Implementation of Wireless based Real Time Transformer Health Monitoring System

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***Abstract*:- Electricity plays an important role in our life. Every moment of our life depends upon electricity. Electricity has several components and equipment helping human to transfer and regulate the distribution according to usage. The most crucial equipment of transmission and distribution of electric power is transformer. As a large number of transformers are distributed over a wide area in present electric systems, it's difficult to measure the condition manually of every single transformer. So automatic data acquisition and transformer condition, measuring has been an important issue. This paper presents design and implementation of a mobile embedded system to measure load currents, over voltage, transformer oil level and oil temperature. This is implemented by using on-line measuring system using Wireless, with single chip Arduino microcontroller and sensors. It is installed at the distribution transformer site. The output values of sensors are processed and recorded in the system memory. System programmed with some predefined instructions to check abnormal conditions. If there is any abnormality on the system, details are automatically updated in the Mobile through Wireless communication. GSM will help the utilities to optimally utilize transformers and identify problems before any catastrophic failure occurs. Thus wireless-measuring system is used to collect and analyze temperature data over time. So Transformer Health Measuring will help to identify or recognize unexpected situations before any serious failure which leads to a greater reliability and significant cost saving.**

Keywords: GSM based wireless Transformer Health Measuring system (THMS)

1. INTRODUCTION

A monitoring system can only monitor the operation state or guard against steal the power, and is not able to monitor all useful data of distribution transformers to reduce cost. Due to over voltage with increase in temperature rises higher than the desirable temperature; the monitoring system will protect the distribution transformer by problems. Need a distribution transformer real-time monitoring system to detect all operating parameters operation, and send to the monitoring entire in time [1]. It leads to online monitoring of key operational parameters of distribution transformers which 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 [2]. This will help to identify problems before any serious failure which leads to a significant cost savings and greater reliability.

2. PROPOSED SYSTEM

In proposed method we implement GSM based Real time transformer health measuring system. Here we place a temperature sensor, voltage divider sensor, current sensor, and ultrasonic level sensor in transformer. The voltage divider sensor measure the voltage consumption in the transformer, current sensor measure the current consumption in the transformer, temperature sensor measure the temperature of the transformer and the ultrasonic level sensor measure the oil level in the transformer.

Here in our proposed system data's are measured from sensors and some common used components simultaneously. Then the arduino UNO controller starts to compare the incoming values with the threshold values. When there is at least one parameter's value exceed the saved value, then the arduino UNO controller takes action and massage notification are send to the electrical board department. So Transformer Health Measuring will help to identify or recognize unexpected situations before any serious failure which leads to a greater reliability and significant cost saving.

3. EXPERIMENTAL ANALYSIS

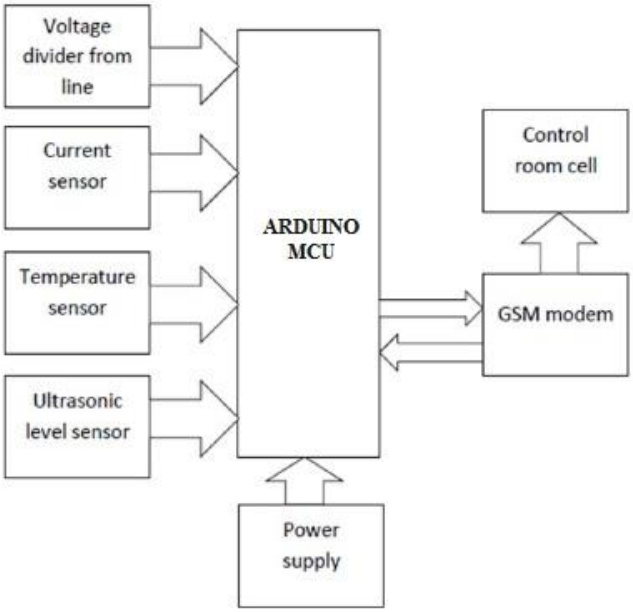

Fig.1 Block Diagram of GSM based THMS

Here we are using arduino microcontroller, the control the whole process. In this system is power supply is connected to the arduino microcontroller. We are placed at the current sensor, voltage divider sensor, temperature sensor and ultrasonic oil level sensor [4]. Then the current

sensor are measure the current consumption, voltage sensor measure the voltage consumption, temperature sensor is measure to the oil temperature and then ultrasonic sensor measure the oil level in the transformer. Relay is a switch; it was acted as on, off button. Here we are using two loads because high voltage is produced [8]. It will be stabilized the current in constant, and then theft is stopped the sensors are sense to the data's send to the micro controller and if transformer's is abnormal condition buzzer is alert to the user.

- ***Merits of Proposed System***
  - It is purely GSM based on SMS along with MQTT services. It include android Mobile application
  - Practically at every points this system could work efficiently. Since along with SMS.
  - MQTT also used so continues monitoring is made possible. Cost effective.
  - Since MQTT service is used it provides live tracking.
  - There is common point of contact with consumer in the system.
  - As a result the consumer will get any knowledge about the power failure or system maintenance.
  - It includes the feature of Phase prevention which is any of phase fails there is no indication.

4. SYSTEM DESIGN

This paper is a presentation of the design implementation of Real Time Transformer Health Monitoring System (THMS) through GSM module. Cost effectiveness and remote location will be given priority to this paper. In case of software driven system total system requires lot of connection and apparatus and technically skilled personnel. Fault information will available only in control room. On the other hand, the designed system has less complexity to install and doesn't require any sort of skilled personnel and can be notified remotely [10]. Automatic decision making is the main feature of THMS.

Decision making steps are given in a flowchart on Fig.2, which indicates how system takes decision. At first all the sensors, processing controller and GSM modem initialization occurs [9]. After the initialization process required data's are measured from sensors and some common used components simultaneously. Then the microcontroller starts to compare the incoming values with the saved values in the EEPROM memory.

When there is at least one parameter's value denied the saved value, then the arduino microcontroller takes action to send this message to the controller cell. If there is no over rated values of current and voltage or oil level is in safer level or the oil temperature is in the predefined value range, then the arduino microcontroller jumps back to the testing procedure. This process continues until the decision making logic's output is negative [7]. When the decision making logic's output is affirmative, then instantly microcontroller will take action for further execution. After sending the information, the loop continues again.

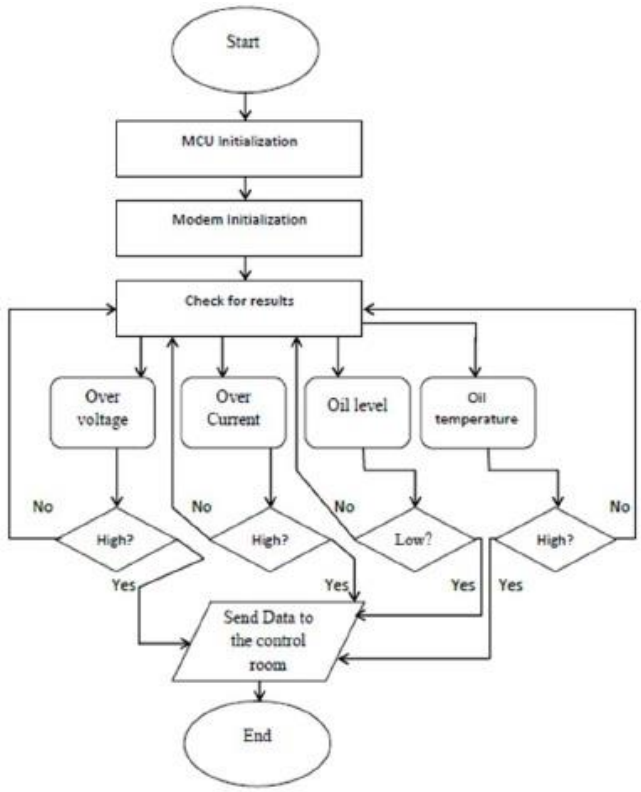

Fig.2 Flowchart of THMS

- ***Interfacing Modules***

The advanced THMS includes arduino Microcontroller, ACS712 current sensor, ultrasonic device, SIM 900GSM module and Mobile Phone. The THMS continuously measures the line voltage, line current, oil level and oil temperature serially. System reads corresponding values for further calculation for monitoring purpose and does the functions according to the program loaded in it. GSM module sends data to Mobile Phone.

The system starts with establishing a serial communication between the arduino microcontroller and GSM modem, after a successful communication the system starts the check the parameters. Baud rate of the established communication was 9600 bps.

To measure the voltage in primary side a capacitor divider was used and then the divided voltage converted to DC for measurement purpose and then through an ADC channel of arduino microcontroller. As the measured value varies frequently a number of 1000 samples taken and the average value calculated and then multiplied with specific constant to get real AC RMS value.

ACS 712 used to measure current which provided an ADC value with proportional to the current through the line measured from another ADC channel. The measured data gives the instantaneous current value. By taking several samples and applying RMS formula to get average RMS current and then recorded.

LM 35 used as temperature sensor which also provides an ADC output as voltage varies 10mV for every degree Celsius change of temperature

Oil level measured using ultrasonic sensor, which provides pulse whose width varies according to the distance between head of oil level. The pulse width of the received signal is

measured using TIMER 0. Time measured by counting overflow then multiplying by the overflow time.

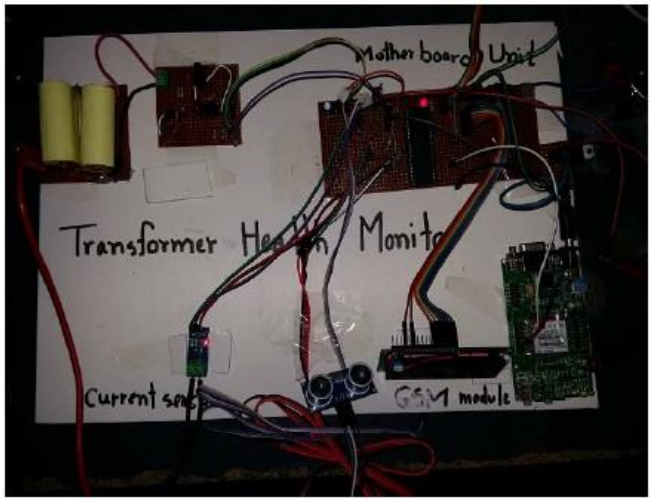

Fig.3 Experimental Setup of THMS

The output information data which is extracted and calculated by arduino microcontroller is then transferred through GSM Module (SIM 900) to desired mobile device.

- ***Advantages***
  - If transformer is in abnormal condition we can know from anywhere.
  - No human power need to monitor the transformer.
  - Details about the transformer are automatically updated when the transformer is in abnormal condition.
  - Reliability

5. CONCLUSION

This paper is about health monitoring system of a transformer. The main function of the system is to sense and measure the load current, over voltage, transformer oil level and oil temperature. Here arduino microcontroller is used to control the entire process. This system is also used to collect the data of the temperature level of transformer at every time. It is installed in transformer's distributed site. Finally this system will help us to protect and prevent the transformer from the serious failure.

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