

## Automated Circuit Breaker with IOT Interfacing

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**Abstract:** Statistics suggests that majority of electrical accidents occurs during electrical line maintenance work and are caused due to mis communication between electric substation staff and maintenance staff. To prevent this we are implementing automated circuit breaker with a better interfacing. Internet of things is at the forefront in areas of real time monitoring, situational awareness and intelligence, control and cyber security which makes the system efficient secure reliable resilient and sustainable. This project gives maintenance complete control for turning ON/OFF the line. The proposed idea put forward a more secured operating condition for the line man and ensures unauthorised access and that an switching of the line does not occurs. This is realized using a password verification method. The password is entered using a matrix keypad which is compared with a pre-set password. If it matches, the line man can operate the line according the requirement. The status of the line which includes the voltage and current and ON/OFF status can be accessed on a webpage, connected via an IOT module. The system is powered by means of a step down transformer 230/12V and rectified to DC, ripples are removed by means of a capacitive filter. A +5 regulator regulate the supply to microcontroller.<sup>2</sup>

**Keyword:** circuit breaker, power line safety, fuse, IOT

### I. Introduction

In India, the number of death due to electrical accidents has reached about 1400 in the last 3 years alone. Of these, majority of the victims are electrical line man who lost their life during maintenance work. The main reason behind these upsetting figures is due to the improper charging and discharging of electrical lines occurring due to miscommunication and lack of coordination between maintenance staff and engineers at the substation.<sup>1</sup> Another cause is the unauthorized operating of line. In the event of power outage due to fault or other abnormalities the lines are sometimes charged without proper communication from the concerned authority. In rural area there are even incidents where civilians themselves operate the line, reason. In order to avoid this, we have designed a system that checks the authenticity of the user. The password based circuit breaker accomplishes this by using a password verification method. By entering in the password by means of a matrix keypad and comparing it with a previously stored password the system allows the maintenance personal to turn ON/OFF the line.<sup>1</sup> This improve the working condition of maintenance personals as he alone can operate the line.<sup>3</sup> The system is linked to internet by means of an IOT module. The voltage and current along with status of line is transferred to the internet via the IOT module and can be accessed by the station personals. This also increase the responsibility of substation staff as the one person is held accountable for operating the line.

### II. Methodology

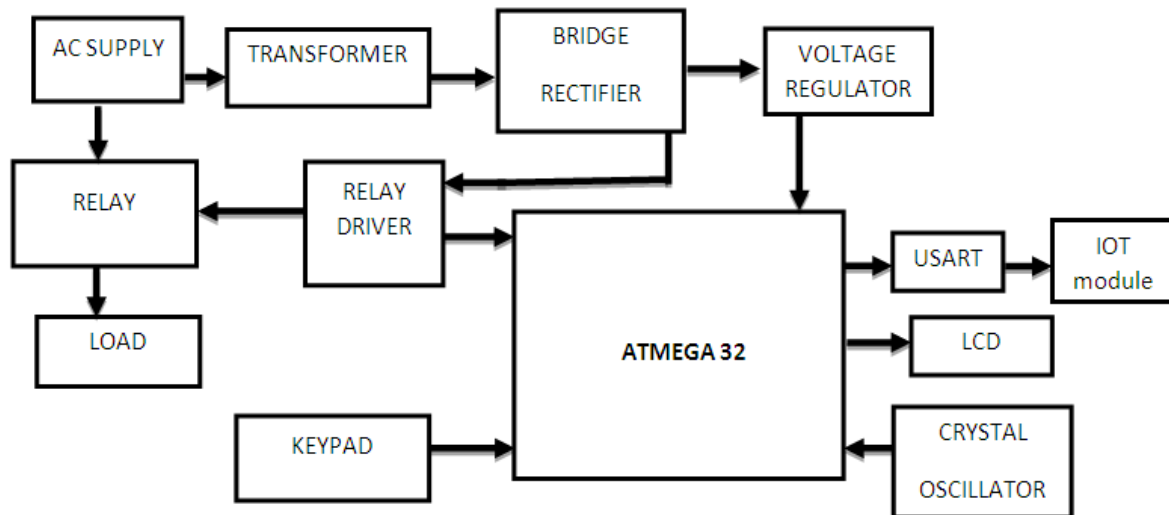
The system is designed to monitor the voltage and current during the entire period of operation on the line. The voltage and current value is displayed through LCD and updated periodically. If the voltage or current value falls outside the set limit, then it is considered unhealthy and the relay trips. The power to that section of the line, where abnormalities exist, is cut off.

The 3 phase supply is provided with its own relay mechanism to operate each line separately. If the supply needs to be cut off in the event of some maintenance work, the operator first presses the key to bring the control to the password display section. The operator then types in required password, which is compared with a pre-set password. If both the password matches, then system asks to specify which line needs to be cut. By selecting the appropriate instruction as shown fig 2, the corresponding line can be powered off/on.



**Fig:2** display to select the line.

This helps the line man switch any one power line without affecting power in other lines. Once the maintenance work is completed, the line can be reactivated by entering the password and comparing again with the pre-set password. If it matches, similar to deactivation, the line can be activated separately. The system is linked to a IOT module which communicates the data and status to a web page ,and can be accessed by personals in the substation.



**Fig1:**block diagram

The block diagram for the system is represented by Fig1. The supply is step-down 230/12v which is provided to a bridge rectifier to obtain the dc voltage equivalent. The regulator gives a constant 5V to the microcontroller. Initially the system is constantly monitoring the voltage and current. When the key to display the password verification is pressed and then the password is entered using a 4×4 matrix keypad. This password is compared with the pre-set password using Atmega 32 microcontroller. If both the password matches then the power to each line can be deactivated, if it is a mis-match then error is displayed. The power to a line can be switched off by providing an relay input of 0 and can be switched on by providing input of 1. The LCD then displays that power to that particular line is cut off. Once the power is switched off the maintenance work can be performed. When the work is completed an exit switch on the keypad can be used to bring the display back to password verification section. The data communication to the webpage is through a IOT module. This is transferred to the IOT module through USART, which is inbuilt in the Atmega 32 microcontroller. The voltage, current value and status ON/OFF of the line is displayed continuously and updated periodically

### III. Hardware

#### Atmega 32

Atmega 32 is the microcontroller used for computing, switching of relay and control of the of the circuits. The port A is a multi-function port, and act as ADC which makes the conversion of input easier as they

can be provided directly to the microcontroller. The inbuilt USART allows the transmission of final data to the IOT module easier. The microcontroller is programmed with the password and monitoring voltage value. Based on these values the relay is operated. It operates on 5V supply input from voltage regulator.

### Instrument transformer

For monitoring of current and voltage values current transformer CT226A and potential transformer 12-0-12 are used. They perform the function of continuous monitoring and send the value to the microcontroller which are displayed onto a 16x2 LCD display.

### Relay

Relay is an electrically operated switch. It is to control circuit using low power signal. This provides complete electrical isolation.<sup>4</sup> The supply is given by stepping down from source. This is driven and interfaced with microcontroller by means of a relay driver.

### IOT module

For wireless transmission of data to the webpage from the microcontroller. ESP8266-based are capable, low-cost, networkable foundation for facilitating end-point IoT developments. It can be easily incorporated with a surface mount PCB module.

## IV. Simulation Results

The password based circuit breaker system is simulated in Proteus, and program in AVR studio 5.0. As shown in Fig 3, the supply is step-down and provided to a sensor which senses the current value and voltage value and then sends it to the Atmega 32 microcontroller. The input is provided to port A which performs the function of ADC and converts the analog value to digital. If the incoming voltage or current value is outside the set range of 120V to 200V (voltage limit) and 5A to 15A the system trips the relay. A 4x4 matrix keypad is used to key in the password which is displayed on the 16x2 LCD screen. The password set to a value. If the user keys in the exact password the system can be used to cut the supply else error is displayed. The switching on/off of supply is represented by means of an LED.

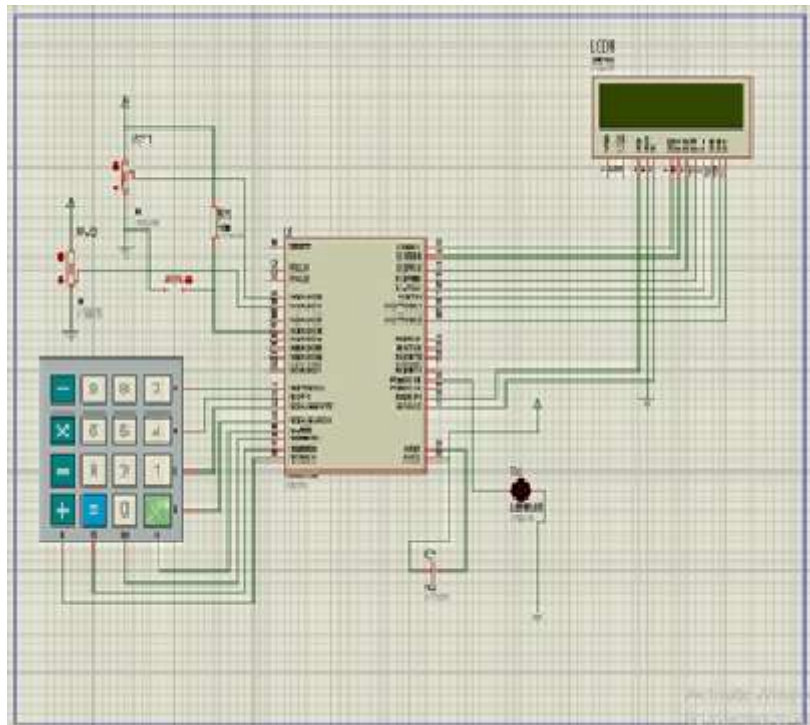


Fig 3: simulation

## V. Conclusion

The password based circuit breaker was designed to protect maintenance personals from accidents occurring due to mis communication and negligence. By utilizing a password to check for authenticity, the

accidents occurring can be reduced to a large scale, as the line man can himself ensure his safety. As all unauthorized access is restricted, outsiders cannot tamper with the supply circuits. This project has been implemented utilizing an IOT module. A detailed account of the working condition of the supply system can be maintained and can be accessed remotely. A modification to this project is possible developing a webpage that can be accessed by the substation personal anywhere. These can be connected to a mobile application and can be made available as an app.

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