

Password Based Circuit Breaker For Line-man Safety

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Abstract - The electric lineman safety system employs an innovative password-based approach to enhance the safety of linemen during power line repairs. Inadequate communication and coordination between maintenance crews and electric substation personnel have led to an increased rate of fatal electrical accidents. To mitigate this issue, we introduce a password-secured circuit breaker system that offers complete control over the activation and deactivation of individual power lines. Linemen and other maintenance staff can safely manage the power status of specific lines. When a particular line section requires maintenance, the staff can deactivate it by inputting a password using a matrix keypad. The system then cross-references the submitted password with the stored one. If they match, power to the line is disconnected, enabling secure repairs. Once completed, the line can be reactivated using the password. This method bolsters the safety of the workers, as it ensures that the power line cannot be activated without the lineman's authorization.

Index Terms - Relays, Microcontroller, IOT Technology

I. INTRODUCTION

Electricity transmitted through power lines for commercial, industrial, and residential use often involves high voltages and currents, posing inherent risks when measuring voltage on a transmission line due to the need for contact. Nevertheless, during installation, servicing, and repair of power lines, contact is sometimes necessary. This project, titled "Password-Based Circuit Breaker," offers a straightforward solution to control electrical lines using a password, enhancing lineman safety. The rising number of electrical accidents involving linemen during repairs can be attributed to insufficient communication between electrical substations and maintenance personnel. This project aims to address this issue and ensure lineman safety.

In the proposed system, the lineman has full control over the electrical line's ON/OFF status. The design requires the maintenance staff or lineman to input a password to activate or deactivate the electrical line. Should there be any fault in the electrical line or if any repair is to be done, the lineman can safely cut off the electrical supply by entering the password, allowing for secure and comfortable repairs. Once the repairs are completed, the lineman can restore the electrical supply to the line by inputting the password again.

1) Objectives

The primary goal of our research is to enhance lineman safety during maintenance work by implementing a unique password-based system. This system, which incorporates relays, circuit breakers, and a microcontroller using IoT technology, leverages the latest innovations to develop a solution that significantly reduces accidents involving maintenance staff.

2) Problem Statement

Modern power systems involve extensive power networks and related electrical equipment. When electrical faults or short circuits occur, these power networks experience high levels of fault current, which can cause permanent damage to the equipment. To protect the power networks and equipment, it is crucial to clear fault currents from the system as quickly as possible. The increasing number of electrical accidents involving linemen during repairs can be attributed to inadequate communication between electrical substations and maintenance personnel. This project aims to address this issue and ensure lineman safety.

3) Proposed Solution

The password-based phase line controller project offers a straightforward solution to control electrical lines using a password. This approach addresses the safety concerns for linemen arising from insufficient communication between electrical substations and maintenance staff. In the proposed system, the lineman has full control over the electrical line's ON/OFF status. The design requires the maintenance staff or lineman to input a password to activate or deactivate the electrical line. In the event of an electrical line fault or required repairs, the lineman can safely cut off the electrical supply by entering the password, enabling secure and comfortable repairs. Once the repairs are completed, the lineman can restore the electrical supply by inputting the password again.

Separate passwords can be assigned to different electrical phase lines, and the system is designed with three outputs, each with its own unique password. A relay is connected to each output, with its contacts used to make or break the supply to the electrical line. The demonstration module currently features three lamp loads, which can be independently controlled.

II. LITERATURE SURVEY

The password-based circuit breaker is a system that requires a specific password to control the circuit, ensuring secure access. Fatal electrical accidents involving linemen have been increasing during power line repairs due to insufficient communication and coordination between maintenance staff and electric substation personnel. To prevent such accidents, the breaker can be designed to allow only authorized individuals to operate it using a password. The system is entirely managed by the Arduino Uno microcontroller.[1]

III. CIRCUIT DIAGRAM

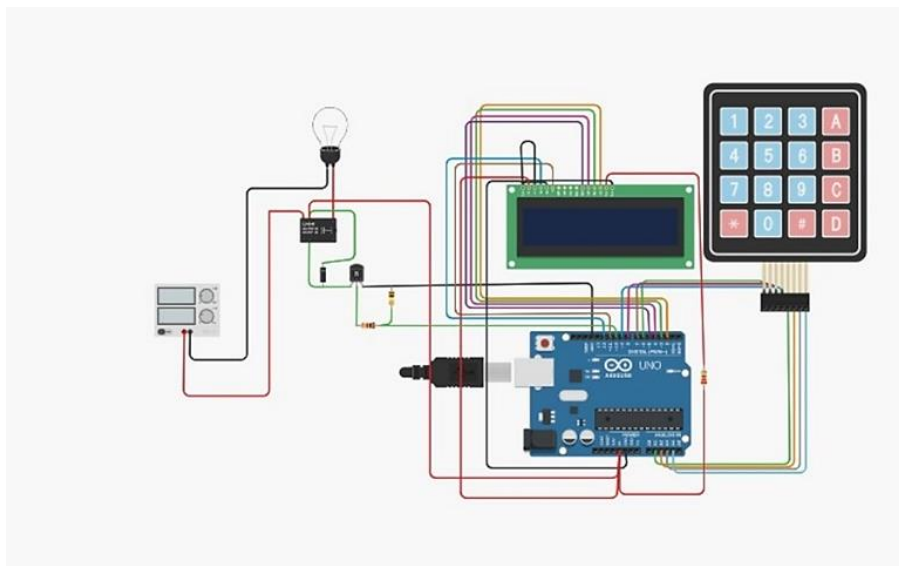


Fig. 1: Circuit Diagram

IV. WORKING PRINCIPLE

The password-based lineman safety system is designed to control a circuit breaker using a password, ensuring the safety of the lineman. The lineman can input the password via a keyboard, giving them full control over turning the line on or off. The system is entirely managed by the Arduino Uno microcontroller, with a matrix keypad interfaced to input the password. Password entered through the keyboard is compared to the one stored in memory. If the entered password is correct, the line can be turned ON/OFF. Each output has a relay connected, and the relay contact is used to make or break the electrical supply. The demonstration module currently features three lamp loads, which can be independently controlled.

A compact 12-key keyboard, designed in a 3x4 matrix form, is used to input the password and is interfaced with the microcontroller. The data generated by the keyboard is stored in RAM, and depending on the preprogrammed controller settings, the corresponding relay is automatically activated if the entered data matches the predefined password. To maintain secrecy, the entered data is displayed on an LCD screen in the form of asterisks. If the entered data is correct, the display indicates that the corresponding electrical line is deactivated. To reactivate the line, the password must be entered again.

V. MODE OF OPERATIONS

The model works in various modes as follows:

Firstly, when the power is turned ON, the LCD will display “Password Based Circuit Breaker” as shown in Fig 5.1

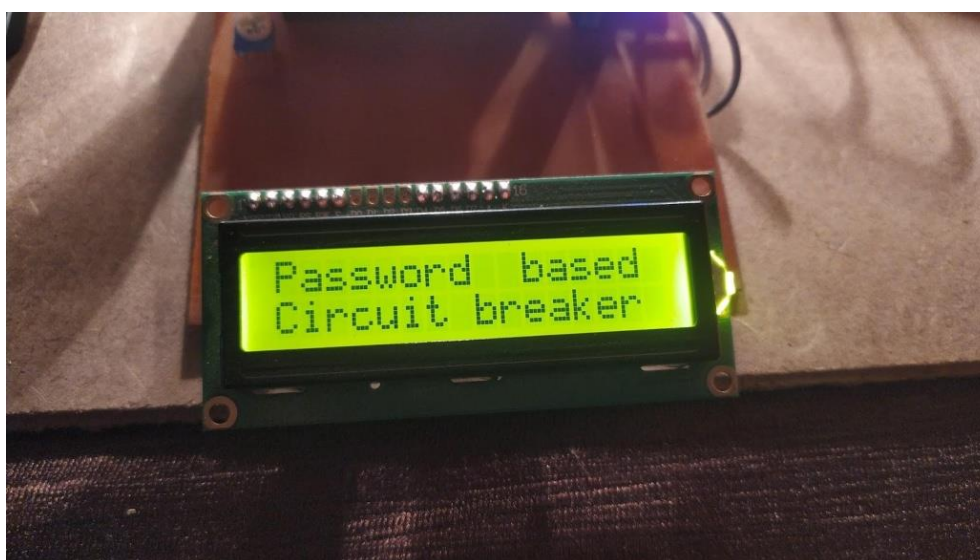


Fig. 5.1: When Power is Turned ON

If all the ‘R’, ‘Y’, ‘B’ phases are ON then all the 3 bulbs will light up. Also, on the dashboard it will display 0 because all phases are ON.

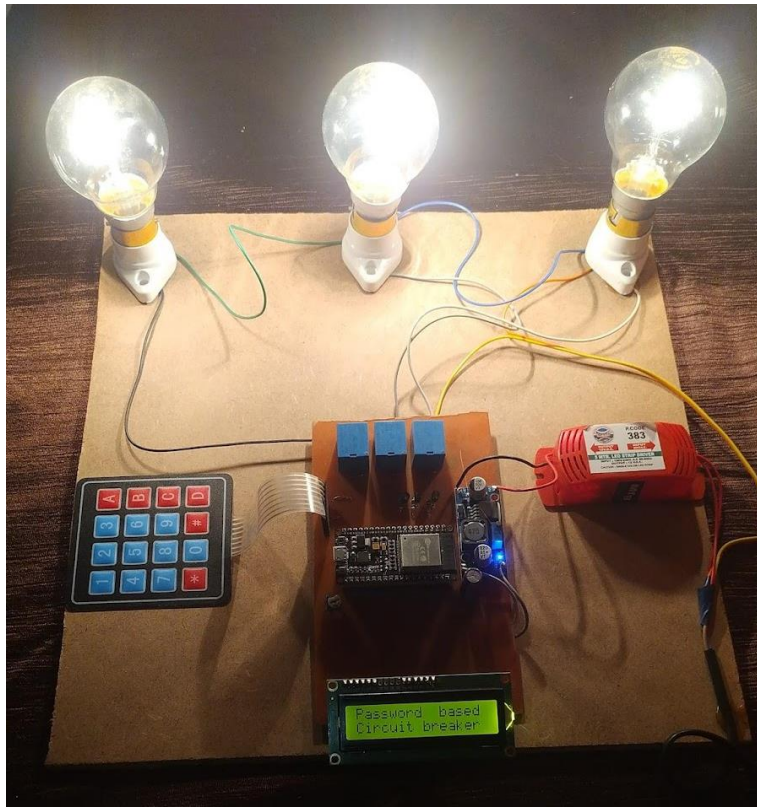


Fig 5.2: All Phases are ON

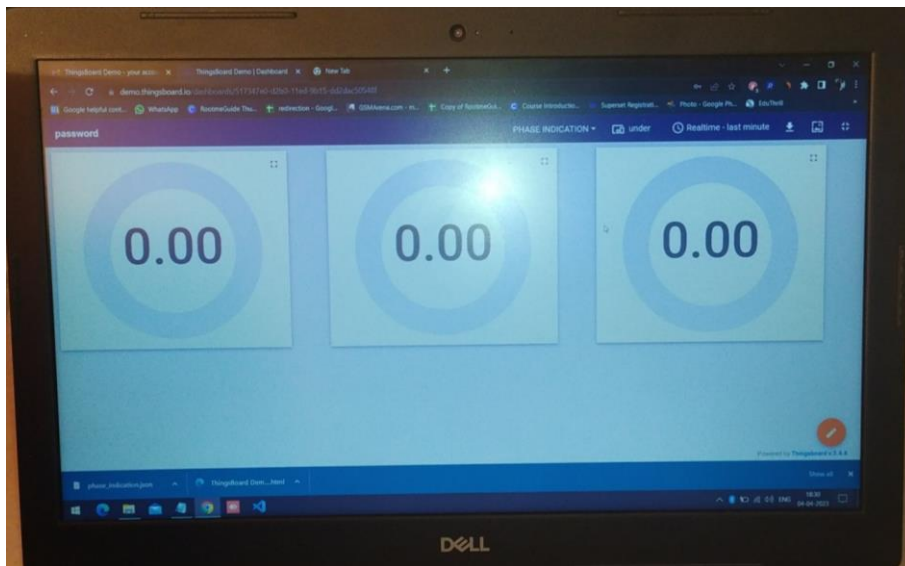


Fig 5.3: All phases ON on Dashboard

If there is a fault and a line needs to be turned OFF, the password can be entered through the hexadecimal keypad after pressing “#”. The keypad is shown in fig 5.4



Fig 5.4: Hexadecimal Keypad for Entering Password

Now the pre-set password is entered as shown in figure 5.5



Fig 5.5: Password is Entered

If the entered password matches the preset password, the LCD will display the options to choose the line that we want to turn off as shown in figure 5.6. To turn OFF the “R,” “Y,” “B” phases we have to press “1,” “2,” “3” on the hexadecimal keypad respectively.



Fig 5.6: When correct password is entered

If we press “1”, R phase will be turned off and the bulb will stop glowing as shown in fig 5.7. Also on the dashboard, it will display 1 in place of 0 because R Phase is OFF as shown in fig 5.8.

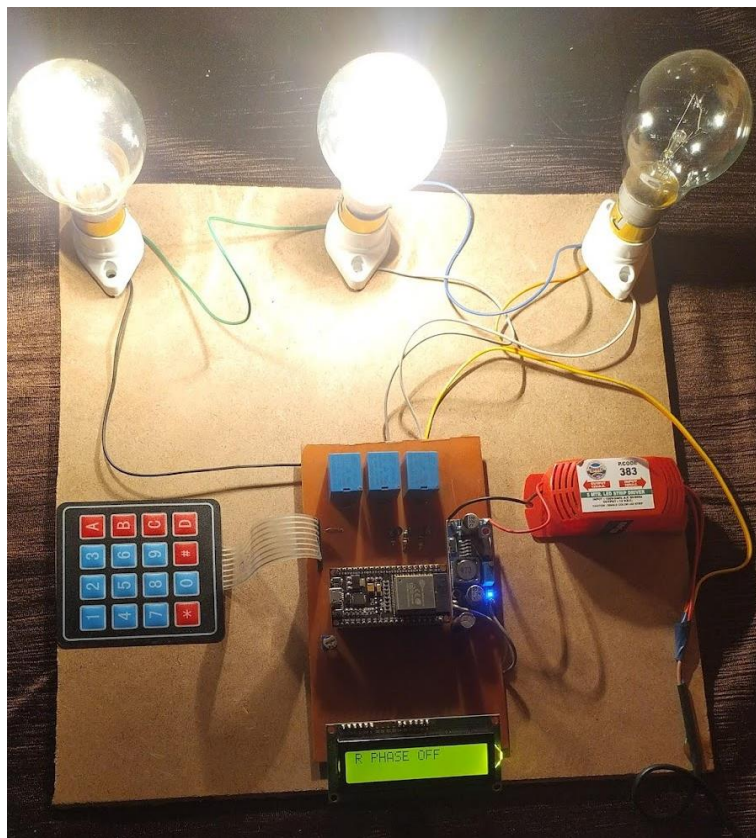


Fig 5.7: When “R” Phase is turned OFF

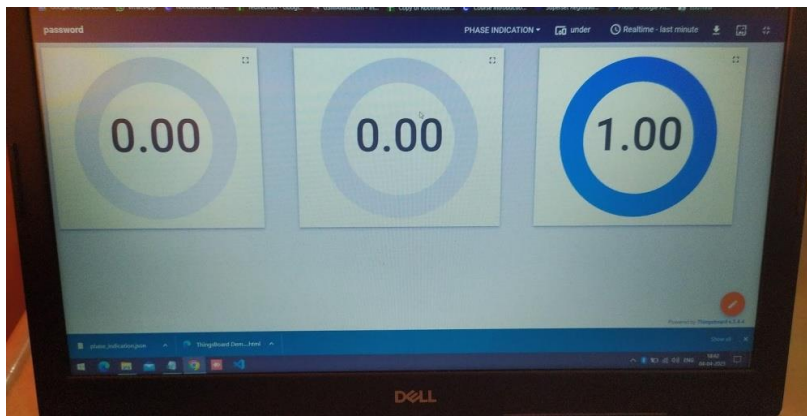


Fig 5.8: “R” Phase OFF on Dashboard

If we press “2”, Y phase will be turned off and the bulb will stop glowing as shown in fig 5.9. Also on the dashboard, it will display 1 in place of 0 because B Phase is OFF as shown in fig 5.10.

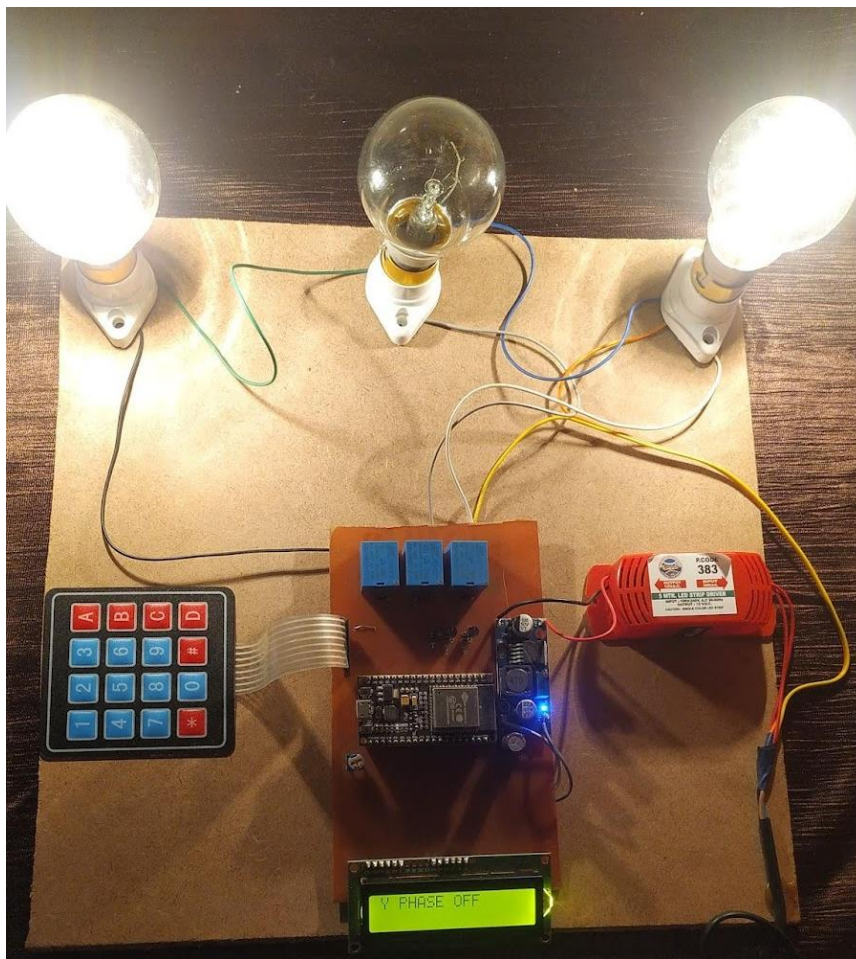


Fig 5.9: When “Y” phase is turned OFF



Fig 5.10: “Y” phase OFF on Dashboard

If we press “1”, B phase will be turned off and the bulb will stop glowing as shown in fig 5.11. Also on the dashboard, it will display 1 in place of 0 because R Phase is OFF as shown in fig 5.12.

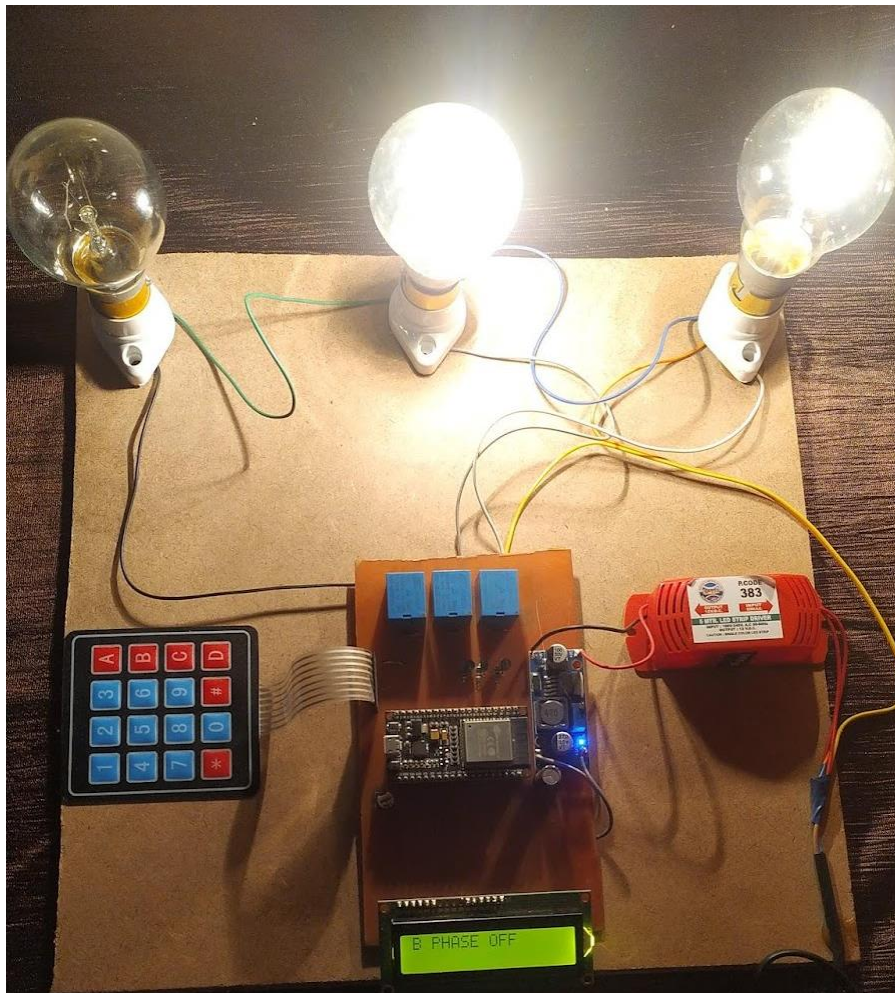


Fig 5.11: When “B” Phase is turned OFF

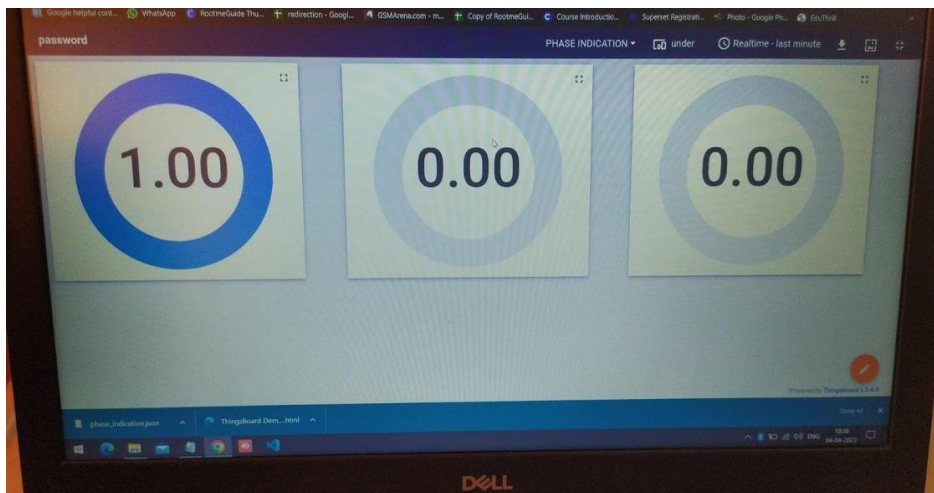


Fig 5.12: “B” Phase OFF on Dashboard

VI. CONCLUSIONS

In conclusion, this system offers a solution to ensure that only the lineman has control over the electrical line, minimizing the possibility of unauthorized interference. The project, titled "Password-Based Circuit Breaker for Lineman Safety," demonstrates the use of an Arduino Uno microcontroller to reduce fatal accidents among linemen during repairs. As technology advances, it is vital that human safety remains a priority. Our project is grounded in this philosophy and has successfully met all requirements outlined in our work. The ultimate goal is to eliminate fatalities among linemen.

For demonstration purposes, a prototype module has been constructed, yielding satisfactory results. The most crucial and challenging aspect of this project is developing software that performs tasks based on user inputs. The system's performance is heavily reliant on the code programmed into the controller. While the technology employed in this project is currently suited for a prototype module, further development is necessary to transform it into a fully functional, real-world system.

VII. REFERENCES

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