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E-Mail :
editor.ijasem@gmail.com
editor@ijasem.org

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IOT BASED THREE PHASE FAULT DETECTION SYSTEM FOR THE TRANSMISSION LINE

[1]M.V.Praveen Reddy, [2]N.Ravali
[1]Assistant Professor,[2]Student
Department of EEE
Sree Chaitanya College of Engineering, Karimnagar

ABSTRACT

Transmission line fault detection is a significant and crucial problem in the present situation. 85-87% of power system problems in transmission lines happen in these overhead transmission lines. This study examines many approaches for managing transmission line faults and providing real-time solutions. The core of this module is an Arduino and Internet of Things-based software that can identify the kind of malfunction as well as its precise location. This information is sent to the control room and will appear on the display and in the program.

Electrical technology refers to the production, transmission, and use of electrical power in the transportation of electricity. Power generation, transmission, and distribution require a large number of components. Thus, there are several kinds of electrical faults or failures in the gearbox system, such as line-to-line and line-to-ground problems in the power system. I'll be demonstrating to you the three-phase fault detection system prototype in this project. Our project, which mostly involves high-voltage transmission lines, uses an Arduino Mega to precisely measure the distance of a three-phase fault from the source system and show the result on the control panel. In this project, a sensing device that is on the line is used, and any asymmetrical faults that occur, even between L-L and L-Gnd, will be shown on the device. The core of our project is Aurdino, which finds faults, assesses and categorises them, and then calculates the fault distance. Next, the control room receives the fault information.

I. INTRODUCTION

The most vital component of a human being's daily existence nowadays is electricity. Transmission line faults may result from lightning strikes, high internal and external stresses, mechanical failure, etc. Three phase line to line faults, three phase line to ground faults, and double line to ground faults are examples of this kind of transmission line fault. There are three primary categories for power systems: generation, transmission, and distribution. The transmission system is regarded as the primary component of the power system. The current transmission network supply and demand situation. The consumer's power supply is disrupted by a transmission line failure. Accurate defect detection systems provide many advantages, such as reduced power consumption, less maintenance costs, and preservation of

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electrical equipment. In the modern Indian transmission network, a system's inability to identify a malfunction in real time poses significant risks.

Any state or nation's economic considerations are significantly impacted by the protection of electricity system transmission lines. It also has a direct impact on people's lives and a secondary impact on the development of any country. One of the protective system's many functions is to separate the functioning system from the malfunctioning system. It is vital to categorise the fault nature in addition to isolating it from the healthy system for the purpose of future research and report generating. The fault categorisation gives details about the defect's severity level, faulty phase, etc. Another crucial component of the power network's power system safety is post-failure analysis. This research uses an algorithm based on symmetrical components to categorise the defects. Furthermore, a well-liked power system distance protection technique is used to find the errors. Line shunt faults may occur in a power system in ten distinct ways. Phase-to-phase (LL), phase-to-phase-ground (LLG), single-phase-ground (LG), and three-phase (LLL) faults are among these types of faults. Table I lists these faults' severity levels. The presented table is based on statistics concerning power system problems and their occurrences during the last 20 years. Table II provides statistics on transmission line towers based on the systems that have been modelled for simulation. Numerous techniques that use instantaneous voltage current data from both ends or just one end have been documented to far for fault classification. These techniques are broken down into a few groups. The fault analysis and classification in the earliest measurement categories use a single end of data and a sophisticated algorithm to find the issue. On this category, the majority of the algorithms are based.

In this

1. Under-impedance;
2. Torque;
3. Over-current Technique;

II. LITERATURE SURVEY

Electrical energy Long transmission lines are a defining characteristic of transmission lines, increasing their environmental exposure. As a result, transmission lines are more vulnerable to malfunctions, which impair the supply of electricity and cause a loss of produced power as well as economic downtime. Rapid problem identification and categorisation speeds up the clearing process and minimises system downtime, enhancing network efficiency and security. Therefore, the goal of this research is to create a single artificial neural network that can identify and categorise faults on 33 kV electric power transmission lines in Nigeria. In order to create the defect detectorclassifier, this research uses feed forward artificial neural networks using back propagation algorithms. SimPowerSystems toolbox in Simulink was used to model the

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transmission lines, while MATLAB was used for simulation. The fault detector-classifier is trained using the retrieved instantaneous voltage and current measurements. The effectiveness of the proposed intelligent systems for fault detection and classification on 33-kV Nigerian transmission lines has been shown by simulation results. The confusion matrix and Mean Square Error (MSE) are used to assess the detector-classifier's performance. The systems' acceptable MSE of 0.00004279 and accuracy of 95.7% indicate that the constructed intelligent system is operating at a good level. When compared to previous systems in the literature about Nigerian transmission lines, the method created in this study produces superior results.

Simulink was used to simulate this model. The three phase V-I measuring block was used to measure the signals for voltage and current. The transmission line, which consists of lines 1 and 2, is 140 km long. At intervals of 2 km, different shunt faults were simulated between 1 km and 140 km. 0.25, 0.5, 0.75, 5, 10, 20, 30 and 50 ohms are the resistances employed. The whole collection of data needed to train the neural network employed in the creation of the IFDC was generated by the model. Six x 6,160 sample data were gathered, and 10 fault scenarios plus no fault case were simulated for the aim of fault detection and classification. At a frequency of 1.5 kHz, the three phase voltage and current waveforms were produced and captured. The findings of a series of studies employing various frequencies that are at least twice the fundamental frequency (50 Hz) were used to inform the sampling frequency decision. As a result, there are thirty samples per cycle, and they weren't designed to be given raw into the ANN. As a result, it has to go through a feature extraction and scaling preprocessing step. As a result, the neural network's total size is decreased and its temporal performance is improved. In the meanwhile, the defect appeared at 0.04 seconds, or the 55th sample.

DISADVANTAGES

1. Harmonic compensation performance of not deteriorated
2. plied, increa Unstable system
3. Dynamic response is low

III. DESIGN OF HARDWARE

This chapter provides a quick explanation of the hardware. It goes into great depth about each module's circuit diagram.

ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno (datasheet). It has a 16 MHz ceramic resonator, 6 analogue inputs, 14 digital input/output pins (six of which may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC converter or connect it to a computer via a USB connection

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to get going.The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a serial-to-USB converter. The 8U2 HWB line on the Uno board is pulled to ground by a resistor, which facilitates DFU mode entry. The Arduino board now includes the following updates:

• 1.0 pin out: two further new pins, the IOREF, are positioned next to the RESET pin, the SDA and SCL pins that were introduced, and they enable the shields to adjust to the voltage supplied by the board. Shields will eventually work with both the Arduino Due, which runs on 3.3V, and the boards that utilise the AVR, which runs on 5V. The second pin is unconnected and set aside for future uses.

• A more robust RESET circuit.

• The 8U2 is replaced with an ATMega 16U2.

"Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future, the Arduino reference versions will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and the platform's standard model; see the index of Arduino boards for a comparison with earlier iterations.

Fig: ARDUINO UNO

POWER SUPPLY:

The purpose of the power supplies is to convert the high voltage AC mains energy into a low voltage supply that is appropriate for use in electronic circuits and other devices. One may disassemble a power supply into a number of blocks, each of which carries out a specific task. "Regulated D.C. Power Supply" refers to a d.c. power supply that keeps the output voltage constant regardless of differences in the a.c. main or the load.

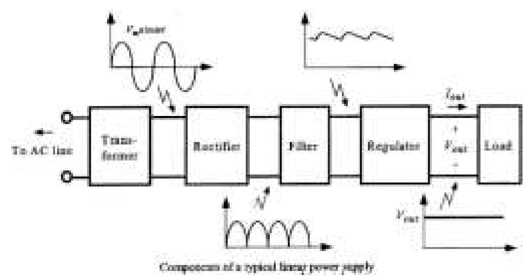

Fig: Block Diagram of Power Supply

LCD DISPLAY

The model shown here is the one that is most often utilised in practice due to its cheap cost and enormous potential. Its HD44780 microcontroller (Hitachi) platform allows it to display messages in two lines of sixteen characters each. All of the alphabets, Greek

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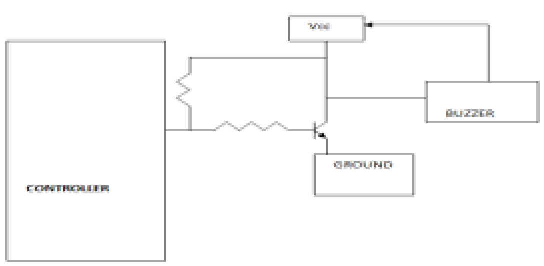
letters, punctuation, mathematical symbols, etc., are shown. Furthermore, it is possible to show custom symbols created by the user. Some important features are the automatic changing of the message on the display (shift left and right), the presence of the pointer, the lighting, etc.

Fig: LCD

BUZZER

Relays, buzzer circuits, and other circuits cannot be driven by the current available on digital systems and microcontroller pins. The microcontroller pin can provide a maximum of 1-2 milliamps of current, even though these circuits need around 10 milliamps to work. Because of this, a driver—such as a power transistor—is positioned between the buzzer circuit and microcontroller.



WIFI MODULE:

A low-cost Wi-Fi microprocessor with complete TCP/IP stack and microcontroller functionality, the ESP8266 is made by Chinese firm Espressif Systems, located in Shanghai.[1]

In August 2014, a third-party producer named Ai-Thinker's ESP-01 module brought the chip to the attention of western manufacturers for the first time. With the help of this little module, microcontrollers may establish basic TCP/IP connections and connect to Wi-Fi networks by utilising Hayes-style instructions. But at the time, there wasn't much documentation available in English on the chip or the commands it could execute.[2] Many hackers were drawn to investigate the module, chip, and software on it as well as translate the Chinese documentation because of its very cheap cost and the fact that it had very few external components, suggesting that it may someday be very affordable in production.[3]

With its 1 MiB of integrated memory, the ESP8285 is an ESP8266 that enables single-chip Wi-Fi capable devices.[4]

The ESP32 is these microcontroller chips' replacement.

LED:

A light source made of semiconductors with two leads is called an LED. When turned on, this p-n junction diode generates light.[5] Within

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the device, electrons may recombine with electron holes when a proper voltage is given to the leads, releasing energy in the form of photons. This phenomenon is known as electroluminescence, and the energy band gap of the semiconductor controls the colour of the light, which corresponds to the photon's energy. Since LEDs are usually tiny—less than 1 mm2—the radiation pattern may be modified by integrated optical components.

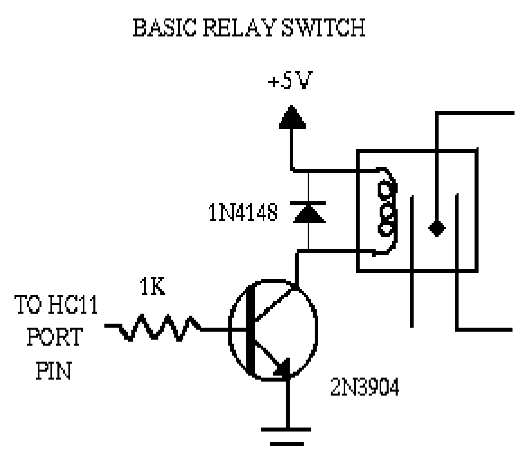
Early LEDs were often utilised to replace tiny incandescent bulbs as indication lighting for electrical equipment. They were quickly bundled into seven-segment displays for use as numeric readouts, and digital clocks became popular with them. Modern advancements have led to the creation of LEDs that are appropriate for task and ambient lighting. New displays and sensors have been made possible by LEDs, and enhanced communications technology has benefited from their rapid switching rates.Compared to incandescent light sources, LEDs are smaller, quicker switching, more physically resilient, need less energy, and have a longer lifespan. Applications for light-emitting diodes are many and include traffic signals, advertising, traffic lights, camera flashes, lit wallpaper, aircraft illumination, and car headlights. Additionally, they are much more energy-efficient, and their disposal may pose less environmental risks.

PUSH BUTTON:

An electrical switch is a part of an electrical circuit that has the ability to halt current flow or transfer it from one conductor to another. An electromechanical switch that may be manually manipulated and has one or more sets of electrical contacts is the most common kind of switch. There are two possible states for each pair of contacts: "closed," which indicates that electricity may flow between the contacts while they are in contact, or "open," which indicates that the contacts are not conducting and are separated.

Fig 4.3 : Push Buttons.

RELAY



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The fundamental circuit is shown in the following diagram.

An electrically powered switch is called a relay. It turns on in a manner that switches on. It flips the opposite way when it's off. Relays may be used to turn high current devices on and off. A lightweight switch and an electromagnet known as a coil are found within a relay. The coil's magnetic field attracts a portion of the switch when it is energised, turning the switch on or off.

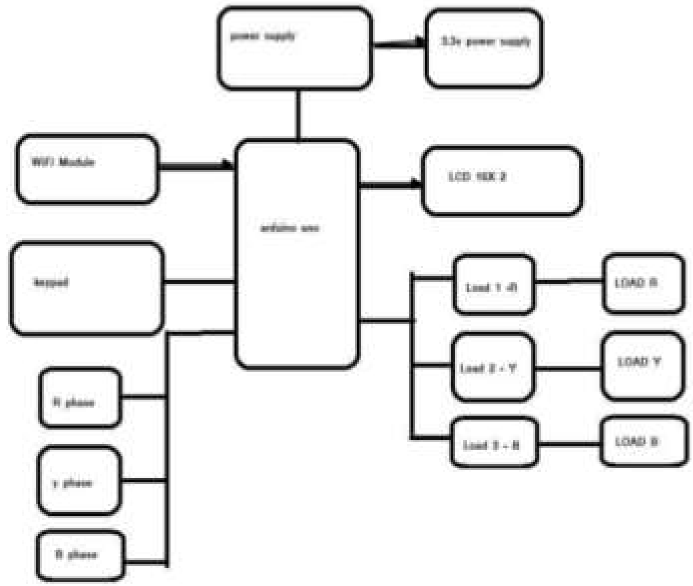
Mechanical relay:

A typical connecting pin for a mechanical relay

This is a crucial part of the article. This electrical control switch is introduced as a relay. Essentially, it is an electrically operated mechanical switch activation mechanism. This is not the same as a manually triggered switch. Put another way, it's a gadget that transforms electrical signals into mechanical energies and back again. They may be referred to as 2P2T, single pole double throw, etc., much like mechanical switches.

How does it operate? The relay's coil will be turned on by an electrical voltage. When the coil is cranked up, a magnetic force is produced that draws the lever in. The mechanical contact will be switched when this lever is drawn in the direction of the magnetised coil.

IV. BLOCK DIAGRAM AND WORKING



BLOCK DIAGRAM

Here, a rectifier and transformer combination is used to produce the DC power that is needed for the controlling board. To locate faults in their corresponding stages, we have used PT sensors. When a fault occurs, the load is isolated using a relay. We are employing the Arduino as the system's brain. Thus, it will be able to interface with input and output devices as well as wifi modules. The display is linked to the digital pin of the Arduino, while the analogue pin of the Arduino receives the output switches. Thus, when a problem arises, the supply is stopped and the Arduino sends output to the relay. An 8266 wifi module is being used. Thus, we obtain information about the malfunction on our computer or mobile device. With the help of this project, we can identify the kind of issue and prevent damage to electrical components.

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V. CONCLUSION

With the help of this prototype model, we can quickly identify the kind of issue, fix it, and determine its distance in real time. It locates the fault at the exact distance in less time. Prevent future transmission line issues.

FUTURE SCOPE

The amount of time and resources that this prototype module or project will save is a topic of much discussion in the future. The project is expected to provide assistance and serve as a reference for the implementation of base protection systems in transmission line systems in the future. Moreover, these systems are much more dependable than SCADA. This technology, which is referred to as an Internet of Things system, will signal or control a smartphone app. This method pinpoints the precise site of faults and clears them quickly, which distinguishes this project and makes it valuable going forward.

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