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Fault Detection and Monitoring in Distribution Line System using Wireless Network

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Abstract: ***Distribution lines plays a very important role in our power system. With the help of transmission and distribution lines the consumers receives electricity thus a fault in the distribution line interrupts the continuity of electricity in the specified area and it takes a lot of time to clear the fault.***
Thus its necessary to clear the fault as early as possible, so with the help of microcontroller and gsm technology the operator of the electricity board can clear the fault as early as possible. This paper presents an overview and an approach of Distribution Line Fault Detection.
For preparing this paper we've studied numerous papers related to the topic and have successfully analyzed them. On the basis of the literature review, we have proposed our system offering rigid, reliable and robust communications like GSM technology, wireless network using ZigBee.
This increases swiftness of communication with distance independency. This technology saves human life from electrical hazard by providing fast fault detection and stops the electricity of the damaged line and sends sms to the electricity board to clear the fault.
Keywords: Distribution line, Fault Detection, GSM technology, Automatic fault detection, Wireless network, Fault locating system, Transmitting unit, Receiving or Substation unit, LabVIEW (Laboratory Virtual Instrumentation Engineering Workbench)

I. INTODUCTION

Leading in a fast moving world it's very important that there must be modifications in our Power System Network, we must move from analog to digital monitoring and enhance the time response of our power system network. This paper represents the Protection of line on the applications of fault detection technology. This addresses the detection of those abnormal conditions where an interruption in supply occurs due to the overcurrent flowing in line . Detection of fault on line is done by automation. System automation has become the demand of the day.

In fact most of the systems are impossible to be controlled by human beings. As fault analysis became important requirements of the electrical power system so it needed to become more accurate. The need for automatic fault clearance became a necessity. There are combinations of a breaker and a relay protection system during a typical fault cleaning system. The main parts in the protection system are wiring, transducers, auxiliary power supply, switches, circuit breakers, relays and the operating coil of the circuit breaker. Earlier faults were automatically cleared by electromagnetic relays. The electrical quantity, which is voltage or a current, was transformed to a mechanical force.

This mechanical force operates the relay when a preset threshold was exceeded. But nowadays the solid state relays are developed so that the operation can be performed easily and accurately.

With the present system, slow fault detection leads to many accidents like electrocutions, fire accidents. In India Accidental Deaths survey shows about 283 people lost their life by electrocution in the year 2017 and 286 people in the year 2018. Thus the death rate due to electrocution should be minimized to a minimum as each and every life matters.

Present Fault locating systems will just give the intimation about the faults in control panels and it does not give any information to the service man.

There is no message passing system present in the latest technologies. Due to no information passing system it may lead to so many accidents which leads to many losses of life and properties. So there is a need for special equipment which finds out the fault locating area and it is necessary to be informed to the serviceman at that moment. In this Fault locating system it finds out the fault and informs the service persons using GSM module respectively..

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II. LITERATURE SURVEY

Sr. No.	Paper Title	Year	Work
1.	Fault detection and Autoline Distribution System with GSM module	2016	Author investigated about the over current and under voltage fault conditions and to clear them economically
2.	Distribution line Fault Detection and Intimation using GSM	2016	Author uses microcontroller and GSM based method to detect and Intimate The Fault
3.	Distribution Line Fault Detection & GSM Module based Fault Signalling System	2016	Author investigated about online monitoring of the distribution transformer

III. REVIEW OF RESARCH PAPERS

As we all know that power systems is required for generation and distribution of power for various purposes so their protection and efficiencies are important aspects. There are many types of faults which occur in power systems which need to be cleared as soon as possible so that power systems don't get affected and they are not harmed to severe conditions. So there are many methods of fault detection and their removal which requires a lot of manpower and time consumption and also real time fault detection is not possible . So in these research papers the author has discussed and provided a very fast and cost effective solution to this problem which is the fault detection by GSM technology . In this technique a microcontroller is used which is the heart of this module ,in this breach in pre short circuit limit is monitored by comparing the present sensed with the pre set limit. If the current sensed is quite the pre set current short limit, the PIC microcontroller sends a sign for the relay to trip off the system, else the system remains connected .whenever the set short circuit limit is breached, the system sends a fault detection SMS alert to the utility mobile phone a bidirectional communication can also be achieved as the system receive command from utility phone to set a short circuit limit. So this technology of GSM module gives a fast real time fault location and also various parameters raised or decreased due to fault is also shown on LCD screen . So a very good monitoring of faults and their fast detection is possible through this technique so that faults don't create a big damage . But the only difficult part is to incorporate all the sensing parameters for the fault analysis because it makes the programming complex. These papers were about designing the controls of an overcurrent relay using a microcontroller. Microcontroller based relays have found their importance growing day by day since it's far more efficient in its working than the mechanical relay conventionally used.

Microcontroller based relays use the controller to read the load current. The load current is read via a CT, a current transducer and an analog to digital converter fed to one of the digital pins of the microcontroller. Use of microcontrollers can enhance the time response of the system so as to recognize huge faults occurring for a short period of time.

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The main attention of the whole circuit in these research paper is the use of a GSM module which is employed to send the status of the circuit to the operating personnel, as well as make the circuit controllable from his/her side. Depending upon the amplitude of the fault, the microcontroller is coded accordingly to prevent the circuit from severe damage also it sends signal to the GSM module which effectively sends SMS to the personnel regarding the condition/status of the circuit .If the fault is rectified either naturally or through some manual efforts within a particular period of time, then the code is made intelligent enough to restart the circuit. Thus, the introduction of microcontroller was being made in order to somewhat add an automotive touch to the project.

IV. APPROACH OF OUR PROTOTYPE MODEL

Using this smart fault locating and monitoring system we will computerize and locate the right fault location and control the electrocution by automatically shutting down the facility supply therein particular area and giving information to the service man by sending sms and computerized voice calls.

In this system we are using LabView ,virtual software which uses 'G'programming. The substations is connected with array of fault indicators in distribution lines. The interruption in line is sent to a substation using wireless communication device(Zigbee) which is connected to microcontroller and interfaced with the labview software in substation or local monitoring stations. It monitors the fault for every second ,in case if any area is under fault the system will automatically generate the SMS and voice call to the service man and also shut down the power in that area which will minimize the electrocution and enhances the fault clearing time as of compared now.

V. BLOCK DIAGRAM OF PROPOSED SYSTEM

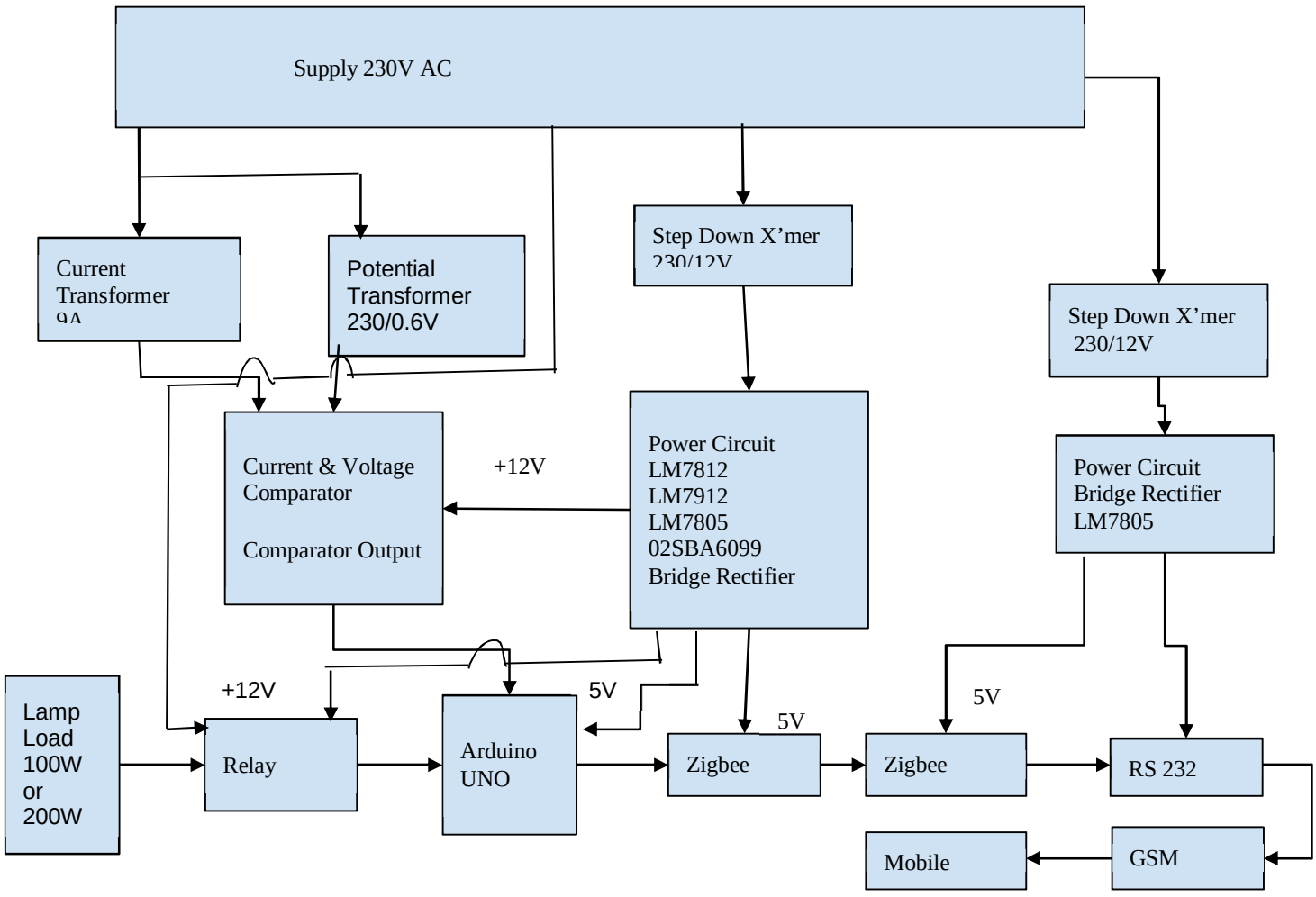


Fig-1

The above Block diagram represents the entire controlling of the power system.It has the following parts as

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A. Step Down Transformer

It is used for Step Down of 230V AC supply to 12V AC.

Two step down transformers are used one at transmitting end and the other at receiving end.It converts the 230V AC into 12V AC.

B. Power Circuit

In order to provide power to the appliances used in the prototype, a power circuit is used, since the appliances can be powered by +-12V and 5V dc, the power circuit comprises bridge rectifier and voltage regulator. The bridge rectifier is used to convert the 120V AC in 12 V DC .With the help of voltage converter we obtain the desired dc voltage required by each appliance in the prototype. Two power circuits are used in this model, one at transmitting end and the other at receiving end .

1) *Transmitting Unit:* It contains bridge rectifier ,LM7812 , LM7912,LM7805 and voltage converter which gives +-12 V and 5V DC respectively 12V DC is fed to the comparator and relay. 5V DC is fed to arduino and Zigbee.
2) *Receiving Unit:* Power circuit at receiving unit consists of bridge rectifier , LM7805 and voltage converter .It provides power to Zigbee receiver and RS232.

C. Current And Potential Transformer

It is used to reduce the current and voltage of AC input supply, so that they could be compared with the reference value in the comparator .Potential transformer is connected in parallel with the input AC supply load and relay.

D. Comparator

The voltage and current comparator is used for comparing the input voltage and current. In case of overcurrent it sends a signal to the arduino.It is powered by 12V Dc supply.

E. Relay

Relay along with circuit breaker is used for breaking the faulty section of the circuit from the healthy section .Thus it plays a very important role in a power system. Here in case if overcurrent is flowing through the lamp load the relay actuates and disconnects it from the supply .

F. Arduino UNO

It is the microcontroller which is used for controlling and displaying current and voltage value of comparator on the LCD connected to it .It is used to give signal to the relay and zigbee.It is powered by 5V DC.

G. ZIGBEE

It is used to transfer the data from one location to another through wireless transmission.The range of Zigbee is 100m .It consists of Zigbee transmitter and Zigbee receiver.It is powered by +5V DC.

H. RS232

It is used to convert 4 bit data into 8 bit data and sends it to the GSM module. RS232 is a protocol that details how a stream of data bits is sequentially transmitted onto a wire i.e. a bit stream. The order and meaning of each bit is defined by the protocol. The given explanation below is sufficient to understand RS232 RS232 is a serial information transfer protocol standard which defines both the protocol (method of transmission of data) and the physical hardware to do it.

I. GSM Module

Global System for Mobile communication or GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system.

VI. ADVANTAGE

A. The system helps in identification of exact faults in the respective phase .
B. Arduino based development provides major sophistications and flexibilities.
C. Minimises human interface
D. Improves the system time response and performance.

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VII. APPLICATION

A. This prototype model has a controlling feature through wireless network so it has a major application in remote places where distance between distribution network and substation is large for example in rural areas.

B. It can be used in mining areas where we could easily monitor the voltage and current and fault without going into mines.

C. In a large industry where large electric networks are present, monitoring and detection of faults in any section of an electric network is easy by this prototype model.

D. A large area of Distribution System could be easily monitored by a single substation unit and rate of detection of fault is faster than other convention means

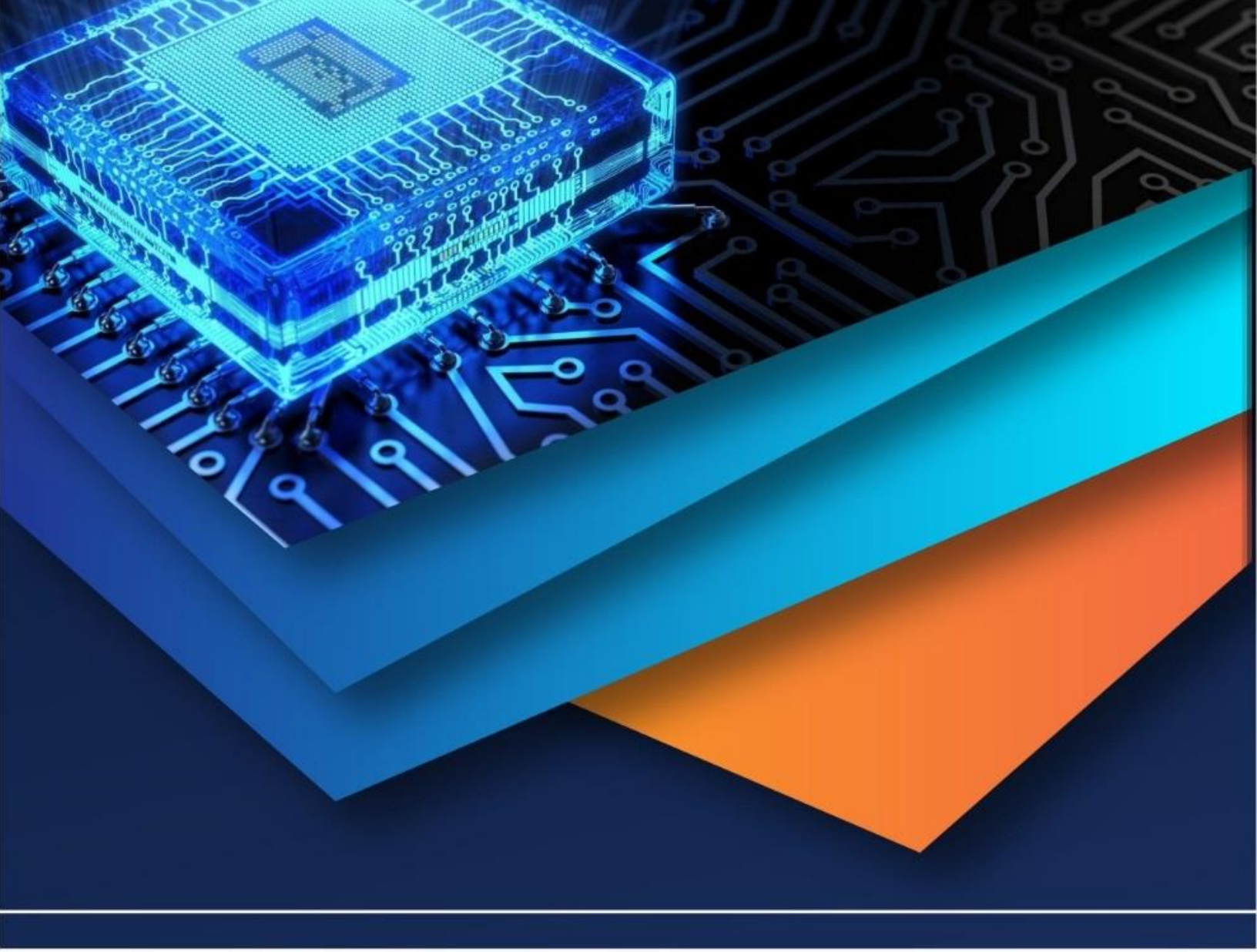
VIII. CONCLUSION

This paper concludes that the GSM technology which is used for the fault detection in the distribution line ,sends a message to the incharge of that location. The message of the faulty location will be sent to the incharge by the internal programming of arduino connected to GSM module. To get the exact faulty phase under abnormal condition ,the RYB indicators are also provided for faulty phase indication purposes .If this system is implemented, our system will become reliable with enhanced time response, which is our main vision.

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