Password Based Circuit Breaker for Linemen Protection Using Microcontroller 8051

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Abstract— Electrical line man safety in power systems is a major concern. Therefore, a new concept of password-based system has been introduced. Fatal electrical accidents while repairing the power line to the line man are increasing day by day. The accidents occur due to the lack of communication and coordination between the maintenance staff and the electric substation staff. Therefore, to ensure safety of lineman, password-based circuit breakers can be installed. If certain sections of the line need to be repaired then a password has to be entered through a matrix keypad to switch the circuit breaker ON/OFF. When the line is repaired, the lineman again enters the password, if the password is matched with the circuit breaker, then it will turn ON/OFF particular section of the line during maintenance, without any external interference from substation staff and can thus, help in saving human lives.

Keywords: Circuit Breaker, Microcontroller 8051, Password, Protection

I. INTRODUCTION

With one of the most prudent problems faced by maintenance staff, especially lineman, today is to maintain and fix the electrical lines that supply power at high voltages. This is a tiring, ardors and a dangerous task. Then a small mistake can cause severe casualties. To counteract this problem, this project can be implemented. Circuit breaker is very crucial for protection of equipment in entire power system. Periodic inspection and proper maintenance are done to ensure circuit breakers are in proper working condition. Power System Network may collapse during electrical accidents, if circuit breaker is not in healthy condition then whole power system network may collapse during electrical accidents. Password based circuit breaker has been designed to ensure the safety of electric line man. This is done by designing a password-based circuit breaker. In this system when password is correct then only the circuit breaker turns ON/OFF and the transmission takes place. This password-based circuit breaker can also be implemented in automatic door locking system for providing high security. And also, can be implemented to control electrical appliances to save the power.

II. CIRCUIT BREAKER

An electrical circuit breaker is a switching device which can be functioned manually as well as routinely for protection and control of electrical power system. As the modern power system deals with huge currents, the special concentration should be given during designing of a circuit breaker to secure interruption of the arc generated during the working of the circuit breaker. Electronic circuit breakers can be designed to trip at small overloads and they do not react to inrush currents.

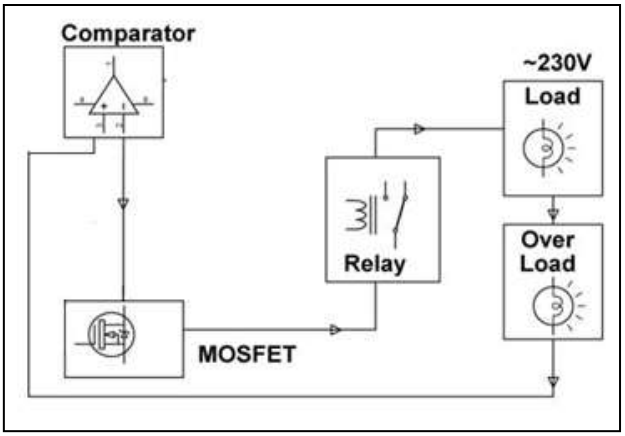

Fig 1: Simple Electronic Circuit Breaker System

III. WHY LINEMAN SAFETY IS NEEDED

Utility work is essential for keeping electricity running into our homes, but it is also highly dangerous. Linemen risk falls, electric shocks, burns, and other injuries while on the job every day, and these incidents can even be fatal. As a lineman, you can understand the magnitude of the hazards you face and take workplace safety measure to keep yourself and those around you safe. By working on electrical lines, utility workers face some of the most dangerous tasks in the industry. It's important for workers to be aware of these hazards.

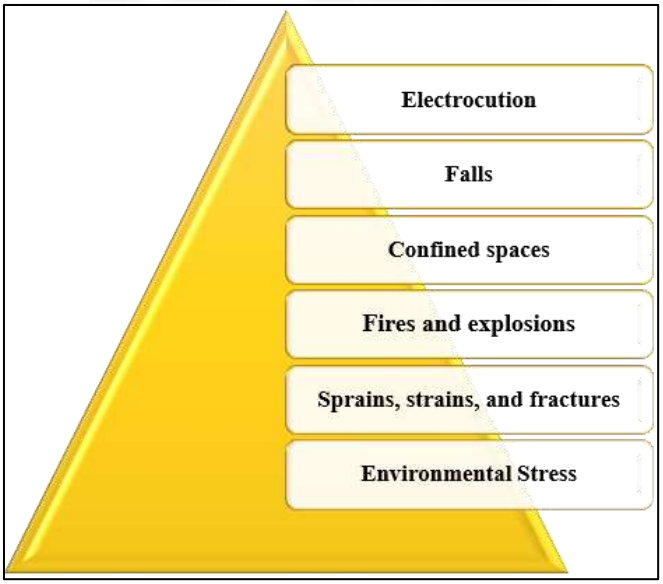

Fig. 2 : Risk factors

So, to reduce these risk factors this idea has been taken up to ensure the lineman safety so that the lineman can restore the fault line without any hazard to his life and indeed ensuring full safety during the fault correcting process. Also, it is very necessary to take care of these linemen as they are providing full of their efforts to turnback

the electricity to those areas without any fail and is therefore an important part of human safety. As many of the lineman had been affected with these types of accidents, the lineman safety is assured by this method and will reduce these types of electric accidents happening in India and all over the world.

IV. METHODOLOGY AND DISCUSSION

The block diagram below is our working model of the proposed idea where we can also use the GSM Module for exact location of the fault. The supply given to the microcontroller is of the range 5-6 volts and the programming is embedded in the microcontroller for further processes. Then the power supply is given to the microcontroller and the password verification will be needed in order to OPEN/BREAK the circuit and in this way the safety of lineman will be ensured thus reducing the risk of electrical accidents and life failure

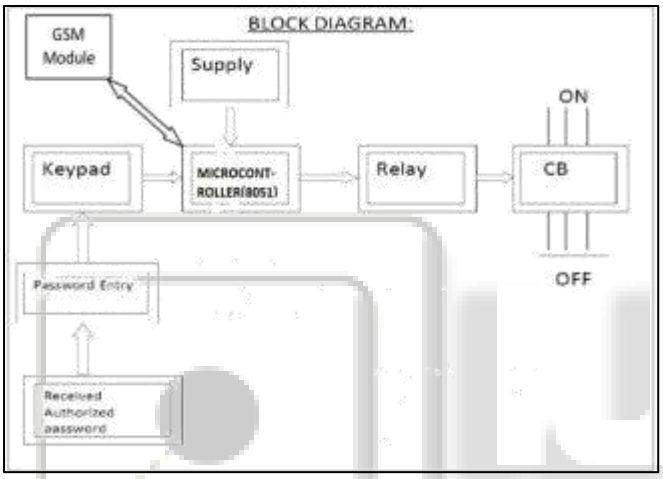

Fig. 3: Block Diagram of password based circuit breaker

V. HARDWARE REQUIREMENTS

- 8051 Microcontroller (AT89C52)
- 8051 Development Board
- 8051 Programming Board
- 4X4 Matrix keypad
- 4 – Channel Relay
- Module 16 x 2 LCD
- 4 Loads (Light Bulbs)
- Power Supply Connecting Wires
- 2 x 33pF Capacitor
- 2 x 10KΩ Resistors (1/4 Watt)
- 10µF Capacitor (Electrolytic)
- Interfacing of Relays

VI. COMPONENTS DECRIPTION

1) 8051 MICROCONTROLLER (AT895C2)

AT89C52 is an 8-bit microcontroller and belongs to Atmel's 8051 family. AT89C52 has 8KB of Flash programmable and erasable read only memory (PEROM) and 256 bytes of RAM. AT89C52 has an endurance of 1000 Write/Erase cycles which means that it can be erased and programmed to a maximum of 1000 time

2) 8051 DEVELOPMENT BOARD

8051 Development Board is proposed to smooth the progress of developing and debugging of various designs encompassing Microcontrollers from Atmel, NXP and Dallas. It's designed to facilitate (8051 DIP / PLCC package) On-board Programmer for NXP and Dallas Microcontroller through ISP on serial port.

3) 8051 PROGRAMMING BOARD

8051 Board Features: DIP40 microcontroller IC Socket, Quartz crystal 11.05892 Mhz., RS232 Interface for serial communication with jumper. Vcc bus. (5V and 12V)., Extension slot on every uC pin., Power plug-in jack., Reset button., ON - OFF switch., GND bus.

4) 4x4 MATRIX KEYPAD

The 4*4 matrix keypad usually is used as input in a project. The Summoner 4*4 Matrix Keypad Module is a matrix non-encoded keypad consisting of 16 keys in parallel. The keys of each row and column are connected through the pins outside pin Y1-Y4 as labeled beside control the rows, when X1-X4, the columns.

5) 4 CHANNEL RELAYS

The 4 Channel Relay Module is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. It is designed to interface with microcontroller such as Arduino, PIC and etc. It also comes with a LED to indicate the status of relay.

6) MODULE 16X2 LCD's

16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2 LCD. So, it will have (16×2=32) 32 characters in total and each character will be made of 5×8 Pixel Dots.

7) 4 LOADS (LIGHT BULB)

We are using 4 light bulbs as 4 different loads in order to distribute the power supply to each light bulb as an individual load distribution. The password required to load different lines(bulbs) will be different for the different bulbs in order to turn ON/OFF the power supply.

8) 2 (33pF Capacitor and 10K-ohm resistors)

We have used 2 different 33pF capacitors and 2 different 10K-ohm resistors for our model in order to provide charge and controlling the voltage

9) INTERFACING OF RELAYS

Relay Interfacing with 8051. Relays are switching that open and close circuits when actuated when an electrical signal. Because relays are the link between the low power digital electronics and high-power devices. It allows digital circuits and digital microcontrollers to high power devices on and off.

VII. OPERATION AND WORKING

The program is written in embedded C using Keil software, then the .c file is converted into .hex file and burnt into the 8051 microcontroller (AT89C52). In this system, we provide 230V supply to a step-down transformer which steps down the supply from 230V to 12V. After that 12V supply is passed through a bridge rectifier that converts 12V DC supply to 5V DC supply.

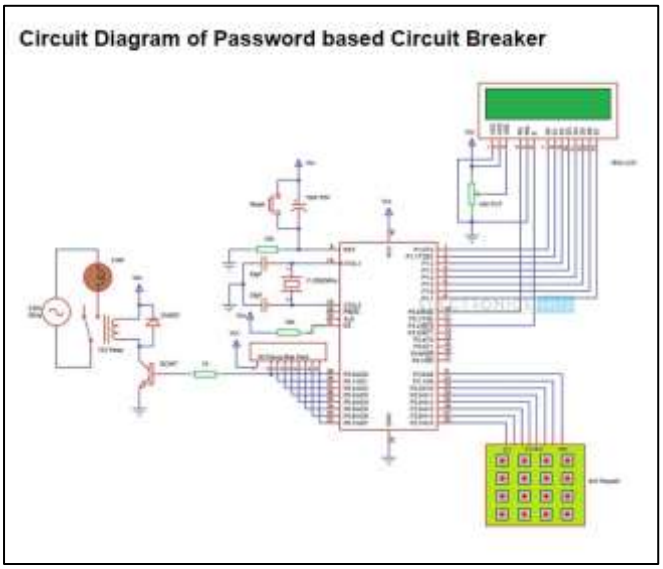

Fig. 4: Circuit diagram of Password based Circuit Breaker

When the circuit is turned ON, the LCD display shows "ENTER THE PASSWORD". If the correct password is entered through matrix keypad, the relays will operate and supply is provided to the bulb (load) and it will glow. But if the entered password is incorrect, then LCD display will show "WRONG PASSWORD". If the correct preset password is entered again, then the microcontroller sends a signal to trip the password-based relay.

VIII. Conclusion

A This system provides a new approach to the security of the lineman and completely eliminates the risk of a fatal accident to a lineman. This system can also be implemented to control load demand on distribution side.

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