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GSM Based Transformer Fault Monitoring System

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Abstract- *Transformers are a vital part of the transmission and distribution system. Monitoring transformers for problems before they occur can prevent faults that are costly to repair and result in a loss of service. This system can provide statistics about a condition of a transformer, but are either offline or very expensive for implementation. Transformers are being the essential part of power transmission network are expensive, as the cost of power interruptions .Due to the cost of scheduled and unscheduled maintenance, especially at remote sites, the utility industry has begun investing in instrumentation and monitoring of transformer. GSM is an open ,digital cellular technology used for transmitting mobile voice and data facilities .The project objective is to progress low cost solution for monitoring the health condition of remotely located distribution transformers using GSM technology to prevent premature damages of distribution transformers and improving reliability of services to the users .Any change in parameters of transformer is sensed to protect entire transmission and distribution .The accomplishment 0f this prototype developed was tested at laboratory for monitoring various parameters like transformer over load ,voltage fluctuations, over temperature, oil quality and level etc. If there is any abnormality on the system ,the GSM module will send SMS(Short Message Service)messages to designated mobile telephones containing information about the abnormality according to the aforesaid predefined instructions. Thus THMS(Transformer Health Monitoring System) offers a more improved transformer monitoring.*

Key Words: Power system faults, GSM technology, micro controller.

1. INTRODUCTION

Transformers have a long life, if they are operates under good conditions. In case they are overloaded then their life is significantly reduced. Overloading and ineffective cooling of transformers, are the main causes of failure, in transformer. All such type of factors can reduce the transformer life. Our system is designed based upon online monitoring of key operational parameters of distribution transformers and provide useful information about the health of transformers. This system will help us to find problems before any catastrophic failure, thus resulting in a long life service for transformers. This system is based on embedded system as we are using microcontroller. Embedded systems are self-contained programs that are embedded within a piece of hardware. Embedded systems are usually set of a specific task. Another way to think of an embedded system is as a computer system that is created with optimal efficiency. It is also has the advantages of significant cost savings, power consumption and greater reliability.

II. TRANFORMER FAULT ANALYSIS

The transformer contain a set of more windings around a magnetic core. Those windings are insulated to the core. Operational stresses can cause damages to the transformer winding, insulation, and the core. The transformer windings and magnetic core are subjected to a number of different forces during operation like expansion, contraction, vibration and eddy currents. These operating limits only considered the thermal effects of transformer overload. Power transformer produce physical faults that cause insulation wear. This effect is cumulative and should be considered over the life of the system. The following are highlights of different capability limits of transformer.

- Over load
- Over temperature
- Over excitation
- Oil level fault

III. RELATED WORK

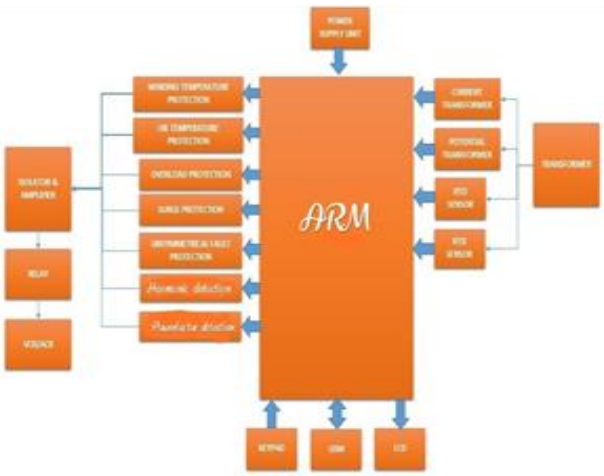
An analysis of these problems and various suggestions about the development of the present research work on the transformer monitoring has been presented by Alessandro Ferrero. Observing and be in control of substations is a necessary task for supplying healthy power to the users in this automated era. But because of the aging infrastructure of the distribution grids(substations)and lack of automation systems that monitors the critical conditions at the substations, the risk of blackouts, brownouts and

fire are rapidly increasing. Substations consist of different electronic components like transformers, circuit breakers, relays etc. Also the substations in the rural areas are even more difficult to monitor manually and hence requires more time to take respective actions. Most power companies use Supervisory Control and Data Acquisition(SCADA) system for online proposition. Distribution transformers are currently monitored manually where a person visits a transformer site for maintenance and records parameter of importance. This type of monitoring cannot provide statistics about occasional overloads and overheating of transformer oil and the windings. All these factors can significantly reduce transformer life.

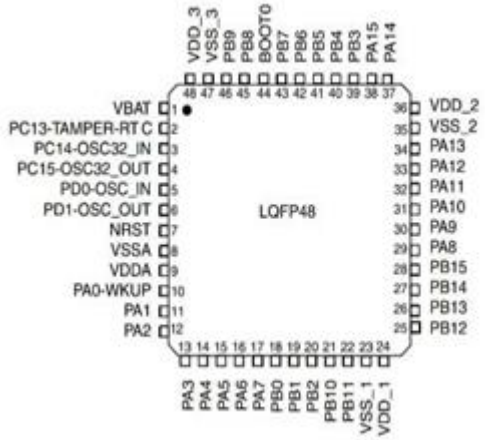
IV. PROPOSED SYSTEM

Distributed transformers are prone to damages because of the raise in oil temperature when there is an overload or huge current flows through the internal winding of the transformer. When the oil temperature rises, accordingly that increases the probability of getting damages in the transformers. The transformers are to be monitored very cautiously during these situations. The proposed systems includes monitoring system which is connected to the distribution transformer for observing purpose. This micro controller consists 0f sensing unit that gathers the essential readings like current, voltage, and the oil temperature within the distribution transformer The digital LED display connected to the processing unit that displays the respective parameter values at the substation. The controller also senses the overload and high current flow process in the internal windings which may lead to breakdown of respective unit. An ARM controller is programmed in such a manner so for the scanning of the transformer continuously. It will update observation readings at particular time period. The AVR microcontroller is transmitted through the ADC(Analog to Digital Converter) transmitter connected to the ARM controller unit.

V.BLOCK DIAGRAM



VI. ARM PIN DIAGRAM



SOME FEATURES

- ARM 32 bit cortex
- 64 or 128 kbytes of flash memory
- 2.0 to 3.6V application supply
- 7-channel DMA controller
- upto 80 fast I/O ports
- serial wire debug(SWG)

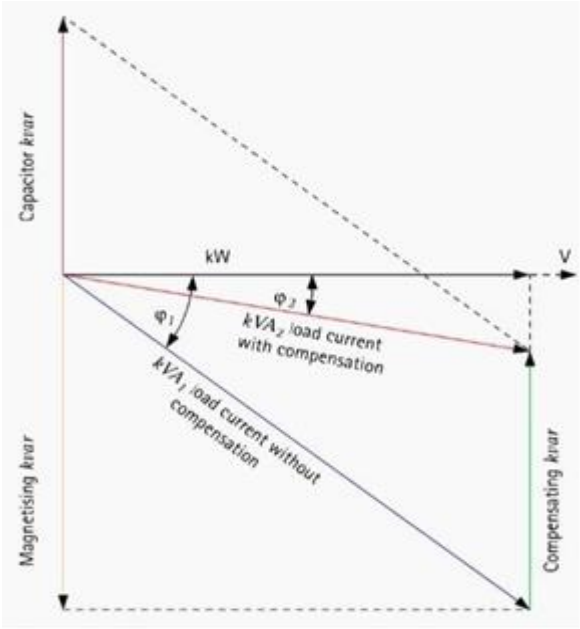
VII. MODEL DEVELOPMENT

Potential transformer(PT),Current transformer (CT), LM-32 are the sensors used for monitoring transformer parameters (oil temperature, winding temperture). Initially input from mains lines to load is monitored by CT current transformer. This CT gives the current level based on the load used by the consumers. The output of the CT is fed to the ADC for the conversion of analog to digital voltage. The output of the ADC is fed into the microprocessor for further processing of the data.

VIII. POWER FACTOR CORRECTION

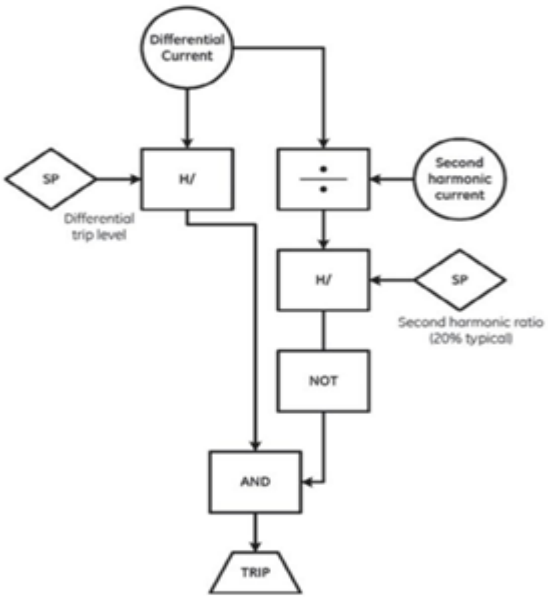
Loads such as induction motors draw significant reactive power from the supply system and a poor overall power may result. The flow of reactive power increases the voltage-drops through series reactances such as transformers and reactors, it uses up some of the current carrying capacity of power system plant and it increases the resistive losses in the power system.

To offset the losses and restrictions in plant capacity they incur and to assist with voltage regulation , utilities usually apply tariff penalties to large industrial or commercial customers for running their plant at excessively low power factor.



IX. HARMONIC DETECTION

Harmonic restraint is the classical way to restrain tripping. There are many variations on this method. All of these methods work on the magnetizing inrush current contains high levels of second harmonic current. The current for an internal transformer fault typically has very low levels of second harmonic current. The simplest method of harmonic restraint uses the magnitude of the second harmonic in the differential current compared to the magnitude of the fundamental frequency component in the differential element is blocked when this ratio exceeds an adjustable threshold.



This method originated in electromechanical relays, and has been carried through as the most common method in microprocessor relays. The harmonic restrain is typically calculated on per phase basis. Variations include using the RMS current as opposed to the fundamental frequency component, and using a cumulative three phase implementation.

X. PROTOTYPE MODEL

APPLICATIONS

- Power Grid
- Factories
- Industrial Area
- Home Automation

ADVANTAGES

- It is reliable system
- It is effective than manual monitoring
- It is recover the system time less
- Life of the equipment is increased
- No manual errors
- Remote location operation can be done.

XI. RESULT ANALYSIS

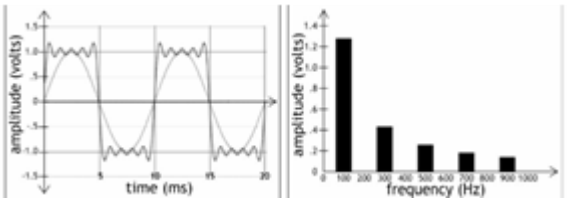
The project is based on ARM micro controller. In testing after successful program burning, avr controller is mounted on its base and kit becomes ready for testing. For testing in program kit has provided with following three parameter of transformer:

1. voltage >440V – Voltage fault

2. Temperature > 1250C – Temperature fault

3. Power >125 W – Over load

HARMONICS:



From the wave form harmonics is 33%.

POWER FACTOR:

The power factor is to be maintained between 0.9 to 0.95 for higher frequency.

If there is any variation in these conditions the circuit will be tripped. 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 the supply with the help of the relay. Results obtained during testing as per given input and fault conditions on LCD.

XII. 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 it is economical but also adds to increased reliability. The GSM based fault monitoring of distribution transformer is useful as compared to manual monitoring and also it is reliable as it is not possible to monitor always the oil level, temperature rise, load current , voltage occur manually. Transformer is undergoing fault from the message sent to mobile. We can recover the system in less time.

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