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Monitoring and Controlling Of Distribution Transformer via GSM Modem

Nagargoje Surekha
M-TECH(EDT), NIELIT,
Aurangabad, India

Abhishek Kumar
M-TECH(EDT), NIELIT,
Aurangabad, India

Mr. Daniel A. Figueiredo
Scientist D(EDT), NIELIT,
Aurangabad, India

***Abstract**: Distribution transformers are one of the most important equipment in power network. Because of, the large number of transformers distributed over a wide area in power electric systems, the data acquisition and condition monitoring is a important issue. The main aim of this system is distribution transformer monitoring and controlling through GSM modem. Here transformers are damaged due to the oil damage. Oil damage is depends on different parameters and environmental conditions. Now in this system we are concentrating on temperature of transformer and viscosity of oil .In this system temperature and viscosity monitoring and control action is performed based on the AVR microcontroller. After interfacing the required components user has to develop one application program in embedded-c. Here controller is continuously reading the temperature and viscosity, and display on the LCD along with the set point. Set point is saved in the external memory. If current value is crossing the set point then device will off and buzzer is ON along with the fan (DC motor). And one alert message is sent to the predefined number which is mentioned in application program. If user wants to change the set point he has to send one predefined message format to the one particular phone number which is placed in the GSM module. Then controller is reading that message and if it is in the valid format then it is updated to the external memory. Now control action is based on the new set point. Here set point is saved in the external memory so even power is gone set point will not change.*

***Keywords**: LM35, viscosity module, AVR atmega-8, LCD, DC motor, sensor*.

I. INTRODUCTION

Distribution transformers have a long service life if they are operated under good and rated conditions. However, their life is significantly reduced if they are overloaded, 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. Most power companies use Supervisory Control and Data Acquisition (SCADA) system for online monitoring of power transformers but extending the SCADA system for online monitoring of distribution transformers is an expensive proposition. Distribution transformers are currently monitored manually where a person periodically visits a transformer site for maintenance and records parameter of importance. This type of monitoring cannot provide information about occasional overloads and overheating of transformer oil and windings. All these factors can significantly reduce transformer life. Our system is designed based upon online monitoring of key Operational parameters of distribution transformers 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. This system will help us to identify 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 as discussed before. Embedded systems are self-contained programs that are embedded within a piece of hardware. embedded systems are usually set to a specific task Another way to think of an embedded system is as a computer system that is created with optimal efficiency, thereby allowing it to complete specific functions as quickly as possible. It is also has the advantages of significant cost savings, power consumption and greater reliability.

II. ARCHITECTURE

A: MICROCONTROLLER UNIT:

In this system AVR AT mega 8 microcontroller is used because of its features. It is low power high performance device, has RISC architecture. It is faster than 8051 and PIC. Here temperature sensor, LCD, color sensor, GSM module , fan(dc motor) are interfaced with this microcontroller unit.

Following figure shows block diagram of system.

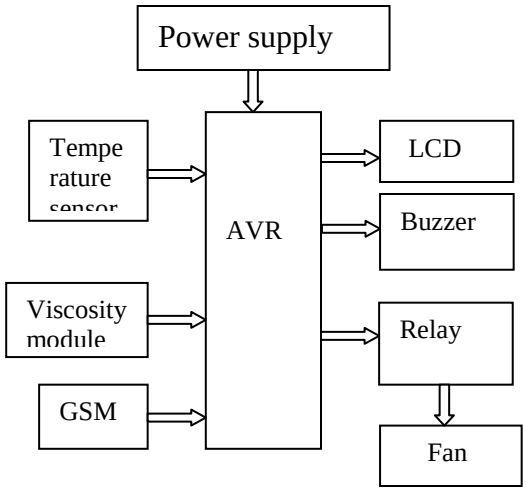

Fig.1 Block diagram of system

B: TEMPARATURE SENSOR:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Whenever there is change in temparature and it crosses the set point value then it send the signal to microcontroller .

C: COLOR SENSOR:

Here we are using IR sensor for detection of change in the color of transformer oil. Oil has 12 years of age. when it is very fresh it has white color, but gradually up to 8 years that color changes from white to yellow and yellow to reddish yellow. After 10 years its color changes to black means it got damage and it is not used for cooling purpose from white color to reddish yellow color it has 500nm to700nm wavelength. To detect that color wavelength we used IR sensor transmitter and receiver pair. And we programmed in such a way that if that sensor receiving the wavelength in between 500nm to 700nm then it will give the 1 output at controller output pin. If that oil wavelength is in between this wavelength then it has following rated readings like dielectric strength: 50KV to 60KV, viscosity:27mm2/sec, density: 0.89kg/m3, flash point:140 min. as above parameters are very important while transformer designing for cooling.

D: GSM MODULE:

Whenever temperature and color wavelength of oil changes than set point then microcontroller sends signal to GSM module to send the message to the user using AT-COMMANDS GSM module send the message to user .SIM900 used here.

SIM 900: This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Co color ofntion of change in throl, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In GPRS mode you can also connect to any remote FTP server and upload files for data logging.This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

E: RELAY:

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism, but other operating principles are also used. Relays find applications where it is necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays found extensive use in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly drive an electric motor is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device triggered by light to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protection relays".

Following circuit shows when there is temperature rise in transformer then user will get message through GSM and fan gets on connected with relay as shown in following figure.

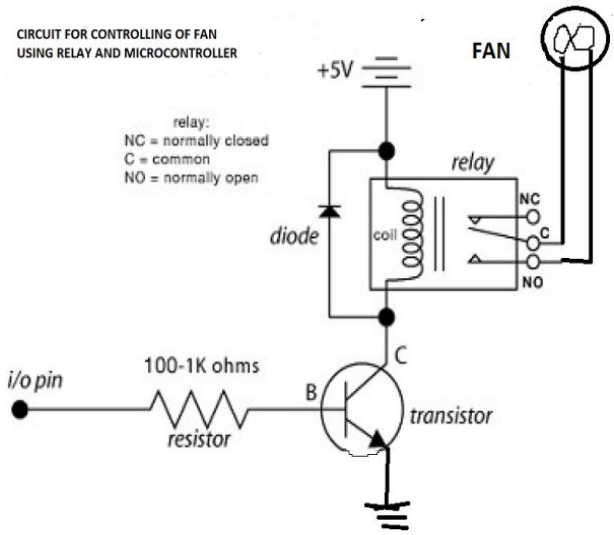

Fig.2.Relay circuit

III. RELATED WORK

FLOW CHART:

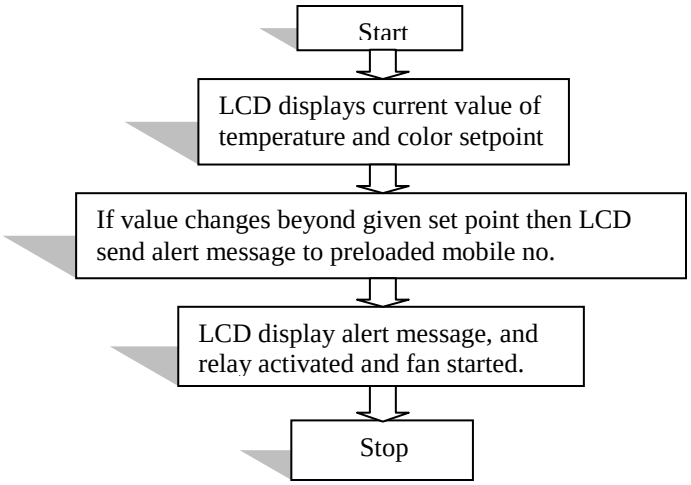

Fig.3.flow chart of system

IV. SOFTWARE

All tests related with this system like LCD interfacing, GSM module interfacing, temperature sensor interfacing, viscosity module interfacing are done by using Arduino software as shown in following picture.

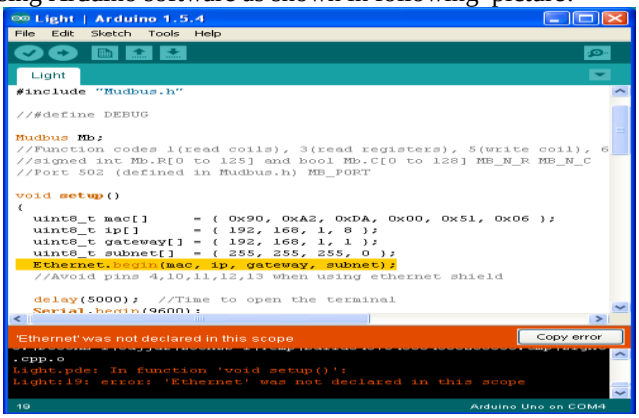

Fig.4. software

V. RESULT AND DISCUSSION

This paper consist of two sections software and hardware. In software section all tests are done in aurdino software and implemented it on hardware and finally it gave:

1. Temperature alert message if temperatures increase beyond the set point temperature range.
2. Color alert message if oil color is not in the range of 500nm to 800nm.
3. LCD continuously shows the current temperature and color set point adjusted by user.
4. Using ardiuno programming we can change set points for both temperature and color.
5. Whenever there is changes in temperature set point automatically load get isolated from transformer and fan get on for cooling purpose.

VI. CONCLUSION

We have designed this more reliable system successfully for temperature and color changes of distribution transformer.

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