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Smart Fault Identification and Monitoring of Transmission Line using X Bee

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Abstract: There are several proposed or developed systems to locate faults on power transmission Lines. The conventional systems employ methods that are very different from the proposed one. They are based on transient detection on phase cables and make the measurements only at the edges of the transmission line to estimate the fault position. These systems do not perform well with branched transmission lines because of line reactions at the branching points, and neither with parallel lines because of the mutual coupling of adjacent circuits. Here, we propose a new method to locate faults on transmission towers. Line-to-ground Or line-to-line faults induce voltages, which on partially to ground through the towers. In the towers closest to the fault position, the voltages are greater and this behaviour can be used to locate the fault

Keywords: Sensors; X Bee.

INTRODUCTION

Faults in transmission lines often occur in remote locations and repairing them can be time consuming, especially if the location of the fault is unknown. So, for this there is a need to smartly identify the type of fault and the location of the fault occurred on the trans-mission lines. The occurrence of the faults can be due to lightning strikes, heavy winds etc. and thus leading to line breaks. So our project smartly identifies the location of the faults occurred and report it to the server room from where all the necessary actions will be taken to solve the problem .In this project we are monitoring transmission line faults. Electricity is generated in power station. From these stations electricity is send to various places through transmission lines. Long transmission towers are used for Transmission lines. Transmission Towers are electrically separated from transmission lines by ceramic material. Causes of faults to were numerous, e.g., lighting, heavy winds, trees falling across lines, vehicles colliding with towers or poles, birds, line breaks, etc. Here we are detecting faults occurring due to lightning, due to vibration and loosening of wires. There are several proposed or developed systems to locate faults on power transmission lines. The conventional systems employ methods that are very different from the proposed one. They are based on transient detection on phase Cables and make the Measurements only at the edges of the transmission line to estimate the fault position. These systems do not perform well with branched transmission lines because of line reactions at the branching points, and neither with parallel lines because of the mutual coupling of adjacent circuits.
Here, we propose a new method to locate faults on transmission towers. Line-to-ground or line-to-line faults induce voltages, which on partially to ground through the towers. In the towers closest to the fault position, the voltages are greater and this behaviour can be used to locate the fault.

Abbreviations

1 ADC Analog-to-digital Converter
2. API Application Programming Interface
3 CT Current Transformer
4 DAC Digital-to-analog Converter
5. GSM Global System for Mobile communication
6. HVTL High voltage Transmission Lines
7. IEEE Institute of Electrical and Electronics Engineers
8. RC Rogowski Coil

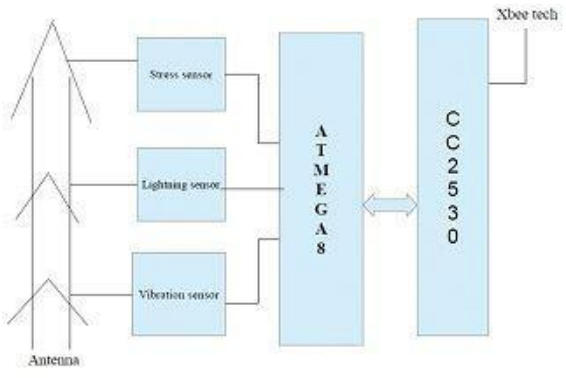
SYSTEM DEVELOPMENT

Block diagram of Proposed

System 1. Transmitter

Transmission of data which includes output of sensors using Xbee model.

Fig. Shows Transmitter system overview



System Overview (Transmitter) Fig 1.1

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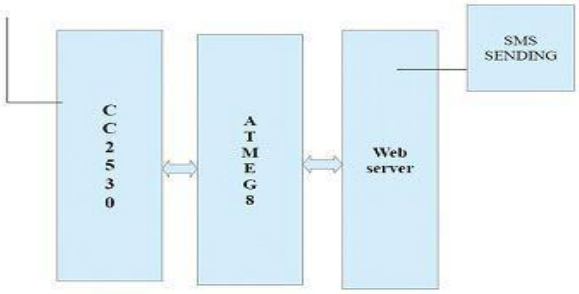
1. Transmission tower:
It is the tower which is used for transmitting electricity from one place to another place. The maximum height of tower varies from 25 mt to 50 mt. They are available in various shapes and sizes.

2. Types of sensors:
Lightning sensor:
As the earth's climatic conditions are not favourable, so as climatic conditions varies from day to day so in this project lightning sensor comes to the picture that as the lightning strikes on the tower there is damage in the tower as we are joining it on the top of the tower. We have designed lightning sensor using potential divider network. We can mount it directly at the top of the tower. If we put a blade near to window in the area where lightning is striking and we measure voltage variations using multimeter it will show some changes. Analysing those voltage variations we can conclude how far that lightning is striking from respected location. Using same logic only we have designed this sensor. Photons emitted because of lightning will fall on sensor. If lightning is in nearer area intensity of light will go on increasing and thus there will be variation in voltage levels. Those voltage level values we are going to send it on receiver side for procedure.
Stress sensor: As to measure the voltages between the lugs in this experiment potentiometer pot for the measurement of voltages between lugs and the transmission lines. This sensor is designed using potential divider network. Potentiometer pot will work as a stress sensor. When lugs of transmission line tower will get lose wire which is present in that pot will start rotating as lugs are getting slide. Thus resistance value will get change and hence there will be variation in voltage values that can be judged by using potential divider network. Later on those voltage values are encode at microcontroller and sent at receiver side using X bee model which is nothing but protocol of zigbee, for further evaluation. Whenever faults generated manual operations are needed. If due to natural calamities there may be a case designed sensors may get collapse. In that case we are giving a special condition in servers program which will convey required message to required person
Vibration sensor: As there will be a hazardous damage due to lightning strikes on the tower in this experiment to sense vibration of the tower there is a requirement of vibration sensor to sense large vibrations of the tower.

ATMEGA 8 microcontroller: We are using this in transmitter for encoding the voltage value of the above three sensors as in transmitter side .It has inbuilt ADC and DAC. It has 10 bit ADC. As the micro controller 89C51 has 10 bit cycle to complete ATMEGA8 complete it in 1 bit cycle only.
X bee transmitter: In this project we are using for radiating the voltage value encoded from atmega8 micro controller this module is a protocol of ZIGBEE with advanced features wireless transmission. This module is kept at about 20 meters away from the tower through server room

Receiver
Reception of all gathered information for further analysis
Fig. shows receiver system

Overview
Objective: To detect fault in the system so we are using transmitter and receiver for
it that we are encoding data in transmitter side and decoding data in receiver side we are doing all process through X bee module which is a protocol of Zigbee IEEE 802.15.4



System Overview (Receiver)
1. X bee receiver: Then as seen in the transmitter that X bee transmitter radiates the voltage values and send X bee receiver captures the voltage values and send this values to the Atmega Micro-controller through which it decodes the data.
2. Web server: As after decoding of the voltage values it compares the voltage values as there is a setting of voltage values on the web server. If certain value exceeds then fault is detected and for such there is a use of the .net software for database and using Web API to send message directly to the control room.

FLOWCHART

Fig. shows the flowchart of fault identification system. It depicts the entire process of fault identification in detail's bee transmitter radiates voltage values to the X bee receiver which is situated near about 1.6 miles from the server room. ATMEGA 8 micro controller decodes the voltage parameters captured by the X bee receiver then voltage values are compared in the web server. If certain value varies than standard value then fault is occurred and send via web API to the monitoring room. X bee transmitter radiates voltage values to the X bee receiver which is situated near about 1.6 miles from the server room. At the transmitter, transmission lines are connected to the transmission tower, due to natural calamities there will be some occurrence of faults. Hence three sensors are introduced to sense the lightning strikes, vibration and stress on the transmission lines. Then these signals are sent to the ATMEGA .microcontroller where these signals get encoded and processed. X bee transmitter is used to radiate these signals to the X bee receiver through wireless transmission. ATMEGA 8 micro controller decodes the voltage parameters captured by the X bee receiver then

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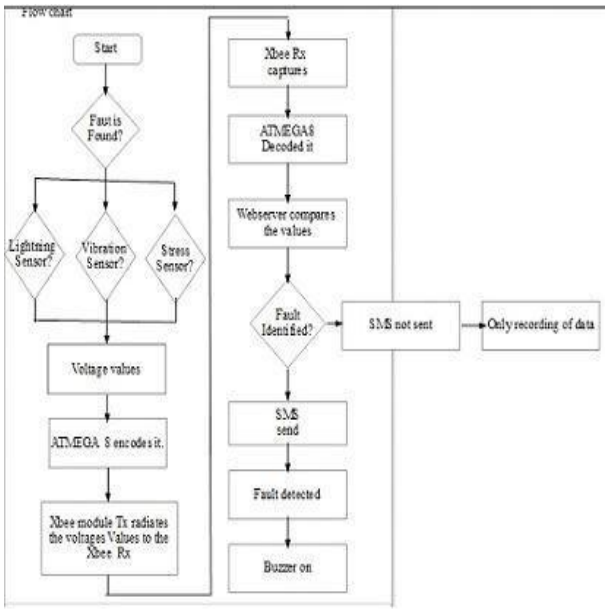
voltage values are compared in the web server. If certain value varies than standard value then fault is occurred and send via web API to the monitoring room. Hence, our project smartly identifies the faults and its location on the transmission lines using X bee technology.

Working Principle

Data collection process

There are two sensors lightning sensor and stress sensor which can be directly mount on transmission tower to detect respected faults. Respected parameters will measured in terms of voltage values those voltage values will be encoded to microcontroller. We are taking

20m long shielded wire from tower to mount our respected unit. Microcontroller is having six analog inputs among which we are using only three analog inputs. Microcontroller is having DAC and ten bit ADC. Now those encoded voltage values will be directly send to receiver side using X bee model. Advantage of using X bee model is that wireless communication is possible as well as its having its own IP address which help us to and respected location of tower. Range of X bee is 1 to 1.3 miles



Analysis of received signal

X bee receiver receives required data now the voltage values will get decoded to ATmega8.Those decoded values will be given to server. Using ASP.net and vb.net as well as C++ programming we are going to set a program in SQL server. This server will compare incoming input voltage values. And continuous data monitoring will be there. If fault occurs message will be sent to respected person using web API. And if there is no fault; continuous data monitoring will be there. As we are using real time clock system; we can have a data base with exact time and location which will reduce our efforts to use additional equipments. Whenever faults generated manual operations are needed. If due to natural calamities there may be a case designed sensors may get collapse. In that case we are giving a special condition in servers program which will convey required message to required person.

CONCLUSION AND FUTURE SCOPE

Conclusion

In this project we are detecting faults on transmission towers using three sensors. Through these sensors we can easily report to control room, faults due to lightning, vibration and stress occurring on transmission lines. Xbee module helps us to send data in wireless mode. Web API application helps in constant reporting.

Future scope

Phase lag can be identified easily in the system, so that prevention of instrument from damage is possible.

Direct video transmission of fault occurring on field can be done Automatic remote tilt adjustment of pole can be done.

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