

TRANSFORMER PARAMETER MONITORING AND ALERTING SYSTEM BY USING GSM

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Abstract: This paper is about design and implementation of a mobile embedded system to monitor and record key parameters of a distribution transformer like load currents, oil level and ambient temperature. The idea of on-line monitoring system integrates a global service mobile (GSM) Modem, with a standalone single chip microcontroller and different sensors. 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 obtained parameters are processed and recorded in the system memory. If any abnormality or an emergency situation occurs the system sends SMS (short message service) messages to the mobile phones containing information about the abnormality according to some predefined instructions programmed in the microcontroller. This mobile system will help the transformers to operate smoothly and identify problems before any catastrophic failure.

1 INTRODUCTION

Transformers are a vital part of the transmission and distribution system. Monitoring transformers for problems before they occur can prevent faults that are costly to repair and result in a loss of service. Transformers being the essential part of power transmission system are expensive, as is the cost of power interruptions. Because of the cost of scheduled and unscheduled maintenance, especially at remote sites, the utility industry has begun investing in instrumentation and monitoring of transformer.[1] A low cost system for determining the health condition of transformer by using the parameters of oil like moisture content, current, voltage and temperature rise in the oil are presented.[3] These parameters are continuously monitored and are sent using GSM technology to prevent premature failure of transformers and improving reliability of services to the customers. An Embedded based hardware design is developed to acquire data from electrical sensing system [1]. It consists of a sensing system, advanced embedded hardware, Arduino to display the parameter values and faults. A powerful GSM networking is designed to send data from a network to other network for proper corrective action at the earliest. Any change in parameters of transmission is sensed to protect the entire transmission and distribution. The condition and faults occur in the transformer can be determined by knowing the transformer parameters such as current, voltage and particular temperature rise of oil.

2.BLOCK DIAGRAM

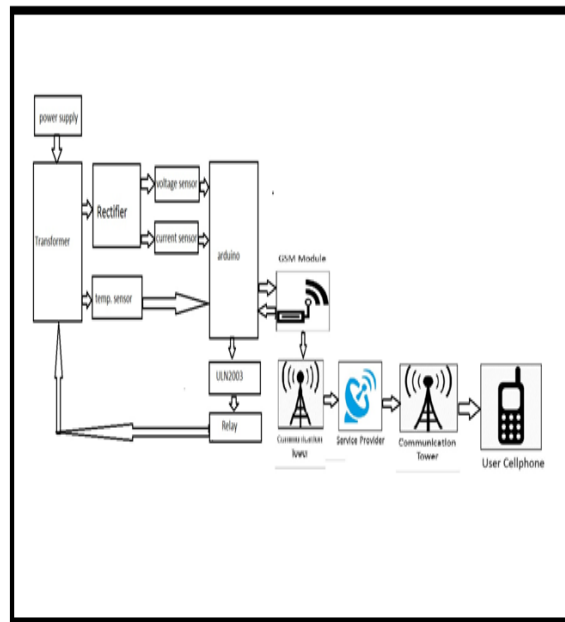


Figure 1: Basic Block Diagram Of Transformer Parameter Monitoring And Alerting System By Using GSM

The above figure 1 shows the monitoring and alerting system by using GSM

1. IC 7805- A voltage regulator IC maintains the output voltage at a constant value.7805 IC provides +5 volts regulated power supply.

2. Arduino UNO Kit- The main function of encoding and decoding of a message is done by arduino kit. It consists of a 28 PIN microcontroller for encoding decoding operations. A program is feed in this kit for functioning the operation of sending and receiving the message.

3. Current Sensor- A current sensor is device that detects electric current in a wire and generates a signal proportional to that current.

4. Voltage Sensor- A voltage sensor that converts voltage measured between two points of an electrical circuit into physical signal proportional to voltage.

5. Temperature Sensor- A temperature sensor is device, that provides for temperature measurement through an electrical signal.

6. Relay- Relay is used for switching operation. It helps to ON/OFF the Transformer.

7. ULN IC 2003: ULN is used in our project for increasing the voltage input to the relay. ULN convert 5 volt input into the 12 volt input to the relay.

8. GSM Module- It is used for sending and receiving message from mobile phones. It directly communicates with the arduino kit for further procedure. GSM module consists of an antenna for catching the network.
9. Transformer: A transformer is a static device electrical device that transfers electrical energy between two or more circuits through electromagnetic induction.
10. LCD Screen- A 2 inches LCD display is used to show the output response. It shows the feedback of overall operation. If transformer is ON it shows it on display, and if transformer is OFF it also shows on display.

3. CONSTRUCTION:

The Transformer parameter monitoring and alerting system based to protect the transformer from over voltage, over current and critical level temperature rise. It consisting of a two main components i.e. GSM Module and ATmega328 Arduino UNO kit. These are the two very important factor of our project. In case Arduino kit is the heart of the circuit. Because it is consist of a microcontroller which controls the whole controlling unit.

A GSM Module is basically a GSM Modem (SIM 300) connected to a PCB with different types of output taken from the board – say TTL Output (for Arduino, ATmega328 and other microcontrollers) and RS232 Output to interface directly with a PC (personal computer). The board will also have pins or provisions to take out +5V or other values of power and ground connections. These types of provisions vary with different modules.

The Atmega328 is one of the microcontroller chips that are used with the popular Arduino boards. The Arduino UNO board comes with either 1 of 2 microcontroller chips, the Atmega168 or the Atmega328. Of these 2, the Atmega328 is the upgraded, more advanced chip. The Atmega328 has 32K of flash program memory and 2K of Internal SRAM. The Atmega328 has 28 pins. It has 14 digital I/O pins, of which 6 can be used as PWM outputs and 6 analog input pins. These I/O pins account for 20 of the pins.

First of all the 12 volt supply is given to the GSM Module, which is consist of a GSM Modem which is nothing but an antenna. There is also one SIM to communicate with the network operator. First of all, one SMS is send through the User Cellphone, this message is communicate with communication tower and then service provider communicate with receiver communication tower and send this SMS to the GSM module. GSM module is communicates with Arduino kit which encodes and decodes the SMS and give logic control to the relay.

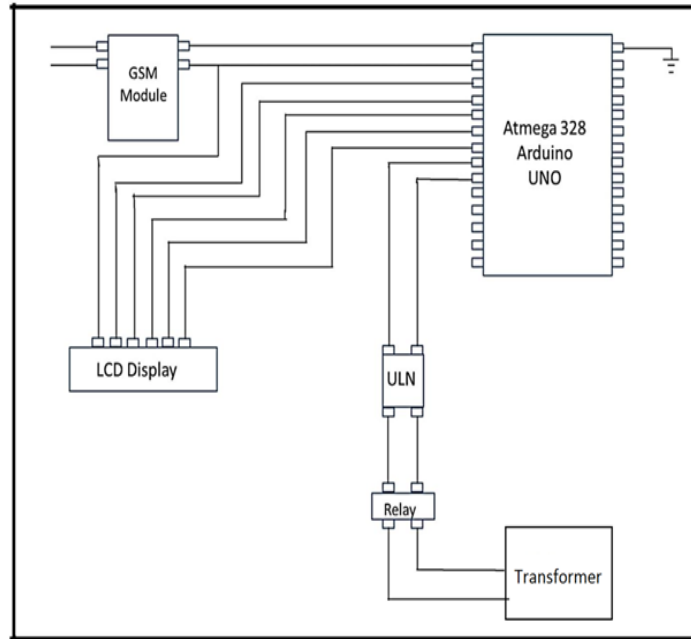


Figure 2: Constructional Overview Schematic of Transformer Parameter Monitoring And Alerting System By Using GSM.

4. WORKING:

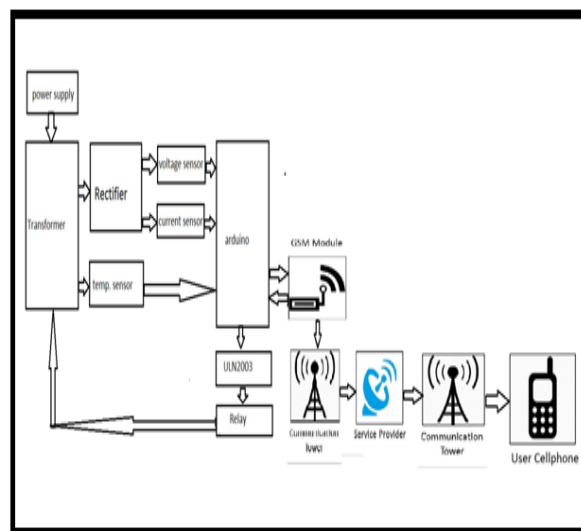


Figure 3: Basic Block Diagram Of Transformer Parameter Monitoring And Alerting System By Using GSM

Firstly we give AC 230v power supply to transformer, The main parts of a transformer are windings, core and isolation. The windings should have small resistance, also the windings turns have to be isolated from each other. Transformer core is made from very thin steel. We use single phase core type step down transformer which convert 230v into 9v. then we give 9v to 7805 ic. The main purpose 7805 ic is regulation. When we give 9v to

7805 ic then it convert 9v into 5v. We use rectifier to get dc output . We required DC voltage for sensors (as ac sensors are not available) so all circuit voltage is 5v Dc voltage. We use temperature sensor, current sensor, voltage sensor for the purpose of sensing the critical level temperature rised, detect the over current and over voltage respectively. We connect temperature sensor on transformer winding for monitor critical level temperature of transformer winding. We connected current sensor in series with transformer and voltage sensor in parallel with transformer. We give output of sensors to aurdino328 as analog input. The aurdino328 contain microcontroller. Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 20 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Arduino ATMEGA-328 microcontroller has been programmed for over current, over voltage and temperature rise, on the base of whole program in microcontroller we control the whole process. We use GSM to communicate with user .when the temperature rises above critical value the transformer will be trip through relay. Then aurdino encode and decode with circuit when fault occur the circuit will trip so that transformer will be protected and at the same time message will send to the user so that problem will be recover in less time. We use LCD display for showing the output of circuit .we use 16*2 display LCD when transformer trip message also will display on the LCD screen

5. ADVANTAGES:

- Operate Transformers from remote locations.
- GSM based, low running cost.
- It is highly sensitive. It gives the accurate feedback.
- Remote control from anywhere in the world.
- It also provides an authentication report to the MSEB weather Transformer is ON or OFF.
- It prevent circuitary from damage.
- Accident prevention

6. DISADVANTAGES:

- As we use GSM module in our project the network error may occurred.
- The arduino kit is very sensitive. Slight distortion in power supply may cause problem in whole working of a project.
- The project work on microcontroller program, hence if the program will get corrupt the whole working of project will stop.
- The whole kit is somehow delicate hence need to be handling with care.

7. AREAS OF APPLICATION

The major area captured by it are:

1. Power Grid:

The electrical power grid are the interconnected network for delivering electricity. It consist of generating station, transmission and distribution line. In such case it is necessary to protect transformer. The whole work of transmission and distribution depend on transformer and these transformer are almost chance to fail due to the over voltage, critical level temperature over current, and over load condition. So we need to protect it by using transformer parameter monitoring and alerting system by using GSM Module.

2. Factories and Industrial area:

Indoor distribution transformers are used with panel boards and are separately mounted to the supply. Several transformer types rated higher than 600 V for oil insulated type, higher than 35,000 V for dry type and other transformers rated higher than 600V are required to be located in vault rooms. It required a lot of electrical power from distribution line. In such a case almost probability to failure of transformer due to the overheating, overvoltage and over current. So it is very necessary to apply transformer parameter monitoring and alerting system.

8. RESULT

Hence, our project “Transformer Parameter Monitoring And Alerting System By Using GSM” is successfully operated. When temperature, voltage and current gets above the critical value then transformer get trip and load is prevented from damage. The message is suddenly given to the MSEB office by using GSM. Hence in this way we can protect the transformer from fault and if it is damaged then we can identify which particular transformer is damaged and repair it in very short duration of time.

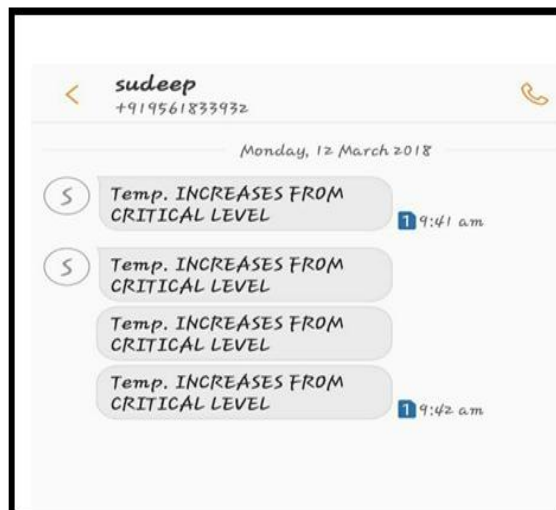


Figure 4: Result of project

9. CONCLUSION

The GSM based monitoring of distribution transformer is quite useful as compared to manual monitoring. We can easily figure out that which transformer is undergoing fault from the

message sent to mobile. We need not have to check all transformers and corresponding phase currents and voltages and thus we can recover the system in less time.

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