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# Secure Circuit Breaker System for Line Worker Safety and Load Distribution

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**ABSTRACT:** This project aims to enhance safety for maintenance staff, such as line workers, during electric line repairs by implementing a password-protected circuit breaker control system. The system allows line workers to turn off the power supply, perform repairs safely, and then restore power by entering a password. Controlled by an PIC Microcontroller, the system includes a keypad for password entry and utilizes indicators to show the status of the circuit breaker. Additionally, the use of EEPROM enables users to change passwords for enhanced security. Integration of GSM technology further improves safety by enabling remote control of circuit breakers, reducing physical contact with high-voltage lines.

**KEYWORDS:** Circuit Breaker, Keypad, GSM, Voltage Regulator, Micro Controller(16F877A), Relay, LCD

## I. INTRODUCTION

The project is designed to control a circuit breaker 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.

The system has two purposes. Firstly, whenever there is overload, the system shuts down automatically. The second purpose is for the electric line man safety which provides a solution that ensures safety of maintenance staff, i.e., line man. The control to turn on/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). This system is fully controlled by a microcontroller from the PIC family. A matrix keypad is interfaced to the microcontroller to enter the password. The entered password is compared with the password stored in the ROM of the microcontroller. If the password is correct, then only the line can be turned on/off circuit using relay. If the password is in correct, then the system will send the alert SMS using GSM and line man will send the correct password by resending the SMS to the GSM modem from anywhere in the world. The activation / deactivation of the circuit breaker is indicated by a lamp. Status of loads is displayed on LCD. Buzzer indicates the alerts if the circuit breaks.

Furthermore, this project in future can be enhanced by using PIC Microcontroller for the user to change the password for more secured system interaction. Status of loads is displayed on LCD. Buzzer indicates the alerts.

## II. LITERATURE SURVEY

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 replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation. During manual operations like electric line repair we observe fatal electrical accidents to the line man.

### Existing system:

While manually operating on electric line we observe fatal electrical accidents. These occur because of lack of communication and coordination between the maintenance staff and the electric substation staff which leads to severe accidents. This communication gap may put electric line man life at risk.

### Disadvantages of existing system:

Improper communication between maintenance staff and substation causes the electrical accidents. During maintenance the entire line is turned off this cause inconvenience to the consumers.



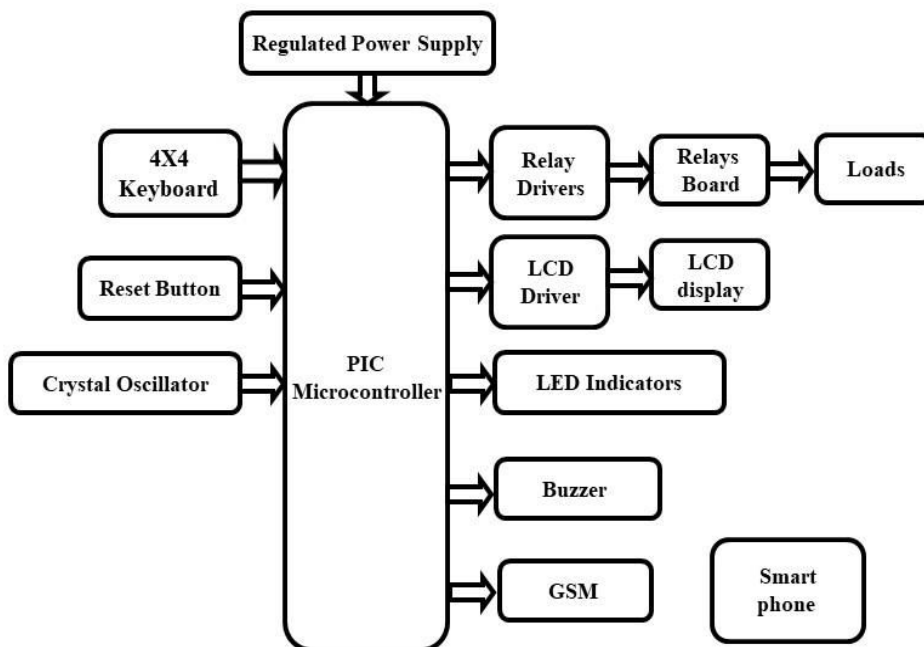
**Proposed System:**

This proposed system provides a solution, which can ensure the safety of the maintenance staff e.g. line man. The control to operate on the line lies with the line man only. This system has an arrangement such that a password is required to operate the circuit breaker. Line man can turn OFF the supply and comfortably repair it, and return to the substation, then turn ON the line by entering the correct password. Since it has the provision of changing the password, person can give any password of his will and have his work done safer. It is effective in providing safety to the working staff and it is economical. The entire line is not turned OFF so there is no inconvenience to the consumer.

**III. METHODOLOGY**

**Block Diagram**

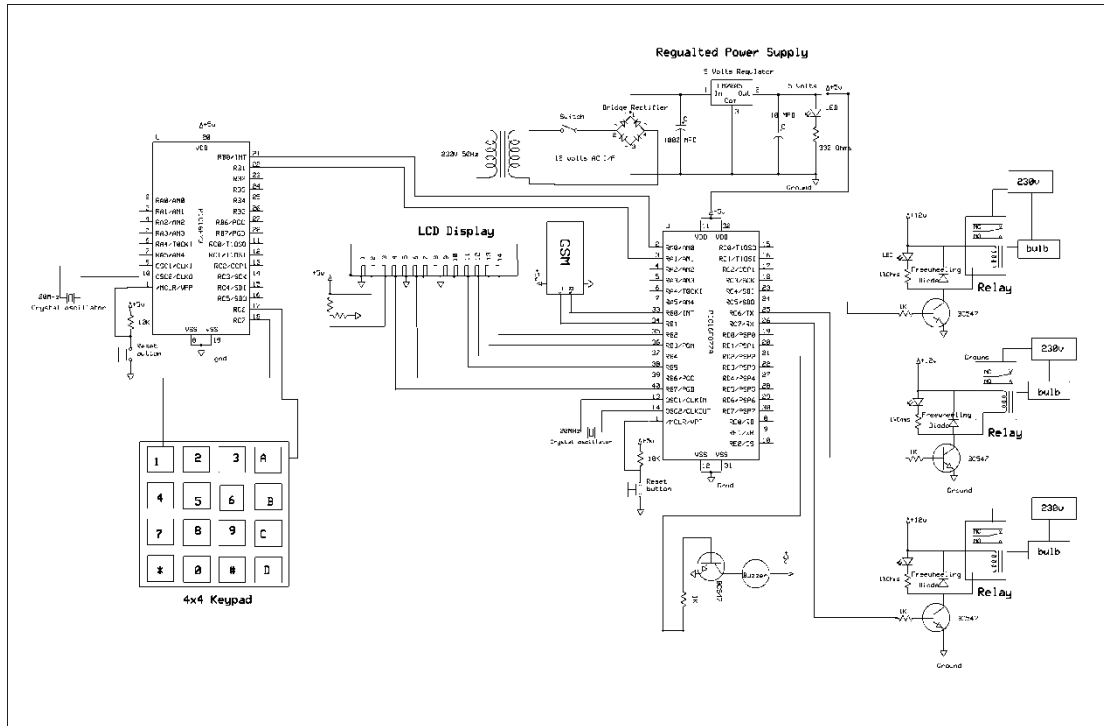
**Block diagram**





### Circuit Diagram

To create a GSM and keypad-based electrical circuit breaker for the safety of electric linemen, you can follow these simple steps:



#### Components Needed:

- PIC Microcontroller
- GSM module
- Keypad
- Relay modules
- Power supply
- Electrical circuit breaker

#### Circuit Diagram:

- Connect the GSM module to the Arduino Uno using serial communication (RX to TX and TX to RX).
- Connect the keypad to the microcontroller.
- Connect the relay modules to the microcontroller.

#### Programming the microcontroller:

- Write a program that reads input from the keypad.
- When a specific code is entered on the keypad, send a message to the specified phone number using the GSM module.
- Upon receiving the message, the microcontroller should trigger the relay to turn off the electrical circuit breaker.

#### Safety Considerations:

- Ensure that the circuit is properly insulated and isolated to prevent electric shocks.
- Test the system thoroughly before deploying it in a real-life scenario.
- This setup allows the electric lineman to remotely disconnect the power supply to a specific location, ensuring their safety while working on electrical lines

#### Working

##### Initialization:

- The system is initialized by powering up the PIC Microcontroller and the GSM module.



- The GSM module is configured to communicate with a specific phone number for sending SMS messages.

**Keypad Input:**

- The lineman enters a predefined code using the keypad to trigger the circuit breaker.
- The microcontroller reads the input from the keypad and stores it for verification.

**SMS Notification:**

- Once the correct code is entered, the PIC Microcontroller sends an SMS message to the predefined phone number using the GSM module.
- The SMS message includes a notification that the lineman is about to disconnect the power supply for safety reasons.

**Circuit Breaker Activation:**

- Upon receiving the SMS message, the lineman acknowledges it and prepares for the power supply to be disconnected.
- The microcontroller receives the acknowledgment and triggers the relay connected to the electrical circuit breaker. Here AC bulbs as indicated by the connect and disconnect circuit.

**Power Disconnection:**

- The relay cuts off the power supply to the specified location, ensuring the safety of the lineman working on the electrical lines.

**Resetting the System:**

- After completing the work, the lineman can reset the system by entering a reset code on the keypad.
- The Microcontroller verifies the reset code and restores the power supply by deactivating the relay.

**Safety Measures:**

- The system is designed to prevent accidental triggering, requiring a specific code to be entered on the keypad.
- SMS notifications provide a clear communication channel between the lineman and the system.
- This system enhances the safety of electric linemen by allowing them to remotely disconnect the power supply while working on electrical lines, reducing the risk of electric shock and other accidents.

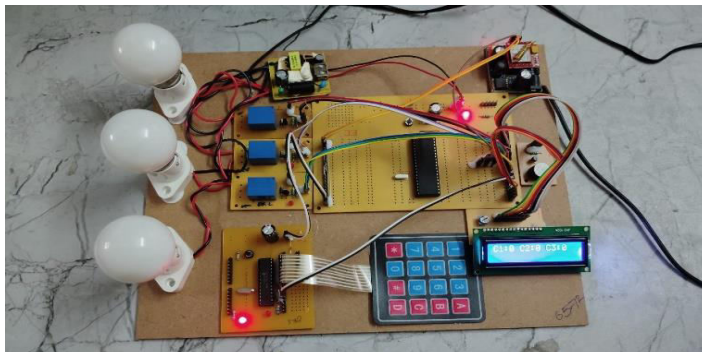


Fig Prototype of Proposed System

#### IV. EXPERIMENTAL RESULTS

The project “**Password Protected based ultrafast acting electronic circuit breaker**” was designed a circuit breaker 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 system is fully controlled by a PIC microcontroller. A matrix keypad is interfaced to the microcontroller to enter the password. When the line men entered password; it is compared with the stored password. If the password is correct, then only the line can be turned on/off circuit using relay. If the password is in correct, then the system will send the alert SMS using GSM and line man will send the correct password by resending the SMS to the GSM modem from anywhere in the world. The activation / deactivation of the circuit breaker is indicated by a lamp. Status of loads is displayed on LCD. Buzzer indicates the alerts if the circuit breaks.

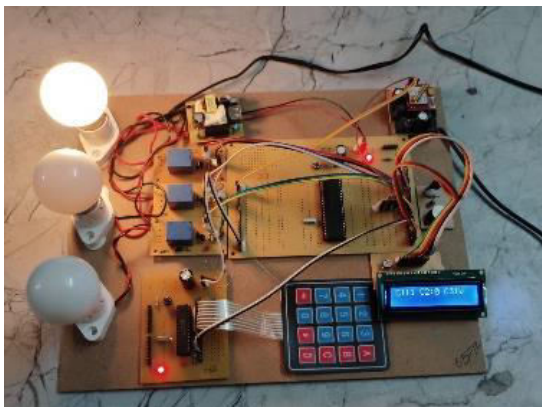


Fig when password entered manually to control CB1

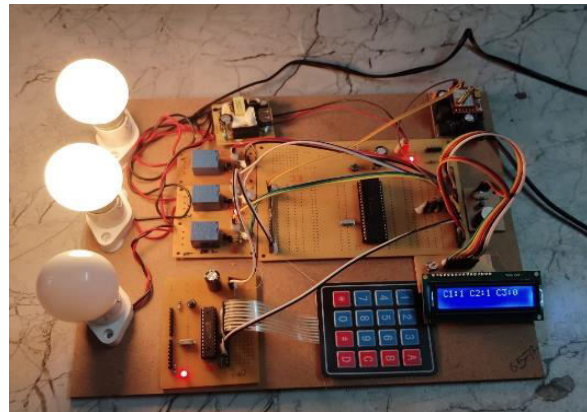


Fig 6.when password entered manually to control CB2

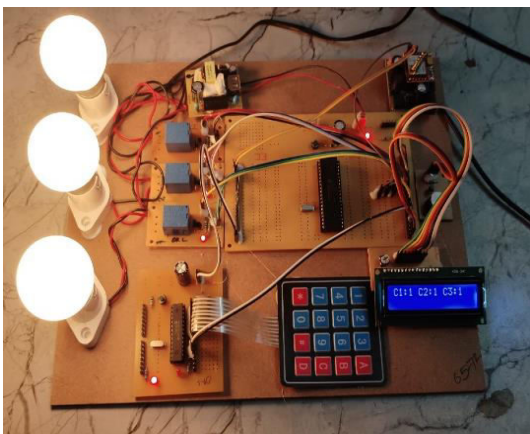


Fig when password entered manually to control CB3

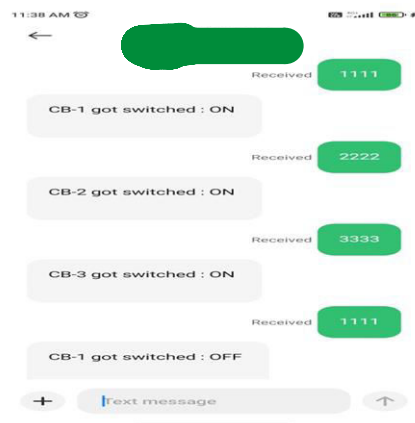


Fig When password entered Through mobile to control(NO) CBs

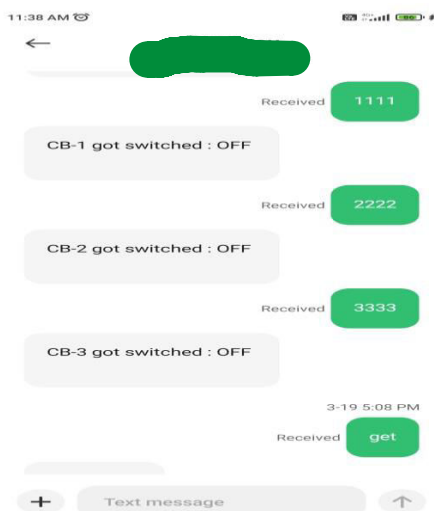


Fig When password entered through Mobile to Off the CBs

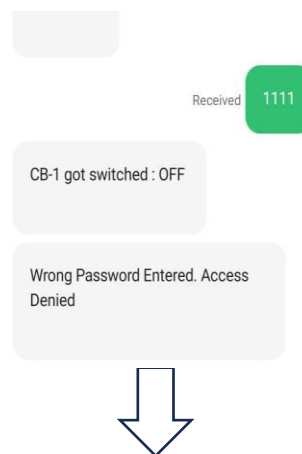


Fig Shows when wrong password entered manually in the keypad to control CB1



## V. ADVANTAGES AND DISADVANTAGES

### Advantages:

- Keypad based password accessing.
- Circuit breaker operation using password access.
- Circuit breaker operation using Relay switches/
- Wrong password authentication using GSM module.
- GSM based SMS alerts.
- Work from anywhere in the world using GSM technology.
- Visual alerts display on LCD module.
- Highly efficient and low-cost design.
- Easily operable.

### Disadvantages:

- Periodic monitoring is required
- Interfacing of Keyboard with Pic microcontroller is sensitive

## VI. RESULTS

The project “**Secure Circuit Breaker System for Line Worker Safety and Load Distribution**” was designed a circuit breaker 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 system is fully controlled by a PIC microcontroller. A matrix keypad is interfaced to the microcontroller to enter the password. When the line men entered password; it is compared with the stored password. If the password is correct, then only the line can be turned on/off circuit using relay. If the password is in correct, then the system will send the alert SMS using GSM and line man will send the correct password by resending the SMS to the GSM modem from anywhere in the world. The activation / deactivation of the circuit breaker is indicated by a lamp. Status of loads is displayed on LCD. Buzzer indicates the alerts if the circuit breaks.

## VII. CONCLUSION

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC’s with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

## VIII. FUTURE SCOPE

This project can be extended using a GPRS module. GPRS module sends the alert message to the respective authorities’ predefined web link when a un authorized person is detected. We can also add wireless camera for line man safety and also theft detection at poles with recordable features in MMC card.

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