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Transformer Health Monitoring Using GSM and GPS Technology

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ABSTRACT

Transformers are essential part of the transmission and distribution system. Transformers faults are costly to repair and result in a power loss. So, by regular monitoring it possible to detect new flaws before much damage has been done. Current systems can provide the state of a transformer, but they are offline or very expensive to implement. Proposed system Monitoring equipment that can acquire, process, analyze & communicates the critical parameters to the concerned official who is at a Power distribution grid with the help of GSM and GPS. Not only the conventional technical data, such as current, voltage, etc., but also other critical information such as temperature, humidity, oil level and location of the transformers. So, it is easy to ensure reliable power delivery and to assist the day-to-day decision making activities. Thus, the proposed system increases the reliability of distribution network and offers a more improved transformer monitoring.

Keywords: GSM technology, Micro Controller, Embedded System, Transformer, GPS.

I. INTRODUCTION

In recent years, increased value has been placed on power reliability and economy. Due to major changes in the utility industry there is increased in more economical and reliable methods to generate and transmit and distribute electric power. Due to this reason monitoring the health of equipment to assure that the supply of power can meet the demand. It has been seen recently in northern grid failure on 30th and 31st July 2012 due to inefficient load management functions lead to wider blackout, leaving almost 700 million people without electricity in six northern states of our country. The main focus with transformer monitoring is to protect the transformer against internal faults and ensuring security to the Transformer. Applying over voltage beyond the nameplate rating can cause a rise in temperature of both transformer oil and windings. If the winding temperature rise exceed above limits, the insulation may fail prematurely. Due to high levels of current flowing through the transformer winding integrity will become weaken. So, A transformer protection scheme needs to include protection against transformer overload, underload and over temperature as well as protection for internal faults.

This proposed system focuses on liquid-immersed transformers because the majority of medium and high-voltage transformers are of this type.

Transformer fault analysis is discussed in section-II, while section III describes about method and material for monitoring of transformer health. Results and discussion is discussed in section IV while Conclusion is discussed in section V.

II. METHODS AND MATERIAL

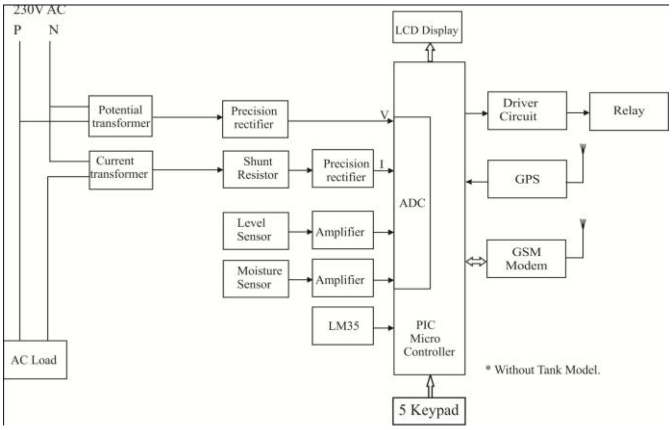

Figure 1. Block Diagram Of Proposed System

Figure 1 It consist of potential transformer, current transformer, temperature sensor(LM35), oil level sensor, micro-controller (PIC16F877A), LCD display, GSM Modem, GPS Module and relay. Normally in transformer, failure occurs due to voltage and current fluctuation, overheating, change in oil level etc. In this project, to sense these fault we have used current and potential transformer, temperature sensor, oil level sensor respectively

All these sensors are connected to converter (ADC) and digital output from converter is given to micro-controller PIC16F877A. PIC has four ports viz. P1, P2, P3 and P0 to which we will be connected to address lines, GSM model and LCD respectively. When fault occurs due to above any reason then change in ratings will be shown on LCD and quick SMS will go to control room via GSM modem along with GPS location using GPS module. A brief discussion about components 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 temperature and oil level following sensors is selected and suitable designed with respect to prevailing conditions of power system and rating of transformer to be protected.

A. Current and Voltage Transformer

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

B. Oil Level Sensor

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.

C. Micro Controller

Operating speed: DC - 20 MHz clock input
Up to 8K x 14 words of Flash Program Memory,
Up to 368 x 8 bytes of Data Memory (RAM)
Up to 256 x 8 bytes of EEPROM data memory
5V source needed for programming capability

D. 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.

E. LM 35 Temperature Sensor

LM35 are used to sense the heat and an IC ADC0808 is used to convert the data into digital. LM35 digital sensor has got 3 pin's i.e., VCC, GND and output pin's when LM35 is heated the voltage at output pin increases, it is connected to the analog to digital convertor IC (ADC). The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

III. RESULTS AND DISCUSSION

The project is based on microcontroller programming. The program for microcontroller in embedded C language. Program written burned into microcontroller and saved as Hex file. For PIC16F877A controller Atmel programmer is used. Program hex file is compiled in μcontroller MPLAB compiler. This compiler converts program into machine language code as well as check program for error if any error found notifies and these errors are corrected manually. Then it successfully executed in compiler. After compiling program in μcontroller flash compiler, it is burned into PIC16F877A microcontroller with the help of universal program burner kit FP8903 programmer which is connected to computer. After successful program burning, microcontroller becomes ready for use. In testing, after successful program burning, microcontroller is mounted on its base and kit becomes ready for testing. For testing in program kit has provided with following four parameter of transformer:

1. 180 >Voltage > 260 ---- Voltage Fault
2. Temperature > 400C---- Temperature fault
3. Power > 125W ----- Over load
4. Oil level < 10 ml ---- Oil level fault

Therefore any change occurred in above rating during running of project model, these changes is shown in LCD and same data obtained in SMS and at the same time transformer gets disconnected from supply with the help of relay.

IV. CONCLUSION

Transformers are among the most generic and expensive piece of equipment of the transmission and distribution system. Regular monitoring health condition of transformer not only is economical also adds to increased reliability. In the past, maintenance of transformers was done based on a pre-determined schedule. With the advancement of communication technology now it is possible to receive fault information of transformer through GSM technology remotely to the operator and authorities so one can able to take possible solution before converting fault in to fatal situation. Depending upon fault analysis a prototype model of microcontroller based transformer health monitoring kit is developed in laboratory. Using digital controller analysis results are regularly updated. During abnormal conditions exceeding specified limits information is immediately communicated through GSM technology to the operator and also to concerned authority for possible remedial action. This type of remote observation of health condition of transformer not only increases the life of transformer increases mean down time of transformer there by increased reliability and decreased cost of power system operations.

V. REFERENCES

The heading of the References section must not be numbered. All reference items must be in 8 pt font. Please use Regular and Italic styles to distinguish different fields as shown in the References section. Number the reference items consecutively in square brackets (e.g. [1]).

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