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Automatic Transmission Line Fault Detection System Using GSM Technology

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Abstract: ***The electrical system is divided into several different parts. One of them is the transmission system, where electricity is transmitted from substations and substations along power lines to consumers. Both methods can experience various types of errors, often referred to as "problems". A fault is simply defined as a sequence of unwanted but unavoidable events that can temporarily disturb the steady state of a power system when the insulation of the system fails at some point. An intelligent fault finding and localization system was used to adequately and accurately mark and locate the occurrence of a fault. This ensures a shorter response time for the technical team to fix these faults, thus helping to save transformers from damage and disasters. The system uses current transformer, voltage transformer, Arduino uno controller, RS-232 connector and LCD display, GSM module, audio signal. The system automatically detects faults, analyzes and classifies them, and then calculates the distance of the fault from the control room by means of an algorithm based on impedance. Finally, the error information is transmitted to the control room. In short, it can be stated that the time required to determine the location of the fault is significantly reduced, because the system automatically and accurately provides information on the exact location of the fault. With this project we can detect single phase transmission line faults, monitor temperature, voltage, current on LCD screen and GSM module.***

Keywords: Transmission line, LCD displays GSM Module, Automatic fault detection, Buzzer etc.

I. INTRODUCTION

In this project, the identification and alleviation of the This project presents the detection and mitigation of a single line fault in an overhead distribution line. GSM Module technology is used to measure, protect and monitor distribution lines against various faults. Voltage and current fluctuations caused by open faults and short circuits are monitored. The line temperature is measured by a thermistor. When the temperature level increases/decreases, a message appears on the LCD screen. A drop in the distribution line is also detected and monitored by a drop sensor. Here we use the GSM module to detect the fault and send the message.

System uses current transformer, voltage transformer, Arduino uno controller, RS-232 connector and LCD display modem, GSM module. The system automatically detects faults, analyzes and classifies them, and then calculates the distance of the fault from the control room by means of an algorithm method based on impedance. Finally, the error information is transmitted to the control room. The project introduces the development and implementation of a distributed monitoring and centralized control system. There are many faults in the transmission that cause blackouts if not dealt with properly.

Notable among them are:

1) Malfunctions in the power plant
2) Damage to power lines (tree falling on the lines)
3) Malfunctions in substations or parts of the distribution subsystem
4) Lighting.

This project represents line protection in problem-solving technology applications. This applies to detecting abnormal conditions when a conductor breaks and does not touch another conductor or a grounded element. Failure detection in the network is done by automation. System automation has become the requirement of the day. In fact, most of the system is impossible for humans to control. When it comes to fault analysis, important electrical system requirements become more detailed. The need for automatic troubleshooting has become imperative. A typical fault clearing system includes combinations of a circuit breaker and a relay protection system. The main parts of the protection system are wires, sensors, auxiliary power supply, switches, switches, relays and the operating coil of the switch.

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II. PROBLEM DEFINITION

Normally, when a fault occurs in a transmission line, it is invisible unless it is severe. But little by little, these small defects can cause damage to the transformer and loss of life. It can also cause a fire. Today in India we do not have a system to notify us in real time when a fault occurs. Worryingly, since we don't have a real-time system, it causes damage to the underlying equipment and endangers the people around us.

To prevent such incidents as widely as possible, power lines are usually maintained or inspected regularly. This increases the need for manpower. The fact is that its real purpose is not achieved because line failures can often be caused by rain, falling trees, which are not predictable. Like in the Western Ghats, where power lines are usually built in the middle of the forest, and places like Chirapunjee, where massive rains stop almost everything. It is imperative to understand the severity and consequences of a line failure. To solve them, we propose a power line fault detection system based on GSM. Once the predetermined threshold is exceeded, the microcontroller immediately initiates a message that is sent to the area lineman and the Control Station, indicating the exact location of the poles. This will help us implement a near-real-time system. The real goal of detecting the fault in real time and protecting the transformer as soon as possible was realized. It is important to note that transformers are very expensive. An 11KV transformer costs $3000 on average. So here we design a cost-effective and quick response system that helps improve security.

III. OBJECTIVE

The grid plays an important role in providing consumers with uninterrupted electricity. Monitoring these systems is very important if we want to ensure a healthy supply of electricity to consumers.

1) Design an effective impedance based and reliable automatic detection and alarm based system for overhead and underground power transmission lines.
2) To reduce repair response time and save expensive transformers from damage or theft, which usually occurs during long power outages.
3) Increasing the work productivity of the technical team, because the time required for the localization of faults is minimized with the help of the GSM module.
4) Ensures the stability and reliability of the country's electricity supply system to boost economic growth.

IV. LITERATURE SURVEY

1) Prof. Vikramsingh R. Parihar1*, Shivani Jijankar2, Anand Dhore3, Arti Sanganwar , Kapil (2017) The system automatically detects faults, analyzes and classifies these faults and then calculates the distance of the fault from the control room using an impedance based algorithm method. The purpose of this project is to determine the distance of the ground cable fault from the base station in kilometers and will be displayed on the Internet. The terrestrial cable system is usually followed in large areas of large cities. Even if a fault occurs for some reason, the repair process for the cable in question at that time is difficult because the exact location of the fault in the cable is unknown. This technology is used to find out the exact location of the fault and send the information graphically to our website using the GSM module, showing it on the LCD screen.

2) Okokpujie Kennedy1, Amuta Elizabeth 2, Okonigene Robert3, Samuel John (2018) In this paper, researchers present research on the use of GSM technology to provide a reliable monitoring and fault detection system. Special purpose-built sensors were used to monitor changes in transmission parameters such as voltage, current, temperature and frequency. Detecting a power line fault requires intensive human effort and resources. This process is usually time-consuming and there is a risk of damaging the insulation when digging the cable. This article provides a simple and safe alternative by automating fault finding and localization. The project uses the simple concept of OHM's law, where a small DC voltage is applied to the power end through a series resistor. The fault is created by a set of switches. The relay is controlled by the relay controller. 16x2 LCD screen connected to a microcontroller to display information. In the event of a short circuit, the voltage across the series resistors changes accordingly, which is then fed to the ADC to develop accurate digital data for the programmed Arduino microcontroller kit, which further shows the exact location of the fault in kilometers from the base. station The project can be carried out in the future using a capacitor in an AC circuit to measure impedance, which can even be used to locate an open circuit cable.

3) S.Chellam*, P.Latha1, K.M.Nivetha2, M.Swathi3 (2019) This paper deals with single line fault detection and mitigation in an overhead distribution line. Thanks to GSM technology, it is used to measure, protect and monitor distribution lines against various fault situations. The main objective of the project is to detect and locate the fault in the ground cable. In urban areas, the electrical cable runs underground instead of above. Once a malfunction occurs, it becomes difficult to repair. It is very difficult to determine the exact location of an underground power cable failure. This project ensures a shorter response time for

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the technical team to fix these errors. Faults are caused by short circuits, low voltage disturbances, high voltage disturbances. The previously proposed technique is only used to detect short circuits. This project is used to detect not only short circuit but also low voltage, high voltage fault. The system developed here works based on Ohm's law. The proposed technology is not only used for detection but also sends detailed information about the fault to the authorities using GSM and disconnects the power supply at that location for the safety of people. LCD screen error type. If there is a fault in the cable, an audible signal sounds to warn and act immediately.

V. BLOCK DIAGRAM

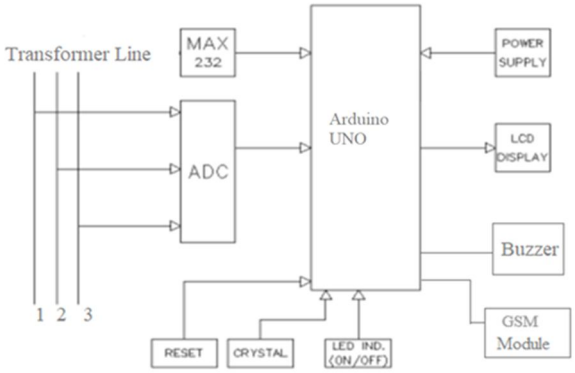

Fig.1.Block Diagram

VI. WORKING

Microcontroller acts as the center of the installation. It contains a set of programming codes stored in the EEPROM memory, which allows classification of the type of fault based on the voltage and current values. Based on the program, the microcontroller compares these values to see if they are in the required range. If the voltage and current values are outside the reference range, this indicates a malfunction. The microcontroller also calculates the fault distance to the device based on an impedance-based algorithm and passes that information to the modem for transmission.

In summary, the microcontroller classifies, calculates the fault distance and transfers the data to the modem for transmission through the serial interface (SCI), which acts as the interface between the microcontroller and the modem. RS-232 acts as a connector between the serial port of the microcontroller and the modem. The device is placed at the border of the crossings of the transmission network and the location of the fault is calculated relative to the location of the device.

There are 3 power cables, each with switches. If we hit the switch, it shows that absolute failures occur. And this signal goes to the controller. The controller detects which transmission line is faulty. The LCD screen and the GSM module show all related operations. In this way, the complete operation of the system takes place and it is identified which power line is faulty.

VII. COMPONENTS

1) Arduino Uno controller
2) LCD Display
3) Transformer
4) ADC
5) Rs232
6) GSM Module
7) Crystal Oscillator
8) Resistance
9) Capacitor
10) Fault Switches
11) Transmission line wire
12) Other

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VIII. SCOPE OF THE STUDY

This article aims to send an instant message to service provider authorities as soon as a transmission line fault occurs. In this model, we predict the fault location using the pole-to-pole distance. In the future, GPS (global positioning system) can be connected to it to transmit the exact location of a power line fault by longitude and latitude. In the future, we can find the distance of the fault from the substation with the help of the corresponding programming.

The purpose of the project is to send an alarm message as soon as an error occurs. In this model, we predict the fault location using the pole-to-pole distance. In the future, GPS can be connected to it, which transmits the exact location in terms of longitude and latitude.

IX. ADVANTAGES

1) This system provides accurate information about the type of fault occurred on the line like LG, L-L etc.
2) Thanks to the GSM system, which gives real-time status, we can easily monitor the transmission system from anywhere in the world of the system.
3) This system is more flexible than the current system, which can easily exceed the time required to find a bug in any environment.
4) Due to its small size and light weight, we can easily install the system on a pole.

X. RESULTS

A. Unit Testing

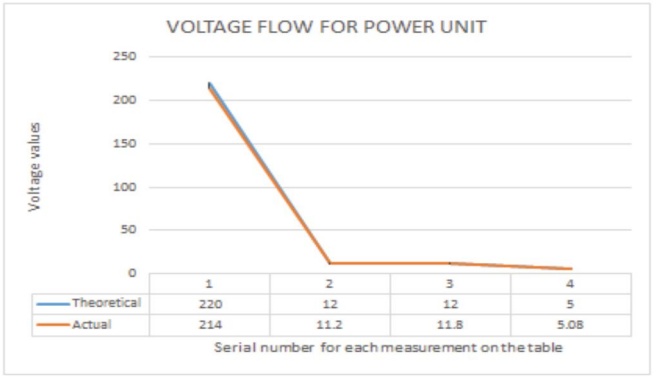
The values of the output voltage of each power unit were observed and noted. These values were compared with theoretical values as shown in Table 1.

Table 1 shows the values of the voltage from the sensing units

Figure 1 is its graphical representation.

TABLE 1: showing discrete voltage readings of the power unit.

S/N	Measurement	Voltage type (AC or DC)	Theoretical value (Volts)	Actual value (Volts)
1	From the Mains	AC	220	214
2	After Stepping down	AC	12	11.2
3	After rectification	DC	12	11.8
4	After regulation	DC	5	5.08



Graphical representation of Table 1

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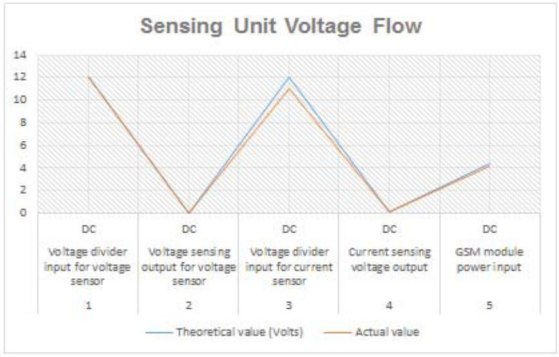
Table 2 shows the output and input voltage readings of each unit.

S/N	Measurement	Voltage type (AC or DC)	Theoretical value (Volts)	Actual value (Volts)
1	Voltage divider input for voltage sensor	DC	12	12.02
2	Voltage sensing output for voltage sensor	DC	0.0099	0.010
3	Voltage divider input for current sensor	DC	12	11.08
4	Current sensing voltage output	DC	0.0909	0.092
5	GSM module power input	DC	4.4	4.2



Graphical representation of Table2.

- The analysis of fault detection and location system of transmission line. Whether it is any type of fault that can be detected and located. When fault get occurs on the transmission line the signal is send to the control room or mobile phone through a GSM modem.
- The message receive on the mobile that is the fault between pole 1 and 2 and the fault which is symmetrical or unsymmetrical like L-G, L-L, L-L-G, L-L-L, L-L-L-G. The signal that appears on the control room or mobile phone is the L*G or any other type of fault occurred on transmission line.

XI. CONCLUSION

As part of this project, we developed a system of monitoring and detecting an electric line, which sends information from there to the control room via an LCD screen. Applied systems planning focuses mostly on the distribution system. This provides an opportunity to detect faults such as energy wastage and power theft. The system continuously monitors various parameters of the system. It also helps to detect malfunctions in time and thus prevent illegal electricity consumption. Automatic monitoring, analysis and recording are performed on a computer screen via a hyperterminal. The project has a continuous monitoring system that combines LCD screen and buzzer communication technology and microcontroller technology. It also represents hardware architecture and software flow. Implementation of the system will save a large amount of electricity and thus electricity will be available to a larger number of consumers in a densely populated country like India.

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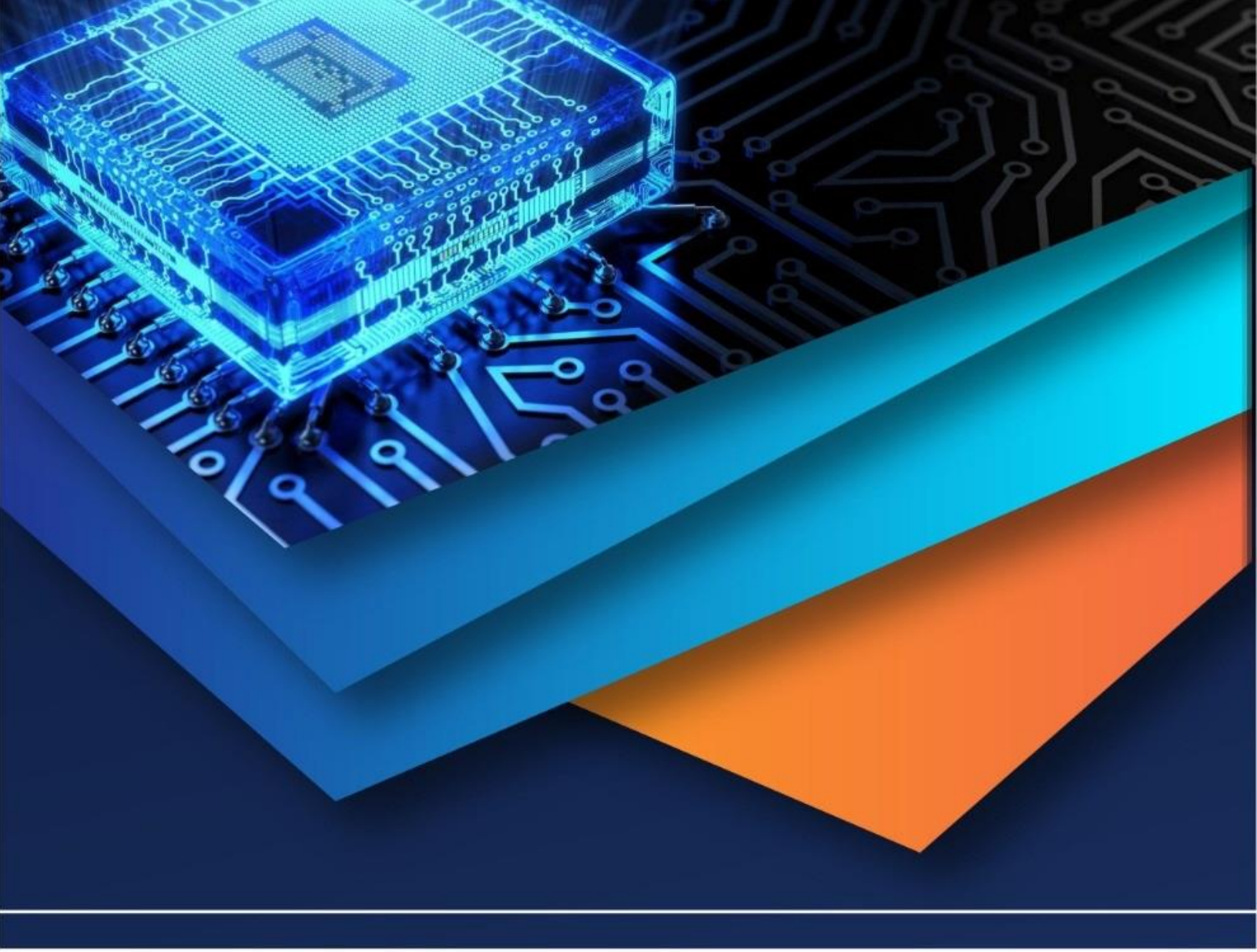

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