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Multiple Transformer oil monitoring with automatic Circuit breakers with SMS based alerts

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Abstract:

Distribution transformer is most important component in power distribution system as it converts high voltages to low voltages for consumption. It can operate efficiently and for a long time if it operates on rated and good conditions. But, due to overload current and unwanted conditions, their life reduced significantly and unexpected failures will occur in the system. In distribution transformers, overloading and overheating are the main reasons for its failure. The aim of this research is to design a micro-controller-based device that can be used for the online monitoring and safety of distribution transformers. The system allows us to monitors the oil temperature, displays the fault status, and forwards the input to the automatic circuit breaker and GSM module, which sends the information to the control department through the SMS warning. It tracks the oil level at different time intervals. If it is above or below the normal operating level, it automatically isolates the distribution transformer from the distribution line. Before any disastrous failure, many operational problems can be recognized, thus, this will lead us to the long service life of the transformer. It has also advantaged of greater reliability and economical method.

Keywords: **Automatic circuit breaker, Distribution transformer, GSM module, Oil temperature monitoring.**

1.INTRODUCTION

Distribution transformer can operate for long time if it operates on rated and good situation [1]. But, due to unwanted conditions and faults their life reduced significantly. When they are overloaded due to excessive load current, losses will increase, and unexpected failures will occur in the system. These losses and failures will affect the system and many consumers badly. These faults will also affect the system reliability. In distribution transformers, overloading and cooling of the transformer is the main reasons for its failure. In present times, distribution transformers are operated manually by manpower. Where some persons monitored the transformer on daily basis by visiting the site for recording the parameters of the transformer and its maintenance. Manual monitoring of the distribution transformer cannot provide us instant and complete information about the transformer heating and overloading of the transformer oil temperature and its windings. Distribution transformer life can be affected badly by these factors. These factors play very important role in reducing the life of transformer.

This paper is to design a system that based on online monitoring of the transformer oil temperature and levels occasionally. This system will be able to provide us information about various parameters of the transformer health, and its working condition through which we can assess the operating condition and parameters of the transformer for long time of period [2]. Before any disastrous failure in the transformer, many operational problems can be recognized, thus, this will lead us to the long service life of the transformer. It has also advantaged of greater reliability and economical method. The preferred monitoring system will be based on GSM module for mobile or any communication device to monitor the system properly on regular basis, with ATmega32 micro-controller and sensors packages. Data of the operating transformer can be received on the device on suggested time interval and notify at some ranges of the temperature. This online method will help workers and engineers to make the system reliable and to keep the transformer service for long

2. LITERATURE SURVEY

The literature highlights the significance of transformer monitoring systems in preventing malfunctions and improving dependability. Newer technologies like infrared thermography being investigated with more conventional techniques like temperature sensors.

Automatic Circuit Breaker Operation: Research focusses on intelligent protection strategies that use relay systems and adaptive algorithms to operate circuit breakers automatically. The objective is to minimize damage risk by promptly cutting off malfunctioning transformers from the grid.

SMS Alert Systems: One important area of research is the integration of SMS alert systems. In order to minimize downtime, enable quick responses to unusual temperature circumstances, and guarantee the general dependability of power distribution systems, timely notifications are seen to be essential.

The existing system can be improved by the use of internet of things (IOT) which is all about connecting the unconnected things.

Site for support and records the important Currently, distribution transformers can be seen physically where a man occasionally visits a transformer and monitors the parameters. This kind of monitoring cannot provide information concerning overheating of transformer oil and windings and incidental overload. Each of these factors has the potential to reduce transformer life.

A monitoring system can only keep an eye on the operation condition and cannot keep track of all relevant data of distribution transformers to reduce costs and stability of the equipment.

Normally transformer health measurement system generally discovers a solitary transformer parameter such as current, voltage, etc. While some techniques could identify multi-parameter situations where testing pace is insufficiently swift and operation parameter times are too long.

Distribution transformers three phase equilibrium cannot be judged as the data for lucky detection won't be delivered to the operator in

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time. To overcome the above deficiencies, this work proposes a real-time monitoring system for distribution transformers with the help of IOT and a widespread use of mobile networks and GSM modems, have made this project an attractive option both for wide area network applications and voice media.

3. PROPOSED METHODOLOGY

The proposed model has a theoretical foundation. By utilizing a strong theoretical foundation across several fields, the suggested model seeks to provide an integrated system for Transformer Oil Temperature Monitoring with Automatic Circuit Breaker Operation and SMS Alert. High-precision sensors, like thermocouples or infrared sensors, will be used for temperature monitoring in order to offer real-time information on the temperature of transformer oil. To understand the complex relationship between temperature changes and the transformer's overall health, theoretical frameworks integrating thermal modelling will be used. By integrating adaptive relay systems, which use sophisticated algorithms to analyse temperature data and initiate automatic disconnections from the grid in reaction to anomalous temperature circumstances, automatic circuit breaker operation will be made easier. At the same time, a sophisticated SMS alert system with GSM integration will be put into place.

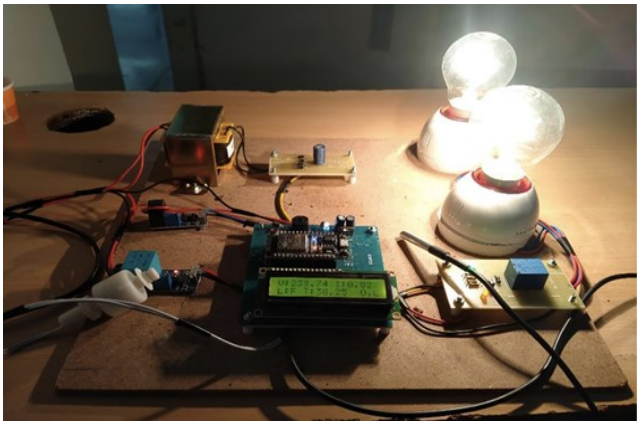

Figure1: proposed model

Applications:

Numerous industries can profit greatly from Transformers Oil Temperature Monitoring Systems with Automatic Circuit Breaker Operation and SMS Alert. Such a device actively monitors oil temperatures to guarantee the safe and ongoing functioning of transformers in industrial environments. The automatic circuit breaker function of the system acts as a safeguard in power distribution networks, reducing downtime and averting any transformer damage. By integrating SMS alerts, its usefulness is expanded to unmanned or remote areas, giving operators or maintenance staff real-time notifications in the event of severe temperature levels. This is especially helpful in lowering the need for frequent human inspection, lowering the risk of transformer failures, and improving the dependability of electrical infrastructure. Additionally, the technique is used in smart grids, where it helps the electrical grid become more resilient and efficient overall by enabling quick responses to temperature anomalies and guaranteeing timely maintenance. All things considered, the Transformers Oil Temperature Monitoring System with Automatic Circuit Breaker Operation and SMS Alert is essential to improving power distribution's efficiency, safety, and dependability in a variety of utility and industrial settings.

Advantages:

Greatly improving power distribution networks' dependability and security. First off, proactive detection of anomalous situations is made possible by real-time transformer oil temperature monitoring, which averts possible equipment breakdowns and prolongs transformer lifespan. By quickly isolating malfunctioning transformers, the automatic circuit breaker operation reduces the possibility of cascading failures and mitigates damage, adding an additional layer of protection. Key staff are instantly informed of critical temperature fluctuations thanks to the integration of SMS warnings, which offers an instant communication channel. By enabling prompt repair and intervention, this rapid response capacity lowers downtime and possible operational disruptions. The solution also improves operational efficiency by facilitating remote monitoring, which enables prompt evaluations and reactions from any location. The capacity of this integrated system to reduce downtime, avoid transformer failures, and support a more robust and responsive power distribution infrastructure are its main advantages. Among the many benefits of a transformer oil temperature monitoring system with automatic circuit breaker operation and SMS alerts are early overheating problem detection, preventative maintenance, decreased catastrophic failure risk, quick reaction to abnormal temperatures, increased reliability, and easy SMS alert notification that enables prompt maintenance staff intervention.

4. EXPERIMENTAL ANALYSIS

The output of the transformer status will be shown on the display when the microcontroller transforms the input analogue signal from the circuit diagram into a digital signal. The transformer's initial value will be established, and if it rises above this point, the LED will turn on and the mobile user who is simultaneously entering the GSM modem number will receive the SMS [6, 8]. Depending on the circumstances, there are several situations. Below are some examples of various fault scenarios and porotype outcomes.

Situation 1:

Low Oil Level A low-level sensor, which is represented in the circuit by a low-level button, will detect a low oil level in the transformer. The designated individual will then receive a text message that reads, "Oil Level is Low in Tran," and an LCD and LED will both display the word "L: Low." as seen in the diagram below.

Figure 3: low oil level

Situation 02:

Elevated Oil Level The high-level sensor in the circuit, which is represented by the high-level button, will sense a high oil level in the transformer. The LCD screen displays the text message "Oil Level is High in Tran," along with the words "F High" and "Reduce the load," as seen in

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Figure 3:high oil level

Situation 3:

Oil Temperature Exceeding 85°C The Thermistor 10k will sense a temperature increase of more than 85°C in the transformer's oil, and the temperature is indicated by temperature. online sensor. The LCD will display the warning as illustrated in figure 5 . "Tran: The oil temperature is high and the supply is cutting off," the text message reads.

5. CONCLUSION

Monitoring the transformer's condition on a daily basis is not only more economical but also more effective. Transformer maintenance used to be done according to a predetermined schedule. Now that everything is more sophisticated, we may use GSM technology to run the transformer online in far-flung and developed areas before minor issues turn into major ones. This design, which was created especially for 500 KVA distribution transformers, improves system management and dependability while also preventing equipment damage. Because GSM-based monitoring can identify changes in load, temperature, and oil level, it is far more accurate and useful than manual monitoring. Such supervision could lead to dependable and effective operations.

SYMBOL	RANGE
T	0-700
L	0<350>700
V	+-5% of 230v

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