

# Monitoring Parameter of Distribution Transformer by using XBEE Technology

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**Abstract** - The distributed transformers monitoring system (DTMS) based on XBEE technology is developed for monitoring and record the parameter like oil level, temperature of distribution transformer. The system consists of PIC microcontroller for handling the sensor and signal is communicated through XBEE transmitter and XBEE receiver. The system is placed near to the distribution transformer side and by measuring the above given parameter it will help to reduced the used of transformer and identify problem before they occur and damage the system. The XBEE based wireless device is used as long range wireless communication between the modules. The information is transmitted point by point using XBEE transmitter and receiver and is sent to the server module to check the state of the transformer. It has a data rate speed of 250 Kbps with minimum power consumption and has a transmission distances range from 10 to 120m. The data transmission rate is higher than other wireless systems.

**Index Terms:** DTMS; distribution transformer; level sensors; XBEE; Kbps; m

## 1. Introduction

The steps down transformer used for electric power distribution purpose are referred as distribution transformer. There are several types of transformer used in the distribution system. Distribution transformers are generally small in size and filled with insulating oil. These transformers are available in the market in a various sizes and efficiencies. Selection of distribution transformer depends upon the purpose and budget of the users.

Secondary terminal of distribution transformer deliver electrical power at a utilization voltage level to the consumers end via energy metering system. In case of three phase distribution system three phases four wire secondary system are adopted. Here, three phases, which means red, yellow and blue phase. Conductors come out from three low voltage bushing studs of the transformer. The neutral wire is connected to the fourth bushing which is also referred as neutral bushing of the transformer.

Transformer is very important device in power system, so it is necessary to monitor the parameter of transformer. Like oil level temperature rise, and over load are need the continuous monitoring to the life of transformer. The failure of transformer is mainly due to increase in temperature, low oil level, poor quality of cables and due to the maintenance. Transformer increases the voltage level to fall down losses and drop the voltage to safe level. Monitoring is defined as online collection of data. In the project

XBEE is used for communicating the monitored parameters.

## 2. XBEE Details

XBEE 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. XBEE 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 XBEE 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 XBEE network can have up to 65535 device nodes. The distance between XBEE device nodes can be up to 50m and each node can transfer signal to the next. This will possibly make a very huge network. XBEE 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, XBEE has some technical advantages over Bluetooth, Wi-Fi, infrared rays etc. XBEE 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 XBEE technology that has potential to be more faith full and low priced, which has been presented in this paper. XBEE is a specification for high level communication, low power digital radios based on standard IEEE 802.15.4-2003.

### 2.1. Description of DTMS system

The DTMS classified into two categories:

- I. Transmitter section
- II. Receiver section

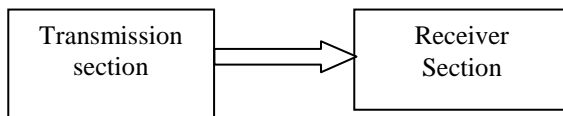


Fig. 1: Block diagram of DTMS

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 XBEE 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 XBEE.

#### 2.1.1 Transmitter section

Fig.2 shows the transmitter section. Transmitter is also known as router. The main components of transmitter are IR (infrared) sensor, oil level sensor, LM-35, microcontroller ATMEGA328. The condition of oil level recorded through sensor and send to the receiver section by the help of XBEE transmitter. Temperature sensor is directly attached to the In- Built ADC (Analog to digital converter). LM-35 is used for the testing of temperature of distribution transformer.

The heart and soul of this project is microcontroller which is ATMEGA328 microcontroller. Transmission media between receiver section and desktop PC is XBEE transmitter. This is the advanced version of XBEE technology.

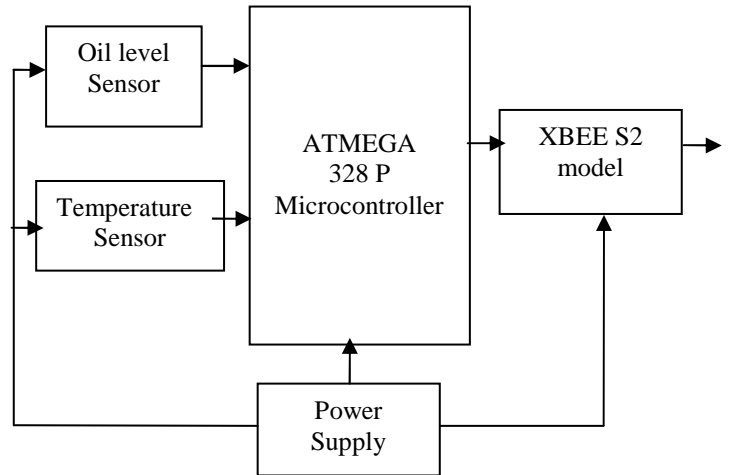


Fig. 2: Block diagram of Transmitter section

#### 2.1.2 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.

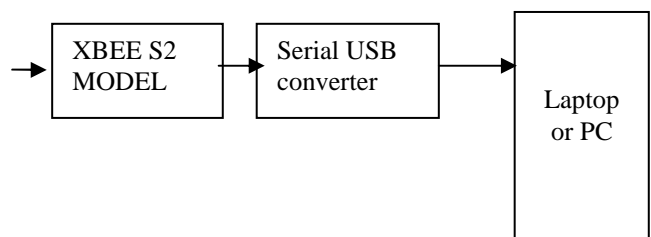


Fig. 3: Block diagram of receiver

### 3. Circuit operation

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 take 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 XBEE 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 XBEE 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.

Wireless ZigBee Technology”,IJNTEC ,Volume1,issue4,Nov 2013.

#### **4. Conclusion**

XBEE technique used to transfer signal from one place to another place, this technique increase the life of distribution transformer. Using this technology it is possible to cover large area. With modern technology it's possible to monitor a large number of parameter of transformer at a high cost. When any parameters of transformer got crosses their maximum limit. System took the action immediately and closed the system. It also enables the operator to monitor the parameters far away from the transformer without the displacement of the crew. This system uses very little power consumption and has a long battery life. This system is cost effective and is easy to operate and to maintain.

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