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THREE PHASE LINE FAULT DETECTION ON DISTRIBUTION LINES USING GSM TECHNIQUE

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ABSTRACT

A TPLFD circuit provides visual indication and remote detection of the abnormal condition on electrical power distribution system. Whenever fault occurs on three phase line there is a need to detect the location, to reduce the patrolling time and clear the fault by communicating with area In-charge as soon as possible. This device improves communication speed which does not depend on distance. This technology gives the exact location of fault and automatically isolates the damaged line and also carries the calls and messages through GSM module to respective authority to clear the fault.

Keywords
TPLFD - Three Phase Line fault Detection, GSM – Global System for Mobile communication module.

1. INTRODUCTION

In day by day increase in electricity supply requirements which increases demands on the network of power lines. This system requires reliable service to power grid. The special protection schemes that could be beneficial by using communication scheme to increase the accuracy & reliability. There are some examples of fault over loading solid faults (i.e. Single line to ground, Double line to ground, Line to line, Triple line to ground, Three phase short circuit Faults), Overvoltage & Under voltage fault.

Using distance protection is a challenging application. A distance relay must correctly identify a single phase fault, and trip only the circuit breaker pole for the faulted phase. The relay also must initiate the reclosing and breaker failure elements correctly on the fault event. The distance elements protecting the healthy phases must maintain security during the open-pole condition and any reclosing attempts.

But in recent condition these conditions are become so critical that the demand at distribution sector is increasing and much time delay of the dead condition of the supply affects the economics growth of Industry or the commercial. To get the proper supply without any disturbances there are many devices used for locating fault such as, PLC, SCADA system, FACTs devices, GSM techniques, GPS techniques, etc.

2. OBJECTIVES

This TPLFD gives the fault location and immediately isolates the faulty part from the healthy part of the network. The circuit under this faulty area creates a messages of location provided to it and will be transferred it directly to the area In-charges rather than the Electricity board. Also at each and every pole the RYB indicators are placed which gives ease of access of faulty phase up to the fault location. According to our survey the cost of one Distance relay is 65 times higher than our TPLFD circuit, so it is also economically beneficial. It can be used for Distribution (400V to 11kV) as well as Transmission (33kV to 765kV) line by replacing the C.T according to the required ratio.

3. CURRENT TECHNOLOGIES

3.1 Distance Relays

Fig.1 Distance Relay

Distance relays respond to the voltage and current, i.e., the impedance, at the relay location. The impedance per mile is fairly constant so these relays respond to the distance between the relay location and the fault location. As the power systems become more complex and the fault current varies with changes in generation and system configuration, directional over current relays become difficult to apply and to set for all contingencies, whereas the distance relay setting is constant for a wide variety of changes external to the protected line.

There are three general distance relay types -

1. Impedance Relay
2. Admittance Relay
3. Reactance Relay

4. PROPOSED METHODOLOGY

4.1 Block Diagram

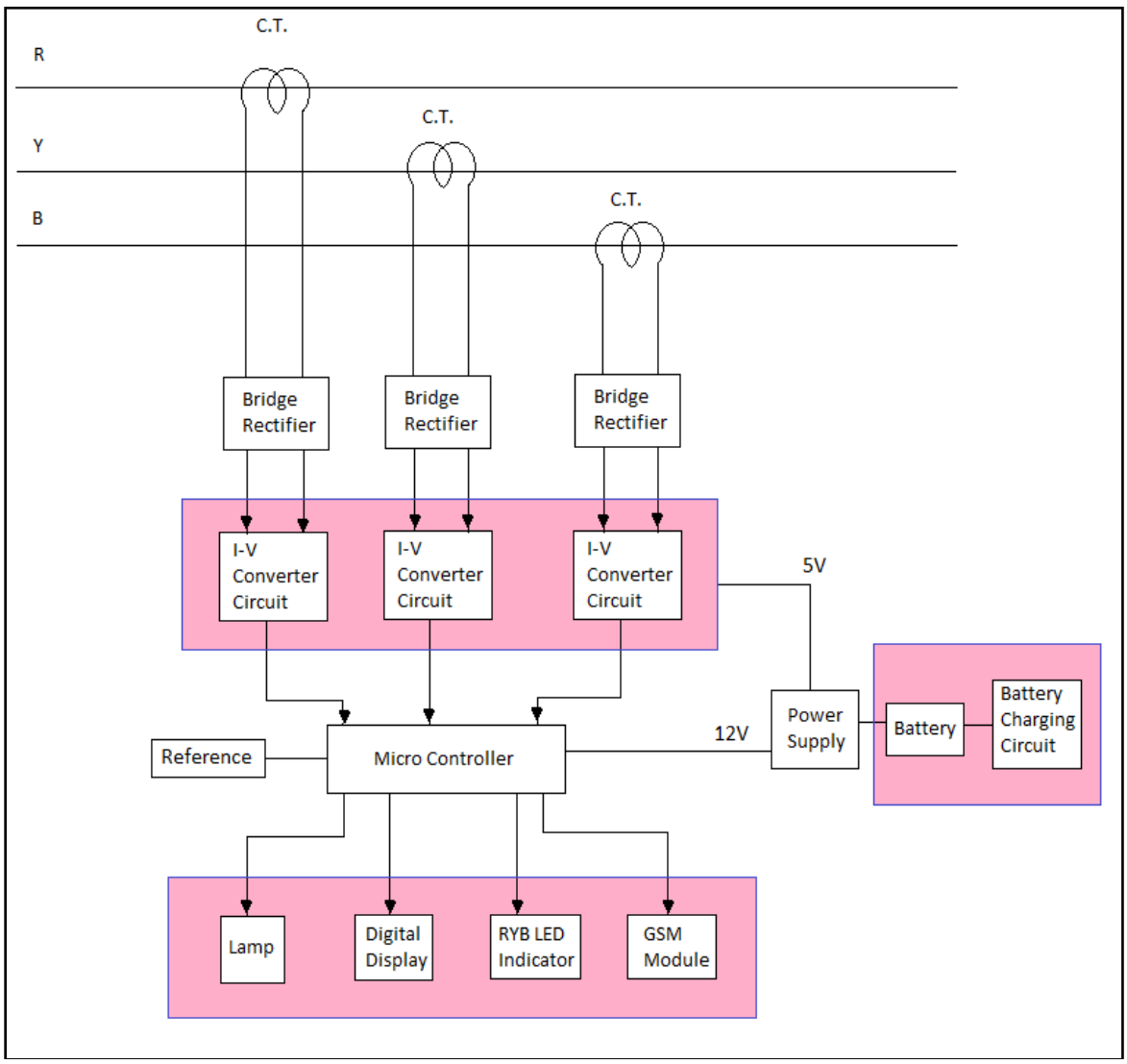

Fig.2 Block Diagram of Hardware

A Three Phase Line Fault Detection (TPLFD) is a device which provides visual indication & remote detection of the abnormal condition on electrical power distribution system. The solid faults as mentioned can be detected by GSM module via calls and messages. While patrolling of this fault it can be indicated by RYB indication lamps, in recent working condition impedance relay or distance relays are used to locate the fault. But this requires long time to calculate the distance using the impedance & the pre-fault current, till to reach the fault location and repair the faulty phase, the system will be in OFF state and the supply to the consumers is unreliable.

In LFD we had used the Current transformer (C.T.) of good sensitivity. As shown in Fig.2 the C.T. is connected or Clamped on each phase and the secondary terminal of each C.T. is connected to three single bridge rectifier which gives D.C. current and converted into respective voltage by using I to V converter. Here some reference output voltage with respect to current is set to the input of microcontroller. Here the microcontroller circuit acts as the zero crossing detector, if the voltage of any circuit exceeds the reference voltage then the microcontroller sends the command to the GSM module and relay of phase indication lamp.

The GSM module creates the message using microcontroller which reads the faulty phase and the location of feeder and sends it to the Operator, Sub Engineer and Junior Engineer of that location. After these the operator will receive the location of fault and faulty phase and alerting calls at certain period. If that operator does not respond the clearing of fault or reset the abnormal condition to normal condition in between the period of calls. The next call will be transferred to the area Sub Engineer; similarly if Sub Engineer does not respond to the Operators work then further call will be transferred to the Junior Engineer.

By this process the work or clearance of fault will be done quickly with their responsibility. The RYB indication is placed at the top of the pole or tower which will indicate at long distance and shows the faulty phase from far end which will shows the actual location of fault and hence Operator can find out the TPLFD circuit and can repair. The digital display is provided to show the pre fault current and the faulty phase on the location. Also after the fault is occurred the supply to the circuit is disconnected, So the external battery source with battery charging circuit is provided to keep the TPLFD circuit continuously in operation.

5. ALGORITHM

Step 1: Start

Step 2: Initialization of reference voltage value.

Step 3: Continues comparing voltage of each phase with reference value.

Step 4: If any phase voltage is more than reference value then ON the corresponding LED else go to step3.

Step 5: Send message of fault location to three authorized persons.

Step 6: Wait for response from first authorized person.

Step 7: If no response then make a call to same person else go to step 3.

Step 8: If no response from first authorized person then make a call to second authorized person else go to step 3.

Step 9: Wait for response from second authorized person.

Step 10: If no response from second authorized person then make a call to third authorized person else go to step 3.

Step 11: Wait for response from third authorized person.

Step 12: If no response from third authorized person then repeat from step 4. else go to step 3.

6. FUTURE SCOPE

[1] In future we can make a voice call which give information about fault and fault location.

[2] In future by using SCADA system the fault location will be displayed on computer screen.

[3] Separate three microcontrollers for individual phase can be provided to give accuracy of the fault indication.

7. RESULTS

7.1 R phase Fault Indication

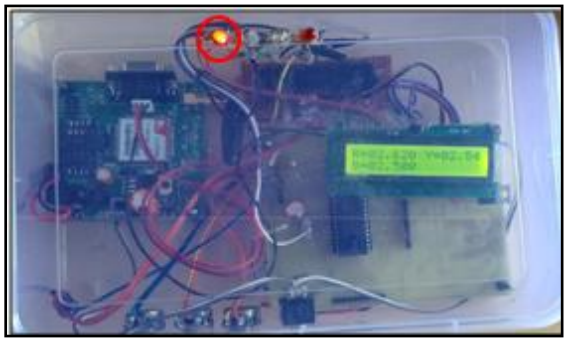

Fig.3 R phase fault indication

7.2 Y phase Fault Indication

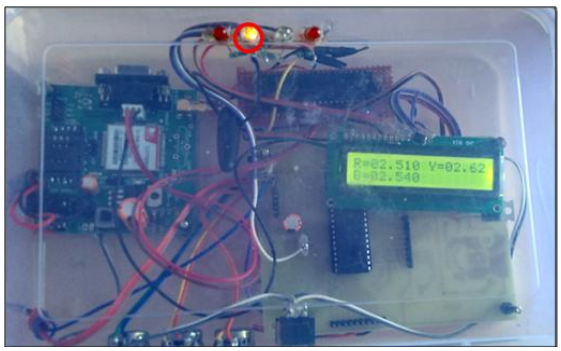

Fig.4 Y phase fault indication

7.3 B phase Fault Indication

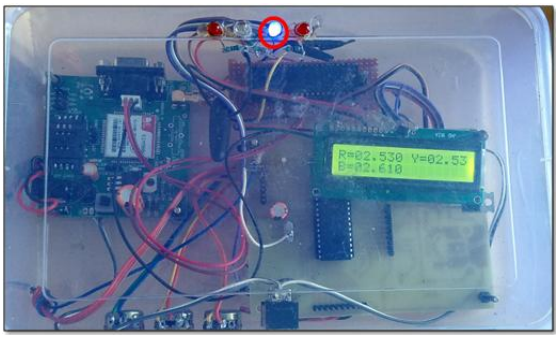

Fig.5 B phase fault indication

7.4 Sample Fault Indication Alert Via Message

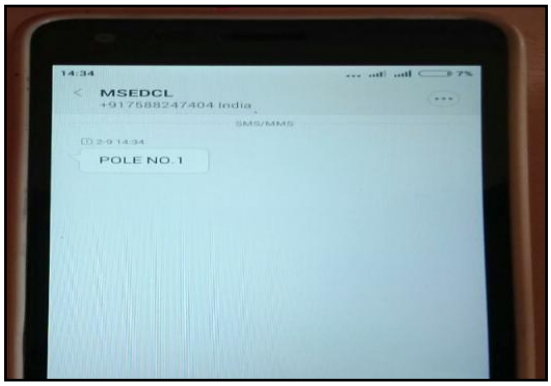

Fig.6 Sample Fault Indication Alert Message

7.5 Sample Fault Indication Alert Via Call

Fig.7 Sample Fault Indication Alert call

8. CONCLUSION

This paper concludes that the GSM technology used for the fault detection of three phase line through calls and messages is provided to the In-charges of that location, by the means of communication protection schemes. The Messages of fault location will send to the all In-charges at a same time by the internal programming of microcontroller connected to GSM Module. But the Calls at some delay will forwarded to that area In-charges according to their post of working Authority. Also the Lamp or Buzzer can be provided if any of the area In-charge doesn't respond the clearing of fault. To get the exact faulty phase under abnormal condition has been occurred, the RYB Indicators are also provided for faulty phase indication purpose.

9. REFERENCES

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