

Electric Lineman Safety with Password Based Circuit Breaker and Intimation of HT Wire Sag Using GSM

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Abstract- 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. When operated 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.

Keywords- OTP, GSM, Circuit breaker; password, wireless communication.

1. INTRODUCTION

Nowadays, electrical accidents to linemen are increasing mainly due to poor communication between substations and maintenance staff. This project improves lineman safety by giving control of the electrical line directly to the lineman safety by giving control of the electrical line directly to the lineman using a password-based system .

A microcontroller from the 8051family is used, along with a matrix keypad, to enter a password for switching

the line ON or OFF. Only when the correct password matches the one stored in the microcontroller memory, the circuit breaker operates, and its status is shown using

an indicator lamp. Ultrasonic sensors based on the piezoelectric principle are used to measure distance and detect faults like wire sag, while PIR sensors detect human movement near the line. Together, this system ensures safe maintenance and reduces the risk of electrical accidents.

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2. NEED OF SYSTEM

Electrical accidents to linemen often occur due to poor communication and accidental energizing of power lines during maintenance work. Manual switching and lack of proper safety monitoring increase the risk of serious injuries and fatalities. This system is needed to ensure that only authorized personnel can control the electrical line using password protection. It also provides real-time alerts through GSM and detects unsafe conditions like low conductor height and human movement near danger zones. Hence, this system is essential to improve safety, prevent accidents, and ensure reliable maintenance of electrical lines.

and the Android application. This phase integrates software with hardware for the system to function as intended. components, and connectivity.

3. LITERATURE REVIEW

Several researchers have worked on improving electric lineman safety using different technologies. Some papers discuss manual and remote-controlled circuit breakers to avoid accidental energizing of lines during maintenance. A few studies focus on microcontroller-based safety systems where relays are used to disconnect power supply securely. Other researchers introduced GSM-based control systems to send alert messages and allow remote switching of electrical lines.

Password-protected switching mechanisms were proposed in some papers to ensure that only authorized linemen can operate the breaker. Certain studies also highlight the use of embedded systems to reduce human error and communication gaps between substations and maintenance staff. A few papers combine GSM technology with safety locks to enhance reliability and response time. However, most existing systems are either costly, complex, or not user friendly for practical field use. Therefore, the proposed system aims to develop a simple, low cost, and reliable password-based circuit breaker with GSM support to ensure effective lineman safety.

4. METHODOLOGY OF SOLVING IDENTIFIED PROBLEM WITH ACTION PLAN :-

- **Planning :** Explanation: In the planning phase, the project's objectives, scope, and timeline are established. A comprehensive project plan, including roles and responsibilities, is created to guide the project's execution.
- **Identified & Defining the Required Resources for the Project as Software & Hardware:** This stage involves identifying and specifying the necessary software and hardware resources for the project, ensuring that they align with the project's objectives and functionality requirements.
- **PCB Designing:** PCB design refers to the process of creating the layout for the Printed Circuit Board, which is a critical component in the project. It involves defining the board's circuitry, components, and connectivity.
- **Implementation & Coding:** Implementation and coding encompass the development of the project's software components, including the password-based circuit breaker system and the Android application. This phase integrates software with hardware for the system to function as intended.
- **Testing:** The testing phase is vital for validating the functionality, security, and reliability of the integrated

system. It involves rigorous testing, issue identification, and resolution to ensure a robust system.

- **Development & Maintenance:** Following successful testing and deployment, the project transitions into a development and maintenance phase. This involves ongoing monitoring, data collection, and improvements based on real-world usage. It also includes the creation of user documentation and a plan for future support and updates.

5. PROPOSED SYSTEM: -

Proposed system: - The proposed project introduces a secure password-based circuit breaker system controlled through an Android application to enhance line man safety. The system addresses the increasing number of fatal electrical accidents caused by poor communication between maintenance staff and substations. By allowing the lineman to control the ON/OFF operation of the circuit using a predefined password, accidental energization during maintenance is prevented. This ensures that power is disconnected before repair work and restored only after completion, under the lineman's direct control. As a result, the system significantly reduces the risk of electric shock and improves overall safety and coordination.

6. CIRCUIT DIAGRAM:-

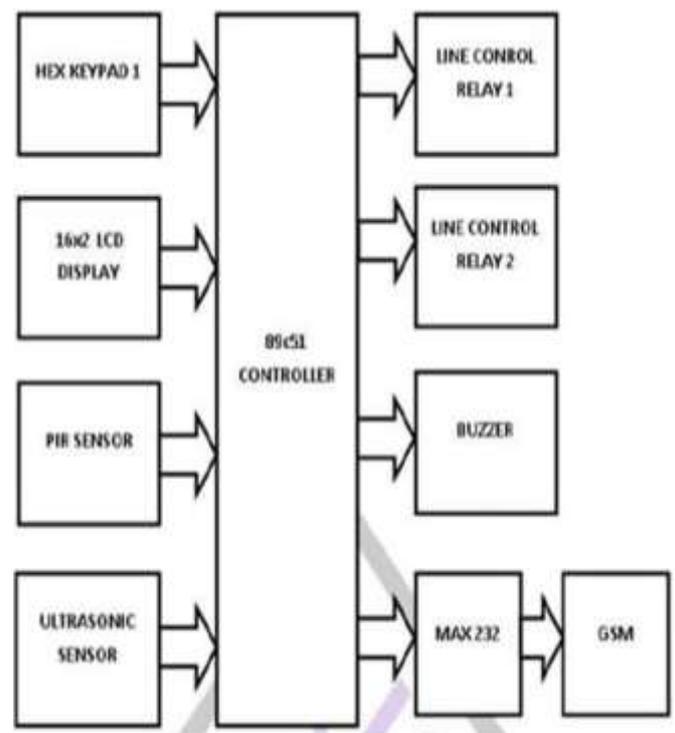


Fig. Circuit Diagram

The circuit uses a 12 V step-down transformer, bridge rectifier, filter capacitor, and 5 V regulators to supply regulated DC power to the system. An 8051 microcontroller controls the complete operation. A keypad is used to enter a password, which is displayed on the LCD and compared with the stored password in the microcontroller. Only when the correct password is entered, the relay turns the electrical line ON or OFF. LEDs indicate the relay status, and the GSM modem sends a message to the receiver about line disconnection or reconnection. During maintenance, the line can be disconnected only by the authorized lineman using the correct password. After work completion, the same password is used to reconnect the line. An ultrasonic sensor measures the distance between the conductor and ground. If the distance falls below a preset safe limit, an alert message is sent through GSM. A PIR sensor detects human or animal movement near the danger zone and activates a buzzer to warn people and prevent accidents.

7. Working principle: -

The system is designed to protect the line man and monitor HT wire conditions. First, the power supply is controlled using a password. When the correct password is entered through the keypad, the microcontroller checks it and allows the circuit breaker (relay) to turn ON or OFF. If a wrong password is entered, the system does not allow any change in power supply and shows "Access Denied" on the display. This prevents unauthorized switching and protects the line man from accidental electric shock. Secondly, the system continuously monitors the HT wire position using a sag detection sensor. When the wire sags beyond a safe limit, the sensor gives a higher voltage signal to the microcontroller. The system then immediately sends a warning message through the GSM module to the concerned authority. If the sag becomes

dangerous, a high-alert message is sent. When the wire returns to normal position, a normal status message is sent again. Thus, the system ensures safety by controlling power with a password and by giving early warning of HT wire sag through SMS alerts

Observation tables: - Table 1: password based circuit Breaker operation

| Sr. no | Enter password | Password status | Circuit breaker status | LCD display message | Remark |
|--------|----------------|-----------------|------------------------|---------------------|--------------|
| 1 | 1234 | Correct | ON | Access granted | Supply ON |
| 2 | 4321 | Wrong | OFF | Access denied | No change |
| 3 | 1111 | Wrong | OFF | Access denied | No change |
| 4 | 1234 | Correct | OFF | Access granted | supply OFF |
| 5 | 0000 | Wrong | OFF | Access denied | Unauthorized |

| Sr.no | HT wire condition | Sensor output (V) | GSM Status | message sent | Time delay (sec) |
|-------|-------------------|-------------------|------------|----------------------------|------------------|
| 1 | Normal position | 0.5V | No SMS | No alert | 0 |
| 2 | Slight sag | 2.0V | SMS sent | "warning : sag detected" | 3sec |
| 3 | Excessive sag | 4.5V | SMS sent | "danger: HT wire sag high" | 2sec |
| 4 | Normal restored | 0.6V | SMS sent | "HT wire normal" | 3sec |

Table 2: GSM Alert for HT wire sag detection

8. RESULT AND DISCUSSION: -

The implemented Line Man Safety System was tested under different operating conditions. The results show that the system successfully control steel electrical line using password authentication, allowing only authorized personnel to turn the line ON or OFF. The GSM module reliably sends alert messages during line disconnection, reconnection, and unsafe conditions. The ultrasonic sensor accurately detects low conductor height and sends warnings when the distance falls below the preset limit. The PIR sensor effectively detects human or animal movement near the danger zone and activates the buzzer for safety. Overall, the system improves communication, prevents accidental energizing of lines during maintenance, and enhances the safety of linemen and the public.

9. CONCLUSION: -

The Line Man Safety System provides a reliable and effective solution to reduce electrical accidents during maintenance work. By using password-based line control, GSM communication, and safety sensors, the system ensures that only authorized personnel can operate the electrical line. The ultrasonic and PIR sensors add an extra layer of protection by detecting unsafe conditions and human movement. Overall, this system improves safety, communication, and operational reliability in electrical distribution networks.

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