Three Phase Fault Analysis in Three Phase Distribution Line

B. Noorul Hamitha[1], M. Nowsath sheriff[2], A. Sivabalan[3], M .Veilumuthu[4]

[1]Assistant Professor, Dept. of EEE, Kamaraj College of Engineering & Technology.
[2]Students, Dept. of EEE, Kamaraj College of Engineering & Technology.
[3]Dept. of Electrical and Electronics Engineering, Kamaraj College of Engineering & Technology, Virudhunagar,
Tamil Nadu, India.

---***---

Abstract :- The major aim of this work is to detect the fault on the distribution line. Generally, there has an lots of fault occurs on the Transmission and Distribution of power system. In which transmission line fault are no exceptions. Due to external fault and internal fault lots of fault occurs on the transmission line like conductor breaking, insulating material failure. In this work arduino and GSM module were selected as intelligent device for detect the fault on distribution line and send the message to the receiver. The voltage level detection and fault analysis were done by arduino software. Further, Hall effect sensor was used for sensing the voltage level of the distribution line. The obtained result shows on LED screen and phone.

*Key Words***:** Arduino, fault analysis, message transferring.

1. INTRODUCTION:

Progress Energy Carolinas (PEC) is a major southeast investor owned electric utility company that operates approximately 47,000 miles of primary distribution circuits covering 33,000 square miles in the states of North and South Carolina. Distribution service is provided to approximately 1.36 million customers from 378 T/D substations and 1,148 distribution feeders. Approximately 72% of the primary feeder miles are constructed from overhead facilities with the remaining 28% from underground facilities. PEC distribution voltages consist of 12kV and 23kV. The average feeder length of a distribution feeder is 41 miles of primary line with approximately 9% of the feeders exceeding 100 miles in length. The 12kV distribution system serves heavily wooded metropolitan areas with an average feeder length of 22 miles and is currently experiencing 0.77 faults per feeder mile annually. The bulk of the 23kV system is rural with an average feeder length of 47 miles and is experiencing 0.57 faults per feeder mile annually.

Fault analysis conducted by Reliability Engineers involves locating faults, determining the cause, determining if protective equipment operated properly, and identifying what can done to prevent the fault from occurring in the future. Prior to the installation of a feeder monitoring system in 1997, engineers at PEC were only able investigate faults that resulted in a recorded outage. With the implementation of the

G.C. Lampley is with Progress Energy Carolinas, Raleigh, NC 27602 (919-508-5712; e-mail: glenn. lampley@ pgnmail.com) Feeder Monitoring System (FMS) at PEC, engineers are not only able to investigate permanent faults that result in outages but are now able to investigate temporary faults that may cause a momentary for customers served from the substation bus. These temporary faults could turn into permanent outages if not investigated and the cause eliminated. Below is a process that has been developed to utilize the FMS data in analyzing distribution faults.

1.   **Block diagram**

1. arduino-(5v)   4.Hall effect sensor-(24 A)
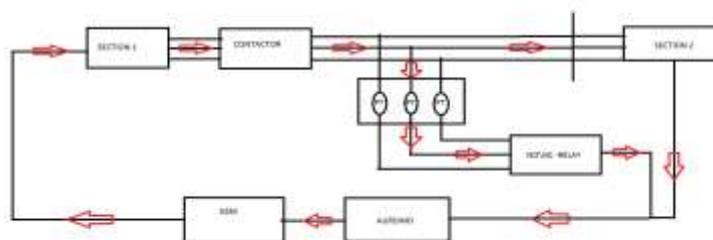
2. GSM module- (sim 900A)   5.optocoupler (contactor)

3. Relay-(120 DC, 10A) (230 AC,10A)

2. COMPONENTS DESCRIPTION

2.1. CURRENT SENSOR

A **current sensor** is a device that detects eletric current in a wire, and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. The generated signal can be then used to display the measured current in an ammeter, or can be stored for further analysis in a data acquisition system, or can be used for the purpose of control.

The sensed current and the output signal can be:
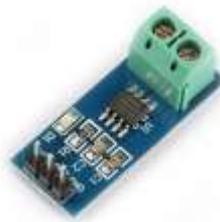
Alternating current input,

- Analog output, which duplicates the wave shape of the sensed current.

- Bipolar output, which duplicates the wave shape of the sensed current.

- Unipolar output, which is proportional to the average or RMS value of the sensed current.

Direct current input,

- Unipolar, with a unipolar output, which duplicates the wave shape of the sensed current

- Digital output, which switches when the sensed current exceeds a certain threshold

Technologies

- Hall effect Sensor

- Transformer or current clamp meter, (suitable for AC current only).

- Fluxgate Transformer Type, (suitable for AC or DC current).

- Resistor, whose voltage is directly proportional to the current through it.

- Fiber optic current sensor, using an interferometer to measure the phase change in the light produced by a magnetic field.

- Rogowski coil, electrical device for measuring alternating current (AC) or high speed current pulses.

The Hall Effect current sensor is a type of current sensor which is based on the Hall Effect phenomenon discovered by Edwin Hall in 1879.

Hall Effect current sensors can measure all types of current signals (i.e. AC, DC, or pulsating current).

These sensors are currently being used widely in many industries because of their vast applications and the type of output they provide, which can be manipulated and can be used for various application

2.2. TRANSFORMER

There are two types of transformer used in field word .They are

- Step up Transformer

- Step down Transformer

In our project we choose a step down up transformer.

STEP DOWN TRANSFOMER:

A Transformer is a static apparatus, with no moving parts, which transforms electrical power from one circuit to another with changes in voltage and current and no change in frequency. There are two types of transformers classified by their function: Step up Transformer and Step down Transformer.

A Step up Transformer is a device which converts the low primary voltage to a high secondary voltage i.e. it steps up the input voltage. A Step down Transformer on the other hand, steps down the input voltage i.e. the secondary voltage is less than the primary voltage.

Real Time Application of Step Down Transformer

The voltage from the Power Plant or Generation Station is around 20kV. In order to transmit this voltage over long distances, it is stepped up to 440kV using a Step up Transformer. This voltage with increased levels is then transmitted to a distribution station.

At the distribution station, the 440kV is reduced to 11kV using a Step down Transformer. The voltage with decreased level is then made ready for consumer use.

Before going in to the details of the Step down Transformer, we will first see the working principle of a transformer in general.

Principle of Working of a Transformer

An electrical transformer works on the principle of Mutual Induction, which states that a uniform change in current in a coil will induce an E.M.F in the other coil which is inductively coupled to the first coil.

In its basic form, a transformer consists of two coils with high mutual inductance that are electrically separated but have common magnetic circuit.

2.3. ARDUINO:

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (*shields*) and other circuits.

The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler tool chains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy,[2] aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuator. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors.

The name *Arduino* comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

2.4 GSM MODULE(SIM 900A)

GSM Module is a device which used to send a message from one device to another device.

Rhydo LABZ's GSM/GPRS Modem-RS232 is built with Quad Band GSM/GPRS engine- SIM900, works on frequencies 850/ 900/ 1800/ 1900 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip(MAX232). The baud rate is configurable from 9600-115200 (default baudrate is 9600) through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface.

The Modem is manufactured with Automatic Pick and place machine with high quality standard .The onboard Low dropout 3A Power supply allows you to connect wide range unregulated power supply . Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet etc through simple AT commands.

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.

3. CONCLUSIONS

- The fault will be analysis and protect the system spontaneously.

- By this project the small amount of current passed through the three phase line detect easily.

4. REFERENCES:

1) INTERNATIONAL JOURNAL OF OCCUPATIONAL SAFETY AND ERGONOMICS 2001, VOL. 7, NO. 3, 285–307 Electric Accidents in the Production, Transmission, and Distribution of Electric Energy: A Review of the Literature Paraskevi E. Batra

2) Fault Analysis of Smart Grid Power System Employing Simultaneous Faults Method Jakub Ehrenbenberger Department of Electrical Power Engineering. Czech Technical University in Prague Technická 2, 166 27 Prague, Czech Republic ehrenjak@fel.cvut.cz