IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, June 2022
Impact Factor: 6.252

Transmission Line Fault Detection Using IoT

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Abstract: *Due to transmission line conditions, transmission lines are susceptible to a wide range of defects. The defect is difficult to diagnose, and the entire cable should be replaced. Using a microcontroller, this project will detect the location of a fault in transmission cable lines from the base station in kilometers. When a defect occurs, the voltage between series resistors changes, which is then supplied to an ADC, which produces exact digital data for a programmed destination. It also shows the distance between faults. Location may be tracked using GPS. On a 16X2 LCD connected to the microcontroller, the fault distance, phase, and time are displayed. The Wi-Fi module is utilized in IOT to display information over the Internet. The information concerning the occurrence of the defect is shown in a webpage produced with HTML code.*

Key Words: Internet of Things, Short Circuit Fault, Open Circuit Fault, Voltage Sensor, Current Sensor, Arduino, Microcontroller, GPS, etc.

I. INTRODUCTION

One of the most important components of the electricity system is the transmission network. When compared to other sections of the power system, transmission and distribution network losses are considered to be extremely high. The electric power grid is extremely vulnerable to a variety of natural and malicious physical events. To detect faulty transmission lines, many electric power transmission companies have relied primarily on circuit indicators. Several of these issues are addressed by wireless sensor-based transmission line monitoring, such as real-time structural awareness, faster fault localization, accurate fault diagnosis by identifying and distinguishing electrical faults from mechanical faults, cost savings due to condition-based maintenance rather than periodic maintenance, and so on.

These applications have strict requirements, such as delivering a large amount of highly reliable data quickly. The design of a cost-effective and reliable network architecture with a fast response time is critical to the success of these applications. The network must be capable of transporting sensitive data to and from the transmission grid, such as transmission line status and control data. This paper presents a framework for designing a real-time data transmission network that is cost-effective. Sensors are installed in various components of the power network to monitor the status of the power system in real time.

II. LITERATURE SURVEY

Title 1: Digital Fault Locator for Double End Fed Transmission Lines: Author: Micheletti. R Year: 2010 The paper presents a digital fault locator by dynamic system parameter estimation for a double end fed transmission line. The method uses about 1/6 cycle of recorded fault data and does not require filtering of dc offset and highfrequency components. The system differential equations are based on a lumped parameter line model, Thevenin equivalents at both ends of the line and an unknown fault resistance. The accuracy is demonstrated by a representative set of tests results obtained with computer simulation.

Title 2: -Detection of Multiple Fault in Transmission Line using IoT Author: Mr. P. Radhakrishnan1, M. Priya, K. Reshmeetha, M. S. Rojaharshini. Year: 2021 Transmission lines are prone to a wide variety of faults due to transmission lines conditions. Diagnosing the fault is difficult and entire cable should be replaced.

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This project is intended to detect the location of fault in transmission line cable lines from the base station in km using microcontroller. In case of fault, the voltage across series resistors changes accordingly, which is then fed to an ADCto develop precise digital data to a programmed.

III. FAULTS IN TRANSMISSION LINE

OPEN CIRCUIT FAULTS:

Failure of one or more conductors causes these faults. Joint failures of cables and overhead lines, failure of one or morephases of a circuit breaker, and melting of a fuse or conductor in one or more phases are among the most common causes of these faults. A series fault is the same as an open circuit fault. Except for three-phase open faults, these are unsymmetrical or unbalanced faults.

SHORT CIRCUIT FAULTS:

A short circuit is an abnormally low-impedance connection between two points of different potential, whether intentionally or accidentally made. These are the most common and dangerous types of faults, which cause abnormally high currents to flow through equipment or transmission lines. If these faults are allowed to persist even for a short time,the equipment will be severely damaged. Shunt faults are another name for short circuit faults. Insulation failure between phase conductors, between earth and phase conductors, or both causes these faults.

Three phases to earth, phase to phase, single phase to earth, two phase to earth, and phase to phase are all possible short circuit fault conditions. A fault can occur between any of the three lines and the ground in a single line to ground fault. A fault occurs between anytwo of the three lines and the ground in a double line to ground fault. A fault can occur between any two lines in a line-to-line fault. A sudden change in voltage occurs when a fault occurs. If not corrected immediately, this voltage change could cause serious system damage.

IV. FAULT DETECTION METHODS

ONLINE METHOD:

This method utilizes and processes the sampled voltages and current to determine the fault points.

OFFLINE METHOD:

In this method special instrument is used to test out service of cable in the field. Existing system used for offline method.This method can be divided into two methods. They are tracer method and terminal method.

V. EXISTING SYSTEM

TRACER METHOD:

The tracer method is an exhaustive way to locate a faulted segment by walking through the cable circuits. A faulted segment can be determined from audible or electromagnetic signals and requires dispatching crew members to the outage area. There have been various techniques largely used in the industries, including the tracing approach through acoustic, electromagnetic or current.

TERMINAL METHOD:

The terminal method is a technique used to determine a fault location of a distribution cable network from one or both ends without tracing exhaustively. A bridge technique is one of the most popular terminal methods that links with a resistor to determine a fault location. It is a technique used to detect fault location of cable from one or both endswithout tracing.

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VI. BLOCK DIAGRAM

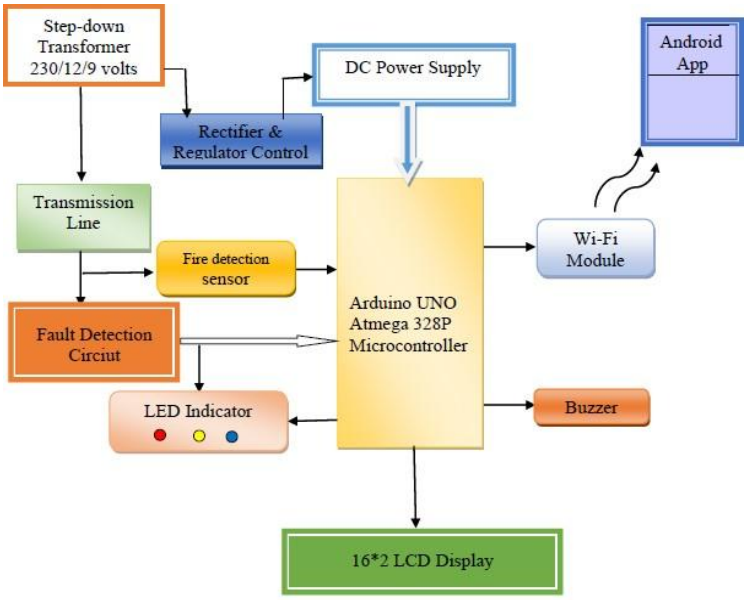
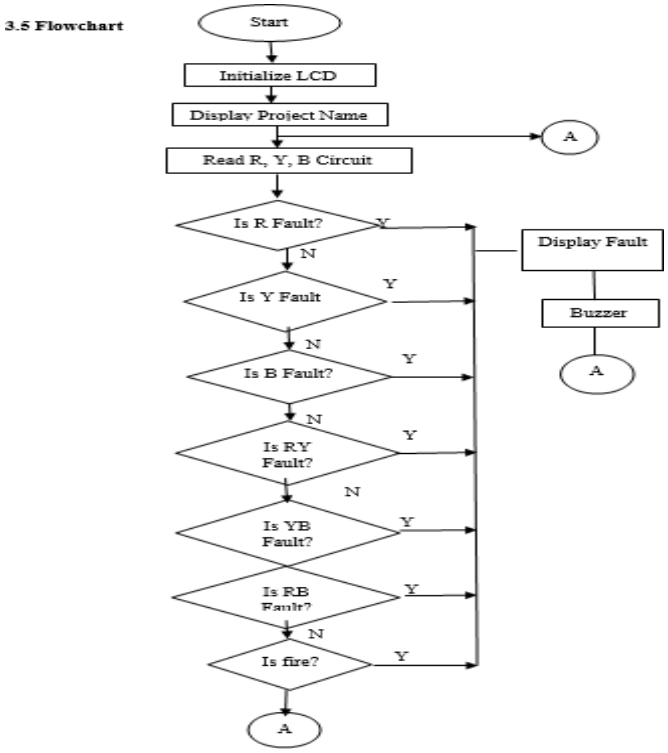


Fig. 1: Block Diagram

VII. FLOWCHART



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VIII. WORKING OF MODEL

- This prototype is used to detect the fault, which has occurred in transmission line.
- By using ATMEG328p microcontroller, Push Switches, Indicating LEDs, LCD; this prototype is assembled with a set of resistors, cables, by using set of switches made to creation of fault in prototype.
- A 230VAC supply is fed through a Step-down transformer which gives 12 V AC output which is to AC-DC Power Modulator, where it converts AC voltage into DC voltage using a Full Wave Rectifier circuit. 7809 voltage regulator is used to regulate voltage output voltage to 9V as micro controller needs 9V power supply.
- Through micro controller, there is only one 5V power output pin and single ground. The main challenge is that the prototype needs to power various components i.e., LCD, Wi-Fi module, buzzer, and fire sensor. To solve this issue, a Power Extension PCB has been introduced in module. It provides multiple power pins which can be used for many components. In short Power extension PCB works as Power extension board which provides multiple outputs using single supply.

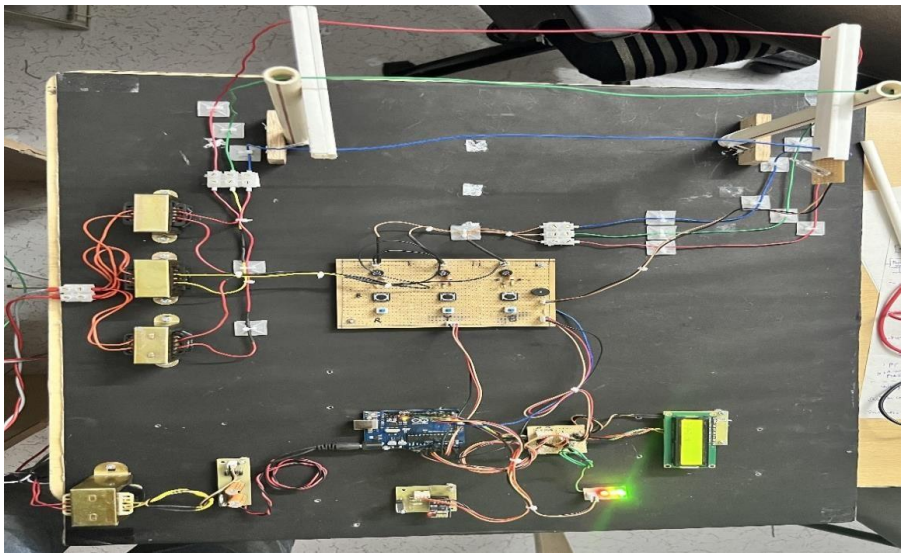

Figure: Working Prototype

- Indicating LEDs are provided in the circuit which shows the status of transmission lines when fault occurs. When any fault in any particular line occurs, that led representing that line turns off.
- ESP8266 Wi-Fi Module is connected to microcontroller through its serial communication ports i.e., RXD and TXD pins.
- Three Step down transformers are given in the prototype to feed the transmission line. These transformers convert 230V AC to 9V AC which is further fed to the Push buttons PCB where three bridge rectifiers convert this 9V ac to 9V DC. these Push buttons are connected to analog input pins of microcontroller
- The push buttons shows/ simulates the faults in the system. Various buttons are allotted for various purposes and each button is responsible for different fault. There is total 6 push buttons from which three are DPDT buttons and three of them are Tactile switches. DPDT buttons are used to show phase to phase faults and Tactile switches for phase to ground fault.

IX. RESULT AND CONCLUSION

When the circuit is powered ON, the display shows the project name as shown in figure

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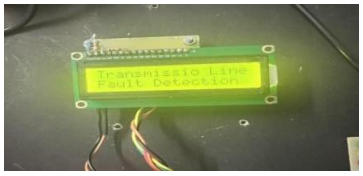
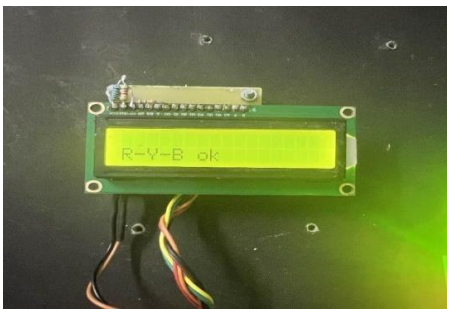


When no key is pressed, i.e., no fault is present in system, display shows "R-Y-B ok" as shown in figure. It meanssystem is not faulty



When Tactile switch T1 is pressed, transmission line goes under R to ground fault which is shown in LCD display as following.

Likewise, assuming these names for push buttons and their faults shown: -

1. DPDT switch 1 – D1 for R-Y fault
2. DPDT switch 2 – D2 for Y-B fault
3. DPDT switch 3 – D3 for R-B fault
4. Tactileswitch 1 – T1 for R phase fault
5. Tactile switch 2 – T2 for Y phase fault
6. Tactile switch 3 – T3 for B phase fault

(It means when a certain key is pressed, it creates its respective fault in system)

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