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FAULT IDENTIFICATION OF TRANSFORMER USING ZIGBEE FOR HIGHLY RISK PLACES

Prof. N.B.Ranotkar[1], Prof.S.D.Jadhav[2], Prof. P. G. Patil[3]

[1,2,3]Electrical Department, Sandip Polytechnic (India)

ABSTRACT

In this paper ZigBee wireless network tomonitor load conditions of transformers and analyze their temperature sensitivity. The developed approach can effectively monitor the of distribution transformers, protecting transformers from burning by overloading via an early overloading warning system. This method is suitable for many underground distribution transformers using a wireless sensor technology with minimal power consumption and good communication quality. Transformer load current and temperature are captured via a temperature sensor and current sensing devices and transmitted the data to ZigBee wireless network. The regressionmodel of transformer load current and temperature is derived for temperature sensitivity analysis of transformer loading. The relationship between load current and temperature is determined using wireless technology method.

The transformer load current variation following a temperature increase is then derived to construct an early warning mechanism for overloading, such that maintenance personnel can take the necessary actions to avoid power interruption andimprove power quality. The degree of internal insulation ageing caused by overloading and high temperatures is determined by the amount of water in the insulating paper.

Keywords: ZigBee wireless network, regression analysis,temperature sensitivity analysis,fault identification of transformer.

I. INTRODUCTION

Monitoring and controlling load status is difficult as in power system transformers are typically distributed throughout a vast territory. Transformers occasionally burn out due to overloading and a lack of long-term monitoring and diagnostic systems. The relationship between transformer load current and temperature is assessed by statistical regression analyses. Consequently, a reliable, simple and effective load supervision and fault diagnosis system can significantly decrease work pressure for maintenance personnel, enhance power supply reliability, improve the utilization rate of transformers, extend transformer life, and reduce transformer maintenance costs. Via information and communication technology, utilities worldwide do everything possible in using advanced sensor technology and a communication interface to enhance the operating performance of transformers in distribution systems. USA Texas Power Company, uses the internet to remotely monitor transformer oil temperature, the amount of water in oil and oil temperature variation.

II. SYSTEM CONFIGURE

This study applies the ZigBee wireless transmissionmodule , Visual Basic 6.0, the Access 2003 database,and statistical regression analysis to monitor load status oftransformers and analyze the influence of temperaturevariation on transformers. are 1 shows the overallconfiguration.Data for transformers installed undergroundare collected via the ZigBee end-device terminal and transmitted to the ZigBee coordinator terminal and the terminals of supervisors via the RS232. Supervisors can thenassess the status of transformers and save data to databasessimultaneously.The overall structures in this paper are divided intohardware and firmware. Several on-the-spot digital meters are installedto conveniently monitor the status of transformers. Bothtransformer data collected by digital electrical meters andtransformer temperature data collected by temperaturemodules are transmitted to the ZigBee end-device terminalfor data transmission via the RS485.When the ZigBee coordinator terminal receives data, it transmits these data tosupervisor computers using the RS232. The man-machineinterface is developed using visualize program language (Visual Basic) to execute the decoding operation. Differentidentifications are displayed during decoding process due todata transmission and receive and error decoding.

III. ZIGBEE MODULE

The zigbee/ zigbee-PRO RF Modules are designed to operate within the ZigBee protocol and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between remote devices. The modules operate within the ISM 2.4 GHz frequency band and are compatible with the following:

- XBee RS-232 Adapter
- XBee RS-232 PH (Power Harvester) Adapter
- XBee RS-485 Adapter
- XBee Analog I/O Adapter
- XBee Digital I/O Adapter
- XBee Sensor Adapter
- XBee USB Adapter
- XStick
- Connect Port X Gateways
- XBee Wall Router.

The XBee/XBee-PRO ZB firmware release can be installed on XBee modules. This firmware is compatible with the ZigBee 2007 specification, while the ZNet 2.5 firmware is based on Ember's proprietary "designed for ZigBee" mesh stack (EmberZNet 2.5). ZB and ZNet 2.5 firmware are similar in nature, but not over-the-air compatible. Devices running ZNet 2.5 firmware cannot talk to devices running the ZB firmware.

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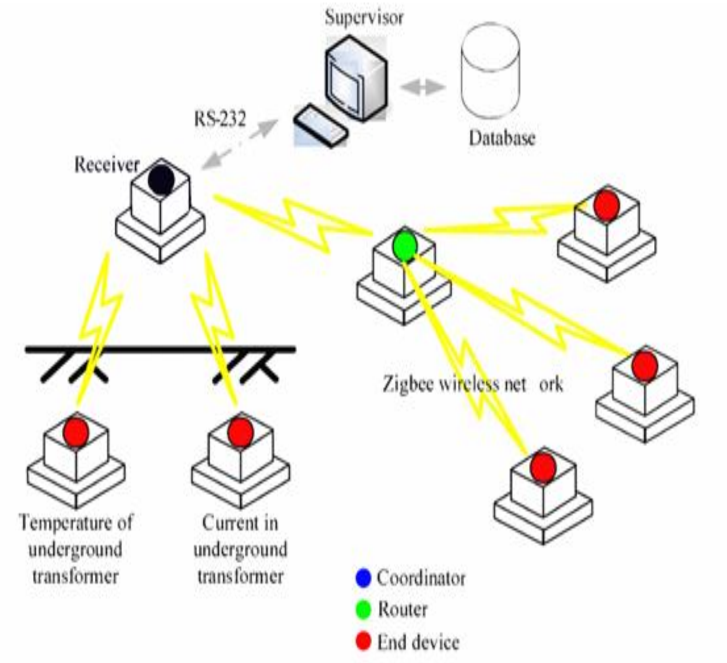
IV. ABNORMAL CONDITION

At the time of abnormal condition or faulty condition the fault current or over voltage rating is given to bridge rectifier, Which converted into DC output voltage. This DC output voltage is not pure form and ripple contain in it. The passive filter are used to remove the ripple in DC output voltage.

This 12 volt DC output is given to voltage regulator converted into constant 5 volt supply. Zener diode are used to block the reverse current.

This fault current value or over voltage value in analog form are given ADC of microcontroller . ADC convert this analog value into digital value and also temperature sensor value given to ADC of microcontroller pin . this faulty value of current and voltage are compare to the normal value store in microcontroller programming which compare the microcontroller . After that faulty signal is given to MAX232 IC.This microcontroller signal send to data to zigbee with the help of MAX 232 IC.

Zigbee is wireless communication device which transfer the data in the digital form to receiver zigbee. This receiver zigbee indication to overcurrent and over temperature and over voltage. to computer.



V. TEMPERATURE SENSITIVITY ANALYSIS

Load current is affected by temperature variations during transformer operation. This study applies statistical multivariable regression analysis to analyze the relationship between load current and transformer temperature. Load current is also affected by temperature variations due to transformer operation. The Nihilism hypothesis and Antagonism hypothesis examination methods are used to identify the interrelated coefficients between load currentand transformer temperature, as shown in (1).

Ho: P = O(interrelated)

HI :p≠O(non-interrelated)(1)

Equation (1) shows an F examination with a double tail [16], wherepis the interrelation coefficient. Equation (2) isused to derive the value of F.

F=MSR/MSE(2)

MSR and MSE in (2) are represented via an ANOVA analysis.

A positive interrelation between load current and

transformer temperature can be demonstrated via the abovethe F examination and ANOVA table. Equation (3) furtherderive the first-order, second-order, and third-orderregression equations for load current and transformertemperature, where a, fJ, r and A are regression coefficientsand t is temperature.

il (t) = a+ fJt

i2 (t) = a + fJt + yt2 (3)

i3(t) = a + fJt + yt2 + /l,t3

Equation (4) derives the decision coefficient? to identify

the fitness [IS] of the related regression equation between

load current and transformer temperature.

r^2 =SSR / SST(4)

Three regression models for related regression equationscan be derived when the regression equation and load currenthave very good fitness. Figures 7, 8, and 9 show the firstorder,second-order, and third-order regression models,respectively. Equations (S), (6), and (7) derive the first-order,second-order, and third-order regression equations,respectively.

i1 (t) = 0.2685t + 0.93 (5)

i2 (t) = 0. 0015t2 + 0.0264t + 1O.595(6)

i3 (t) = -O.OO02e + 0.0467t2 - 301193t + 82.586 (7)

Among (5), (6), and (7), (6) has the best fitness based on the decision derived using (4). Table II lists decision coefficient comparisons among various regression models.

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	ZigBee™ 802.15.4	Bluetooth™ 802.15.1	Wi-Fi™ 802.11b	GPRS/GSM 1XRTT/CDMA
Application Focus	Monitoring & Control	Cable Replacement	Web, Video, Email	WAN, Voice/Data
System Resource	4KB-32KB	250KB+	1MB+	16MB+
Battery Life (days)	100-1000+	1-7	.1-5	1-7
Nodes Per Network	255/65K+	7	30	1,000
Bandwidth (kbps)	20-250	720	11,000+	64-128
Range (meters)	1-75+	1-10+	1-100	1,000+
Key Attributes	Reliable, Low Power, Cost Effective	Cost, Convenience	Speed, Flexibility	Reach, Quality

VI. EXPERIMENTAL ANALYSIS

This paper is based on the ZigBee wireless transmission network. Collected data are transmitted to monitors via the ZigBee wireless network and the Access database is constructed. This project utilizes statistical regression analysis to determine temperature sensitivity to data variation in transformers due to temperature variation.

VII. CONCLUSION

In this way we can detect Over current, over voltage & over temperature occurring in transformer. This paper describes an advanced remote monitoring system for distribution transformers which utilizes the existing communication network. Numerous distribution transformers are installed underground over a vast territory; therefore, manpower needs are considerable. However, after installing the ZigBee wireless network, personnel can be dispatched and transformers monitored conveniently. The regression model is then obtained via regression analyses and accurately identifies the transformer overloading as temperature increases. Load shedding or load transfer can be employed immediately to prevent transformers from overloading and ensure power supply quality from distribution transformers before overloading.

The reliability of operation of distribution networks can be increased by using automatic monitoring systems for transformers not only for power transformers but also for distribution transformers. At present, operators do not have either much measured data or advanced information on transformer substations for maintenance and control. This paper describes an advanced remote monitoring system for distribution transformers which utilizes the existing Communication network has low investment and operation costs and is easy to install and use.

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