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# GSM Based Transformer Monitoring System

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***Abstract — In this project we are going to design and implement a mobile embedded system to monitor and record the key parameter of transformer like load current, oil level and ambient temperature. These parameters are measured and recorded by the standalone single chip microcontroller and different sensors. The collected data is process and converted in digital form by A2D converter and send to concerned authority through GSM. Here we going to design a relay system so that when any abnormality occurs in the any parameter and it starts over heating or any other the transformer get tripped thus saving it from permanent damage. If any emergency situation occurs then the system send SMS message to mobile phone containing location and nature of situation according to instruction programmed in microcontroller .This system will help transformer to operate smoothly and identify and if possible take required action before any catastrophic failure.***

*Keywords- TRANSFORMER, LM35, ADC, MCP 3208, GSM, MAX 232.*

## I.INTRODUCTION

In the field of energy distribution we know that transformer is the most important device, we know that transformer is the static device in power systems, distribution transformer is electrical equipment which distributes power to the low-voltage users directly, Operation of distribution transformer under rated condition 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 **[3]-[4]**and its operation condition is an important component of the entire distribution network operation As we see very less importance is given in maintenance of transformer as it is located at the remote location. In current scenario we see that a maintenance man visit once in month or two to inspect to condition and health of transformer. In such case the person may file his report without inspection or else he may have to manually record various reading and record the transformer parameters .This type of record do not provide information about occasional overloading and overheating of transformer. There is need of continuous and real time monitoring **[1]** system, which sends records to the monitoring centre. 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. This will help to identify problems before any serious failure which leads to a significant cost savings and greater reliability. Transformer fault analysis describes about designing of microcontroller based monitoring system here we have mainly focus mainly on core temperature and max temperature of cooling oil use for the insulation purpose

## II.DESIGN OF MICROCONTROLLER BASED TRANSFORMER MONITORING SYSTEM

It consist of stepdown transformer, power transformer, LMN35, oil sensor, micro-controller (AT89C52), converter (MCP3208), LCD display, GSM modem and relay. Normally in transformer, failure occurs due to voltage and current fluctuation, overheating, change in oil level etc. In this project, to sense these fault we have temperature sensor and oil sensor majorly because ultimately each and every fault mentioned above head to heating of transformer which causes heating of core. All these sensors are connected to converter (MCP3208) and digital output from converter is given to micro-controller 89S51. AT89C52 has four ports viz. P1, P2, P3 and P0 to which we will be connected to address lines, GSM model and LCD respectively. When fault occurs due to above any reason then change in ratings will be shown on LCD and quick SMS will go to control room via GSM modem. A brief discussion about components used is as given Sensors play a vital role in effective implementation of the project. As we are interested in monitoring over temperature LM35 sensors is selected and suitable designed with respect to required condition of transformer

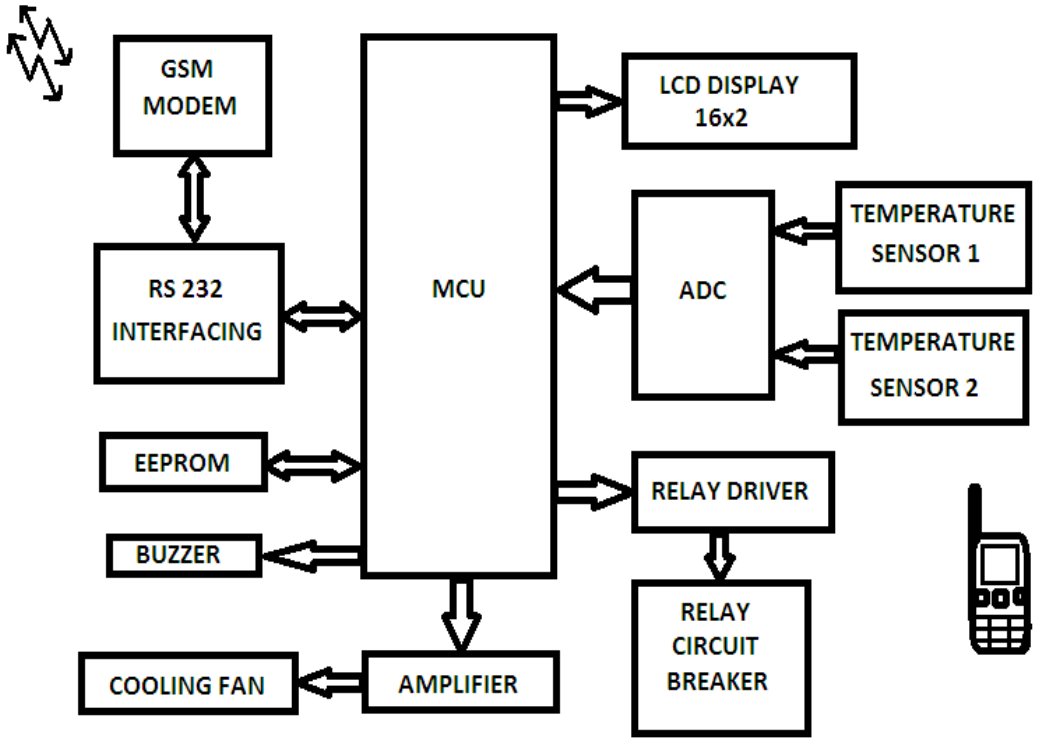


*Figure 1 Block diagram*

**2.1Current and Voltage Transformer**

Current or voltage transformer is necessary for isolating and protection of the system. The working of current and voltage transformer before and after any fault has occurred is critical in protection of designed circuit as any error in signal may result in mal operation of relays

**2.2Temperature sensor**

The LM35 sensor is précised linear integrated temperature sensor. The output voltage of this is linearly proportional to degree Celsius temperature range. The output of LM35 is in centigrade scale, the accuracy provided by this sensor is ±1⁄4°C at room temperature. The range of sensor is -55 to +150 °C temperature range.

**2.3Analog to digital converter**

The most important component of this is its 8-bit analog-to-digital converter. The pin diagram and block diagram of MCP 3204/3208 is s as shown in fig.1 and 2 respectively. The converter is designed to give fast, accurate, and repeatable conversions over a wide range of temperatures. The converter is partitioned into 3 major sections the 256R ladder network, the successive approximation register, and the comparator. The converters digital outputs are positive.

**2.4Gsm module**

GSM module is use for serial communication between microcontroller and mobile unit here we are using SIM900. Whenever temperature changes than set value then microcontroller sends signal to GSM module to send the message to the user using AT-COMMANDS GSM module send the message to user This GSM Modem as stated earlier uses SIM900 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. 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. This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications.

**2.5Microcontroller AT89S52**

AT89S52 microcontroller **[5]** is used in this work which is an 8-bit microcontroller and has 4KB of (ISP) Flash memory and 256 bytes of RAM. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. The Atmel AT89S52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications. AT89S52 has four ports designated as P1, P2, P3 and P0 and all these ports are 8-bit bi-directional ports; they can be used as both input and output ports.

**2.6Relay**

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. 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 contractor. 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".

## III.PROGRAM EXECUTION AND TESTING

The project is based on microcontroller programming. The program for microcontroller is done in C language. Program is written burned into microcontroller and saved as Hex file. For AT89S52 controller Atmel programmer is used. Program hex file is compiled in microcontroller flash compiler. This compiler converts program into machine language code as well as check program for error if any error found notifies and these errors are corrected manually. Then it successfully executed in compiler. After compiling program in microcontroller flash compiler, it is burned into AT89S52 microcontroller with the help of universal program burner kit programmer which is connected to computer. After successful program burning, microcontroller becomes ready for use. In testing, after successful program burning, microcontroller is mounted on its base and kit becomes ready for testing. For testing in program kit has provided with following parameter

1. Temperature > 400C---Temperature fault

Therefore any change occurred in temperature rating during running of project model, these changes is shown in LCD and same data obtained in SMS and at the same time transformer gets disconnected from supply with the help of relay. also time to time status can be obtained by sending the STATUS command by mobile unit which gives of the condition of model working. The max temperature can also be set using mobile unit.

## IV.CONCLUSION

This project has presented a design of a system based on microcontroller that is used to monitor and control the temperature of a distribution transformer .The proposed system which has been designed to monitor the transformer's essential parameters continuously monitors the parameters throughout its operation. If the microcontroller recognizes any increase in the level of temperature values the control relay will break the circuit in order to prevent it from further damages and send SMS alert to the concerned personal.

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