IJETIE International Journal of Emerging Technology and Innovative Engineering
Volume I, Issue 3, March 2015
ISSN: 2394 - 6598
www.ijetie.org

# Automatic Fault Location and Monitoring on Distribution Line with MATLAB

**Nikhil S Navkar**
Department of Electrical Engineering
AISSMS IOIT, pune
nsnavkar@gmail.com

**Akash T Madane**
Department of Electrical Engineering
AISSMS IOIT, pune
akashmadane007@gmail.com

**Sachin G Kalyankar**
Department of Electrical Engineering
AISSMS IOIT, pune
sachinkalyankar14@gmail.com

## ABSTRACT

Increase in demand of electricity for entire application in any country, require to establish new consistently with advanced protection system. There are lots of special protection systems are available based on volume of power distributed and often the load changes without prediction required an advanced and special communication based system to control electrical parameter of generation. Most of the existing systems are reliable on various applications but not perfect for electrical application. Electrical environment will have lots of disturbance in nature, due to natural disaster like cyclones storms, or heavy rainfall distribution lines may lead to damage. The electrical conductors may cut and fall on ground, this leads to very harmful for human beings and may become fatal. So, a rigid, reliable and robust fault location and monitoring system with XBEE communication for substation operation used.

XBEE communication technique is more reliable than other communication technique used earlier. This increases the speed of communication with distance independency. This technology is very useful to saves human life from this electrical danger by providing fault detection and automatically stops electricity to damaged line. Also provide visual indication to substation and electricity board to clear the fault. An embedded based hardware design is developed and must acquire data from electrical sensing system. Any change in parameter of distribution is sensed to protect entire distribution system.

## Keywords

Fault and abnormal condition sensing hardware kit, load arrangement to create fault, XBEE PRO transmitter and receiver unit, display and control unit using MATLAB, special fault protection and monitoring system (SFPMS).

## 1. INTRODUCTION

We ask With the growing population of India and its rising electric power need the demands on the power grid continue to rise. This demand necessitates additional grid reliability. Special fault protection and monitoring system (SFPMS) are an example of a class of protection scheme that can benefit from the use of communication to increase their accuracy and reliability. The job of an SFPMS is to detect system fault and take corrective action. Faults can be broadly classified into two main areas which have been designated “active” and “passive”. Types of fault in three phase system are shown in fig 1.

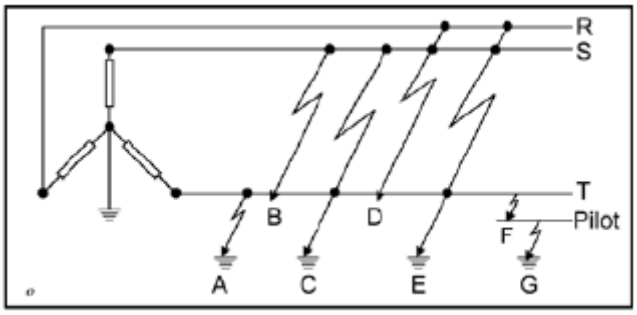


***Fig.1:Types of Fault in Three phase system.***

(A) Phase-to-earth fault.

(B) Phase-to-phase fault.

(C) Phase-to-phase-to-earth fault.

(D) Three phase fault.

(E) Three phase-to-earth fault.

(F) Phase-to-pilot fault.

(G) Pilot-to-earth fault.

IJETIE
International Journal of Emerging Technology and Innovative Engineering
Volume I, Issue 3, March 2015
ISSN: 2394 - 6598
www.ijetie.org

The "Active" fault is when actual current flows from one phase conductor to another (phase to phase) or alternatively from one phase conductor to earth (phase-to-ground). This type of fault can also be furthermore classified into two subgroup, namely the "solid" fault and the "incipient" fault. The solid fault takes place as a result of an immediate complete breakdown of insulation. Passive faults are not real faults in the true sense of the word but are rather conditions that are stressing the system beyond its design capacity, so that finally active faults will occur. Typical examples are: Overloading - leading to overheating of insulation (deteriorating quality, reduced life and ultimate failure). Over voltage - stressing the insulation beyond its limits. [5]

## 2. FAULT CHARACTERISTICS WITH AND WITHOUT FAULT CURRENT LIMITER

Fig-2 shows the wave shape of a typical unlimited fault current as well as the influence on this wave shape if FCL devices with and without fault current interruption capability are applied to the system. A distinction among the different types of FCL is made between passive and active fault current limiting measures. Passive measures make use of already initially high source impedance both at normal and at fault conditions whereas active measures bring about a fast increase of the source impedance at fault conditions only.

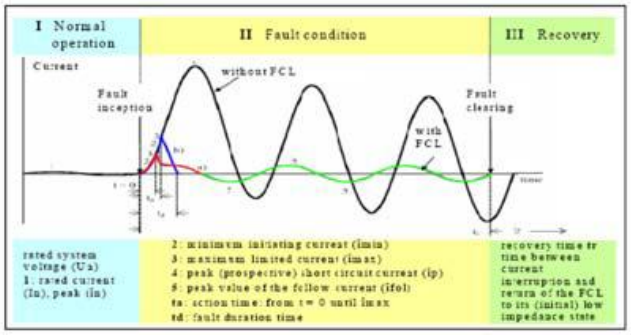


***Fig.2:Typical fault current wave shape and characteristic data***

## 3. BACKGROUND AND LITERATURE REVIEW

Many protection systems are available based on volume of power distributed and often the load changes without prediction required an advanced and special communication based systems to control the electrical parameters of the generation.

## 4. PROPOSED METHODOLOGY

The proposed methodology is based on Robust XBEE technology meets safety reliability and fastest in operation. It consists of a sensing system, advanced embedded hardware for middle level computing, signal conditioning electronic circuits, a powerful XBEE for transmission of data to various places. The above said system can able to locating and monitoring of three phases of distribution lines. But for demo purpose we locate and monitor fault on single phase. The Whole system must be employed to make perfect distribution control system. The system design is shown fig 2. [7][8]

The Sub elements of proposed system are

- Sensing Transformers.
- Signal Conditioners.
- Embedded based electronic Hardware.
- XBEE technology for Data transfer.
- Powerful MATLAB software to display and monitoring.

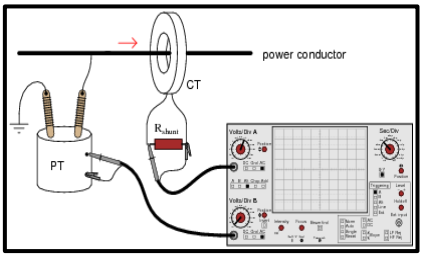


***Fig.3: primary sensing unit***

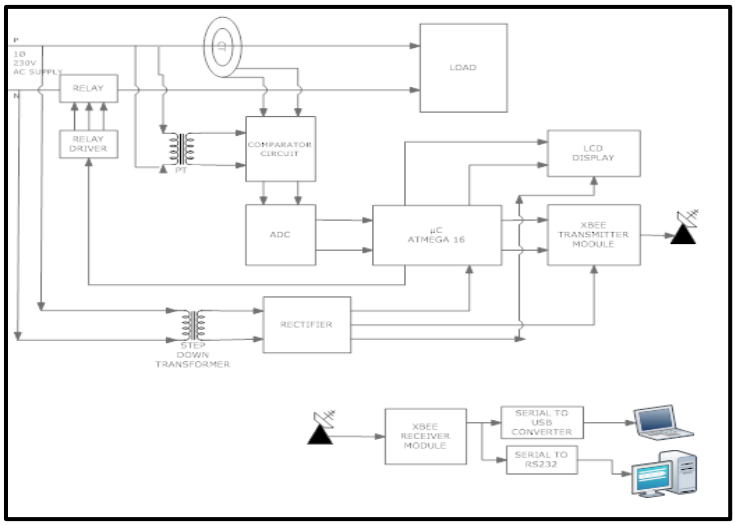


***Fig.2: block diagram of special protection and monitoring system.***

IJETIE
International Journal of Emerging Technology and Innovative Engineering
Volume I, Issue 3, March 2015
ISSN: 2394 - 6598
www.ijetie.org

Control and sensing switchgear refers to the combination ofrelay, current transformer, potential transformer fuses and other electrical disconnections to It is shown in Fig.3 and 4.

***Fig.4: primary protection unit***

Signal conditioners are essential to improve received signals. eliminate the unwanted frequencies during amplification. It consumes very low current from the source. It consists of voltage sensing, current sensing. The voltage sensing will senses any changes in the input voltage and output of the circuit is given to µC ATMEGA 16 in Fig 5.

A Relay driver is an Electro-magnetic Switch which is useful for a low voltage circuit. The relays used in this work are self-contained devices, compact, which respond to abnormalconditions. [13]

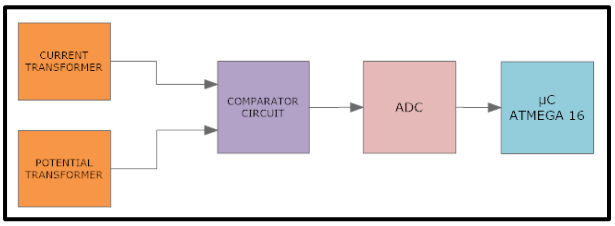


***Fig.5: block diagram of voltage and current sensing unit.***

## 4.1 Design Features:

Fig 5 shows the µC ATMEGA 16 power supply is provided to operation of controller. ADC output givenTo the controller to get input signals from sensing circuit. Output is provided to the XBEE transmitter to transmit the data. XBEE receiver receives data at substation and displayed on the screen using MATLAB software. LCD display used to display real time input isolate electrical equipment. The purpose of switchgear is to sense real time voltage and current to avoid further shut down shut down.

data. External clock source must be used which enables the user to design the required speed. [1][11][12]

.

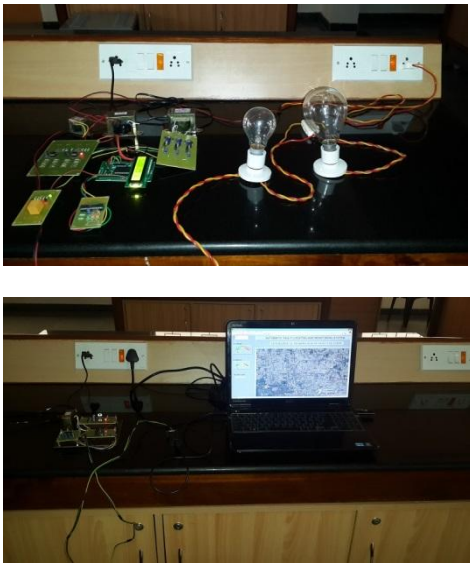

***Fig.6: hardware implementations of special fault protection and monitoring system***

## 4.2 Algorithm with XBEE

Step1: switch ON the supply to circuit.

Step2: adjust the load arrangement to create fault or abnormal condition.

Step3: Initializing the µC values i.e. digital and analog digital values.

Step4: LCD display shows the real time input values from sensing devices.

Step5: Initializing the corresponding components of the XBEE module settings.

Step6: Get voltage and current values from PIC.

Step7: Analog values from PIC will be read and display in the system.

IJETIE International Journal of Emerging Technology and Innovative Engineering
Volume I, Issue 3, March 2015
ISSN: 2394 - 6598
www.ijetie.org

Step8: monitor the values, level, type and location of fault.

Step9: It will check for fault for example if there is overload condition, then it is overload and the circuit is tripped and then send the corresponding data to the substation and displays on monitor screen.

## 5. XBEE TECHNOLOGY FOR DATA TRANSFER

As shown in fig 2. Output of µc ATMEGA 16 is connected to XBEE transmitter module. Data received at substation by XBEE receiver module. In this system XBEE PRO modules are used. [6]

***Fig.7: XBEE PRO module***

Features of this XBEE PRO as shown below

- Indoor/Urban: up to 200' (60 m), 300' (90 m), for International variant
- Outdoor line-of-sight: up to 1 mile (1600 m), 2500' (750 m) for International variant
- Transmit Power: 63mW (18dBm), 10mW (10dBm) for International variant
- Receiver Sensitivity: -100 dBm
- TX Peak Current: 250mA (150mA for international variant)
- TX Peak Current (RPSMA module only): 340mA (180mA for international variant
- RX Current: 55 mA (@3.3 V)
- Power-down Current: < 10 µA

Easy to use:

- Analog-to-digital conversion,
- Digital I/O
- I/O Line Passing
- No configuration necessary for out-of box Radio frequency communications
- Free X-CTU Software (Testing and configuration software)
- API and AT Command Modes for configuring module parameters
- Extensive command set
- Small form factor

## 6. CONCLUSION

This paper shows that a XBEE technique can be successfully apply to the earlier developed communication based special protection systems to increase its reliability during abnormal condition. The XBEE enhances speed of communication with distance independentancy. A suitable authenticated hardware is designed to meet the credibility of the fault location and monitoring. An Embedded based hardware is designed to acquire data from electrical sensing system, it sends from one station to other and change in parameters of distribution to be sensed to protect the entire distribution line. XBEE enables uni-directional communication as a data.

## 7. REFERENCES

[1] Luis A. Oquendo Class, Kenneth M. Hopkinson, *Member, IEEE*, Xiaoru Wang,*Senior Member, IEEE*,Todd R. Andel, and Ryan W. Thomas "A Robust communication based –special protection systemize transactions on power delivery, vol. 25, no. 3, july 2010.

[2] Takay Shono Katsuhiko Sekiguchi, Tatsuji Tanaka Member, IEEE, and Shigeki Katayama. A Remote Supervisory System for A Power system Protection and Control Unit Applying Mobile Agent Technology.

[3] Using key performance indicators to manage power system reliability,john vangroup,Schneider electric. key performance indicators of a transmission

[4] system, Omar H. Abdalla*, Masoud Awlad- Thani, Mohamed Al- Wardi,Khalfan Al- Qaidi, Saqar Al-Farsi, Ibrahim Al-Balushi, and Saeed Al-Mahdhooriaman electricity transmission company, sultanate of a oman.

[5] Fault Location on Power Networks By Murari Mohan Saha, Jan Jozef Izykowski, Eugeniusz Rosolowski

[6] Hands-On ZigBee: Implementing 802.15.4 with Microcontrollers By Fred Eady

[7] R. Das, M.S. Sachdev, T.S. Sidhu, "A fault locator for radial subtransmission and distribution lines", Proceedings 2000 IEEE Power Engineering Society Summer Meeting, vol. 1, 443 - 448.

[8] SHU Hongchun, Sun Xiangfei,Si Dajun. Distribution network fault diagnosis based on rough set theory. Chinese Society for Electrical Engineering [J],2001,21(10):73-77.

[9] Cai Jianxin, Liu Jian.2003 Fault-complaints Based Distribution Network Fault Location imprecise reasoning system Chinese Society for Electrical Engineering [J].23(4):57-61.

[10] Lampley, G. C., "Fault Detection and Location on Electrical Distribution System Case Study," IEEE Rural Electric Power Conference, 2002.

[11] Stergiou, P. V., "Substation Monitoring to Locate Distribution Feeder Faults," PQA Conference, 2005.

[12] Girgis, A. A., Fallon, C. M., and Lubkeman, D. L., "A Fault Location Technique for Rural Distribution Feeders," IEEE Transactions on Industry Applications, vol. 29, no. 6, pp. 1170-5, November/December 1993.

[13] S.R. Samantaray, P.K. Dash, “Pattern recognition based digital relaying for advanced series compensated line,” a National Institute of Technology, Rourkela, India, Orissa 751 024, 6 June 2007.

[14] IEEE Std. C37.114-2004 “IEEE Guide for Determining Fault Location on AC Transmission and Distribution Lines,” In: Proceedings of IEEE transmission and distribution conference, 8 December 2004.