column pinouts of the keypad
Keypad customKeypad = Keypad( makeKeymap(hexaKeys), rowPins, colPins, ROWS, COLS);
int buzzer = 10;
int m13=13;
int k=1;
int numdata;
boolean started=false; char smsbuffer[160]; char n[20];
void setup()
{
Serial.begin(9600);  //Serial connection delay(2000);
if (gsm.begin(9600)){ lcd.print("READY"); delay(1000); started=true;
}
else Serial.println("\nstatus=IDLE");
if(started){
//Enable this two lines if you want to send an SMS.
//if (sms.SendSMS("3471234567", "Arduino SMS"))
//Serial.println("\nSMS sent OK");
} lcd.begin(16,2); pinMode(led, OUTPUT);
pinMode(buzzer, OUTPUT);
pinMode(m2,OUTPUT); pinMode(m13,OUTPUT);
lcd.print(" Electronic "); lcd.setCursor(0,1);
lcd.print(" Keypad Lock ");
delay(2000);
lcd.clear();
lcd.print("Enter Password:");
lcd.setCursor(0,1); for(int j=0;j<4;j++) EEPROM.write(j, j+49); for(int j=0;j<4;j++)
pass[j]=EEPROM.read(j);
}
void loop()
{
} if(customKey=='#') change();
if (customKey){password[i++]=customKey;
lcd.print(customKey);
} if(i==4){ delay(200);
for(int j=0;j<4;j++) pass[j]=EEPROM.read(j);
if(!(strncmp(password, pass,4))){ digitalWrite(led, HIGH); lcd.clear();
lcd.print("Password Accepted");
delay(2000); if(k==1){ digitalWrite(m13,HIGH);
k++;
} else{ digitalWrite(m13,LOW); k--;
} lcd.setCursor(0,1); lcd.print("#Change Password");
delay(2000);
lcd.clear();
lcd.print("Enter Password:");
lcd.setCursor(0,1);
i=0;
}
else{
digitalWrite(buzzer, HIGH);
lcd.clear();
lcd.print("Access Denied..."); lcd.setCursor(0,1);
lcd.print("#Change Password"); delay(2000);
lcd.clear();
lcd.print("Enter Password:");
lcd.setCursor(0,1);
i=0;
digitalWrite(buzzer, LOW);
}}}
void change()
{
int j=0;
lcd.clear();
lcd.print("Current Password");
lcd.setCursor(0,1);
while(j<4){
char key=customKeypad.getKey();
if(key){ pass1[j++]=key; lcd.print(key);
}
key=0;
}
delay(500);
if((strncmp(pass1, pass, 4))){
lcd.clear();
lcd.print("WrongPassword..");  lcd.setCursor(0,1);
lcd.print("Better Luck Again");
delay(1000);
} else{ j=0;
lcd.clear();
lcd.print("Enter New Passk:");
lcd.setCursor(0,1);
while(j<4){
```

```
char key=customKeypad.getKey();
if(key){pass[j]=key; lcd.print(key);
EEPROM.write(j,key); j++;
}}
lcd.print(" Done.....");
delay(1000);
}
lcd.clear();
lcd.print("Enter Ur Passk:"); lcd.setCursor(0,1);
customKey=0;
}
```

VI. CONCLUSION

A perfect protection has been achieved to line man, in whilst of increase of line man accident that happens while repairing the electrical lines due to the lack of communication between electrical substation and maintenance staff nowadays. Finally protective system has given to line man protection.

The solve of this problem clarified on using a password to turn ON/OFF circuit breaker. It is not a teaser to turn OFF circuit breaker the issue is that to turn ON circuit breaker whilst line man on a task that may cause a fire, blast, burning, also we can't ignore the damage that may cause burning the station this lead to financial losses.

The needle of turn off circuit breaker has represented on adding a buses to station or to treating (lines, transformers, generators etc). The manual part is using the keypad to entering password that will appear on LCD screen to be absolute about that you enter the password you preselected. The password will store on Arduino's EEPROM and the output is to rotate a motor that separate a moving contact and break the circuit. Here a safety has provided to the line man because the moving contact will not move unless we entering the same password that line man select. In addition to alarm that has made in case that someone try to turn ON circuit breaker after he entering a wrong circuit breaker.

REFERENCES

[1] Viral P. Solanki, Ajit J. Parmar, Nikul S. Limbachiya, Rakesh Koringa, and Shivangi Patel, "Arduino Based Protection System for Wireman," Int. J. Electr. Electron. Res., vol. 3, no. 1, pp. 76–79, 2015.

[2] J.Veena, G.Srivani, Afreen, M.Sunil Kumar, J.Santhosh, and K.B.V.S.R.Subrahmanyam, "Electric Lineman Protection Using User Changeable Password Based Circuit Breaker," Int. J. Curr. Eng. Sci. Res., vol. 2, no. 5, pp. 44–49, 2015.

[3] P. N. Mahadik, P. A. Yadav, S. B. Gotpagar, and H. P. Pawar, "Electric Line Man Safety using Micro Controller with GSM Module," Int. J. Sci. Res. Dev., vol. 4, no. 1, pp. 205–207, 2016.

[4] A. M. Hassan Ali, "Enhancement of a GSM Based Control System," in Advances in Circuits, Systems, Signal Processing and Telecommunications, 2015, pp. 189–202.

[5] D. R. Brooks, "Arduino-Based Dataloggers: Hardware and Software," 1.3, 2016.

[6] A. M. Gibb, "New Media Art, Design, And the Arduino Microcontroller: A Malleable Tool," School of Art and Design, Pratt Institute, 2010.

[7] V.K Mehta, "Principle of power system", S. Chand, 2005.

[8] Wiley, "Exploring Arduino", Tools and Techniques for Engineering Wizardry, india, 2013.

[9] Christopher kilian, "Modern control technology", Cengage Learning, 2005.

[10] Gunther Gridling, Bettina Weiss," Introduction to microcontroller" , in Vienna University of Technology, 2007.