Design And Implementation Of Electrical Transmission Line Monitoring And Controlling System

Trupti Sudhakar Somkuwar
P.G. Student, Department Of Computer Technology
Priyadarshini College Of Engineering
Nagpur, India
truptisomkuwar92@Gmail.Com

Mr. Mahesh G. Panjwani
Assistant Professor, Department Of Computer Technology
Priyadarshini College Of Engineering
Nagpur, India
maheshpanjwani@Gmail.Com

Dr. Prakash S. Prasad
Associate Professor, Department Of Computer Technology
Priyadarshni College Of Engineering
Nagpur, India
prakashsprasad@gmail.com

Mr. N . A. Ghodichor
Assistant Professor, Department Of Computer Technology
Priyadarshini College Of Engineering
Nagpur, India
niteshgho@rediffmail.com

***Abstract*—** As the electric transmission line is spread widely at long distance location is become difficult to monitor, control the power supply in the transmission line. Physical inspection at every location and troubleshooting is not feasible. Same problem is still facing at traffic monitor and control units as every square which are currently controlled manually by operator. Wireless Sensor Network (WSN) provides access over remote location with centralized monitoring and controlling on different channels so it can be utilized for electric transmission line monitoring. While the WSNs are capable of cost efficient monitoring over vast geo-locations, several technical challenges exist. To overcome these problems in regional areas proposed system is designed to monitor and control the electric transmission line using WSN. Here we are building a wireless node which can centrally monitor and controlled through base station or the wireless cluster head. A centralized server will be responsible to see the electric poll status and control the poll activities to enable or disable power in particular area. As it is not feasible to monitor the central server full time, So the proposed system is designed to have emergency alert system for remote user with the help of a GSM modem will be connected to the central server which will send the emergency alert SMS to administrator and user.

Keywords- *overhead transmission line,electric distribution system,smart grid,wireless sensor network*

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I. INTRODUCTION

For our current society electricity is important, and in order to properly maintain and develop power distribution system, it is needed to understand and monitor the system behavior. The system behavior i.e. Power grid constitute the electricity generation system, electric power transmission system, and electric distribution system. Transmission line monitoring is very significant issue to ensure useful and reliable transmission of electricity.

For transmission of electric power high voltage transmission line are responsible. Their sag and electric current are important parameter for transmission line monitoring. Internet of thing (IOT) used in smart grid is the predictable result of the growth of information communication technology to a certain stage. It will be capable of effective integrate of the infrastructure resources in communications and electrical control system, create the information and communication services manage for electrical power system , increase the level of power system information, and to get better the utilization efficiency of infrastructure in the existing power system. since Internet Of Thing technology has been used in smart grid, the important technical support for the generation, transmission, substation, distribution, electricity and other aspects of power grid can be efficiently provided. Smart grid is totally enclosed with an electrical system. For the developing countries, smart grid technology has great importance. Smart grid involves the complete electrical network and regional electrical network and a sub network like local utility transmission grid and distribution grid.

Electricity in a remote location is carried by a simple distribution grid linking a central generator to homes. In India during the process of electricity transmission and electricity distribution losses are occurred at very large amount and change between 30 to 45%. Low metering efficiency, theft and pilferage this are the main reason for electricity losses in India .for electricity and security of smart gird, intelligent power line monitoring is important part. For that large number of sensors is required to find out the power system fault in a distributed network. By including the number of sensor nodes, position of accuracy can be easily found. WSN are generally used to detect and locate the fault. Our goal and contribute in this work is to provide an efficient electrical distribution line. Transmission lines are consistent with each others, It can be utilized for electric transmission line monitoring, controlling then it turn into association of transmission network. Wireless sensor network (WSN) offer access over

remote areas with centralized monitoring and controlling on different channels so real time power flows.

Increase in demand of electricity for entire applications in any country, need to create exclusive of fail with advanced monitoring system. Consider a condition when there is power failure at particular area then anybody from that area has to inform electric support office and then and then only official person come to know about the failure of power. On other hand if due to any reason if officials wants to shut down power at particular area there is no direct remote control over the supply hence linemen has to go and manually shutdown the system.

These both the issues are very critical and it is expected minimum time support from the support system. Implementing this will reduce more time and also officials can give better supports to their customers. Considering all these problem we are trying to design and developing the remote electric transmission line monitoring and control system where autonomous system fixed at every electric pole will look at the power supply state and control its supply on command. Along with the pole fixed device there are base stations which will monitor pole status by communicating with pole device through wireless medium.

II. RELATED WORK

"Wireless Network Design for Transmission Line Monitoring in Smart Grid" Benazir Fateh, *Student Member, IEEE*, ManimaranGovindarasu, *Senior Member, IEEE*, and VenkataramanaAjjarapu, *Fellow, IEEE*.

In this paper, they develop a real-time situational awareness framework for the electrical transmission power grid using Wireless Sensor Network (WSN). While WSNs are capable of cost efficient monitoring over vast geographical areas, several technical challenges exist. The low power, low data rate devices cause bandwidth and latency bottlenecks. In this paper, their objective is to design a wireless network capable of real-time delivery of physical measurements for ideal preventive or corrective control action. For network design, they formulate an optimization problem with the objective of minimizing the installation and operational costs while satisfying the end-to-end latency and bandwidth constraints of the data flows. They study a hybrid hierarchical network architecture composed of a combination of wired, wireless and cellular technologies that can guarantee low cost real-time data monitoring. They formulate a placement problem to find the optimal location of cellular enabled transmission towers. Further, they present evaluation results of the optimization solution for diverse scenarios. Their formulation is generic and addresses real world scenarios with asymmetric sensor data generation, unreliable wireless link behavior, non-uniform cellular coverage, etc. Their analysis shows that a transmission line monitoring framework using WSN is indeed feasible using available technologies. Their results show that wireless link bandwidth can be a limiting factor for cost optimization .

"An efficient monitoring of substations using microcontroller based monitoring system" V. Thiyagarajan& T.G. Palanivel 1Assistant professor, PeriyarManiammai University 2Principal, Kamban Engineering College, Thiruvannamalai.

The paper proposes an innovative design to develop a system based on AVR micro controller that is used for monitoring the voltage, current and temperature of a distribution transformer in a substation and to protect the system from the rise in mentioned parameters. Providing the protection to the distribution transformer can be accomplished by shutting down the entire unit with the aid of the Radio frequency Communication. Moreover the system displays the same on a PC at the main station which is at a remote place. Furthermore it is capable of recognizing the break downs caused due to overload, high temperature and over voltage. The design generally consists of two units, one in the substation unit, called as transmitter and display unit, and another in the Main station called as controlling unit. The transmitter and the display units in the substation is where the voltage, current and temperature are monitored continuously by AVR microcontroller and is displayed through the display unit. The controlling unit in the main station by means of a PC and a RF receiver receives the RF signals that are transmitted by the Transmitter unit and reacts in accordance to the received signal. In general, the proposed design is developed for the user to easily recognize the distribution transformer that is suffered by any open or short circuit and rise in temperatures. The ultimate objective is to monitor the electrical parameters continuously and hence to guard the burning of distribution transformer or power transformer due to the constraints such as overload, over temperature and input high voltage. If any of these values increases beyond the limit then the entire unit is shut down by the designed controlling unit.

"Smart grid (WAMS) for transmission line through GSM".Engr. Muhammad Junaid, Engr. Shakeel Ahmad, and Engr. QaziWaqar Ali, department of electrical engineering, sarhad university of science & it Peshawar Pakistan.

Modern grid is the most complex man-made monitoring system, which is a wide-area monitoring system (WAMS). Next-generation smart grid will play a crucial role which will provide time synchronization of the data, the electric power system status (WAMS), protection and control. WAMS will provide safe and efficient energy transfers they will as reliable and optimize the management of the grid. Fuses are used more in power supply, transmission lines and associated equipment. As a general rule increased Uses of fuses can be attributed to the low-cost, simple to maintain and reliable protection. Application of fuse is one of the main areas in the entire conservation plan and other significant protection coordination unit used in smart grids. This paper attempts to review the current status of the fuse according to its rated voltage and to improve smart grid dynamic response based on real-time monitoring system for high voltage fuse blown up Indicators, second is earthling fault .

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Indicator and the third is bus bar temperature rise indicator. Furthermore dynamic protection mode is discussed and to provide more optional applications in the smart grid to provide high-voltage fuses blown up indicators, earthlings fault indicator and bus bar temperature indicator. They use GSM technology for monitoring indication.

III. PROPOSED SYSTEM

Increase in demand of electricity for entire applications in any country, need to produce consistently with advanced monitoring system. Consider a condition when there is power failure at particular area then anybody from that area has to inform electric support office and then and then only official person come to know about the failure of power. On other hand if due to any reason if officials wants to shut down power at particular area there is no direct remote control over the supply hence linemen has to go and manually shutdown the system.

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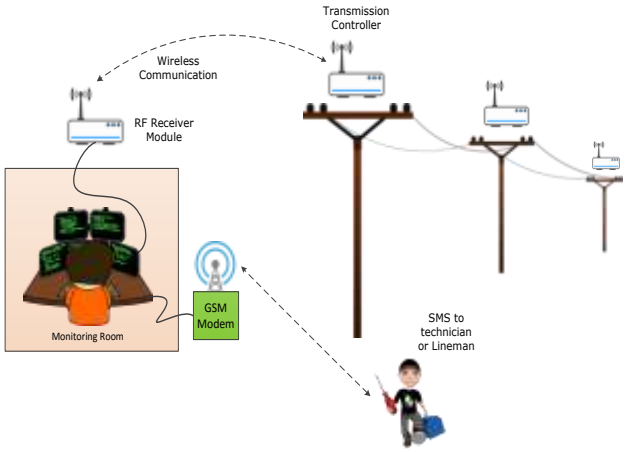

Fig : Propose system

Above figure shows the detailed working of proposed system where it shows the proposed wireless autonomous node at every electric pole and which are directly communicating with the base station over wireless link. This wireless communication is bi-directional and on demand data transfer will be done and not continuous data transmission hence it will save more energy and increase node life. If any node detected failure in power supply it will send some pre-defined code along with pole identity to base station and automatically software will show the failed pole location on mapand detailed information about pole. After getting the pole details system will fetch the contact number of the linemen to whom pole maintenance of failed node is assigned and then inform linemen to have look over the problem if possible.

System Requirement:

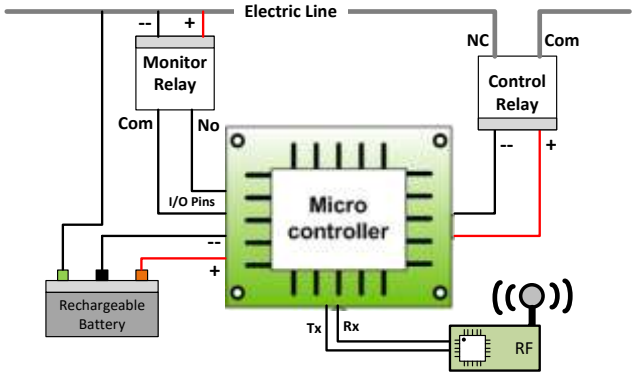

Fig : Component blocks

- The entire project consist of RF Transmitter and Receiver, Microcontroller Circuit, Electrically operated Relays, power supply
- As soon as the current falls out the back-up batteries will take over the functions of the power failure detector.
- The power failure message is transmitted via RF transreceiver to the monitoring station.
- Monitoring station will find out the location of the pole and display its location over area map at central station send SMS to assigned lineman along with failed pole position.
- Lineman will take control over the failed line and repair within minimum possible time which will save the time duration to find out failed line also will minimize the downtime.

IV. IMPLEMENTATION OF PROPOSED METHODOLOGY

A. *System Requirements*

- RF transceiver modules
- Electrically operated relays
- Atmega16 Microcontroller Module
- Battery power supply
- Connecting wires
- GSM Modem
- Switches

B. *Design platform*

An **embedded system** is some combination of computer hardware & software, either fixed in capability or programmable, i.e. specifically designed for a particular for a particular function. Industrial machines, automobiles, medical equipment, cameras, household appliances, airplanes, vending machines and toys (as well as the more obvious cellular phone and PDA) are among them yriad possible hosts of an embedded system. Embedded systems that are programmable are provided with programming interfaces, and embedded systems programming is a specialized occupation.

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Microsoft Visual Studio 2010 is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silver light. It can produce both native code and managed code.

C. Base station

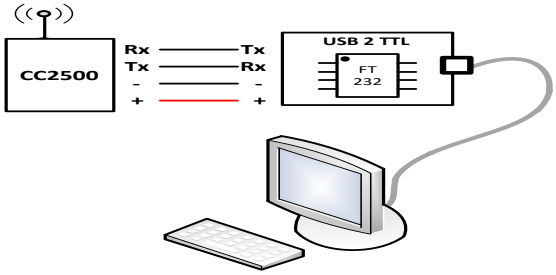

Fig :base station

USB to TTL module having FT232 IC to convert microcontroller signals in to serial format. USB connector provides connection between FT232 serial to USB convertor board and USB port of computer system

FT232 acts as transition state between USB and TTL/CMOS voltage levels thus allowing data to be read/write through USB port. It helps to interface USB or serial port device with module supporting UART. USB convertor interface PCs or laptop with UART(TTL/CMOS logic) supporting module/devices like microcontroller, Wi-Fi module, GPS(global positioning system) module, GSM(global system for mobiles)module, RFID(radio frequency identification)and finger print scanner module. FT232 IC is the one which convert TTL logic to USB logic so that devices works on TTL logic can share the data with devices connected through USB cables.

USB to TTL module driver will let the application access it data using COM port. As the system is connected to the USB 2 TTL module this module will then let the application access its data using COM port. COM port is a logical hardware access medium. COM (communication port) is the original, yet still common, name of the serial port interface on IBM PC-compatible computers. It might refer not only to physical ports, but also to virtual Ports, such as ports created by Bluetooth or USB –to-serial adapters.COM ports are interfaced by an integrated circuit such as 16550 UART.

Programming language provides classes to read from or write to data on COM port. Proposed system is using *"Serial Port"* Class from .Net base classes

D. RF module

This CC2500 RF module is used for communication purpose. And following are some important features of RF:

- This RF CC250 transreceiver module is easy to use.
- It Allows configuration of 255 Device IDs.
- It Allows configuration of 255 Channel IDs.
- It communicates in peer to peer mode.
- It supports broadcast mode.
- There is No need to configure at restart.
- Quick Response Time.
- It has Low Power Consumption.

E. Interfacing with microcontroller

- It first Wait for some time (say 300 millisecond).
- Then Initialize USART of microcontroller. Initial baud rate should be 9600.
- Configure CC module for its own SELF ID & CHANNEL ID
- Also Configure CC module for baud Rate (if required). Default Baud rate is 9600.
- Then Transmit data after RID (receiver id). Here data can be a single Byte or packet of many bytes (max packet length is 64).

F. Configuring self ID and channel ID

By sending the string using UART port microcontroller can communicate with CC2500 module i. e

- .'< 'Part of protocol (less than) ,
- '1' Self id,
- '2' Channel id,
- '>' Part of protocol.

G. Google map API

- Google provide MAP API for developing application to use Google Earth.
- It is a Predefined function
- Need to pass parameter to for map view Like, Longitude, Latitude, Map type, Zoom Level, Label etc.
- To use Google script, we have to need to set the parameters like longitude ,latitude, zoom level, map type, map types shows map satellite and hybrid we have to select the one out of this three parameters.

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- Send the request to Google. And after that it shows map view in the image format.
- Thus by doing this we can found out the pole location on MAP.

V. RESULT ANALYSIS

Overhead transmission lines are vulnerable to weather, common weather component like smokes, fumes, rainfalls, snowfalls, winds and heavy storms, humidity, line and air temperature, all this things affect a lot, therefore, the damages occurred in power transmission line and due to this type of obstacle power line failure is occurred at any area. For this purpose we need an advance monitoring system. Transmission line is important to measure the use of power line capacity. Electric current and line position are two important parameters to measure the transmission line. The aim of this project is to monitor and control the line position at any area using the concept of electrical distribution line.

A. Hardware photos

In this fig, there are two poles, i.e. pole A and pole B. below the each pole two relays are located. Two relays are used to control and monitor the power supply line. Beside the lights there are two connector. These connectors are similar to wire. One adapter is used to switch on the power supply. LCD is used to display the information related to pole. Two RF are use to transmit and receive the message. This whole construction is located at fom sheet. By using embedded C whole data is uploaded on the microcontroller circuit.

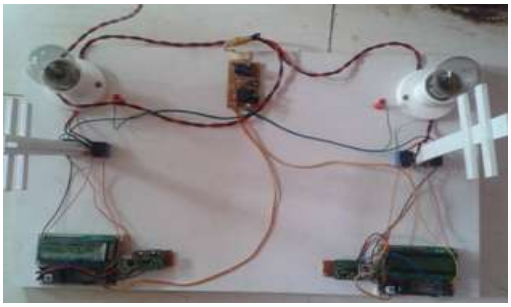


Fig : both poles are off

As soon as the light is switch on, the light gets on, and the display which is mounted on AVR microcontroller shows pole A is ON and pole B is on.

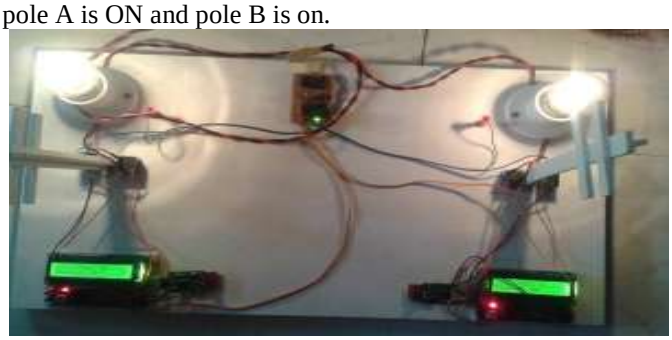
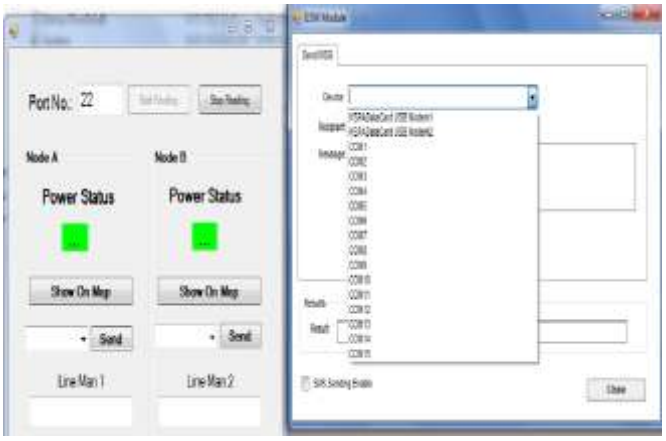


Fig :both poles are on

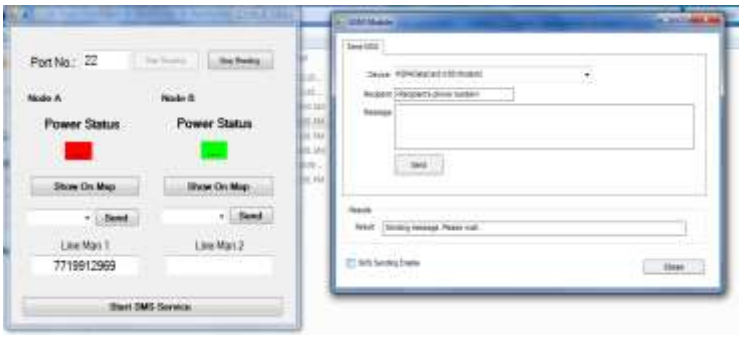
B. Software snapshots

Step 1: open the power line transmission box ,Take port no 22 and then start reading

Step 2: click on start SMS service button select the device modem 2



Step 3: if due to any reason failure of power is occurred in any area,then base station gives a red signal and GSM module send the msg to the lineman with the exact position of that faulty line pole area



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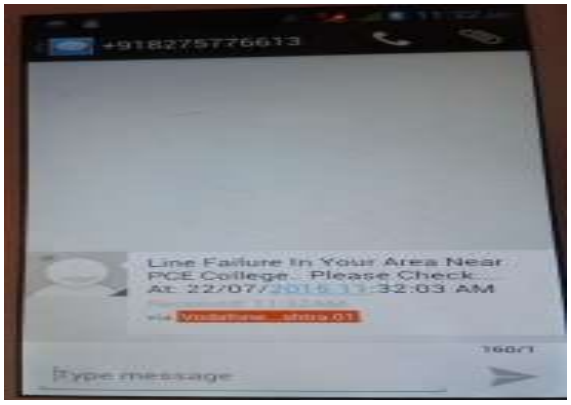
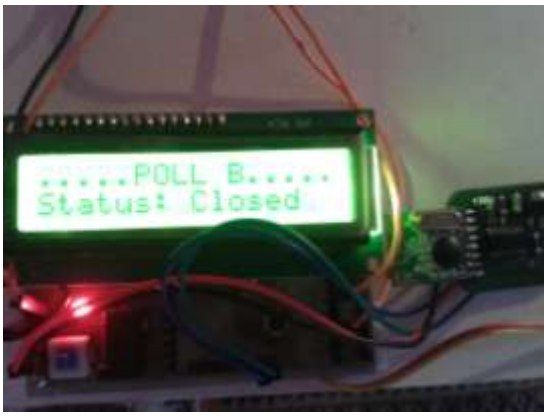


Step 4: if the official person wants to shut down the power at perticular area,then lineman has do this work automatically,



VI. CONCLUSION

In our project there is one control switch. If some problems will occurs in some area then with the help of control switch we can able to cut the supply of that particular pole. If the supplies of pole B fail then this notification will be displayed on the LCD which is mounted on the AVR microcontroller. After that this message will be transmitted via RF transceiver to the base station. and from base station the message will be send to the lineman's number.

Again we also have a monitor switch, by using monitor switch we can monitor the power supply of the area, when there is a power failure at any particular area, the pole status shows that at this this area the light gets off. So nobody have to go to the electric support office, by using monitor switch electric support office can easily understood that the light gets off in that particular area.

in this paper we proposed the novel approach for monitoring and controlling the electrical distribution line using wireless sensor network

VII. FUTURE WORK

Analyses of these stored data help the utility in monitoring the operational behavior of their distribution transformers and identify faults before any catastrophic failures thus resulting in significant cost saving as well as improving system reliability.

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Trupti S. Somkuwar received undergraduate degree in electronics & telecommunication engineering in 2013. She is currently student of M.E. in wireless communication and computing branch at priyadarshini college of engineering.

Mr. M. G. Panjwani

He has obtained B.TECH in Computer Science Engineering in the year of 2006 from ACET, Nagpur and M.TECH in Embedded System Computing in the year 2010 from GHRCE, Nagpur. He is currently working as Asst. Prof. at P.C.E. Computer Technology Dept. PCE, Nagpur.

Dr. Prakash S. Prasad obtained PH.D degree in computer science & engineering. He has published more than 16 papers in a national international conferences. He is member of IEEE, ISTE and IACSIT. He has completed his bachelor’s degree in 1997 and master degree in 2007. He is currently working as associate professor at priyadarshini college of engineering Nagpur and head of the department of computer technology. He is having 16 years of teaching experience and his interests include network security, operating system and system software.

Mr. N. A. Ghodichor

He has obtained M.TECH degree in Computer Science Engineering, He is currently working as Asst. Prof. Of department of computer technology at Priyadarshini College of engineering, Nagpur. He is specialize in computer organizations, computer network and system programming.