IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 4, June 2023

IoT Based Power Lines Fault Detection

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Abstract: *This paper helps in describing an automatic way to determine the fault in Power line and inform to specific authorities of that location. In this project, a device has been introduced which will use the incoming and outgoing values to detect abnormalities with the help of sensors. This paper deals with the straightforward concept of Ohm's law. Whenever any fault occurs in transmission lines such as short circuits, the resistance becomes small, and the current becomes too high and there is also a change in voltage. The microcontroller senses the Resistance changes and as per the programming, it provides fault information and displays the location of the fault and in which phase fault has occurred on LCD as well as on blink (Android app) with the help of Wi-Fi Module.*

Keywords: Power Lines, Liquid Crystal Display (LCD), Node MCU, Internet of Things (IOT).

I. INTRODUCTION

BACKGROUND

Fault detection is important task to protect electric power systems. Protection of the transmission line is an important part in power system engineering because 85-87% faults of power system occur in the transmission lines. The occurrence of short circuit in main power line causes serious problem. It affects the actual load and voltage which can easily damage the many electronic devices. The main problem in high voltage transmission line is efficiency and safety. Some unexpected faults arise due to falling trees, wind speed, construction work.

The design methodology includes the use of microcontroller and the combination of relay circuitry with display on a LCD screen. It sends the notification to nearest power distribution center with location using IOT technology so that the data can be easily sent to the server.

IOT

Internet evaluation in the electrical industry transformed things. Generally, the boom in wireless technology came due to the Internet of Things. This wireless connectivity connects our household, infrastructure to power industry. Now Indian Government starts connecting power grids using IoT to each other so that power loss and fault detection can be minimum and frequently respectively. The devices in IOT collects data from various sensors are attached. IOT system has various layers and these layers are Perception layer, Network layer and application layer. The perception layer includes internet enabled devices that detect objects and collect information.

The microcontroller used is Node MCU which is a High-Performance Low Power CMOS 8- Bit microcontroller and we have also interfaced this project with IoT so whenever there is any fault occur in transmission line LCD Display will showing the location of the fault and in which phase fault has occurred and it is also displayed on a blynk App.

Design Procedure

The circuit consists of display, Node MCU and resistance measurement circuit & Relay Module. To induce faults manually in the kit, fault switches are used. About 12 fault switches are used which are arranged in three rows with each row having 4 switches. The 3 rows represent the 3 phases namely R, Y and B. The fault switches have 2 positions- No fault position (OK) and fault position (KM). Main component of the Power Line fault detection circuit is low value resistance measurement. This circuit can measure resistance up 400 Ohm, Maximum cable length it can check up to 4 kilometers.

So, starting from the reference point 3 sets of resistances are placed in series, Relay for each phase R,Y and B as three relays are used and the common points of the relays are grounded and the another points are connected to the Analog input pin of Microcontroller (Node MCU).

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12 switches create fault as per the switch operation. As a result of the fault, there is a change in resistance value. This value measured across the resistance 1k is fed to the Microcontroller. Using this value, the controller computes the distance. Finally, the distance of the fault from the base station is displayed in kilometer on LCD Display as well as on blynk (Android app) with the help of Wi-Fi Module.

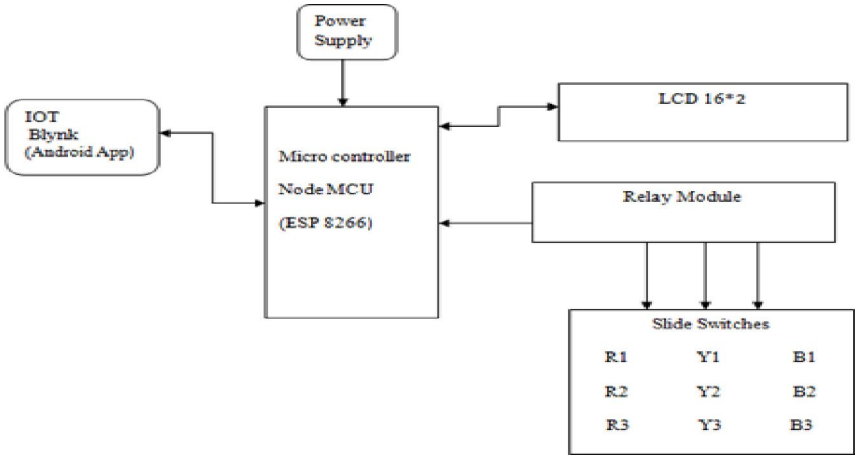

Fig. 1 Block diagram of proposed system

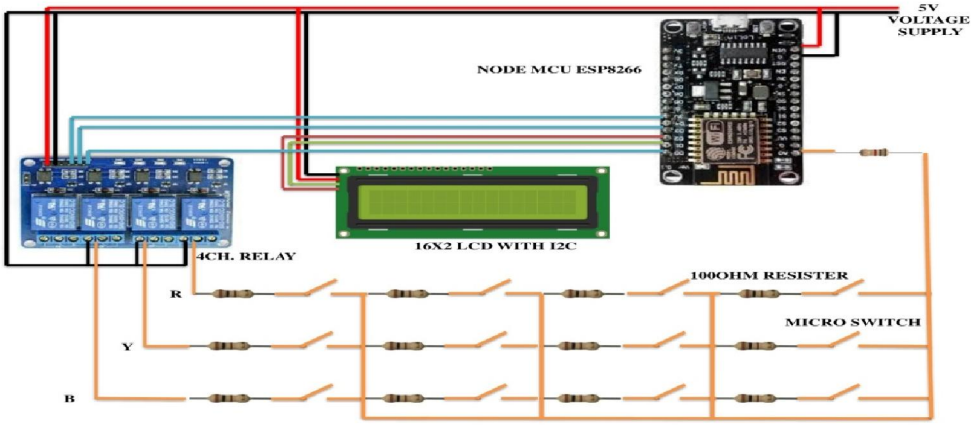

Fig. 2 Circuit diagram of project

Node MCU (Node Micro Controller Unit)

Fig. 3 Node MCU (Node Micro Controller Unit)

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The Node MCU ESP8266 development board comes with the ESP-12E module containing the ESP8266chip having Ten silica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. Node MCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

Relay Module

The 4 channel 5V Relay board module is used for controlling higher current loads from your microcontroller development board, PC parallel port or Arduino Uno. This board has four (4) on-board relay which can switch up to 7Amps. Relays terminals (C, NC, NO) are accessible through screw terminals which makes wiring up the board very easy. The relay is safely driven by ULN2003 IC hence your input device, such as Arduino, is protected from relay circuit and IC will further protect your microcontroller from relay kick back. This is a 5V 4-Channel Relay interface board which can be controlled directly by a wide range of microcontrollers such as Arduino, AVR, PIC, ARM, 8051 and so on.

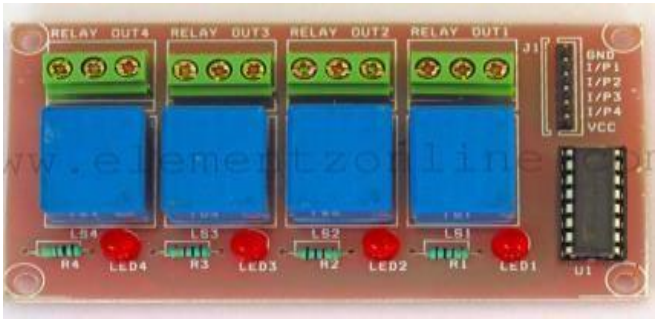

Fig. 4 Relay Module

An LCD screen is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used. The 16×2 display shows 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7-pixel matrix.

I2C modules are currently supplied with a default I2C address of either 0x27 or 0x3F. To determine which version, you have check the black I2C adaptor board on the underside of the module. If there are 3 sets of pads labeled A0, A1, &A2 then the default address will be 0x3F. If there are no pads the default address will be 0x27.The module has a contrast adjustment pot on the underside of the display. This may require adjusting for the screen to display text correctly.

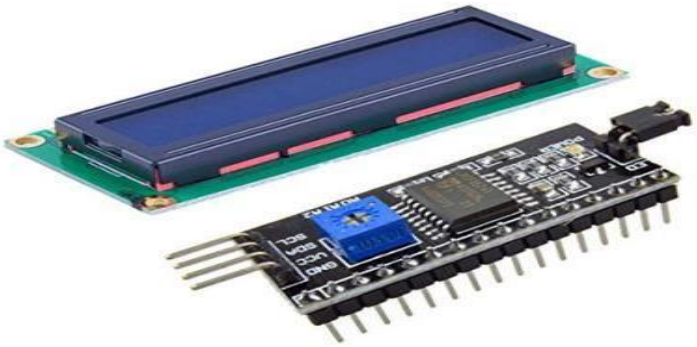

Fig 5: LCD Display with I2C Module

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Flowchart: Flow of project working is as follows.

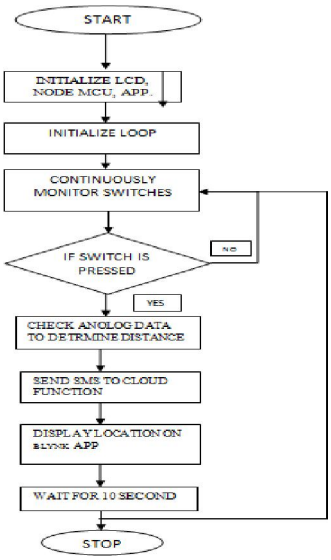

Fig. 6 Flow chart

II. RESULT AND CONCLUSION

The following figures show the result of the project.

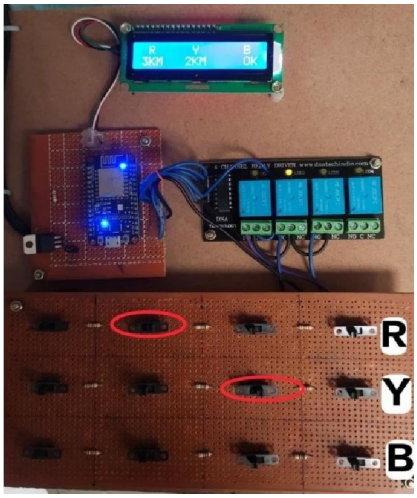

Fig. 7: Show the Result

Fig. 8: Result

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Fig 9:Blynk App Result in Mobile

III. CONCLUSION

The motivation behind this project was difficulties due to faults detection and location in power distribution lines. Power lines in our country are subjected to faults due to various forces and it is very difficult to identify and maintain it in short interval of time. This may cause many electrically induced accidents and hence must be prevented. This project finds a solution for this problem by implanting a set of units on various points on power distribution line and measuring the instantaneous values continuously. The fault can easily be detected, identified and located using this arrangement. This system can help the authorities to maintain the power line easily and can avoid line fault induced accidents up to a limit.

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