GSM Based Health Monitoring of Transformer
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Abstract:
Transformers are one of the most important equipment of the Transmission and Distribution System. As there is a large spread of the transformers for the power distribution, so the monitoring of current and voltage is very difficult. In the remote areas where transformers are difficult to monitor and cost of maintenance is high. And this system is a way to monitor the transformer efficiently. Distributed and Internet-based systems are having its own limitations but the GSM is an open source of monitoring the transformers. This system is designed in such a way with a single chip microcontroller, oil sensor, a current sensor, voltage sensor and temperature sensors are used to monitor the transformers. This project is designed in such a way that it provides cost effective solution to the user. It consists of the microcontroller, LCD display, GSM Module and some sensors such as Temperature and oil level. A powerful GSM module is designed and implemented for the proper sending of the messages to the user for the over temperature and over voltage.

Keywords: Current Transformer, GSM Module 900/1800 MHz, Microcontroller PIC18F25K22, Oil Sensor, Potential Transformer, Transformer Fault.

I. INTRODUCTION
In recent years, increased emphasis has been placed on power reliability and economy. In particular, major changes in the utility industry have caused increased interest in more economical and reliable methods to generate and transmit and distribute electric power. In this regard monitoring the health of equipment constituting the system is critical to assure that the supply of power can meet the demand. Our system is designed based upon GSM 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. This system will help us to identify problems before any catastrophic Failure, thus resulting in a long life service for transformers. This system we are using a microcontroller as discussed before. The main concern with transformer protection is protecting the transformer against internal faults and ensuring the security of the protection scheme for external faults.

II. TRANSFORMER FAULT ANALYSIS
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. [2] These operating limits only considered the thermal effects of transformer overload. Power transformer faults produce physical forces that cause insulation wear. These effects are cumulative and should be considered over the life of the transformer.

- **OVERLOAD**: Over current is the current flowing through the transformer resulting from faults on the power system. Fault currents that do not include ground are generally in excess of four times full-load current. Conductors and the transformer structure. Three factors, namely water, oxygen, and heat, determine the insulation life of a transformer. Filters and other oil preservation systems control the water and oxygen content in the insulation, but heat is essentially a function of the ambient temperature and the load current.

- **OVER TEMPERATURE**: Excessive load current alone may not result in damage to the transformer if the absolute temperature of the windings and transformer oil remains within specified limits. 30°C (86°F). Due to over voltage and over current, temperature of oil increases which cause failure of insulation of transformer winding.

- **OVER EXCITATION**: The flux in the transformer core is directly proportional to the applied voltage and inversely proportional to the frequency. Over-excitation can occur when the per-unit ratio of voltage to frequency (Volts/Hz) exceeds 1.05 p.u. at full load and 1.10 p.u. at no load. An increase in transformer terminal voltage or a decrease in frequency will result in an increase in the flux. Over-excitation results in excess flux, which causes transformer heating and increases exciting current, noise, and vibration. [1]

- **OIL LEVEL FAULT**: Oil mainly used in transformer for two purposes one is for cooling of the transformer and another use is for insulation purpose. When the temperature of transformer goes high, oil level in the 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 affects cooling and insulation of the transformer.

III. PROGRAMMING OF MICROCONTROLLER AND DESIGNING OF KIT FOR HEALTH MONITORING OF TRANSFORMER
It consists of a current transformer, power transformer, thermister, oil sensor, a microcontroller (PIC18F25K22), converter (ADC0808), LCD display, GSM modem, and relay. Modem and relay. Normally in the 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 power transformer, temperature sensor, oil sensor
respectively. All these sensors are connected to a converter (ADC0808) and digital output from the converter is given to microcontroller PIC18F25K22 [3]. It has four ports viz. P1, P2, P3 and P0 to which we will be connected to address lines, GSM model, and LCD respectively. When a fault occurs due to above any reason then change in ratings will be shown on LCD and quick SMS will go to the user via GSM modem.

IV. COMPONENTS USED-

Temperature Sensor:-
The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

GSM Modem:-
A GSM Modem is a specialized type of modem which accepts a sim card and operates oversubscription to a mobile operator, just like a mobile phone from the mobile operator perspective.

Relay Circuit:-
Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate.

V. LOCK DIAGRAM:

VI. WORKING:-

This project is used to detect the incipient fault in Power transformers. Various parameters like Oil level, Temperature, voltage and current are monitored. Oil sensor works as a switch. It contains one reed switch & one magnet. When Oil comes near oil sensor then SW (switch) goes open. If oil level goes down, then SW will on. It works as a normal push button. According to oil level SW (switch) automatic close & up. Our Device is password protected & default Password is 12345. TRF is our prefix for SMS setting & should be in capital letter. The message should end with; char otherwise device will not respond that message & deleted by the device. To Change Mobile Number must start with +91. How to change mobile number.

Type to Send ➔ TRF: 1:12345:+91+10 digit mobile number;
Received Response<Mobile-1 OK +91 + 10 digit mobile number;
In this way, we can add up to three mobile numbers more for the data delivery. These numbers are stored in the memory of the GSM Module. So if the SIM is changed there is no loss of the mobile numbers. The SMS is sent periodically at the set time interval as well as displayed on the LCD.

As there is the use of oil level sensor it senses the Oil level and sends the data to the microcontroller through the ADC which converts the analog data to digital and then microcontroller sends the data to the user through the GSM Module.

VII. CONCLUSION:

The GSM based monitoring of distribution transformer is quite useful as compared to manual monitoring and also it is reliable as it is not possible to monitor always the oil level, oil temperature rise, ambient temperature rise, load current

V. FLOWCHART:
manually. After receiving the message of any abnormality we can take action immediately to prevent any catastrophic failures of distribution transformers. 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 into a fatal situation. This type of remote observation of health condition of transformer not only increases the life of transformer increases mean downtime of transformer thereby increased reliability and decreased the cost of power system operations. [4]

VIII. REFERENCES:


