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A REVIEW ON GSM BASED TRANSFORMER HEALTHCARE MONITORING WITH OVERLOAD ALERT

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ABSTRACT- A crucial component of the transmission and distribution system are transformers. Monitoring transformers for issues early on can help avoid faults that are expensive to fix and cause a loss of service. Although current systems can give information about a transformer's condition, they are either offline or extremely expensive to implement. This study presents a novel method based on remote transformer monitori ng system employing PIC Microcontroller and GSM technology. Transformer condition monitoring remotely using a variety of methods is already well-known and used. The monitoring is mostly carried out to reveal significant parameters that reflect conditions of transformers, such as increase or decrease in oil level, over voltages, over currents, and increase in winding temperatures. Also the GSM modem used is a two way communication device, so the mobile user can any time know the condition of the transformer parameter by simply sending message to the modem.

Index Terms- Temperature sensor; Oil Level Sensor; PIC18F4520; GSM Modem;

I. INTRODUCTION

The main concern with transformer protection is protecting 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. Prolonged thermal heating weakens the insulation over time, resulting in accelerated transformer loss-of-life. Power system faults external to the transformer zone can cause high levels of current flowing through the transformer. Through-fault currents create forces within the transformer that can eventually weaken the winding integrity. A comprehensive transformer protection scheme needs to include protection against transformer overload, through-fault, and over excitation, as well as protection for internal faults.

Transformer is a high efficient static electrical device used for power transfer from one voltage level to the other and plays the vital role in electrical transmission and distribution system. From the day of this equipment in service, different stresses like electrical, mechanical, chemical, and environmental factors affect the condition

transformer.The initial stage of insulation quality decline happens gradually. Yet as time passes, this degenerati on intensifies and eventually causes the transformer to fail completely.

So, for the transformer to be properly maintained, continual condition monitoring and preventive measures are needed to overcome this issue. If operated under good and rated circumstances, distribution transformers have a long service life. But, if they are overloaded, their lifespan is drastically shortened, which affects system depen dability because it leads to unanticipated failures and supply loss for a large number of clients.The two main factors that lead to distribution transformer failure are overloading and inadequate transformer cooling. Current ly, distribution transformers are manually inspected, with occasional maintenance inspections by a person w ho keeps records.This type of monitoring cannot provide information about occasional overloads and overheating of transformer oil and windings. All these factors can significantly reduce transformer life. Our system is designed based upon online monitoring of key operational parameters of distribution transformers can provide useful information about the health of transformers which will help the utilities to optimally use their transformers and keep the asset in operation for a longer period.

II. METHODOLOGY

It consists of transformer, oil sensor, voltage sensor, current sensor, temperature sensor, PIC microcontroller, power supply, LCD display, GSM modem, MAX 232 and relay. Normally in transformer, failure occurs as a result of fluctuating voltage and current, overheating, changes in oil level, etc.

We have employed current and power transformers, temperature sensors, and oil sensors, respectively, in our project to detect these defects.All of these sensors are connected to the transformer, and the microcontroller receives the transformer's output. Address lines, a GSM model, and an LCD are linked to the PIC microcontrolle r interface, accordingly. When a fault arises for any of the aforementioned reasons, an LCD will display a change in ratings, and a rapid SMS will be sent to the control room via GSM modem. A quick review of the elements used is as given below Sensors play a vital role in effective implementation of the project. As we are interested in monitoring over current, over voltage, over temperature and oil levels following sensors are selected and suitable designed with respect to prevailing conditions of power system and rating of transformer to be protected.

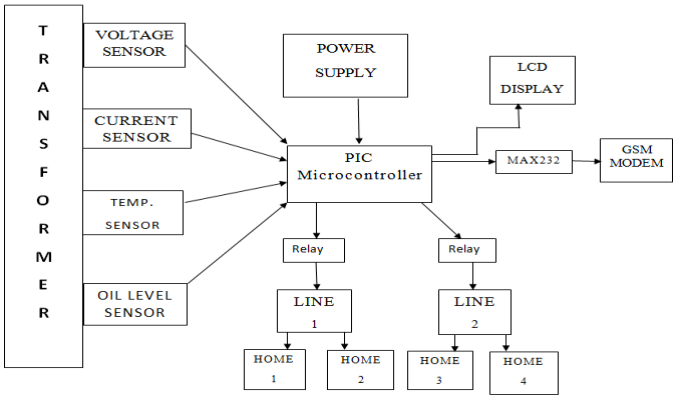

Fig 1. Block Diagram of System

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2.1 Transformer

Current or voltage instrument transformer are necessary for isolating the protection & control. The behavior of current and voltage transformer during 1and after the occurrence of fault is critical in electrical protection since error in signal from transformer can cause mal operation of the relays.

A transformer is an electrical device that transfers energy between two or more circuits through electromagnetic induction. A varying current in the transformer's primary winding creates a varying magnetic flux in the core and a varying magnetic field impinging on the secondary winding. This varying magnetic field at the secondary induces a varying electromotive force (EMF) or voltage in the secondary winding. Making use of Faraday's Law in conjunction with high magnetic core properties, transformers can thus be designed to efficiently change AC voltages from one voltage level to another within power networks.

2.2 Sensors

Sensors are installed on transformer site which reads and measures the physical quantity from the distribution transformer and then it converts it into the analog signal. These analog signals are given to the microcontroller. Sensors are used for sensing load current, load voltage, winding temperature and oil level.

Following general set-up of sensors for example is proposed for the use at a Distribution transformer. LM35 for temperature measurement PT for load voltage measurement (single phase) C.T to measure load current (single phase) Oil Level Sensor. It is fundamental to measure electrical quantities like voltage and current directly at the transformer.

2.3 Oil Level Sensor

Ultrasonic oil level sensor is used for oil level measurement in the transformer. When temperature of transformer goes high, oil level in transformer tank decreases due to heating effect. For normal operation of transformer oil level should maintain at required level. If oil level decreases beyond required level, it affect cooling and insulation of the transformer. Oil level sensor is float connected angular potentiometer. Float is immersed in oil and its mechanical output is given to angular potentiometer. When there is any mechanical movement of float, there is voltage generation corresponding to mechanical movement of float. That voltage is used for oil level monitoring.

III. CONTROLLING

3.1 PIC18F4520

Microcontroller is defined as a system on computer chip which includes number of peripherals like RAM, EEPROM, etc. required to perform some predefined tasks. There are number of popular families of microcontrollers which are used in different applications as per their capability and feasibility to perform various task, mostly used of these are 8051, AVR and PIC microcontrollers.

PIC18F4520 is a great PIC MCU to start working. It has many features and easily affordable. This PIC is reprogrammable many times because it has flash memory and programming can be done using IC-program. The PIC18 family has special features to reduce external components, Thus minimizing cost, enhancing system reliability and reducing power consumption.

3.2 GSM Modem

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. We are using the GSM 300 modem. This is a powerful GSM/GPRS Terminal with compact and self-contained unit. This has standard connector interfaces and has an integral SIM card reader. The modem has a DB9 connector through which a speaker and microphone can be connected allowing audio calls being established, but this feature is not utilized. In this project as only data transfer is needed.

IV. RESULT

For performing the Experimental test of condition monitoring and controlling of transformer, we need a some sensor, a GSM modem, and a logic level converter. The tests that are run on the Transformer are outlined here. All of them have been previously explained. Test of the transformer's When the load value exceeds 130W, a "over load" notification will appear on LCD and be sent to the mobile user. Transformer winding temperature test results It is not practical to raise winding temperature for a prototype. By putting a temperature sensor close to a bright light source and measuring the temperature of that sensor, an experimental fault was formed. When the temperature exceeds 40°C, the relay trips, and the system displays a notification on the LCD and sends it to the mobile user 'temperature is high'. Oil level test of the transformer Experimentally fault created by measuring the distance from a reference point. Reference value is fixed. If oil level is below the 30% then the LCD displays ' minimum oil level ' then message is sent to the mobile user.

V. CONCLUSIONS

We have designed a circuit for online monitoring and controlling parameter of transformer such as overvoltageoverload, rising winding temperatures, fluctuating oil levels in transformers, and overload.
Compared to manual monitoring, GSM condition monitoring of transformers highly beneficial and dependable because it is not always possible to check the oil level, winding temperature, load current, and overvoltage man ually. The operator can act right away stop any catastrophic breakdown of the transformer after obtaining notice of any irregularity. As a result, this is an easy approach to prevent catastrophic failure and avoid having to re place everything. the transformer. Use of GSM technique provides speed of communication with distance independency. This way of sending and receiving message-based communication is easy and fast and is even reliable. It is also cost effective compared to other methods of online monitoring of transformer.

REFERENCES

[1] Microcontroller Based Transformer Cooling Control System (Bhushan S. Rakhonde, Nikita A. Tekade) *e-ISSN: 2278-1676, p-ISSN: 2320-3331*
[2] Improving the Life Cycle Management of Power Transformers (Nadrae T. Waugh, Dave D. Muir)978-1-4673-7300-5/15/$31.00 m015 IEEE
[3] Neural Network Ensemble for Power Transformers Fault Detection(DraskoFurundzic, ZeljkoDjurovic, Vladimir Celebic, and Iva Salom) 978-1-4673-1572-2/12/$31.00 ©2012 IEEE

[4] Time-frequency Analysis for Power Transformer Fault Detection Using Vibration Method (Hong Kaixing, Huang Hai, Zheng Jing, Zhou Jianping, Zhou Yangyang, Liu Jiangming)978-1-4799-4315-9/14/$31.00_c 2014 IEEE

[5] MONITORING TECHNOLOGIES FOR LARGE POWER TRANSFORMERS (Claude Kane) 978-1-61284-298-1/11/$ 26.00 ©2011 IEEE

[6] Survey on the Transformer Condition Monitoring (Ahmed E. B. Abu-Elanien, and M. M. A. Salama)978-1-4244-1583-0/07/$25.00 ©2007 IEEE

[7] Implementation of a Power Transformer Temperature Monitoring System (. I. Q. Feng, P. Sun, W.H. Tang, D. P. Buse, Q. H. Wu, Z. Richardson, J. Fitch)0-7803-7459-2/02/517.00*0* 2002 IEEE