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Health Condition Monitoring of Transformer by using Microcontroller

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Abstract:-*Transformers are the vital part of the transmission and the distribution system. Monitoring transformers for problems before they occur prevent faults that are costly to repair and result in loss of service Distribution transformers of substation are one of the most important equipment in power system network. Because of, the large number of transformers and various components over a wide area in power systems, the data acquisition, condition monitoring, automatic controlling are the important issues. This paper presents design and implementation of automatic control circuits which uses microcontroller for automation to monitor as well as diagnose condition of transformers, like load currents, transformer temperatures and voltages. The transformer health condition monitoring can be achieved by the continuous condition monitoring using microcontroller. The proposed monitoring system integrates a microcontroller and sensor packages. The suggested monitoring system will help to detect the internal fault as well as external fault of transformer and also diagnose these faults with the help of desired range of parameters which is mentioned by the programmer in program.*

Keywords— Transformer health Monitoring, current Transformer, Potential Transformer, Microcontroller.

I. INTRODUCTION

In recent trends, automation has been placed on power reliability and economy. A power transformer is a valuable and vital link in a power transmission system. Monitoring of transformer is essential to evaluate transformer performance and safe operating conditions. High reliability of the transformer is important to avoid disturbances in transmission of power. Due to wide range of microcontroller automation, the various types of fault in power transformer can be detected and diagnosed by using this system This project presents an innovative design to develop a system which is based on PIC microcontroller that is used to log the voltage, current and temperature of a power transformer and to protect the system from any perplexity conditions. PC monitoring is available to see the logged data and LCD display will show all the information related to transformer health. It ensures that the system is protected from itself and that the consumer is also safe as he is benefited from the electrical power supply. There are various components in an electrical power system such as generators, switches, transmission cables, transformers, capacitor banks among other components. It therefore needs an effective protective device to operate to keep these components safe and the system stable. Faults in a power system may cause undesired conditions that occur in the electrical power system. These conditions may include short circuit, over current, over voltage, high temperature among others.

II. LITERATURE REVIEW

[1] Dhingra Arvind :-

In this paper diagnosis is the interpretation of these monitored data including the history of the transformer and the statistical judgment of the failure rate. The importance of the monitored transformer and the economic consequences are the basis for the asset management of transformer together with the risk evaluation.

[2] Avinash Nelson :-

In this paper explain the system architecture and method of analysis used in the first sections. Then test results on a distribution transformer are discussed. This system is different from power transformer condition monitoring techniques used and communication. RCMS implementation in distribution network can reduce failure and ageing rate of distribution transformers.

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[3] A.Z. Loko:-

This paper describes the design and implementation of an "Automatic method of protecting transformer as an alternative to the fuse protection technique". The aim of this paper is to provide an alternative, effective, efficient and more reliable method of protecting fault from power transformer or a high input voltage

[4] Akshay R. Thakare :-

In this paper to prevent the transformer from the fault due to the over current, temperature rise in transformers oil and over voltage we used relay and sensor. In this protective methodology is implemented by using of Arduino controller. Load current and transformer temperature are continuously monitored.

[5] SH. Mohamadi:-

[6] In this paper presents designed and implementation of mobile embedded system and a novel software to monitor and diagnose condition of transformer like load currents, transformer oil, ambient temperatures and voltage of three phases. The propose on-line monitoring system integrate a global service mobile modem, with stand only single chip microcontroller and sensor package.

III. BLOCK DIAGRAM

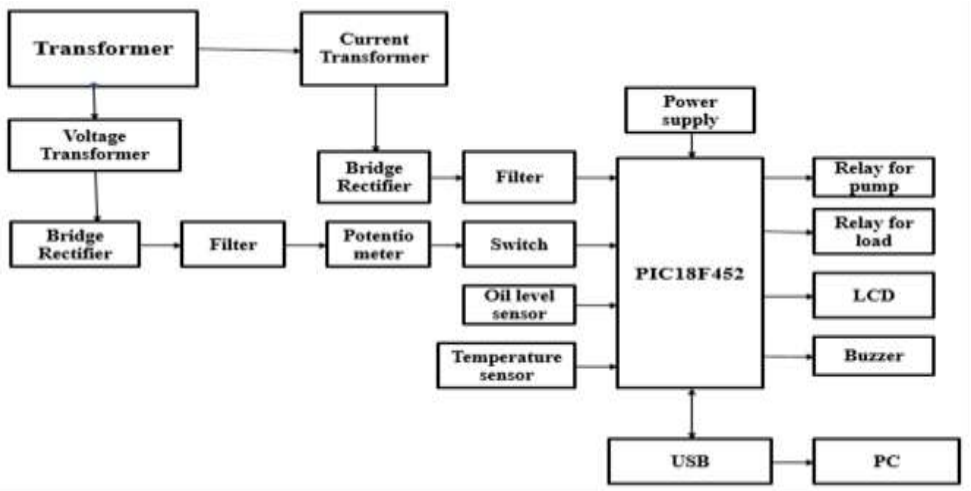

FIG. 1 BLOCK DIAGRAM

IV. WORKING

4.1 Over Voltage protection

Over voltage is generated using potentiometer, the input is monitored by microcontroller. If the voltage goes above threshold voltage then the switch connected to pot act as short circuit and voltage supply is blocked.

4.2 Over Current

Whenever the over current condition is observed the relay goes off, over current is detected using current transformer. If over current is detected then controller will sense high load across relay and it will turn of the respective relay which have high current than threshold.

4.3 Fault in the oil level

Oil level is monitored using level sensor it will detect the level of oil. When low level is detected by the microcontroller, the microcontroller starts the relay and fills the tank automatically through DC pump.

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4.4 Temperature rise fault

It is detected using LM35 and sensor output is given to microcontroller to measure their high temperature. A 16*2 LCD is used to show the details of Temperature, Current, and Voltage and Oil level. All this can be monitored using PC from user side. To send the data on PC , Microcontroller will be connected to PC through USB to TTL If any kind of fault is generated then Microcontroller will send an alert by activating buzzer.

V. CIRCUIT DIAGRAM

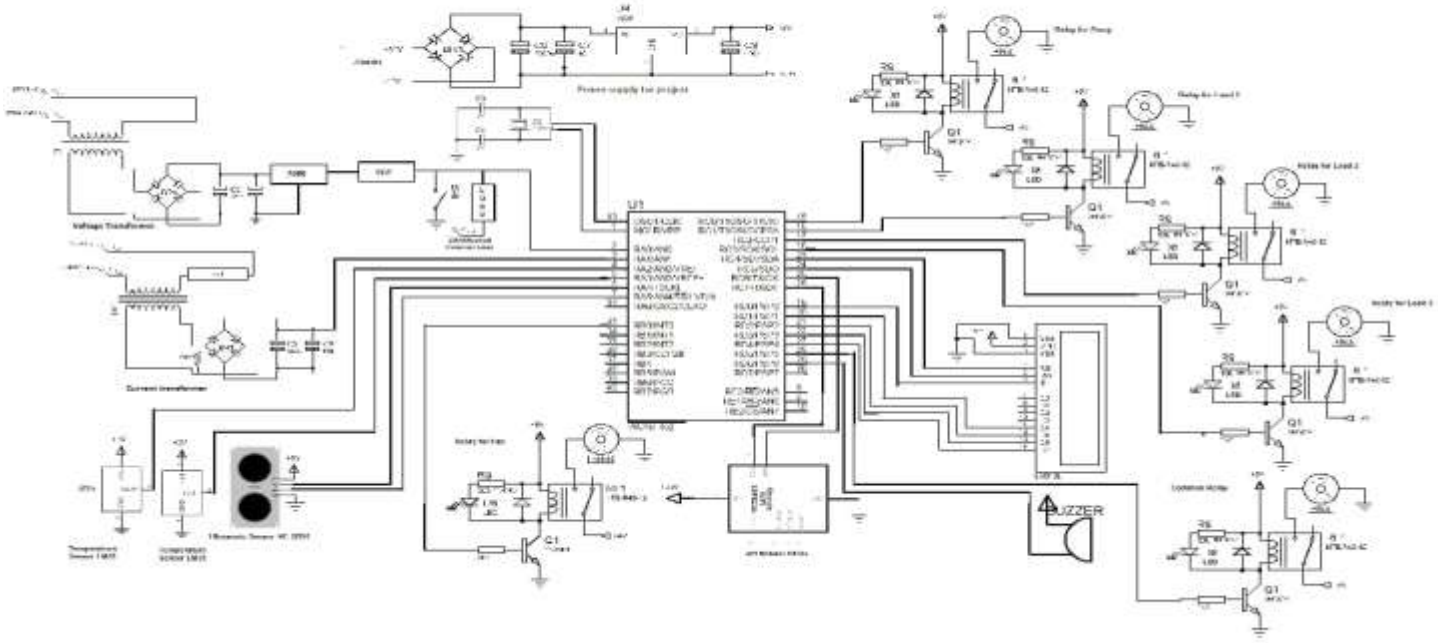

Fig.2 Circuit Diagram

The microcontroller is already programmed using C language and parameters are programmed in microcontroller. The potential transformer is connected to the pins of the microcontroller. The output of potential transformer is fed to the bridge rectifier. For rectification purpose and the rectifier output is fed to the filter circuit in order to remove the ripples. The DC voltage is stabilized using voltage regulator (7805) before is fed into microcontroller. The potentiometer is connected to the switch. The over voltage is generated using potentiometer that input is monitor by microcontroller. If the voltage goes above threshold voltage the switch is connected to potentiometer .It acts as a short circuit and voltage supply will be stopped. The Current transformer is connected to the pin 3 of the microcontroller and the load of current transformer is connected to the pin 16, pin 17, pin 18 through the relay R1, R2 and R3 respectively. CT is connected to the bridge rectifier for the rectification purpose and the rectifier output from the bridge rectifier is again feed into the filter circuit in order to remove the ripples and voltage regulator is used for the stabilization of DC voltage there are 3 kinds of load L1, L2, L3 are used respectively. Whenever the over current condition is observed the relay which is connected to the load goes on. If over current is detected then controller will sense high load across relay and it will turn respective relay which have high current than threshold. There are two temperature sensors (LM35) are used. The temperature sensors are connected to the pin 4 and pin 5 respectively. One of them are used for the internal circuit and other used for surrounding temperature the sensor output is given to the microcontroller to measured the high temperature. The ultrasonic oil

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level sensor is connected to the microcontroller pin 6 and pin 7. The ultrasonic sensor is used for monitoring a oil level in transformer tank.. Oil level is monitored using level sensor. It will detect the level of oil when low oil level is detected by the microcontroller; the microcontroller starts the relay and fills the tank automatically by the DC pump. And the DC pump is connected to the pin 15 of Microcontroller. The 16*2 LCD display is connected to the microcontroller. The RS, RW & E (Enable) pins of LCD are connected to the pin 19, pin 23 and pin 24 respectively to the microcontroller and D4,D5,D6,D6,D7 pins of LCD display are connected to the pin 27, pin 22, pin 21 and pin 20 respectively to the microcontroller. This is 16*2 LCD is used to show the details of temperature, current, voltage oil level all this can be monitored using PC from user side to send the data on PC microcontroller connected to the PC through USB to TTL. The buzzer is connected to the pin 28 of microcontroller. If any kind of fault is generated the microcontroller will send and alert by activating buzzer.

VI. COMPONENTS

6.1 PIC microcontroller - PIC18F452

PIC microcontrollers (Programmable Interface Controllers) are electronic circuits which are programmed to carry out a vast range of tasks. They are programmed to be timers or to control a production line and much more. They are found in almost all the electronic devices such as alarm systems, computer control systems, phones, etc.

6.2 Relays

A relay is an electrical switch which uses an electromagnet to move the switch from the off to ON position instead of any person moving the switch. It takes relatively small amount of power to turn on a relay but the relay can control something that draws much more power.

6.3 Current transformer:

The Current Transformer refers to “Instrument transformer”. It is basically designed to produce an alternating current in its secondary winding which is proportional to the current being measured in its primary.

6.4 Temperature sensor - LM35

The LM35 is a temperature sensor which is precision integrated-circuited., whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It is be used with single power supplies or with plus and minus supplies. +5V supply is provided to it by using 7805 regulator IC.

6.5 16*2 LCD Display

The LCD (Liquid Crystal Display) is an electronic display module and has a vast range of applications. A 16x2 LCD display is a basic module and it is very commonly used in various devices and circuits. The LCD modules are preferred over seven segments and other multi segment LEDs. The LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

6.6 USB to TTL

The USB TTL Serial cables are in the range of USB to serial converter cables. These cables provide connectivity between USB and serial UART interfaces.

VII. CONCLUSION

Transformers are the most generic and expensive piece of equipment of the transmission and distribution system. Regular monitoring health condition of transformer is done to increase reliability. In the past, maintenance of transformers was done based on a predetermined schedule. With the help of communication technology, fault information of transformer can be received by the operator and authorities so one can able to take possible solution before converting fault into fatal situation.

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