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Low Voltage Cable Fault Detector

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Abstract - The faults in the wires are quite difficult to analyze. The faults in the wire may be due to breakage in the wire, human and animal contact, etc., In an electric power system fault is nothing but any abnormal electric current. RF Transmitters & Receivers have been proposed for the detection of faults in the wire. This technique can detect the faults in the wires. RF Transmitter units are fixed along the length of wire at regular intervals and the RF receiver unit is placed at the remote area. Signal communication occurs between the transmitter and receiver unit. The transmitter units designed to consist of an RF transmitter module that transmits the signal as long as it receives the power. The microcontroller receives the signal through the relay. The transmitter unit which does not transmit the signal indicates the area of fault in the wire. The receiver unit comprising of the RF receiver module receives all the signals from the transmitter units accordingly. If all the transmitter's signals are received, this indicates that there is no fault in the wire. The transmitter units from which the signal is not received indicates the portion or area of the fault in the wire. The decoder circuit connected to the RF receiver passes the signal to the microcontroller which is then displayed on LCD. Hence the fault location can be detected.

Key Words: Power Supply, Microcontroller, LCD, RF Transmitter and Receiver, Frequency Driver.

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I. INTRODUCTION

The location of faults in the wires has become an area of international concern. Away from the earlier concepts of visual inspection and impedance testing, the concept of wireless communication is widely used today to help to detect and locate the faults in the wires. RF (radiofrequency) communication is the most extensively used method today for wireless communication. This project aims at developing a system that will automatically detect the fault and will provide the information to the receiver unit. The communication between the RF transmitter and receiver is used for the detection of faults. This system will overcome the difficulty of fault detection in the wires which are unapproachable. Additionally, it also has more features as compared to earlier used methods. There is no need to approach the wire manually and detect the fault. The whole receiver unit operates on battery; thus, it can work even if there is no power. The RF transmitter modules are fixed along the length of the wire to be tested at regular intervals. As long as there is current in the wire, all the transmitter units will send the signal to the receiver unit. In case of a fault in the wire, the RF transmitter module corresponding to the area of fault in the wire will not transmit the signal. This gives the location of a fault in the wire. The system is built upon RF transmitters and receiver, Microcontroller AT89C51, Frequency driver IC L293D and electromagnetic relays.

II. RELATED WORK

Presently, the approach of fault detection includes visual inspection and Impedance Matching. This paper presents Time-domain reflectometry (TDR) as one of the standard methods for detecting faults in electrical wires.

This project focused on a new concept of fault detection in wire networks, based on the properties of frequency response, so this method can be termed as a matched pulse approach. In this, the testing signal is made to adapt to the analyzed network, instead of using a predefined signal, in contrast to existing reflectometry methods. Mathematical study and numerical simulations have been used to show the benefits of this technique. A physical model is also used to better understand this approach. This work proposed a combined treatment of information from computer analysis and the monitored protection devices. The accuracy of this method is further calculated through theoretical calculation via estimated fault reflection coefficients and comparison with known fault resistance terminations.

III. BLOCK DIAGRAM

The block diagram of the proposed system "Low Voltage Cable (conductor) Fault Locator" has been shown in Figure. Along with it, there are again two block diagrams which are of the transmitter unit and receiver unit. The Transmitter module is an integration of the Power supply unit (12V,5V), Transformer (230/6v), RF transmitter (27 kHz), 6V

relay, Rectifier. As long as the power is received by the transmitter from the microcontroller, it transmits the signal. The controller gets the signal through a 6V relay so that it only sends the signal when the bit is high. The design of the rest of the transmitter units is also the same. The core part of the Receiver Unit consists of an RF Receiver (23 kHz), Power supply unit (12V,5V), AT89C51 microcontroller, LCD (16/2), MAX 232. AT89C51 microcontroller is energized by a 5V power supply. For this 5V power supply a circuit of 1000uF Filter Capacitor, LM7805 3PIN Voltage Regulator, 1 LED indicator and 1k resistor is made. The block diagram consists of the following key components:

1. Power supply
2. Microcontroller
3. LCD
4. RF Transmitter and receiver
5. Frequency Driver

AT89C51 microcontroller is preferred over other microcontrollers because of features like: It has a flash memory etc. The RF receiver receives all the signals from the transmitter modules and passes it to the microcontroller. The controller displays the result on LCD. The message received by the microcontroller is in the form of ASCII characters. The power supply unit consisting of transformer, rectifier, and regulator converts the 230 V Ac supply to 5V DC for the operation of AT89C51 microcontroller and other components as well. LCD is interfaced with port 0 of the microcontroller. The frequency output is generated from port 1.

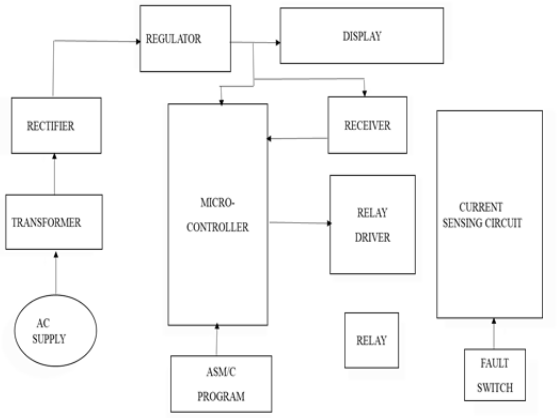

Fig -1: **Block Diagram**

In Fig.1 it is shown that the block diagram of Low voltage cable fault detector which includes 1φ transformer, rectifier, voltage regulator, microcontroller, relay, a driver circuit for a relay, current sensor and fault switch.

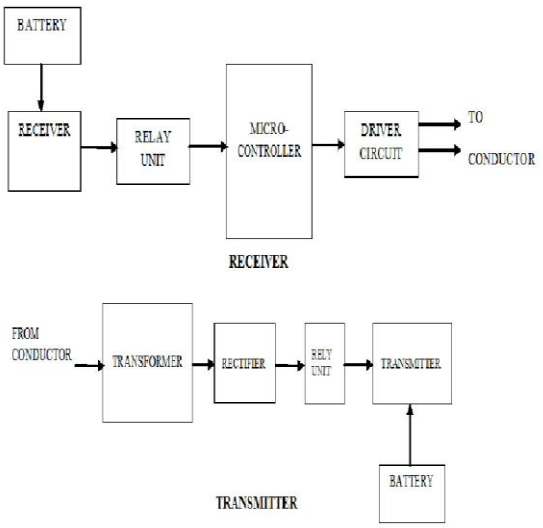

Fig -2: **Transmitter & Receiver Unit**

In Fig. 2 it is shown that there are two circuits i.e., transmitter and receiver circuit, which includes battery, transformer, transmitter, receiver, relay, microcontroller and the driver circuit.

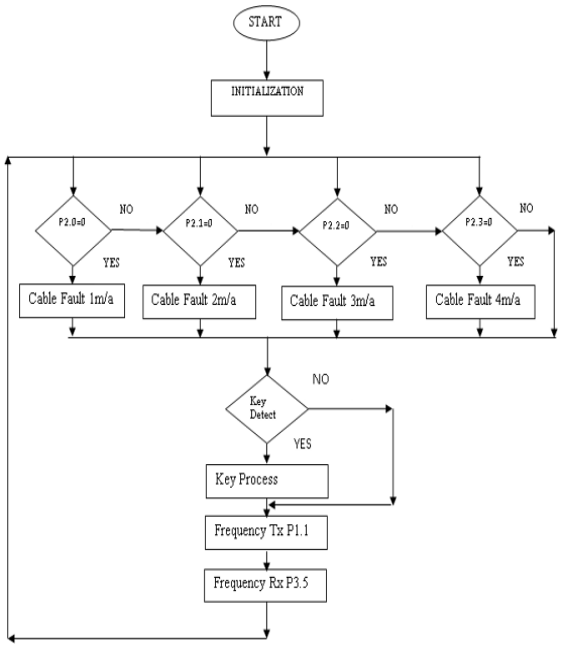

Fig -3: **FAULT DETECTION METHODOLOGY**

In Fig. 3 flow chart of operation and the execution of low voltage cable fault locator is shown

IV. RESULT

FIG. 4 PROGRAM MODE

First, the program will initialize by testing complete wire for the fault. As shown in fig 4.

FIG. 5 FREQUENCY SETUP

Then, the frequency is set at any desired value which is then fed to the conductor. As shown in fig 5.

FIG. 6 FREQUENCY DURING OCCURRENCE OF OPEN CIRCUIT FAULT

If the conductor is open at any point then the transmitted frequency will not be received any signal at the receiving end. As shown in fig 6.

FIG. 7 FREQUENCY DURING SHORT CIRCUIT FAULT

If the conductor is shorted at any point, then the frequency at the receiving end will be approximately the same as that of the transmitted frequency.

FIG. 8 DISTANCE OF OCCURRENCE OF CABLE FAULT DURING TESTING

When the fault occurred then by using this module one can easily identify the distance and the location of a fault. For e.g., 1m signifies that the cable fault has occurred at a 1-meter distance from the source.

FIG. 9 DISTANCE OF OCCURRENCE OF CABLE FAULT DURING TESTING

When the fault occurred then by using this module one can easily identify the distance and the location of a fault. For e.g., 1m signifies that the cable fault has occurred at a 4-meter distance from the source.

V. CONCLUSION

This project provides for the detection of faults in the live wires and their protection in a purely wireless manner. The RF transmitter modules transmit the signal to the RF receiver unit as long as they receive power. The RF receiver unit then identifies the transmitter module from which the signal is not received, and passes the information to the microcontroller. The microcontroller displays the message regarding the fault location on the LCD. Thus, fault detection and protection of the circuit are achieved. Again, there are still new ideas to improve it and to add new functionality to it. Parameters such as Current Rating and Impedance can be calculated as a future enhancement.

REFERENCES

[1]. Stefan Schuet; Dogan Timucin; Kevin Wheeler, "A Model-Based Probabilistic Inversion Framework for Characterizing Wire Fault Detection Using TDR," IEEE Transactions on Instrumentation and Measurement, vol. 60, no. 5, May 2011.

[2]. M. Sperandio, G. Lopes, "Fault Location in Distribution Networks by Combining Studies of the Network and Remote Monitoring of Protection Devices," 46th International

Universities Power Engineering Conference,5-8th September 2011.
[3]. S.J. Lee, et al. "An intelligent and efficient fault location and diagnosis scheme for radial distribution systems." IEEE Transactions on Power Delivery, v. 19, n.2, pp.524-532, 2004.
[4]. B. Clegg, Underground Cable Fault Location, McGraw Hill Book Company Europe, 1993.
[5]. M. Komoda and M. Aihara, "Development of a current detection type cable fault locator," IEEE Trans. on Power Delivery, vol. 6, no. 2, pp. 541–545, Apr. 1991.
[6]. Mora-Florez, 1. Melendez, and G. Carrillo-Caicedo, "Comparison of impedance-based fault location methods for power distribution systems," Electric Power Systems Research, vol. 78, pp. 657-666, 2008.
[7]. J. IC¥kowski "Impedance based fault location algorithms for power transmission lines", Scientific Papers of the Institute of Electric Power Engineering of the Wroclaw University of Technology, No. 92, Monographs, No. 28, Wroclaw, pp. 1-156,2001.
[8]. Y. Liao, "Fault location for single-circuit line based on bus-impedance matrix utilizing voltage measurements," IEEE Trans. Power Del., vol. 23, no. 2, pp. 609–617, Apr. 2008.

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