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GSM Based Transformer Fault Monitoring System

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ABSTRACT

Transformer is a important part of the transmission and distribution system. Transformers Monitoring for problems before they occurs can prevent the faults that are expensive to repair and results in loss of service. Transformers are the essential part of power transmission network and expensive, as the cost of power failures. Because of much cost of scheduled and unscheduled maintenance, especially at the remote sites, the utility industry began investing in instrumentation and monitoring of the transformer. in this project we are implementing and of a mobile embedded system to monitor key parameters of a distribution transformer like load currents, oil level and ambient temperature. The idea of monitoring system integrates a global service mobile Modem, with a single chip microcontroller and different sensor interfacing. It is installed at the distribution transformer site and the above parameters are recorded using the analog to digital converter (ADC) of the embedded system. The parameters are processed and recorded in the system memory. If any emergency situation occurs the system sends SMS message to the mobile phones containing information about abnormality according to some predefined instructions which are programmed in the microcontroller. This system mobile will help the transformers to operate perfectly and identify problems before any failure.

KEYWORDS: *16x2 LCD, Distribution transformer, sensors, Arduino controller, GSM*

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1. INTRODUCTION

Now day's protection of equipments in power system is a very important aspect. The power system equipments are valuable and important for well operation of power system network. A Transformer is such equipment which is one of the most important machines in the power system network. High reliability is required for a transformer even in adverse conditions. PLC automation used for this condition; many types of faults in the transformer can be detected and rectified. The power systems with no transformer is like a human without heart. So the protection of a transformer is of utmost importance. The Relays here are provided for sensing the fault current and provide the protection to the transformer. The receipient gets a message in the form of a SMS using of a GSM module interfaced with a PLC. Distribution transformer is electrical equipment in power systems, which distribute power to the low voltage users directly, and the operation condition of that transformer is an important component of the entire distribution network operation. Operation of distribution transformer under the rated condition as per specifications their long life depends. Their life is significantly reduces if they are subjected to overloading conditions, resulting in unexpected failures and loss of supply to a large number of customers this affects system's reliability. Overloading and ineffective cooling of transformers are the major causes of failure in distribution transformers. Presently used devices for monitoring distribution transformer have some problems and deficiencies. Few of them are mentioned below.

- Ordinary transformer measurement system generally detects a single transformer parameter, such as power, current, voltage, and phase. While some ways could detect multi parameter, the time of acquisition and operation parameters is too long, and testing speed is not fast enough.

- Detection system is not reliable. The main performance is the device itself instability, low measurement accuracy of the data, or even state monitoring system should have no effect.
- Timely detection data will not be sent to monitoring centers in time, which cannot judge distribution transformers three-phase equilibrium.
- 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 costs.

According to the above requirements, we need a distribution transformer real-time monitoring system to detect all operating parameters operation, and send to the monitoring centre in time. This leads to monitoring of key operational parameters of distribution transformers which can provides the useful information of health of transformers which will help utilities to optimally use their transformers and keep the asset in operation for a long time. This system will help to identify problems before any failure which leads to significant cost savings and greater reliability. Widespread use of mobile networks and GSM devices such GSM modems and their decreasing costs have made them an attractive option not only for voice media but for other wide area network applications.

2. HARDWARE DESCRIPTION

The hardware parts used in this project are mentioned below.

A. GSM Module:

Fig 1: GSM Module

GSM is mobile communication module, stands for global system for mobile communication. The idea of GSM was developed at Bell Laboratories in the 1970. It is largely used mobile communication system in the world. GSM is digital cellular technology used for transmitting mobile voice and data services operates at the 900MHz, 1800MHz, 850MHz, and 1900MHz frequency bands. We are interfacing GSM module to send sms and call alert if fire detected near system.

B. LCD Display:

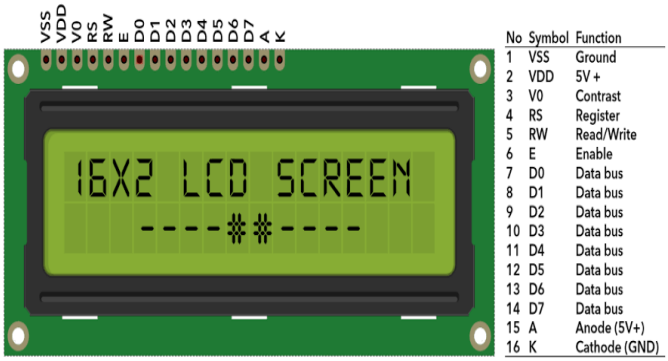

Fig 2: 16x2 LCD

LCD stands for Liquid Crystal Display, this screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic and is very commonly used in many devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons are: LCD is economical, easily programmable, no limitation of displaying special & even custom characters.. A 16x2 means it can display 16 characters per line and there are 2 such lines, each character is displayed in 5x7 pixel matrix. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc.

C. Transformer:

Fig 3: Transformer

Transformer is the electrical device which converts voltage levels with little loss of power. Transformers work only with AC. There are two types of transformers as Step-up and Step-down transformer. Step-up transformers steps up voltage, step-down transformers steps down voltage. Many power supplies use a step-down transformer to reduce the high mains voltage to a safer low voltage. Here we are using step down transformer to get 12V AC from the supply i.e. 230V AC.

D. MicrocontrollerATmega328:

Fig 4: Atmega328 Microcontroller

It is a Atmel 8-bit AVR RISC-based microcontroller with 32KB ISP flash memory and read-while-write capabilities, 1KB EEPROM, 23 general purpose I/O lines, 32 general purpose working registers, 3 flexible timer/counters with compare modes, internal, external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

Key parameters for ATmega328:
Flash (KBytes):32kBytes, Pin count: 28, Max. Operating Frequency (MHz): 20MHz, CPU: 8-bit AVR, Touch channels: 16, Hardware touch Acquisition: No, Max I/o pins: 22, Ext Interrupts: 24, SPI: 221, TWI (12c):1, UART: 1, ADC Channels:8

ADC Resolution (bits): 10, ADC speed (kbps): 15, Analog comparator: 1, DAC Resolution: 0, Temperature sensor: yes, Operating voltage: 1.8 to 5.5

E. Magnetic oil level indicator:

Fig 5: Oil Level Indicator

The magnetic oil level indicators are used to give a visual indication of the oil level inside the conservator by a graduated dial with arrow plus electric signals, when the oil inside the conservator reaches the max or min level. This way, for every variation of the oil inside conservator tank the movement of the float cause the rotation of the magnet joint with consequent variation of the indication on the dial of the gauge. The pointer indicates the level that the oil should reach. The electronic version of the oil level gauge provides an analogical and a digital signal proportional to the oil level inside the conservator. These signals can be remote to: PLC, PC, integrated monitoring system, Remote Indicator.

When transformer is working near its maximum rating, the oil temperature starts to increase which will expand the oil volume. This expansion may let the oil reach its maximum limit. Conversely, if there is substantial oil loss or leakage, oil may reach its minimum limit. For the importance of these two levels, the proposed monitoring system will send a SMS to NEC engineer whenever one of them reach its limit.

F. Temperature sensor LM35:

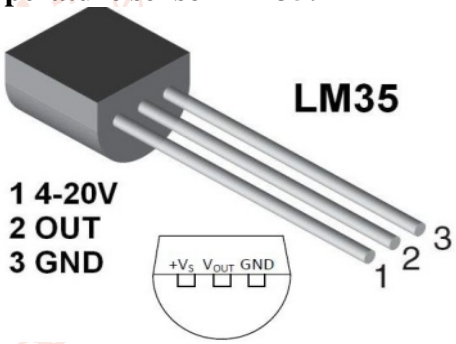

Fig 6: LM35

It is a temperature sensor that outputs an analog signal which is proportional to the varying temperature. The voltage output can easily be interpreted to obtain a temperature reading in Celsius. The advantage of lm35 over thermistor is it does not require any external calibration. The coating also protects it from self-heating. Low cost and great accuracy make it popular among hobbyists, circuit makers, and students. Many low-end products take advantage of low cost, greater accuracy and used LM35 in their products. Its approximately 15+ years to its first release but the sensor is still surviving and is used in any products.

3. BLOCK DIGRAM:

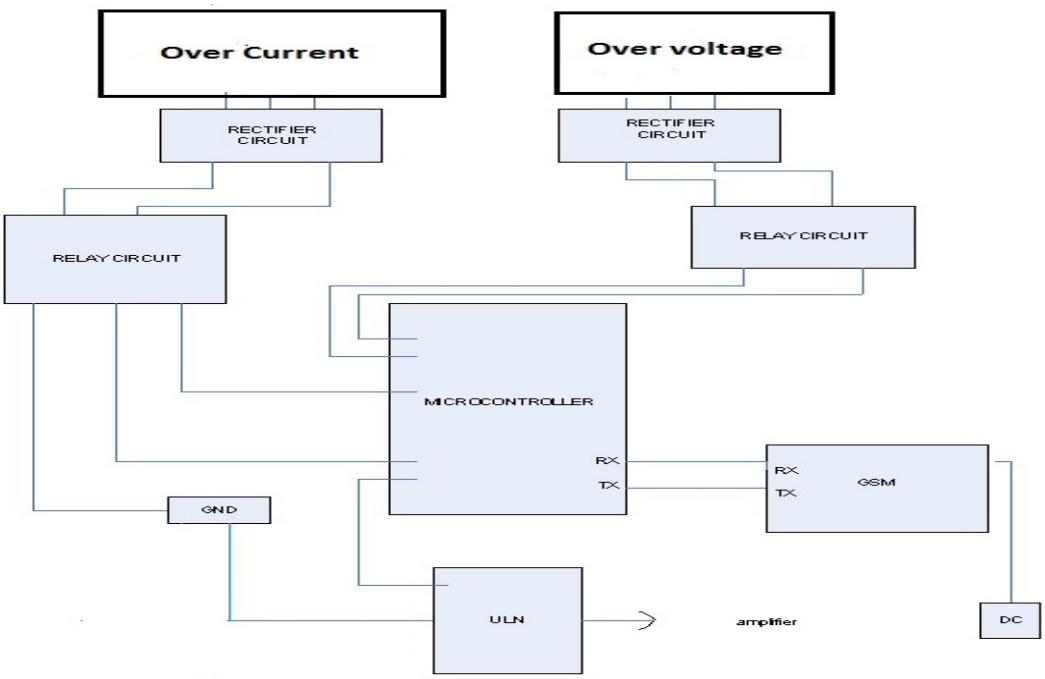

Fig 7: Block Diagram

Working:

First sensors which are installed at the transformer site sense the various parameters of transformers and convert into analog signal to be processed in signal conditioning circuits. then the SCC consisting of opamps and resistors which manipulates the analog signal to a compatible value so that can be read by the embedded system. Then Next the signal is passed through microcontroller. ADC is used to read the parameters, EEPROM is used to host the embedded software algorithm that takes care of the parameters acquisition, processing, display, transmit and receive. The built-in EEPROM is used to save the online measured parameters along with their hourly and daily averages. GSM modem interfaced with the microcontroller through RS 232 port by which it upload and download SMS messages that contain information related to the transformer parameters and status. This GSM modem then sends this SMS to mobile users containing information about parameters value of the distribution transformers.

4. RESULT:

The result shows prototype project model. This project works perfectly and sends sms with related faults occurring in the transformer.

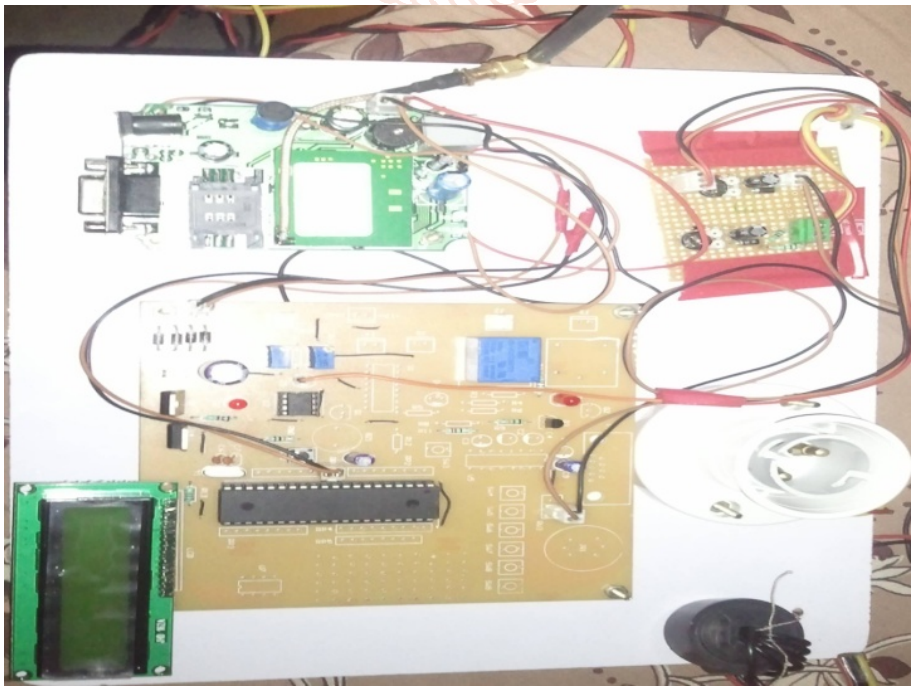

Fig 8: Final Project Model

5. CONCLUSION

Monitoring of distribution transformer using GSM is quite useful as compared to manual monitring and also it is reliable as it is not possible to monitor always the oil level, oil temperature rise, ambient temperature rise, load current manually. After receiving of message of any abnormality we can take action immediately to prevent any catastrophic failures of distribution transformers. In a distribution network there are many distribution transformers and associating each transformer with such system, we can easily figure out that which transformer is undergoing fault from the message sent to mobile. We don't need to check all transformers and corresponding phase currents and voltages and thus we can recover the system in less time. Time for receiving messages may vary due to the public GSM network traffic but still it is effective than manual monitoring.

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