

Automatic Electrical Fault Identification and Alerting System

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ABSTRACT: Recent days, death rate of humans and animals are increased due to direct contact with the broken or hanging electrical wires with supply. Safety circuits in distribution of electrical energy insufficient and thus the line remains active even the electrical wires got broken. This paper describes a modification in the automatic detection in electrical wire breakage in the power distribution system. Circuit breaker with shunt trip mechanism breaks the supply and avoids damages from electrical accidents due to breakage problems in overhead transmission lines. This system improves the safety by using the various communication devices to provide indication about the amount of voltages transmitted from one section to another in order to break the supply if any unwanted incidents taken place.

KEYWORDS: Power demand, Breakage, Safety system, Automatic monitoring.

I. INTRODUCTION

As demand of the worldwide power increases, the producing limit and power exchange through transmission lines should be upgraded; in the restricted vitality assets, deregulated power showcase, ecological limitations, time and capital required to construct new transmission systems has driven the framework organizers to search for the new strategies to enhance the power framework execution.

Distance relay-based protection is for the foremost part used for securing the transmission framework amid the deficiencies. These distance transfers attempts to locate the powerful impedance amid fault by estimating the basic part of voltage and current. The utilization of numerical relays began in mid-1980's, these microchip-based transfers are especially adaptable and were using different techniques, such as counting., to alleviate the impact of off base estimation of impedance in light of the use of first request differential line conditions.

The algorithm which utilizes first order differential line conditions for impedance estimation requires digital filter to extricate key parts and henceforth, initiates delay in the estimation of impedance. With the improvement of shabby and quick chip, the defensive relay utilizations Discrete Fourier Transform (DFT) for estimation of impedance relating to the basic part. In the existing process there's no automatic system for locating the source of line break occurrence. The identification and rectification are done by manually which is shown in figure 1. To overcome this, proposed project is used.



Figure 1: Damaged pole under dangerous situation.

II. RELATED WORK

The following are the reviews from previous works. These are many alerting systems for breakage of conductors in power distribution lines which were implemented in the past. Many researches were done to design a perfect system to identify the breakage of conductors in power distribution lines by using modern technologies. The designs so far consist of Hall Effect current sensors, voltage sensors, magnetic sensors for voltage and current measurement in order to differentiate between the healthy and broken lines of electric poles.

Ferreira and Emanuel [1] explored the possibility of replacing current transformers with magnetic field sensing coils. The coils were located at the sending and receiving ends of the power lines, in the proximity of the conductors. Rather than monitoring the current in each individual phase conductor, magnetic flux sensors allowed cable monitoring by means of a one collective measurement. They proposed the usage of magnetic field sensors because during fault transients, the secondary current is not a true replica of the primary current that might cause deviation in accurate measurement.

Liao[2] presented novel fault-location algorithms for overhead distribution systems which provided a unified solution that would eliminate or reduce iterative procedures applicable to all or any sorts of faults. Two sort of methods, respectively, for non-radial systems and radial systems had been proposed by utilizing voltage and current measurements at the local substation. The proposed methods were supported on the bus impedance matrix, through which the substation voltage and current quantities might be expressed as a function of the fault location and fault resistance, an answer to which yields the fault location. The methods were developed in phase domain and, consequently, were naturally applicable to unbalanced systems. The assumptions made were that the distribution network parameters and topology were known so that the bus impedance matrix could be developed.

Sujatha and Vijay kumar [3] proposed a methodology based on Robust GSM technology that could meet safety, reliability and speed in operation. It comprised of a sensing system, signal conditioning electronic circuits, advanced embedded hardware for middle level computing, a strong network for further transmission of knowledge to varied places. The above said system was able to communicate with one grid and its subsequent related actions. This system is an Advanced Intelligent Electronic Device (AIED). The system used GSM technology rather than Wireless Sensing Networks to enhance the speed of communication independent of distance.

Abraham et. Al [4] described a simple method to implement a wireless embedded system to monitor the RMS current on an electric power line. The system used a set of low data rate ZigBee (IEEE 802.15.4) based wireless transceivers for the communication. The description included functions like current sensing from the electric line using transducer, signal conditioning using analog circuits, analog to digital conversion and serial transmission by microcontroller, RMS calculation, serial data framing, and wireless communication and monitoring. By using clip-on (split-core design) current sensors and enclosing the entire transmitter unit during a detachable casing, the system was mounted on the line without interrupting the facility flow through the line.

D. Ferreira et al [5] proposed a procedure that was based on matching both magnitude and angle of the load impedance at the local terminal before fault and the load impedance estimated through the power-flow analysis. This method used time-varying load profile of distribution systems by using an iterative procedure that updated the load data used in the fault location algorithm. The main drawback of the impedance-based fault location technique is that it depends on the system loading conditions during the fault interval.

III. METHODOLOGY

The proposed system continuously monitors if any discontinuity occurs in power line due to any physical breakage in the cables. The pole module consists of a Voltage sensor. The voltage sensor is used to measure the input voltage from the power station and that value is transmitted to the next section using WSN. The block diagram of pole module and substation modules are shown in given in Fig.2 and Fig.3.

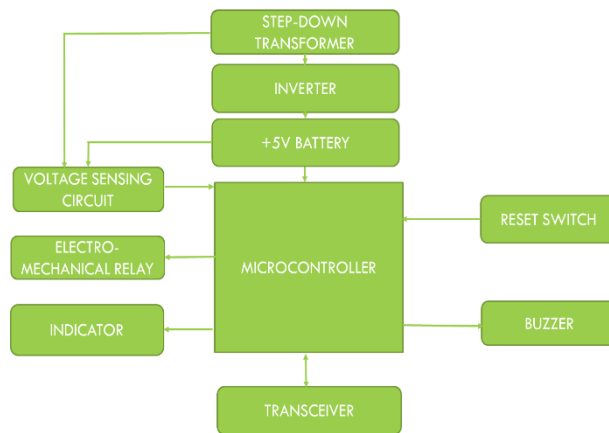


Figure 2: Block diagram of pole module

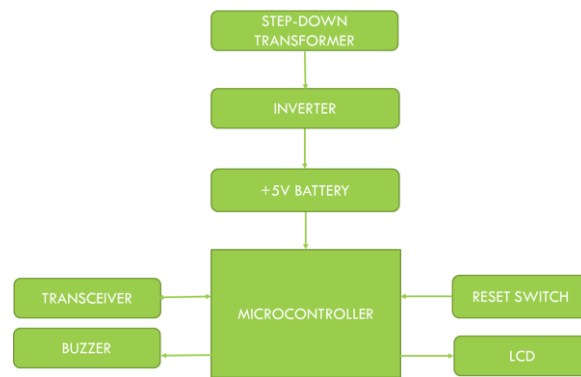


Figure 3: Block diagram of Sub-station module

The driver circuit is used to control the voltage from power station to the next section. The next section receives the voltage level from first section and measures the input voltage from the first section. If both values are approximately same, then it transmits the voltage to the next section. If a rapid change is found by the voltage sensor in the second section, then a signal is transmitted to the first section indicating that a rapid voltage change is occurred. Also, the power supply from first section to second section is cut-off. If the second WSN section receives approximate voltage values from the first section, then the voltage is directed to the third section. Now the voltage received by the second section is transmitted to the third section using driver circuit and also the voltage values of the second section is transmitted to the third section using WSN. Now the received power is verified by the third section.

If the received voltage is approximately equal, then there's no breakage within the circuit. If any change occurs then the WSN of the third section transmits a signal to the second section indicating that rapid change is occurred. Based on this signal, the voltage from second to third section is turned OFF by the controller. Whenever a change in voltage is occurred between any two sections then the respective buzzers connected with the sections starts alerting the public. The statuses of the circuits are displayed on the LCD display. The flow of the process is represented in Fig.4.

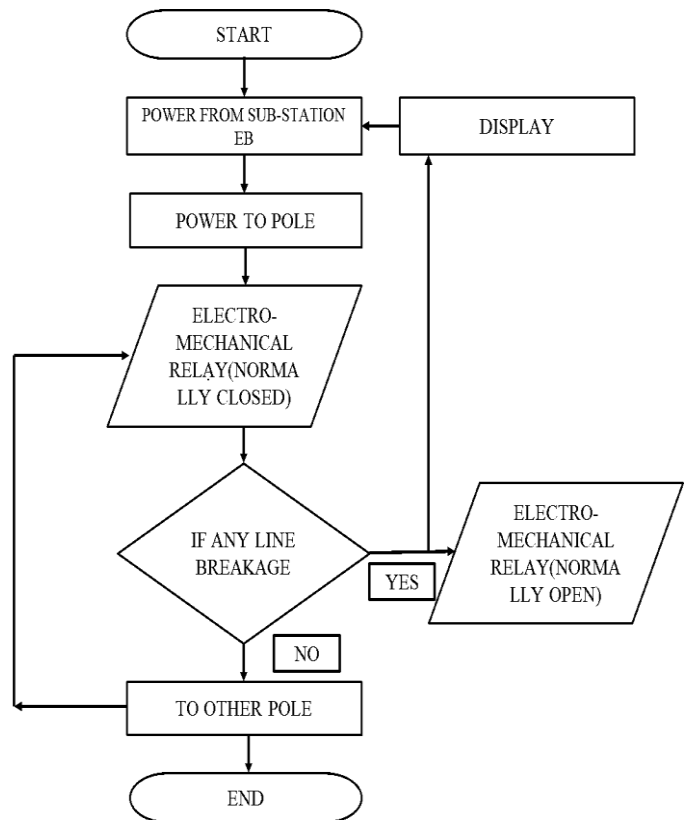


Figure 4: Flow chart.

3.1. SUB-STATION

It's a main power distribution centre from here only the power is distributed across city. Power distributed through multiple transformers and poles. Here, the sub-station consists of Microcontroller, transceiver, LCD & buzzer. It simply receives information from damaged pole with the help of transceiver then it displays serial number of a pole which has been damaged and gives an alert sound using buzzer.



Figure 5: Working model of Sub-station module.

3.2. POLE 1

It also consists of almost same components as the sub-station module but here it has one more component called relay which acts as switch. Whenever a wire breakage is found it will send information to the sub-station and the relay in previous sub-station turns OFF power supply to present pole to avoid the damage an electrical wire could cause.



Figure 6: Working model of Pole module-1.

3.3. POLE 2

It also consists of almost same components as the sub-station module but here it has one more component called relay which acts as switch. Whenever a wire breakage is found it will send information to the sub-station and the relay in previous sub-station turns OFF power supply to present pole to avoid the damage an electrical wire could cause.



Figure 7: Working model of Pole module-2.

IV. EXPERIMENTAL RESULTS

Whenever the current is passing through the power line this corresponding kit will observe the current conduction using the voltage regulator step-down transformer and PIC microcontroller.

Case 1(Normal state):

If there is no fault in the power line the conduction will be normal on the line. Then the PIC will detect that through its B-port (I/O pin). RB7 receives its input from the voltage regulation circuit, normally the pin RB7 will be in high state (5v) the circuit will send the signal to the HC-12 wireless communication device.HC-12 device sends the signal to the previous poles kit, which is the signal used to indicate that there is no fault in all the kits.



Figure 7: Sub-Station Module in Normal state



Figure 8: Pole 1 Module in Normal state

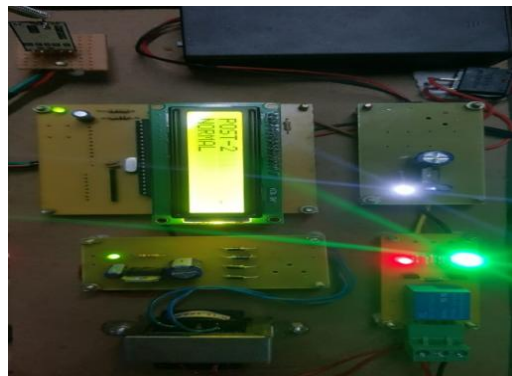


Figure 9: Pole 2 Module in Normal state

Case 2(Fault between Pole1 and Pole2):

If there is the fault in between the pole-1 to pole-2 in the power line the conduction will be stopped on the line. Then the PIC will detect that through its B-port (I/O pin). RB7 receives its input from the voltage regulation circuit, When the pin RB7 hits Zero the circuit will send the signal to the HC-12 wireless communication device.HC-12 device in the pole-2's kit will send the signal to the previous poles kit, which is the signal used to shut down the power through the damaged line.

Once the signal is passed from the pole-1's HC-12 transceiver, pole-2 kit will receive that signal, once that signal is received the PIC will act to shut down the power to the next pole with using relay an electrically operated switch.PIC will send the signal to the relay which will be in the normally closed mode by default, Once the signal is received by the relay it will change to normally open mode. By which we can shut down the power through that faulty line. These processes will similar for the continuous sequence of pole following pole-2.

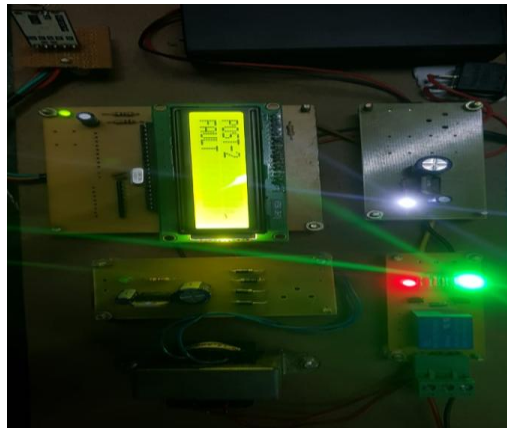


Figure 10: Fault in Pole 2



Figure 11: Information passed to Sub-station

Case 3(Fault in Pole1):

If there is the fault in between the substation and the pole-1 in the power line the conduction will be stopped on that line. Normally the PIC will detect that through its B-port (I/O pin). RB7 receives its input from the voltage regulation circuit, When the pin RB7 hits Zero the circuit will send the signal to the HC-12 wireless communication device.HC-12 device sends the signal to the substation kit, which is the signal used to shut down the power through the damaged line.

Once the signal is passed through the HC-12 transceiver in the pole-1, substation kit will receive that signal, once that signal is received the PIC will act to shut down the power to the next pole in the transformer along the way. To indicate the fault in that line we used a buzzer in the kit.

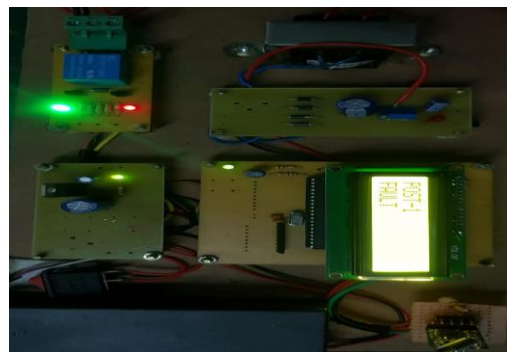


Figure 12: Fault in Pole 1



Figure 13: Information passed to Sub-station

V. CONCLUSION

Electricity wire breakage is a common issue and it is extremely dangerous for living beings where their lives could have been lost due to high voltage. This system not only solves this issue but also informs the authorized person with specific identification of pole for further rectification.

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