IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

## IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 7, July 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.542

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 7, July 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0907101 |

# Smart Multiple Fault Detection in Transmission Line

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**ABSTRACT:** Transmission line multiple faults detection and indication to Electricity Board (EB) deals with the problem of detecting the fault in the transmission lines and the automatic intimation to EB. The fault location detection has been a main objective of power system engineers, in transmission and distribution systems. Identification of fault source is tedious task; fast fault detection can help to protect the equipment before any significant damage of the equipment. The objective of this work is to monitoring a power transmission line in real time to avoid overload condition and power loss of transmission line. . Initially the transmission line the voltage, current and the oil temperature level are monitored and automatic load turn off has performed. The voltage status, current status and oil temperature have monitored by potential transmission line, current transmission line and temperature sensor respectively. The Ultrasonic sensor is used to find the distance of cable. The fault location has identified using MSP430 board and the information is transmitted to Electricity Board using IoT device. All the transmission line parameters are monitored by IoT server. In the case of power failure and any other transmission line fault, it can be easily solved by Electricity Board. The exact fault location can help service man to remove persistent of the faults and locate the areas where the faults occur regularly, thus reducing the occurrence of fault and minimize the time of power outages.

**KEYWORDS:** Electricity Board(EB); MSP430, Ultrasonic sensor, Internet of Things(IoT).

## I. INTRODUCTION

The transmission lines and distribution system plays significant part in current distribution to the consumers without interruption. Transmission lines are among the power system components with the maximum fault incidence rate, since they are exposed to the environment. Line faults due to lightning, storms, etc., the balanced faults in transmission line are three phase shunt and three phases to ground circuits. Single line-to ground, line-to-line and double line-to-line faults, overload, overvoltage, short circuit are unbalanced in nature. On a transmission system the protective relaying the protective system is integrated to detect the abnormal signals indicating faults isolate the faulted part from the rest of the system with minimal disturbance and equipment damage.

A.S.Pawar et al [1], described to monitor the status of the power system, a large amount of sensors are deployed in both the transmission grid and distribution grid. The sensors generate massive amount of data periodically for automation.

Ing. Komi Agbesi et al [2], describes the fault monitoring system using Arduino, where in the time is saved in finding the fault location and studies how the data measured on transmission lines can be delivered efficiently to substations.

Barsoum Nader et al. [3] gives an overview of the application of WSNs for electric power systems along with their opportunities and challenges and opens up future work in many unexploited research areas in diverse smart-grid applications.

S. Chavhan et al. [4] described that scalable and pervasive communication infrastructure represents a crucial issue in both structuring and operating smart networks, it analyses the performance of IEEE 802.15.4 based WSNs in order to establish their suitability for a typical set of monitoring and supervision functionalities required by urban-scale Smart Grids applications .

Stephen, J. C. et al. [5] analyzed the fault occurred in transmission line is very much dangerous for the locality , so need to design a model which is to be detect the fault in transmission line by comparing the voltage signal between the transmission line and a reference value the reference value is predetermined and if the transmission line voltage is more than or less than reference value then fault is to be shown in display.

Nweke Chisom B et al. [6] described a method which helps to locating the fault in the transmission line .This is designed with micro controller, GSM mobile, Driver circuit and control circuit interfaced with GSM modem. In normal

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conditions, the system records and periodically reports the overall performances, whereas, in case of incorrect behaviors it immediately informs to the operators.

Keith Harker et al [7] described that the project deals with the design and fabrication of power supply, microcontroller, RF Transmitter, RF Receiver, sensors and GSM modem. It greatly reduces the manpower, saves time and operates efficiently. When the voltage through the line falls below a programmed voltage, an immediate indication is provided by the microcontroller through the RF transmitter. The RF receiver of GMS modem will receive the signal and send the message to the electricity board.

P.Chandra shekar et al. [8] described that the protection of transmission line is important, because 85-87% faults of power system occur in these transmission lines. In the Transmission Line Falling Detection System, the 3 axis position sensor will be used to detect any post fall and line fall.

Pituk Bunnoon et al. [9], described the RF receiver of GMS modem will receive the signal and send the message to the electricity board. The system automatically detects faults, analyses and classifies these faults and then, calculates the fault distance from the control room using an impedance-based algorithm method. Finally the fault information is transmitted to the control room.

Manohar Singh et al [10], described that easily or quick fault detection can help protect the equipment by allowing disconnection of faulted lines before any major damage of the equipment as energy leakage is one of the major problems that the corporation faces in recent times.

A Aziz A Rhim et al [11], explained the uninterrupted power supply has to prevent as much as possible. So,need to detect faults within the shortest possible time. Microprocessors and microcontroller based systems used for these fault detection have been advancing rapidly. . They have increased range of setting, high accuracy, reduced size, and lower costs, along with many other functions, such as fault event recording, auto-resetting, etc.

Jones, L.D. et al [12], discussed that a smart GSM based fault detection and location system was used to adequately and accurately indicate and locates the exact spot where fault had occurred. This will ensure a shorter response time for technical crew to rectify these faults and thus help save transformers from damage and disasters.

## II. METHODOLOGY

The set up or field device consists of 3 major components, instrument transformer (CT and VT), GSM modem and microcontroller. The primaries of the CT and VT which are connected to the line sense the corresponding current and voltage values of the system and feed the output to the ADC of the microcontroller which converts the signal to a digital form in order to be processed by the CPU of the microcontroller. The microcontroller serves as the central point of the set up. It contains a set of programming codes which have been stored in the EEPROM which enables it to classify the fault type based on the voltage and current values.

### 2.1 POTENTIAL TRANSFORMER

Potential Transformer is used for metering and protection in high-voltage circuits. It is designed to present negligible load to the supply being measured and to have a precise voltage ratio to accurately step down high voltages so that metering and protective relay equipment can be operated at a lower potential.

### 2.2 CURRENT TRANSFORMER

Current transformers used in metering equipment for three-phase 400 ampere electricity supply. A current transformer (CT) is a measurement device designed to provide a current in its secondary coil proportional to the current flowing in its primary. Current transformers are commonly used in metering and protective relaying in the electrical power industry where they facilitate the safe measurement of large currents, often in the presence of high voltages.

### 2.3 TEMPERATURE SENSOR

Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements. Thermistors differ from resistance temperature detectors (RTD) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a higher precision within a limited temperature range [usually −90 °C to 130 °C].

### 2.4 RELAY

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first.

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### 2.5 LCD DISPLAY

A liquid crystal display is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs).LCs do not emit light directly. These are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they cannot suffer image burn-in. LCDs are more energy efficient and offer safer disposal than CRTs. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically-modulated optical device made up of any number of pixels filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome.

### 2.6 MSP430

The MSP430 is a mixed-signal microcontroller family from Texas Instruments. Built around a 16-bit CPU, the MSP430 is designed for low cost and, specifically, low power consumption embedded applications. Using this Launch Pad MSP430 Microcontrollers which works and it offers 16-bit performance with an operational speed up to 16MHz. It can be able to Blink an LED at the end of this tutorial.

### 2.7 WI-FI

A Wi-Fi-enabled device, such as a personal computer video game console, Smartphone or digital audio player, can connect to the Internet when within range of a wireless network connected to the Internet. The coverage of one or more (interconnected) access points called hotspots comprises an area as small as a few rooms or as large as many square miles. Coverage in the larger area may depend on a group of access points with overlapping coverage.

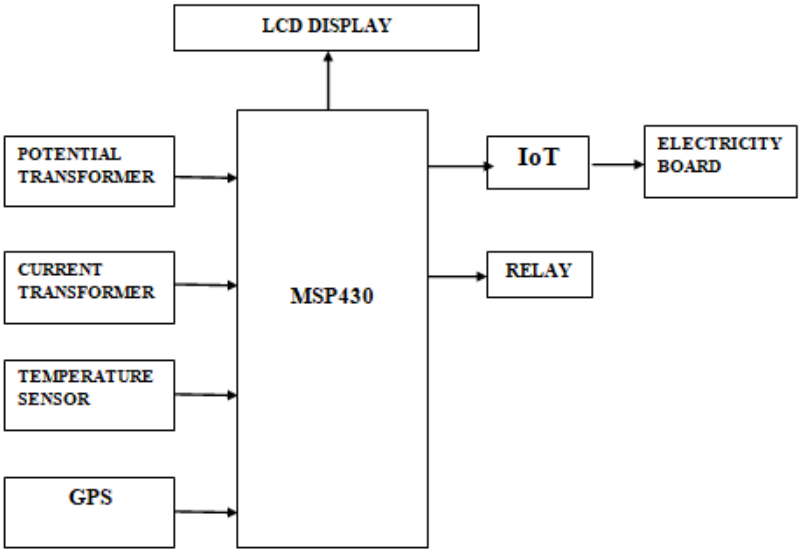


**Figure.1 Block Diagram for Transmission line fault Detection**

### 2.8 MSP430

MSP430 launch pad is a development board which can be used to design all Arduino based applications since both have similar capabilities and features. Similar to Arduino being developed on AVR controllers, the MSP430 launch pad is developed on TI MSP430 microcontrollers. This device can be used to develop low end applications and not high end applications, as it does not have high processing power like Raspberry pi.

*2.8.1 How to use MSP430 Launch pad*

Similar to arduino we need IDE software for interfacing the board to PC and programming the microcontroller seated in it. In both IDE using energia is easier, as the software is developed based on arduino IDE and they share similar programming feel. So for those who are familiar with arduino will fell energia IDE similar and helpful.

Once downloaded the IDE software install it in PC and do it with administer rights for avoiding future troubles. Run the installed program and connect the development board to the PC using the cable provided along with the kit.

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The PC will detect the board automatically after connecting. Once detection in done go to the example programs in the IDE and choose blinking program to execute.

Once it is done the IDE will debug the blinky program for error and after successful compilation the program will be transferred to microcontroller in the board. Once the program is transferred, the microcontroller executes the blinky program saved in its flash memory and we will see the LED present in the board blinking. So with that we have successfully programmed the controller via usb interface and in the similar way we can write the other programs in the IDE and dump these programs in the controller after compilation.

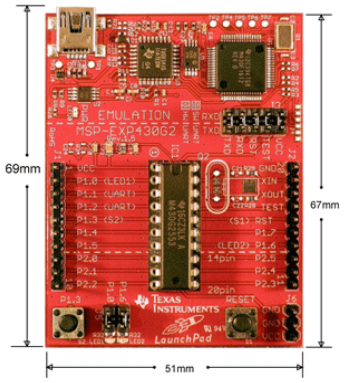


**Figure.2 MSP430 pin out**

## III. RESULTS AND DISCUSSION

The main aim is to find transmission line faults in power network. Mainly this work will detect the fault like “wire fault” & “voltage fault”. When a wire fault created by switching on & off a message of “wire fault” will be detected in mobile cell phone. On the same way by making a voltage fault by varying the voltage regulator we’ll get a message like “voltage fault” in that cell phone. The message will go to that mobile or sim that is mentioned in the program. So that it can clear the fault as quick possible in the power network.

The developed system identifies the fault and displays the fault location on the LCD screen and sends the data within fraction of seconds through IoT to the web page. This helps the operators to locate the fault precisely and send the service man to clear the fault and restore the power system back into service. The data for every phase can also be recorded for every second and can be used for data sampling; behaviors of the transmission network for various load flow studies can be analyzed.

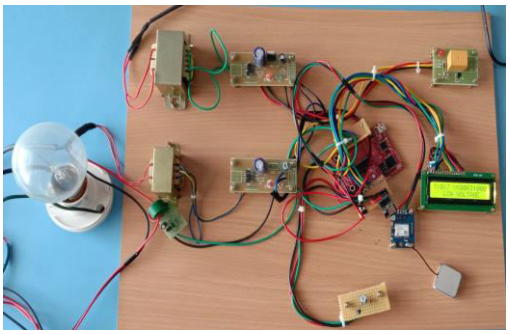

**Figure.3a. Output of Low Voltage**

The output of low voltage as shown in figure 3a, it take the voltage about 200 or below, then it will send an information to Electricity Board as a form of Low Voltage.

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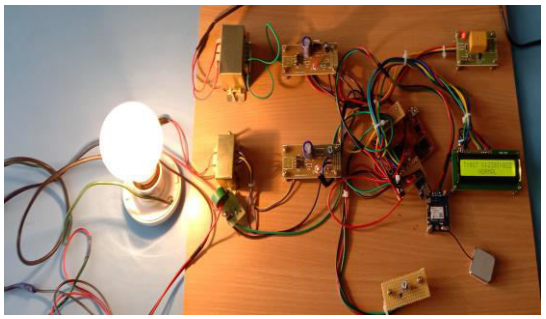

**Figure.3b. Output of Normal Voltage**

The output of Normal voltage as shown in figure 3b, it takes the voltage range of 220v – 240v. If the voltage goes above the normal range, it will send the message to Electricity board automatically as a Normal Voltage.

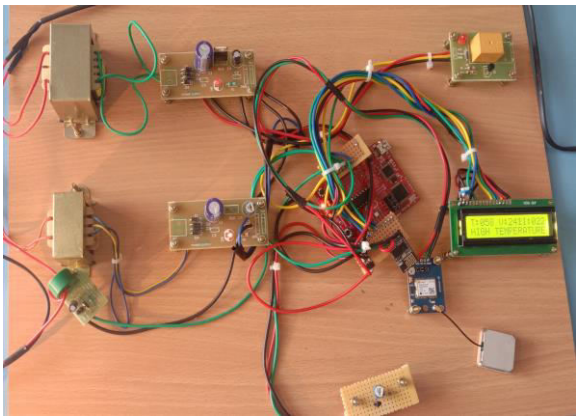

**Figure.3c. Output of High Temperature**

The normal temperature level is $50^0$c and the output is shown in figure 3d. When it goes beyond the normal level, the message will automatically sent to the Electricity board

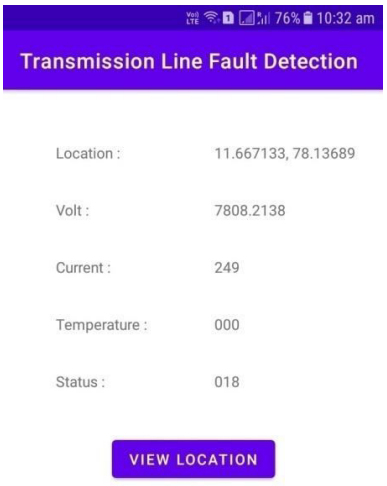


**Figure.3d. Fault Location Message**

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The screenshot image of fault location message is shown in the below figure 3d. Once the fault location has been detected, it sends the information to the mobile app which is named as Transmission line fault detection. The fault information will be Low voltage, High Voltage, Low current, High current, Temperature, status and the location where the fault is detected. It finds the exact location through the goggle map by using the Transmission line fault detection app.

## IV. CONCLUSION

The developed work has the feature of continuous monitoring of IoT based real- time technology. In case of fault occurs an emergency message has been sent automatically to Electricity board. All the status of transmission line is continuously updated to IoT server in case of overload fault occurs. Then the power supply has terminated by Electricity board. In the case of power failure and any other transmission line fault, it can be easily solved by Electricity Board. The exact fault location can help service man to remove persistent of the faults and locate the areas where the faults occur regularly.

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