

Transformer Health Monitoring System

Amulya. D. M¹, Kruhti. Y. B², Monica. C. K³, Neha. G. Goyal⁴, Ashwini. K. R⁵

^{1,2,3,4} students of 8th semester EEE Department, GSSSIETW, Mysuru, Karnataka, India

⁵ Asst. Professor, Department of EEE, GSSSIETW, Mysuru, Karnataka, India

ABSTRACT

In the power system the transformer and generator are our expensive and important equipments. If either one of them is damaged or trip due to any reason such as temperature, current or voltage then the whole supply would be switched off. Then the time and money both would be waste, so the monitoring of transformer and generator is mandatory for supplying the smooth supply to the consumer. Monitoring transformer for the problem before they occur can prevent faults that are costly to repair and result in a loss of electricity. The main aim of developing this system is to monitor the status of the transformer, and also to reduce cost of repair, and improve services to customers.

Keywords: Transformer Health Monitoring System, Arduino Uno, Arduino IDE, Sensors.

I. INTRODUCTION

The distribution transformer is an electrical equipment which distributes power to the low-voltage users directly, and its operation condition is an important component of the entire distribution network operation. Operation of distribution transformer under rated condition(as per specification on their name plate) guarantees their long life. However their life is significantly reduced if they are subjected to overloading, resulting in unexpected failures and loss of supply to a large number of customers thus effecting system reliability. Overloading and ineffective cooling of transformers are the major causes of failure in distribution transformers.

Transformers have a long life, if they are operated 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. The main

concern with transformers protections is protecting the transformers, against internal faults & external faults. If transformer becomes overloading, it causes a rise in temperature of transformer oil and windings. If winding temperature of transformer is increased, as compared to transformer limit then insulation will deteriorate. The transformer protection scheme, need to protection against transformers overload, transformers faults, as well as protection against internal fault. The main concern with transformers protections is protecting the transformers, against internal faults & external faults. If winding temperature of transformer is increased, as compared to transformer limit then insulation will deteriorate.

Transformer failures can be broadly categorized as electrical, mechanical or thermal. The cause of a failure can be internal or external. Table lists typical causes of failures. In addition to failures in the main tank, failures can also occur in the bushings, in the tap changers, or in the transformer accessories.

II. OBJECTIVES

- Normally the transformer failures occur due to the over voltage fluctuations and over current fluctuations, overheating and spark etc.
- So that purpose we can develop these system to reduce the faults respectively. The parameters of the generator like voltage fluctuations, current fluctuations, Temperature, oil chamber moisture, spark, Gas are monitored remotely through arduino.
- To monitor and record parameters of a distribution transformer like Current, Voltage, Temperature and Humidity. Remote terminal unit is installed at the distribution transformer site and above parameters are processed and recorded.
- It is important to keep an eye on transformer health when operator is not present at transformer site, so we are introducing embedded system named as two way communication systems between transformer and operator.
- This system is designed to send alert messages, whenever related parameters value exceeds the predefined limits. This system proposes a compact design and development of remote monitoring system, for a distribution transformer.
- The main objective of this project is to develop mobile embedded system will help the utilities to optimally utilize the protection of power line of transformer and identify problems before any catastrophic failure.
- This system will help the transformers, to operate smoothly & to detects the problems before any failure.
- The main objective is, to develop a real time monitoring, health conditions of transformer to prevents failures of transformers & improve reliability of services of the customers.
- The main aim is to develop these system for monitoring the real status of the transformer,

and also to reduce cost, improve efficiency and services to customers.

- By using this system, the user or supply company can easily check the instant temperature, current or voltage of transformer or generator if they increased their rated parameters then the user can shift the load to another supply source before something occurred

III. BLOCK DIAGRAM

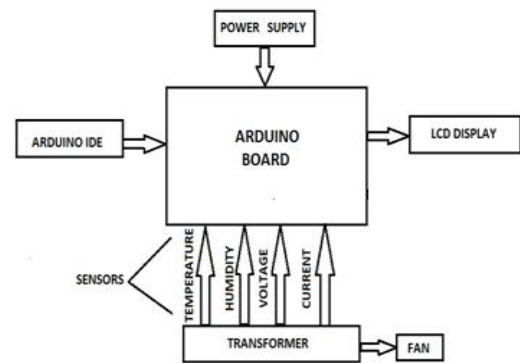


Figure 1.1: Block Diagram

1) HARDWARE

a) Transformer: The use of transformers with unity turns ratio is to isolate two circuits operating at same voltage levels. (hence called isolation transformer). Transformers that have a ratio of 1 to 1 between the primary and secondary windings are often used to protect secondary circuits and individuals from electrical shocks between energized conductors and earth ground. Suitably designed isolation transformers block interference caused by ground loops.

b) Arduino Board: It is a microcontroller board based on 8-bit atmega328p microcontroller. Along with atmega328p, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. To support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog

input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

c) LCD Display: LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability and programmer friendly. Most of us would have come across these displays in our day to day life, either at PCOs or calculators. The appearance and the pinouts have already been visualized above now let us get a bit technical. **16x2 LCD** is named so because; it has 16 Columns and 2 Rows.

d) Temperature and humidity Sensor: The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data.

e) Voltage Sensor: The max Arduino analog input voltage is 5 V, so the input voltage of this module should be not more than $5\text{ V} \times 5 = 25\text{ V}$ (if for 3.3 V system, the input voltage will not more than $3.3\text{ V} \times 5 = 16.5\text{ V}$). Because the Arduino AVR chip have 10 bit AD, so this module simulation resolution is 0.00489 V ($5\text{ V} / 1023$), and the input voltage of this module should be more than $0.00489\text{ V} \times 5 = 0.02445\text{ V}$.

f) Current Sensor: The **ACS712 Module** uses the famous **ACS712 IC** to **measure current** using the Hall Effect principle. These ACS712 module can measure current AC or DC current ranging from +5A to -5A, +20A to -20A and +30A to -30A.

g) Motor Driver : The L293D is a famous 16-Pin Motor Driver IC. As the name suggests it is mainly used to drive motors. Using this L293D motor driver IC is very simple. The IC works on the principle of Half H-Bridge. L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can

control a set of two DC motors simultaneously in any direction.

2) SOFTWARE

a) ARDUINO IDE: The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.

IV. METHODOLOGY

Transformer health monitoring system worked on the principle of hardware components and programmed microcontroller. Suppose we want to monitor the data such as temperature, current or voltage of any transformer, generator, industrial or domestic load then this system is directly connected with these components or equipments. Then we just switch on this system directly from 220V ac. After that, the current sensor, voltage sensor and temperature sensor sense their corresponding data but this data is in analogue from it converted into digital form through the arduino board, which is interfaced with current, voltage and temperature sensors. Then this data is received by the 8bit atmega 328p microcontroller through the arduino board, then microcontroller display this data at LCD.

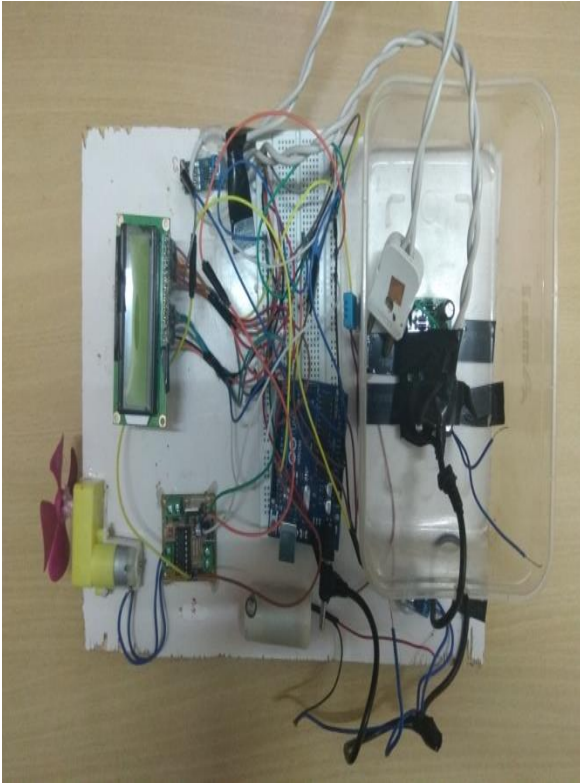


Figure 1.2: Model of transformer health monitoring system

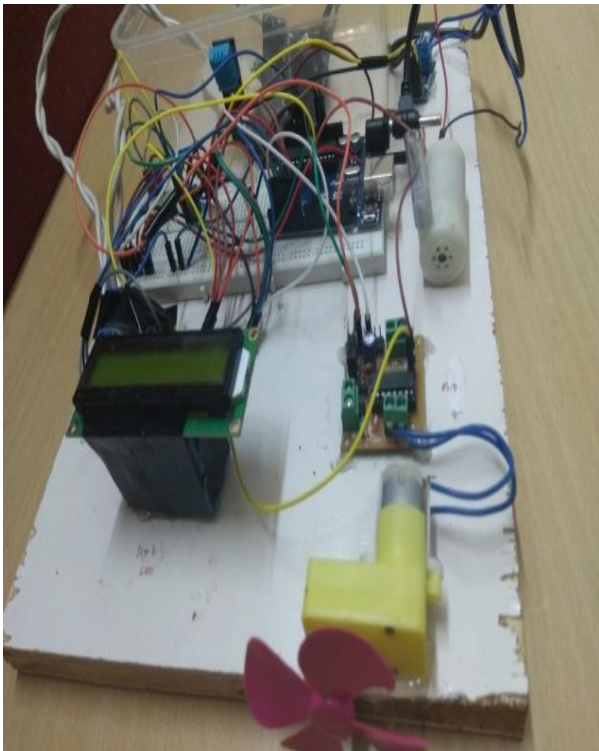


Figure 1.3: Working model of health monitoring system

V. CONCLUSION

Transformers are among the most generic and expensive piece of equipment of the transmission and distribution system. Regular monitoring of health condition of transformer not only is economical also adds to increased reliability. In distribution network there are many distributions transformer & associating each transformers with such a system, we can easily figure out health of the system by using particular sensors. We can use this system to monitor different parameters in substations, distribution transformers in street and small systems at houses. We need not have to check all transformer & corresponding phase current & voltage & thus we can recover system in less time.

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