Distribution Transformer Monitoring System Based On Zigbee Technology

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Abstract – Transformer is the valuable link of the transmission of electricity all over the world. If any fault causes in transformer it will reduce the life of it, this will causes to need of continuous monitoring of various transformer. Distribution transformer remotely monitoring system (DTRMS) based Zigbee technology is developed for motoring parameter such as oil level and temperature of oil. This system has using the microcontroller for handling various value of the sensors and that are given to the Zigbee for transmitting the data of the sensor value to receiver for the remotely monitoring parameter of distribution transformer. Zigbee has less power consuming and higher data transmitting rate than other devices such as Bluetooth and Wi-Fi. It has widely range from 10m to 1km with the data rate of 250 kbps.

Index Terms – Distribution transformer, DTRMS, Zigbee, Wi-Fi.

1. INTRODUCTION

The purpose of a distribution transformer is to reduce the primary voltage of the electric distribution system to the utilization voltage serving the customer. A distribution transformer is a static device constructed with two or more windings used to transfer alternating current electric power by electromagnetic induction from one circuit to another at the same frequency but with different values of voltage and current. The transformer is valuable link in the transmission system ,if transformer get fails then the whole power system will be fail to supply power to consumer. The distribution transformer is widely used for distributes power to the consumers. Due to which it is very essential to monitor the distribution transformer, It not possible to monitor every transformer manually it will increase the cost of manpower. Mostly the fault occur in transformer due the increase in temperature of winding and oil, that will causes the reduction in the life of transformer, so need to be monitor oil level and temperature of oil. So by using Zigbee technology it is very easy to monitor number of transformer from the office, there is no need to monitor every transformer from side individually. Using Zigbee technology it is very easy to collect online data from system.

2. ZIGBEE DETAILS

ZIGBEE is based on IEEE 802.15 standard used to create a personal area network built from low power digital radios. It often transmits data over longer distances by passing data through intermediate devices to reach more distant ones. It targeted at radio frequency applications that require long battery life, low data rate and secure networking. ZIGBEE has a data rate speed of 250 kbps best suited for single signal transmission from an input device or sensor. Transmission distances range from 10 to 120 meters line of sight, depending upon power output and environmental characteristics. The ZIGBEE specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. It is a low cost, low power wireless mesh standard. The low cost allows the technology to be widely used in wireless control and monitoring system applications.

Each ZIGBEE network can have up to 65535 device nodes. The distance between ZIGBEE device nodes can be up to 50m and each node can transfer signal to the next. This will possibly make a very huge network. ZIGBEE is a wireless technology standard that has characterized of low power consumption having up to 6555 nodes and low data rates. Therefore it is suitable to apply in many home and industrial applications.

In many countries, communication based controlling and monitoring architecture is used for save power. Communication network may be wired or wireless. Communication through wired interface is very intricate and hard to implement or install. Wireless interfaces are chosen because they are easy to organize and install. Furthermore, ZIGBEE has some technical advantages over Bluetooth, Wi-Fi, infrared rays etc. ZIGBEE is a kind of low power-consuming communication technology for coverage area surrounded by 200m, with a data rate ranging from 20Kbps to 250Kbps, it is appropriate for use in home area networks, mainly for the remote control of electric home appliances. Monitoring system base on ZIGBEE technology that has

potential to be more faith full and low priced, which has been presented in this paper. ZIGBEE is a specification for high level communication, low power digital radios based on standard IEEE 802.15.4-2003.

3. DESCRIPTION OF DTMS SYSTEM

The DTMS classified into two categories:

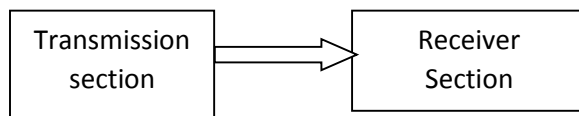* Transmitter section
* Receiver section

Figure1:Block diagram of DTMS

The transmitter contains different types of sensors, the sensors are used to sense the various parameters of transformer and send it to microcontroller, and microcontroller transmits the data through the ZIGBEE transmitter. The receiver receives the whole data and displays it on the LED. This whole process is real to monitoring the parameter of transformer. The main components of DTMS are liquid level sensor, voltage regulator, operation amplifier, LED display and ZIGBEE.

3.1 TRANSMITTER SECTION

The below figure show transmitter section of zigbee module,The main components of transmitter are the oil level sensor, RTD, microcontroller ATMEGA328. The condition of oil level recorded through sensor and send to the receiver section by the help of ZIGBEE transmitter. Temperature sensor is directly attached to the In- Built ADC (Analog to digital converter).RTD is used for the testing of temperature of distribution transformer.
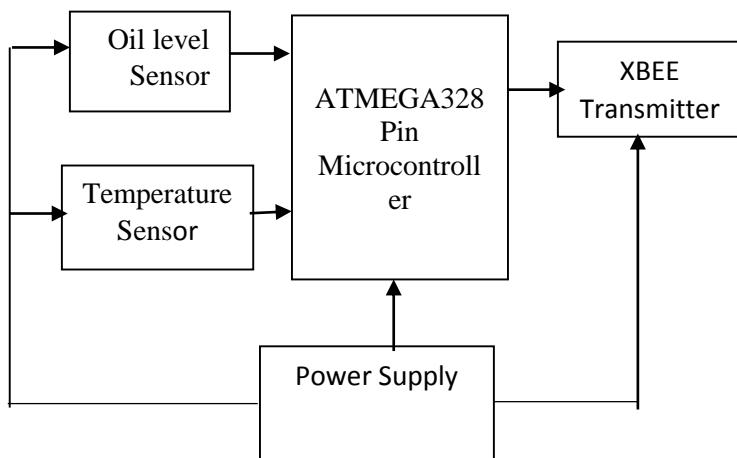

Figure2: Block diagram of Transmitter section

The heart and soul of this project is microcontroller which is ATMEGA328 microcontroller. Transmission media between receiver section and desktop PC is ZIGBEE transmitter. This is the advanced version of ZIGBEE technology. The transmitter section is used to transmit the data from the end device to coordinator.

3.2. RECEIVER SECTION

Fig.3 shows the receiver section. The receiver section is also called as coordinator unit. In this section all data which is transmitted through the transmitter section is receive through the receiver section with the help of microcontroller. Then microcontroller display the condition of oil level and temperature of distribution transformer.
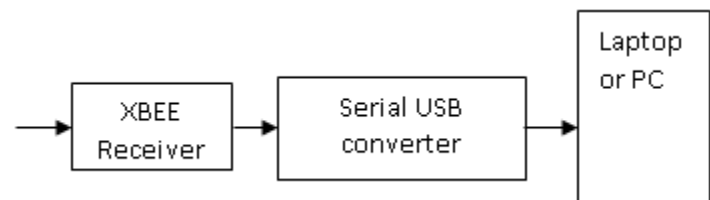

Figure 3: Block diagram of receiver

4. CIRCUIT DESCRIPTION

A step down distribution transformer and bridge rectifier are used to obtaining a DC supply which is regulated to 5V DC using a 7805 voltage regulator IC. The sensors are used to sense the continuously changes in parameter of distribution transformer. The fluid level sensors respond to any change in parameters with change in voltage level of transformer. This whole data is send to the ADC (Analog to digital converter) which converts this analog data into digital form because microcontroller can took the digital form only.

The sensors continuously send data to the ADC. The ADC sends those data to the microcontroller. Also with the help of ZIGBEE transmitter this whole data send to the computer on which we can continuously monitor the whole data. The controller restores the data on LCD. On receiver section ZIGBEE receiver is connected with the USB port to the computer system which have already software installed on it. We can set all parameter of transformer before starting the system we can viewed on the computer screen. In this oil levels are set if the transformer cross the these level then it can show variation on the LCD screen which is placed at control room, after this variation in the LCD screen the control room took immediate action towards it and it can save the life of a transformer which is very costly. ADC is used to read the sensor parameters. A display unit, which may be LCD display receives signal from microcontroller unit and display the parameters of distribution transformer. After receiving transmitted signal by transmitter section, receiving section display it through microcontroller.

5. CONCLUSION

All the objectives outlined in this project are achieved. The study of ZigBee modules available in market was done and the best ZigBee module was chosen. The chosen modules were studied and were implemented as end device and coordinator. Successful communication was setup between coordinator and end device. There are two most important feature of this product. First one is the use of ZigBee technique to transfer data from one point to other; this method increases the life of battery and the product. Using this technology it's possible to cover large fields of about 1 km square area. With modern technology it is possible to monitor a large number of parameters of distributed transformer at a relatively high cost. The challenge is to balance the functions of the monitoring system and its cost and reliability. In order to get effective transformer monitoring system to a moderate cost, it is necessary to focus on a few key parameters. WDTMS is able to record and send abnormal parameters of a transformer to concerned office. It works on Zigbee technology that supports multiple network topologies such as point-to-point, point-to-multipoint and mesh networks. It has low duty cycle provides long battery life.

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