Pole Line Fault Detection System

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Abstract

A device that detects, identifies, and locates faults in electricity distribution pole lines caused by natural or manmade factors is known as an automatic pole line fault detection system. The stretch of electricity line that connects the transformer to the customers is the focus of this project. These flaws have a direct impact on clients, thus they must be identified and corrected as soon as feasible. Individual units, which are made up of a set of voltage and current sensors, are placed at specific spots along the power line to do this. The system uses sensor values to determine whether or not there is a failure on the line. This effort put a stop to the conventional approach of climbing electricity poles and discovering pole line issues. It provides field electricians with a handheld gadget to help them monitor defects in pole lines. The transmitter will be installed on the pole lines, and continuous monitoring will take place. If any defects are discovered, they will be reported to the local Electricity Board office via IoT technology. The lineman arrives at the targeted spot and utilises the LoRa portable device to pinpoint the exact pole line where the fault occurred, as well as ensuring their safety while climbing up.

Keywords

relay, fault detection, monitoring, GSM.

1. Introduction

Electricity plays an important role in our day to day life. As we have a complex network of power supply, faults can occur naturally in the transmission line. The conventional methods of detecting and locating faults on high voltage HT lines, including as assigning a technical team to the site, are still used today. The defect in the transmission line is located using an automatic pole line fault detecting technology to resolve this issue. Because transmission lines are exposed to the atmosphere, they are more susceptible to failures, which must be found and cleared as quickly as possible to ensure system reliability. The design and execution of a distributed monitoring and centralised control system are presented in this project[1]-[5]

Since the introduction of numerical relays into the power system protection sector, it has been possible to speed up circuit breaker tripping. The numerical relay's microprocessor stores the programme needed to link with other relays, trip the circuit breaker, and signal the relay setting. The relay is used to ensure that the circuit is tripped in the event of a problem, and the load is linked to ensure that the complete circuit is tripped [6]-[10]. Finally, the control room receives the fault information. The circuit receives all of the essential data from the UNO. LoRa is a protocol for long-range communication. The LoRa is used as a transmitter in the pole circuit and a receiver in the main device in the control room to relay information such as

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voltage, pole address, and the faulty phase in this example. To sufficiently and reliably warn and find the issue, a smart GSM-based fault detection and localization system was implementedThis will allow technical crews to respond more quickly to these issues, perhaps saving transformers from damage and disaster. The voltage is measured using a potential transformer. The status of the device is displayed on an LCDvoltage and the pole's address are examples of output.The fault information is relayed to the control room. Because the technology provides exact fault location information promptly and correctly, the time it takes to discover a problem is considerably reduced. We can save time and manpower by searching for the position of the defect in the HT feeder line, which stretches for kilometres. We can use a GSM modem to identify HT line problems and monitor the voltage and address of the pole by sending a message to a selected mobile number.For wireless communication applications, the GSM module has become a popular choice. The GSM network guarantees stable communication quality with its nationwide coverage. Short message service (SMS), which is based on the GSM standard, is the most extensively utilised service. Simultaneously, as the cost of GSM devices such as mobile phones and GSM SMS falls, the remote control unit gains a unique address (SIM card number)enabling the delivery of orders using a wireless communication network In a densely populated country like India, the system's implementation will save a huge amount of electricity, making it available to a larger number of consumers[11]-[12]. As a result, we will be able to provide an uninterrupted electrical supply and will be able to remedy any faults as soon as they occur. In this instance, a significant quantity of manpower and time can be saved.

2. Components

- Arduino UNO
- LCD
- Potential transformer
- LORA device
- GSM module
- Relay

Arduino UNO

The ATmega328 is a microcontroller with Advanced Virtual RISC capabilities (AVR). It is equipped with an 8-bit processor. Internal flash memory of the ATmega-328 is 32KB.The ATmega328 has a 1KB programmable read-only electrically erasable memory (EEPROM). This characteristic means that even if the microcontroller's power source is turned off, it can still store data and produce results when it is turned back on. The ATmega-328 also has a 2KB static random access memory (SRAM) (SRAM). Other features will be discussed later. Because of its numerous functions, the ATmega 328 is currently the most popular gadget on the market. Advanced RISC architecture, fast performance, low power consumption, and a true timer counter with a separate oscillator are just a few of the advantages. Six PWM pins, a programmable Serial USART, a software programming lock, and a 20 MIPS throughput, to name a few features. Later in this part, the ATmega 328 will be

explored in in depth..

LCD

The liquid crystal display (LCD) is built of a material that has both liquid and crystal qualities. The molecules flow almost as if they were in a liquid, but they have a temperature range where they group together in an organised crystal-like shape instead of having a melting point. In an LCD display, two glass panels are sandwiched between liquid crystal layers. The character, symbol, or pattern to be displayed is determined by a transparent electrode covering the inside surface of the glass plate. There is a polymer layer between the electrode and the liquid crystal to ensure that the orientation angles of the molecules are consistent. The outside of one of the two glass panes is bonded with a polarizer. Light rays travelling through these polarizers are bent at a given angle and directed in a specific direction. When the LCD panel is turned off, the polarizers rotate the light rays, causing the liquid crystal and directionless light rays to escape the LCD screen, rendering it transparent.

Potential Transformer

The air conditioner voltage is reduced to the ideal dc yield level by connecting the ac voltage, which is normally 220V rms, to a transformer. A full-wave redressed voltage is produced by a diode rectifier at that time, which is separated by a simple capacitor channel to produce a dc voltage. The dc voltage that follows is usually wave or ac voltage based. A controller circuit eliminates the waves and preserves the previous dc esteem, even if the information dc voltage varies. This voltage guideline is obtained using one of the most prevalent voltage controller IC chips.

The potential transformer will reduce the force supply voltage (0-230V) to (0-15V and 0-9V). The voltage of the essential, the optional loop, and the current or AMPS will increase or decrease dependent on the wire check if the auxiliary has less turns in the curl. A STEP-DOWN transformer is what this is called. The rectifier will then be connected to the auxiliary of the potential transformer.

LORA Device

With adequate FSK remote modulation and demodulation that can be done fast, the Ra-02 can be utilised for ultra-long-distance spread spectrum communication, eliminating the problem that standard wireless designs don't account for distance, anti-interference, and power consumption.

The Ra-02 is a networking device that can be used for automatic metre reading, home building automation, security systems, and remote irrigation, among other things. For networking applications, it is the ideal option.

Ra-02 comes in an SMD packaging and can be manufactured quickly using typical SMT equipment. Customers benefit from a high-reliability connection mode.

GSM Module

This is a plug-and-play GSM modem with a sequential interface that is simple to use. Control it with basic AT commands from small regulators and PCs to send SMS, make and receive decisions, and perform other GSM tasks. For all of its actions, it makes use of the well-known SIM800 module. It comes with a conventional RS232 interface that may be used to connect the modem to micro regulators and computers.

The modem comes with all of the essential external gear to get started with the SIM800 module, such as the force guideline, outside receiving wire, SIM Holder, and so on, as well as the GSM module.

Relay

A relay is a switch that uses electricity to operate a magnetic field is created by current flowing through the relay coil, which attracts a lever and alters the switch contacts. Relays feature two switch positions and are double throw (changeover) switches since the coil current can be turned on or off. Relays allow one circuit to control another circuit that is fully independent of it. A relay, for example, can switch a 230V AC mains circuit in a low voltage battery circuit. Instead of an electrical connection, the relay uses a magnetic and mechanical link to connect the two circuits.

The coil of a relay conducts a significant amount of current, typically 30mA for a 12V relay but up to 100mA for relays built for lower voltages.Because most integrated circuits (ICs) can't deliver this current, a transistor is usually used to increase the IC current to the higher level required for the relay coil.

3. Lora Sx1278 with Arduino

Enough with the theory Let's assemble it and see how it functions. Remember how I said that two LoRa modules couldn't interact with one another? I lied, of course... Yes, the LoRa WAN Protocol prohibits communication between two LoRa modules, however there is a method known as the Radio Head Packet Method that adheres to the LoRa WAN protocol while allowing us to connect with two LoRa modules. So let's send data from one board to the other using two LoRa modules and two Arduino boards. On the transmitter side, we'll utilise an Arduino Uno. On the receiving end, there's an Arduino Nano. The SX1278 Ra-02, which works at 433MHz, is the LoRa module I'm utilising here. I'm from India, where the On the transmitter side, an Arduino Uno will be used.unlicensed frequency range is 865MHz to 867MHz, so I'm not allowed to use the 433MHz frequency module for an extended period of time unless it's for educational purposes. Check your country's authorised ranges to make sure you're able to utilise the frequency range in question. LoRa modules are available in a variety of frequency bands, with the most popular being 433MHz, 915MHz, and 868MHz. At the rear of the module, you'll find the frequency at which your module operates.You can also get LoRa as a module or a single chip. If you only want the chip, make sure you have decent Let's assemble it and see how it functions soldering abilities because connecting wires to the LoRa chip is a delicate job. The Antenna is the next most crucial component of your LoRa module. It's important to remember that the LoRa module must be used with an antenna Otherwise, the module will be damaged by the output transmitting power. My antennas are 433MHz rated because I'm using a 433MHz Lora module; you'll need to choose your antenna accordingly.; otherwise, the output transmitting power will harm the module. Because I'm using a 433MHz Lora module, my antennas are also 433MHz rated; you'll need to choose your antenna accordingly.

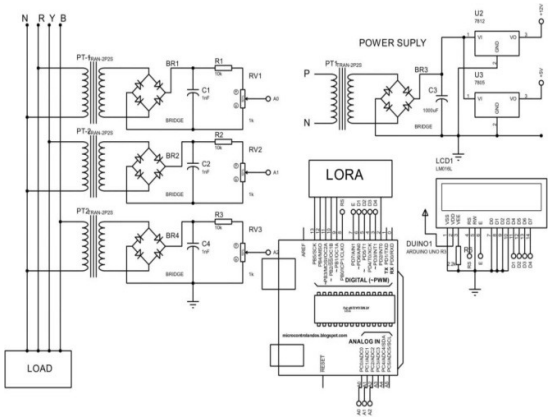
The LoRa module has 16 pins on each side, with 8 on each side. Six of the 16 pins are used by GPIO pins, which range in size from 0 to 1. Ground pins utilise DIO0 to DIO5, and DIO0 to DIO5.The 3.3V pin of the LoRa module is wired to the 3.3v pin on the Arduino UNO board

because the module runs on 3.3V.. Then we link the LoRa's SPI pin to the Arduino board's SPI pins.

I used connecting wires to make the connection between the Arduino UNO and the LoRa Module. The entire setup is powered by a power bank, making it portable for range testing.

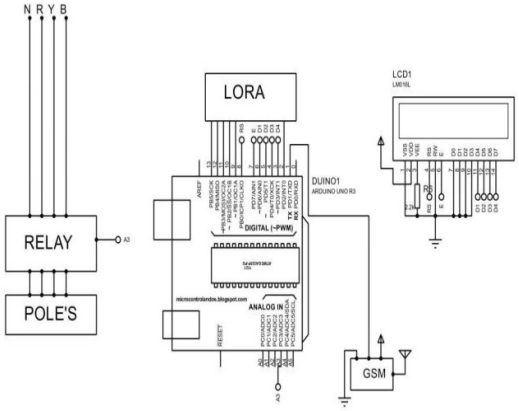
4. Preparing the Arduino IDE For LORA Wireless Communication

Once the hardware is complete, we may move on to the Arduino IDE. To deal with LoRa modules using Arduino, we already have a well-built LoRa library by Sandeep Mistry.. In this post, we'll simply add the Library to our Arduino IDE and utilise the example sketches to let our LoRa modules interact with one another. To add the library, go to Sketch -> Include Library In the Arduino IDE, you may manage libraries. Then look for "LoRa Radio" and install it by clicking on the library built by Sandeep Mistry. Wait for the installation to complete, and you should see something like this. Both programmes can be downloaded from



the links at the bottom of the page. The entire process is self-explanatory. The The Sender software delivers a "hello" message every 5 seconds. Every.seconds, the counter's value is increased.The receiver then receives this and prints the RSSI value on the Serial monitor. The LoRa.begin() function is a crucial line that needs to be changed.

Circuit diagram

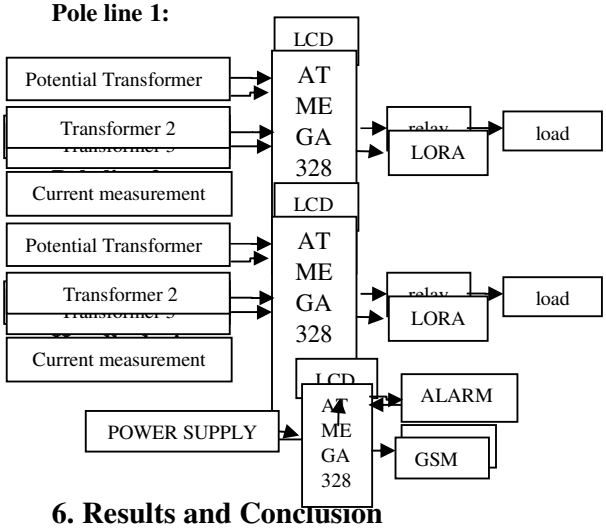


5. Working

The three-phase transformer is connected to the load. The current fault and voltage fault are measured when the value exists the given value information is given to the microcontroller. The microcontroller transfers the value to the 16x2 LCD and the fault is identified. The identified fault was transferred to the LOAR device from the microcontroller through the LORA module. When a limit exists the LORA device gives buzzer and message to the worker through the GSM module.

Block diagram

Pole line 1:



6. Results and Conclusion

In this project, the fault in the HT lines can be identified much faster and can be rectified as soon as possible by the technical crew. In this case there will not be any power loss for a long duration of time and the power loss can be minimized. Here the both man power and the time can be saved also can provide an provide a clear power supply from the respected sub-power station without any interruption. Here LoRa is been used as a mode of wireless communication which makes it much more simple. If the LoRa is used by gaining lisence the information that is communicated can be transmitted and received from any part of the word.

The mechanism for detecting and finding faults on HT lines was looked into. As demand has grown and developments in the field of power systems have been established, fault detection in transmission lines has become a necessity, and fault categorization and identification have become easier. This project presents an audit on the procedures utilized for flaw identification, order and area in transmission lines. Various plans are presented and delegate works are portrayed to sum things up. Different sorts of changes are introduced. It is discovered that the flaw location strategy relies upon the element extraction. Shortcoming characterization method for the most part utilizes a mix of two unique methodologies. For the area of issues, different plans have been talked about in this paper .So there is a requirement for growing all

the more new strategies utilizing some high level methodologies that have predominant computational precision and viability for the constant applications. It doesn't matter if it's a problem of any kind that can be identified and located. When a problem occurs on the HT lines, a GSM modem sends a signal to the control room or a mobile phone. The issue is from pole 1 or 2 or 3 according to the notice received on the mobile.The detected issues are communicated through SMS to the concerned persons. When LoRa-based fault indicators are realised, increased range is more helpful. The architecture proposed in this study increases range while increasing power consumption to a minimum. A unique approach to fault localization using paired nodes and GPS coordinates has been developed in this project. A LoRa-based WSN that can cover a bigger region has been proposed for enhanced coverage.

7. Future Enhancement

A novel various leveled signal handling system is proposed for generator condition checking also, flaw determination dependent on crude.In power organisations, electrical waveform When LoRa-based fault indicators are realised, increased range is more helpful. The architecture proposed in this study increases range while increasing power consumption to a minimum. A unique approach to fault localization using paired nodes and GPS coordinates has been developed in this project. A LoRa-based WSN that can cover a bigger region has been proposed for enhanced coverage.information can be evaluated on a regular basis using strategically placed waveform sensors. In Matlab Simulink, the impact of generator stifling blames on strategically placed electrical waveform sensors in power networks is evaluated and approved right away. Because of the large amount of electrical waveform data generated by Mat-lab Simulink, a multi-leveled calculation is used to locate deficiency sites and monitor the state of generators in force organisations. Finally, in a number of cases, the proposed approach has been approved in the IEEE 14-transport standard force network (e.g, one generator shortcoming, two-generator-flaw, different maturing levels, and so on) Our findings show that in force organisations, we can pinpoint fault locations and track the evolution of generators.Unlike traditional condition monitoring and fault analysis utilising generator sensors, our proposed philosophy can screen a large number of generators with a small number of waveform sensors, saving maintenance costs and enhancing the consistency of the force matrix.

Motor Current Signature Analysis is the most widely used technique for diagnosing defects in , and so on.) Our findings demonstrate that in force organisations, induction motors (MCSA). MCSA focuses on the stator current spectrum analysis as well as the evaluation of the accompanying harmonics when the machine is in a failure state. Motor issues include broken rotor bars, bearing corrosion, and rotor axis eccentricity. However, due to the close proximity of the observable frequencies and the restricted amplitude of the generated harmonics, the technique has significant limits at low speeds and torques.. Because the side band harmonic is closed to the fundamental in both circumstances, frequency precision is a difficult challenge to solve.The spectrum read could be meaningless because the precision is inversely related to the data collecting duration. As a result, establishing the precise amplitude of the side band harmonics, even while windowing, is difficult This research involves injecting an additional

voltage into the machine under inquiry at a frequency other than the fundamental, and then examining the harmonics that occur from the injected and main frequencies' composition.

In cutting-edge vehicle control and wellness frameworks for driver aid in dangerous situations, visual display frameworks displaying a vehicle's sidelong street position have been utilized snow ploughing, for example. The vehicle's parallel control soundness is recreated in a straightforward way. The harmful impact of the driver staring between the windshield and the display is highlighted. An event-driven inciting show is being created to lessen the impact This research involves injecting an additional voltage into the machine under inquiry at a frequency other than the fundamental, and then examining the harmonics that occur from the injected and main frequencies' composition.of dead time and improve the driver assistance system's health. The goal of the test is to evaluate the new showcase's presentation to that of the prior showcase framework, as well as to clearly demonstrate the improvement in sidelong vehicle security..

The Electrical Research Institute (IIE) developed an improved Human Machine Interface (HMI) modernization for a Combined Cycle Power Plant (CCPP) at the Process Super Vision Department to meet the Mexican Electric Utility's (CFE) modernization requirements, replacing the old one based on VAX workstations with a microcomputer base system using personal computers (pc), maintaining the same functionali1y and integrating management and processing capabilities. The modernisation of the HMI provided CFE with an integrated solution via a single interface that allowed the system to communicate with commercial controllers, PLCs, and other devices in addition to the current proprietary controllers.

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