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# Electric Fault Location Detector

Manvitha Poka[1*], Mohana Krishna Punna[1], Mahendra Ponugoti[1], Abdul Nehal Shaik[1], A. Sai Anusha[1]
[1]*Department of Electrical and Electronics Engineering, Vasireddy Venkatadri Institute of Technology, Guntur, India*

***Abstract*: Protection of transmission and distribution lines is an important issue in modern power systems, as a large percentage of system faults occur on these lines. Locating the exact point of fault is often difficult; however, rapid fault detection helps in preventing serious damage to electrical equipment. Accurate fault location also assists maintenance personnel in repairing faults quickly and identifying regions where faults frequently occur, thereby reducing outage duration and improving system reliability. This work focuses on detecting the position of faults in distribution lines using an Arduino-based system, and the fault information is transmitted to a control unit using an Arduino Uno controller. The system determines fault location based on voltage variations across series resistors using Ohm's law. The processed signal is then given to the Arduino Uno microcontroller. When a short circuit occurs, the current through the series resistors changes according to the fault distance and connected load. If the resistance falls below a predefined threshold, a relay connected to the Arduino disconnects the line. Additionally, an LCD module displays the line condition, and a buzzer provides an alert when a fault is identified.**

***Keywords*: Arduino Uno, Fault Detection, LCD Display, Relay, Buzzer, Voltage Analysis.**

## 1. Introduction

Identifying and classifying faults in electrical distribution systems is a crucial task for protecting power networks. An important component of power system protection is the fault selector unit, which determines the type of fault and restores the system to normal operation. Correct selection of the faulty phase is necessary to prevent disconnection of healthy phases and to avoid unnecessary interruptions. Fast operation of the fault detection unit is also essential, as the selection process must be completed quickly before the circuit breaker operates. Fault detection in power systems is influenced by several factors such as system complexity, limited knowledge of network parameters, disturbances, and interactions between nearby transmission lines, which can negatively affect performance. Therefore, proper fault identification is required to maintain stable system operation. Modern transmission line monitoring is based on real-time measurements rather than assumptions, enabling quicker fault isolation, improved reliability, and clear separation of electrical faults from mechanical problems.

Such applications, including condition-based maintenance, require the rapid transmission of large volumes of highly reliable data. The successful implementation of these applications depends on an efficient and robust network structure with fast response time. The system must support the transfer of sensitive information, such as real-time status and control data of transmission lines across the power network. This work presents a structured approach for designing a continuous data communication framework. To assess operating conditions in the power system, sensors are installed at various locations throughout the network. These sensors are capable of generating extensive data, which enables accurate measurement and analysis of different electrical and physical parameters.

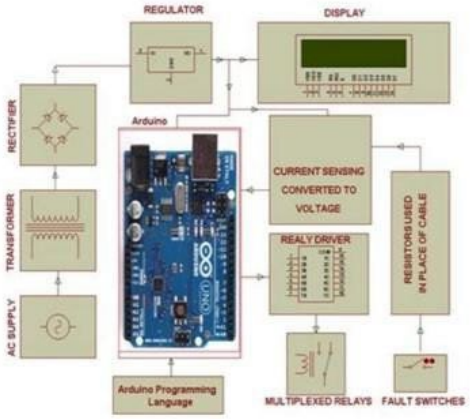

Fig. 1. Block diagram

## 2. Working

A rectifier is used to convert 230V AC into 12V DC. A bridge-type full-wave rectifier is implemented to obtain DC output, and a 12V voltage regulator is used to maintain a constant DC voltage. Fault sensing circuits and a buzzer indication unit are connected to the Arduino Uno. The Arduino along with an LCD display is used to control the operations and to show the required information. In this project, three lines (L1, L2, and L3) are connected through the rectifier and fault sensor circuits. Each line uses an LED lamp as a load. Initially, all loads are supplied with 12V DC through their respective line.

Three junction points are provided for each line to create fault conditions in the circuit. When all three lines are properly connected with loads, the sensor does not detect any fault. As a result, no signal is sent to the Arduino, no fault message is displayed, and the buzzer remains in the OFF state. When any junction is disconnected from the load, the load turns OFF and a fault signal is sent to the Arduino. The Arduino then activates the LED display to show the fault message and also triggers the

*Corresponding author: manvithapoka@gmail.com

buzzer for indication.

1. When junction one is disconnected, the display shows Electric Fault Village-1, Distance–6 km along with buzzer indication.
2. When junction two is disconnected, the display shows Electric Fault Village-2, Distance–5 km along with buzzer indication.
3. When junction three is disconnected, the display shows Electric Fault Village-3, Distance–4 km along with buzzer indication.

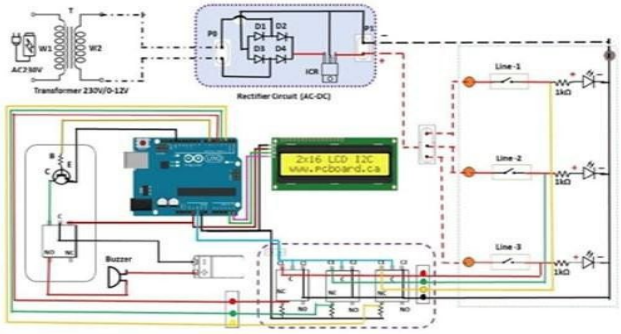


Fig. 2. Circuit diagram

### A. *Advantages*

1. Provides real-time response to fault conditions.
2. Covers a larger area when compared to existing systems.
3. The system is cost-effective.
4. Devices can operate using wireless communication.
5. It is economically dependable.
6. The number of components used is compact in size.
7. No need to report power failure at the substation manually.
8. Fault location and distance information can be obtained easily.
9. Public inconvenience is reduced as faults are resolved quickly.
10. The buzzer alert continues until the electrical fault is cleared by the department.

### B. *Application*

1. Industrial areas and Factories to prevent equipment damage.
2. Power transmission and distribution systems for quick fault detection.
3. Electrical maintenance systems for faster fault repair.

## 3. Conclusion

In this project, a fault detection–based distribution system and alert mechanism has been developed to transmit information to the monitoring unit using sensors. The implemented system mainly concentrates on transmission and distribution sections. It provides an effective method to identify faults such as power loss and electricity theft. The system continuously monitors different operating parameters and helps in detecting faults at the correct time, thereby preventing unauthorized use of power. Automatic monitoring, analysis, and fault detection are displayed through the LCD interface. The proposed model includes continuous monitoring modules integrated with modern communication technology. It also represents both hardware implementation and software operation. Hence, applying this system can help in saving a significant amount of electrical energy and ensure reliable power supply to a large number of consumers, especially in highly populated regions like our country.

### A. *Scope for Future Work*

1. The system can be extended to detect faults in underground cables and transmission lines.
2. By further improving the model, unsymmetrical faults can also be identified.

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