Advance Automation for Transformer Monitoring and Control 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. Current systems can provide information about the state of a transformer, but they are either offline or very expensive to implement. The system has been designed to monitor the transformer's oil temperature and oil level continuously throughout its operation. If the device recognizes oil temperature violates the limit then the entire unit is shut down by the designed controlling unit. And also the systems display the values throughout the process on the SCADA for user's reference and further inform the current status of the transformer. Thus, the system makes the transformer more secure and intelligent.

Keywords: DAQ device, Transmission & Distribution System, Transformers, SCADA.

I. INTRODUCTION

New modern electronic technologies motivate the creation of new generation of transformers as intelligent devices for advanced distribution automation in future. The Power transformer is essential equipment of the Electrical power system. Usually power transformers have a 20-35 year design life. In practice, a transformer can reach 60 years of useful life if it is properly operated and maintained. With the normal aging, their internal condition degrades, which increases the risk of failure. Traditionally, the evolution of these faults was accompanied with preventative maintenance programs combined with regular tests. With deregulation, it has become necessary to reduce maintenance costs and equipment inventories, thus there is a trend in the industry to move from traditional time-based maintenance programs to condition based maintenance.

This paper presents a monitoring system for integrated diagnosis of power transformers. The monitoring system can be integrated into the plant controlled system allowing smooth operation and reduce interfaces between different systems.

The equipment is permanently mounted on the transformer and is online. The system is made up of static controllers hence it needs less maintenance. And also it helps to cut transformers operational and maintenance cost. The system is modular and expandable for additional requirements that may be needed in future. The ultimate objective is to monitor the electrical parameters and to inform the observed data to the concerned official

II. ASSESSMENT OF POWER TRANSFORMER IN SERVICE

In practice, life assessment of the transformer may be performed for any of the following reasons:

- To monitor the transformer condition and possibly detect incipient faults;
- To diagnose problems when a transformer exhibits danger signals or following the operation of their protection devices;
- To determine whether a transformer is in condition to cope with unusual operating conditions;
- To obtain reference results to assist in the interpretation of subsequent tests;
- To assist in planning the replacement strategy for a population of transformers;
- To satisfy the requirements for insurance cover;

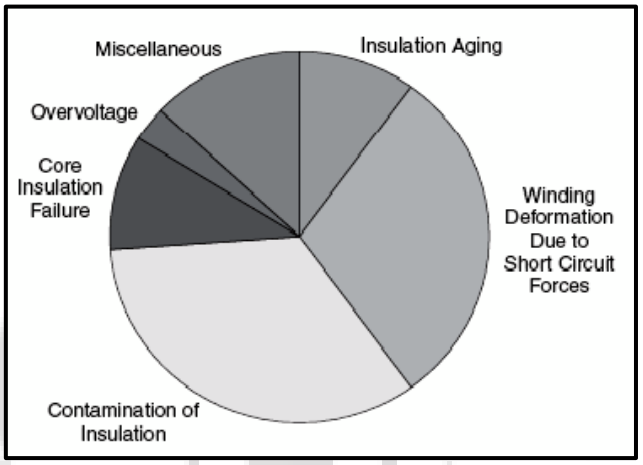

Fig. 1: failure statistics of transformer

Failure statistics of large transformers can be beneficial in determining which component is more important to evaluate the condition of the equipment . Figure shows the results of a failure analysis carried out in South Africa, from 188 power transformers in the voltage and power range of 88kV to 765kV and 20MVA to 800MVA, respectively.

For the development of transformers diagnostic tools, it has been essential to undertake a survey about the transformer main components, the associated defects and their diagnostic methods:

III. TRADITIONAL DIAGNOSTIC METHODS

A. Dissolved Gas Analysis: By means of this analysis, it is possible to distinguish faults such as partial discharge, overheating and arcing in a great variety of oil filled equipment.

B. Insulating Oil Quality: A combination of electrical, physical and chemical test is performed to measure the change in electrical properties, extend of contamination and the degree of deterioration in the insulating oil.

C. Thermograph: This method is used to check external temperature of a transformer on *line.*

IV. DESIGN CONCEPT OF PROPOSED SYSTEM

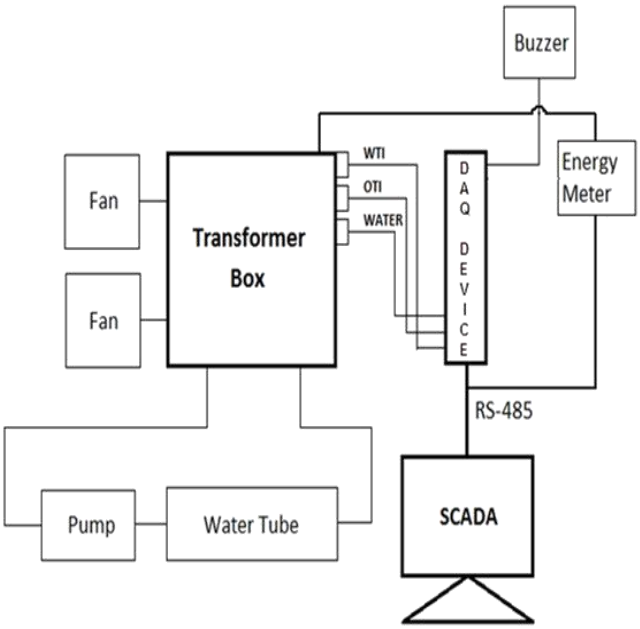

Fig. 2: Block Diagram of Proposed Monitoring System

V. MONITORING SYSTEM

The Proposed monitoring system shown in Figure 2 is designed using DAQ Device (SCANNER). The system consist of Sensing units temperature sensors, which collects the essential parameters such as oil temperature and overload condition within the transformer. The system consist of Sensing units level sensors, which monitors the oil level. The SCADA connected to the processing unit displays corresponding parameter values for any technical operations in PC. The device is programmed in such a manner so as to continuously scan the transformer and update the parameters at a particular time interval. The device is connected to SCADA using RS-485 converter cable.

VI. SCADA INTERFACING

The SCADA interfacing will provide the user interface and all updates regarding the temperature and level of the oil hence decreasing human effort.

VII. CONCLUSION

Transformer diagnostics is an expanding field of study. The monitoring system presented in this paper can be altered and expanded to provide more and more valuable information on the health of a transformer. The potential of this system is vast and with further investigation, the concept of an intelligent diagnostic for transformer or even substation level can be realized. The result of this paper, which is designed for monitoring essential parameters of the transformer, shows great promise on being a successful monitoring system for high voltage transformers. The proposed design of the system makes the distribution transformer more robust against some key power quality issues which makes the voltage, current or temperature to peak. Hence the distribution is made more secure, reliable and efficient by means of the proposed system.

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