XBEE BASED TRANSFORMER PARAMETER MONITORING

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ABSTRACT

Transformer is the key equipment in power system to ensure it is safe and stable operation is important. Transformers either raise a voltage to decrease losses or decreases voltage to a safe level. Monitoring is defined as online collection of data. It is very difficult and expensive to construct the communication wires to monitor and control each distribution transformer station.

By using XBEE module we continuously monitoring transformer parameter like oil level, current, voltage and temperature. Xbee based transformer protection involves monitoring of multiple transformer from a single remote control center. In this project we have monitor and parameters of transformer namely Voltage, current, Temperature and Oil Level. The project can be expandable in future for various other parameters like Surveillance camera, Smoke detector, etc. xbee module use for wireless communication for sending and receiving data i.e for two way communication.

Aim of our project is to protect the transformer against fault and continuously monitoring transformer parameter. Transformer parameter is specified on nameplate for giving protection to transformer. if limit exceeded as per predefine limit then fault occur in transformer. due to this transformer temperature may increases and winding may damage. If there is a fault in the transformer, by our project we can detect the fault in the transformer and there will be notification to the control regarding the fault.

KEY WORD: *IC- integrated circuit, DC- direct current, RTD- resistance temperature detector, ADC- analog to digital converter, EHV- extra high voltage. UART- universal asynchronous receiver transmitter*

1.INTRODUCTION:

XBEE is used for communicating the monitored parameters and also control them. The failures of transformers in service are broadly due to temperature rise, low oil levels, over load, poor quality of LT cables, or improper installation and maintenance. Out of these factors temperature rise, low oil levels and over load, need continuous monitoring to save transformer life.

XBEE based transformer protection involves protecting of multiple transformer from a single remote control center. In this project we have monitor and control four parameters of transformer namely Voltage, Power Load, Temperature and Oil Level. The project can be expandable in future for various other parameters like Surveillance camera, Smoke detector etc. Here we have used XBEE Technology for sending and receiving data *.i.e.* two way communication.

The basic aim of our project is to protect the transformer against internal faults and ensuring security of the protection scheme for external faults. System conditions that indirectly affect transformers often receive less emphasis when transformer protection is specified. Overloading power transformers beyond the nameplate rating

can cause a rise in temperature of both transformer oil and windings. If the winding temperature rise exceeds the transformer limits, the insulation will deteriorate and may fail prematurely. If there is a fault in the transformer, by our project we can detect the fault in the transformer and there will be notification to the control room regarding the fault.

A power transformer consists of a set of windings around a magnetic core. The windings are insulated from each other and the core. Operational stresses can cause failure of the transformer winding, insulation, and core. The power transformer windings and magnetic core are subject to a number of different forces during operation:

- Expansion and contraction caused by thermal cycling
- Vibration caused by flux in the core changing direction.
- Localized heating caused by eddy currents in parts of the winding induced by magnetic flux.
- Impact forces caused by through-fault currents. Thermal heating caused by overloading.

ANSI/IEEE standards provide operating limits for power transformers. Initially, these operating limits only considered the thermal effects of transformer overload. Later, the capability limit was changed to include the mechanical effect of higher fault currents through the transformer. Power transformer through faults produce physical forces that cause insulation compression, insulation wear, and friction induced displacement in the winding. These effects are cumulative and should be considered over the life of the transformer.

2.Block diagram

Block Diagram for Transmitter section of Xbee Based Transformer Protection

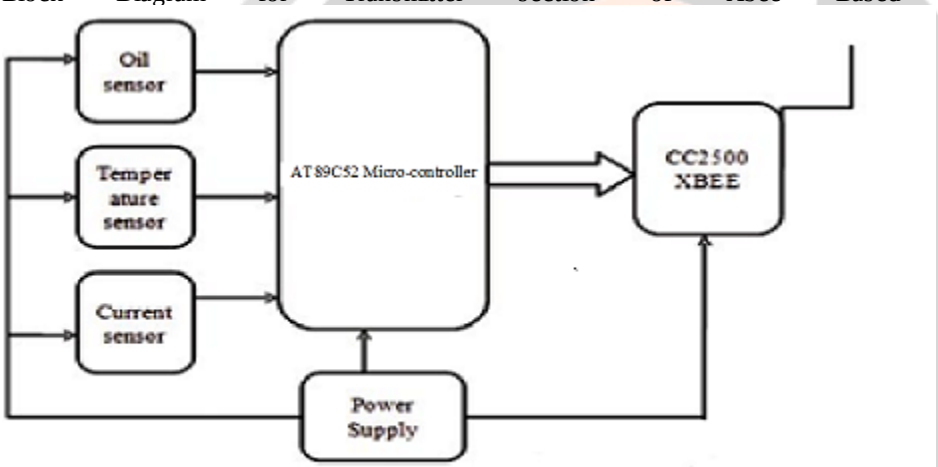

Fig: Transmitter section

Block Diagram for Receiver section of Xbee Based Transformer Protection

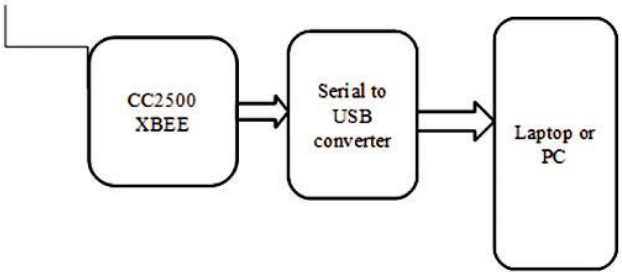

Figure 3.2: Receiver section

2.1 Working of Project

- A step down transformer and bridge rectifier are used for obtaining a DC supply which is regulated to 5V using a 7805 voltage regulator IC.
- The sensors are used to monitor continuously changes in parameters.
- The transducers viz. RTD, tachogenerator, fluid level sensor and MQ6 respond to any change in parameters with a change in voltage level.
- This data is fed to the micro controller AT89C52 which has inbuilt ADC that converts this analog data into digital domain.
- The ADC is connected to the port C of micro controller where the digital data comes.
- The XBEE transmitter is connected on port D. A pull up resistor network is required for port C.
- The sensors continuously send their output to the ADC. The ADC work on it through microcontroller. Also with the help of XBEE transmitter module this performance data is sent to the computer on which we can continuously monitor all the data
- On receiver side there is a XBEE module connected with USB to the computer system which have the VB8 software installed on it.
- We can set all the performance parameter before starting the system and can be viewed on the computer screen. If we want to change any parameter's max limit then it can be changed on computer screen. This change will be done in the system.
- If any change is occurred and the transducer output exceeds maximum set value then the controller forces the relay line to NC position. This is visible on the computer screen and any controlling action can be initiated

System Performance For Conventional and Xbee Based Transformer Protection:

In case of conventional transformer protection, Protection of large and medium power transformers by means of differential relaying has been a common practice. Differential relaying technique is based on comparison of the transformer's two winding currents. When these currents deviate from a predefined relationship an internal fault is assumed and relay operates. This high current causes mal-operation of the relay. Therefore, main challenge is to precisely distinguish between magnetizing inrush and fault current to avoid any mal-operation of relay, this method sometimes fail to discriminate between magnetizing inrush and internal fault currents because high second harmonic components are generated during internal faults and low second harmonic component are generated during magnetizing inrush having modern core material of power transformer and due to the presence of shunt capacitance or distributive capacitance in long Extra High Voltage (EHV) transmission line to which power transformers are connected. The magnetizing inrush current exhibits a characteristic peaked wave, which is caused by asymmetric saturation of the transformer core.

In case of XBEE based transformer protection, XBEE is used for communicating the temperature rise, low oil levels, over load, poor quality of LT cables, or improper installation and maintenance. Out of these factors temperature rise, low oil levels and over load, need continuous monitoring to save transformer life .This Project increases the reliability of distribution network, by monitoring critical information such as oil temperature, and oil level of transformer. Data are collected continuously. Monitoring the transformers for problems before they occur can prevent faults that are costly to fix and result in a loss of service life. At the same time multiple transformers can be monitored and controlled from a single remote location.

2.2 XBEE MODULE

XBEE is the brand name from for a family of form factor compatible radio modules. The first XBEE radios were introduced under the MaxStream brand in 2005 and were based on the 802.15.4-2003 standard designed for point-to-point and star communications at over-the-air baud rates of 250kbs.

Two models were initially introduced lower cost 1mW XBEE and the higher power 100mW XBEE-PRO. Since the initial introduction, a number of new XBEE radios have been introduced and all XBEE are now marketed and sold under the Digit brand.

The XBEE radios can all be used with the minimum number of connections power (3.3V), ground, data in and data out (UART), with other recommended lines being Reset and Sleep. Additionally, most XBEE families have some other flow control, I/O, A/D and indicator lines built in. A version of the XBEE called the programmable XBEE has an additional onboard processor for users code. The programmable XBEE and a new surface mount (SMT) version of the XBEE radios were both introduced in 2010.we used CC2500 module in our project That is explain above.[6]

CC2500 XBEE Module

CC2500 RF Module is a transmitter receiver module which provides easy to use RF communication at 2.4 GHz. It can be used to transmit and receive data at 9600 baud rates from any standard CMOS/TTL source. This

module is a direct line in replacement for your serial communication it requires no extra hardware and no extra coding to. It works in Half Duplex mode i.e. it provides communication in both directions, but only one direction at same time.

The CC2500 is a low cost true single chip 2.4GHz transceiver designed for very low power wireless applications. The circuit is intended for the ISM (Industrial, Scientific and Medical) and SRD (Short Range Device) frequency band at 2400- 2483.5 MHz

The RF transceiver is integrated with a highly configurable baseband modem. The modem supports various modulation formats and has a configurable data rate up to 500 kbps. The communication range can be increased by enabling a Forward Error Correction option which is integrated in the modem.

CC2500 provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment link quality indication and wake-on-radio.[7]

3. CONCLUSION:

The Conventional Transformer parameter monitoring we required pilot wire to transmit data from remote location to control room but due to fault create in pilot wire such as capacitance of pilot wire damage pilot wire environmental effect on pilot wire. In proper protection give to transformer remove this drawback by using XBEE based monitoring. In this monitoring transmit data through 1.2GHZ band width. In this way we giving proper protection to transformer. With the help of XBEE module we continuously monitoring transformer parameter like oil level, current, voltage and temperature.

4.ACKNOWLEDGMENT

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5. REFERENCES:

1. S.M.Bushi and N.Marina " Power transformer protection using microprocessor based relay " p.p. 3-5
2. Vishwanath R ,Akshatha V, Shetty " A New Approach to monitor Condition of Transformers incipient fault diagnosis based on GSM & XBEE " © 2015 IJEDR | Volume 3, Issue 2, p.p. 2-6
3. suribabu.miriyala , B. v. sanker ram & k. s. r. anjaneyulu "protection of power transformer from various faults using ann" Vol. 2, Issue 9 p.p 5-6
4. S.M.Turkane and M.D.Rahane " 256 key secured communication using bluetooth & XBEE" E-ISSN 2277 volume 5 p.p. 5-7
5. Martin Hebel and George Bricker with Daniel Harris "XBEE RF modules a tutorial for basic stamp and propeller microcontrollers" volume 1 p.p 8
6. "Texas instrument CC2500 XBEE" p.p-25
7. Manoj Tripathy 1, R. P. Maheshwari 2, H. K. Verma3 "Improved transformer protection using probabilistic neural network and power differential method" Vol. 2, No. 3, p.p. 29-44
8. Ahmed Abdulkader Aziz,Dr. Abbas H. Abbas, Dr. Abduladhem Abdulkareem Ali "Power Transformer Protection by Using Fuzzy Logic" Vol.5 No.1
9. Tammam Hayder, Ulrich Schaerli, Kurt Feser, Fellow, IEEE, and Ludwig Schiel "Universal Adaptive Differential Protection for Regulating Transformers" VOL. 23. NO. 2,
10. "automatic method of protecting transformer using pic microcontroller as an alternative to the fuse protection technique" Volume 3, Issue 2 ,p.p. 23-27