Microcontroller Based Transformer Health Monitoring System Using IOT

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***Abstract*— The progress and development of national economy as well as power system, reliability and safety issues of power system have been more important. Development of Transformer Health Monitoring System (THMS) has been done in that reason. Transformer is the most vital asset in any electrical distribution network and therefore it needs special care and attention. The implementation on-line monitoring system integrates Global Service Mobile (GSM) Modem, with single chip microcontroller and sensors. It is installed at the transformer site. The output values of sensors are processed and recorded in the system memory. System programmed with some predefined instructions to check abnormal conditions. If there is any abnormality on the system, the GSM module will send SMS (Short Message Service) messages to designated mobile telephones containing information about the abnormality according to the aforesaid predefined instructions and also other management services such as Voice announcement facility to the concerned department, finding location of Overloading (power theft) of transformers, Plotting GPS points in Google maps, auto police complaint to nearest police station, Overloading (POWER THEFT) sharing to police and finally capturing photos remotely for proof of theft. Our project consists of SMS enabled application and voice-based applications. This project will also consist of the following features by measuring temperature in the transformer such as high or low and measuring oil level in the transformer. Measuring of temperature and oil level in the transformer and taking necessary actions will lead to improve power transmission and it also boost transformer efficiency. This system will be an advanced step to the automation by diminishing human dependency. Thus Transformer health monitoring system offers a more improved transformer monitoring.**

Keywords: ***Microcontroller, Global Service for Mobile, Temperature Sensor, Current Sensor, Relay, Liquid Crystal Display, Analog to digital Convertor.***

I. INTRODUCTION

Reliable and quality power is needed for our economic development of a country. For providing reliable electrical energy, it is very necessary to have highly reliable associated electrical equipment. The transformer, being a key element in the transmission and distribution of electrical energy, improving its reliability is of most important. The transmission power line lengths are exposed to different faults and errors. The error rate is very high in transmission power lines. Faults and errors on power system transmission lines need to be identified and located very speedily, classified perfectly and cleared as fast as possible [1].

Hence it is, all the more essential to employ continuous monitoring techniques and on-site diagnostics followed by quality maintenance for having trouble-free and reliable operation with minimum outages. The embedded technology will be used in our project to minimize the electronic hardware components [2]. Embedded technology is used to minimize the cost and maximizing the work ability. Embedded systems will provide the needs of industrial control, monitoring, interfacing with any latest communication systems like GSM, GPRS, Bluetooth [3].

This project is helpful in Overloading (POWER THEFT) of transformers detection from intruders and provide various management services such as voice announcement to the concerned department, detecting power theft location, provides facility to plot power theft location on Google maps, automatic police complaint through online, capturing photos remotely for proof of theft [4]. Overall this project improves power transmission by monitoring transformer temperature and oil level in the transformer using corresponding sensors. It is IOT CLOUD based project [5].

REVIEW STAGE

The existing system for detecting Overloading (POWER THEFT) of transformer is not an efficient one. The Overloading (power theft) happening is detected while taking the energy meter readings by calculating the difference between the power received in the transformer and that received in the destination. No measure is taken to prevent it [6].

FINAL STAGE

The proposed system involves both detecting Overloading (POWER THEFT) of transformer and also taking necessary actions on the spot. Using the IOT application we can detect the power theft and the status of the transmission lines, capture the photos of the power theft and also track location [7].

II. COMPONENTS REQUIRED

2.1 Microcontroller

The SST89E516RD is a 8-bit microcontroller product manufactured by CMOS semiconductor technology. It offers significant cost and reliability for customers by using split gate cell design and thick-oxide tunneling injector. The instruction set used is 8051 and it has more random access memory and read only memory capacity. It also has 3 timers.

Fig 1. Microcontroller

2.2 Current Sensor

A current sensor is a device that detects electric current (AC or DC) in a wire, and generates the pulses with fixed interval of time.

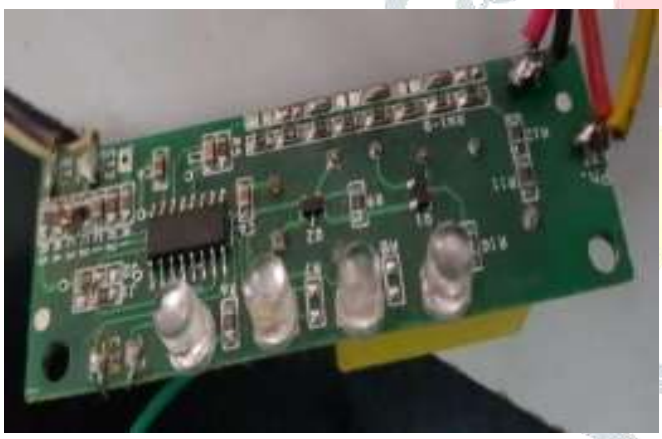

Fig 2. Current Sensor

2.3 ADC (Analog to digital converter)

ADC is mainly used as analog to digital converter. The readings coming from temperature and humidity are in analog as the microcontroller cannot understand readings in analog hence, readings are converted into digital by using analog to digital converter. Successive approximation is the technique used to convert analog to digital. This ADC are designed to perform repeatable, accurate and fast conversions over a wide range of temperature and humidity readings.

2.4 Liquid crystal display

LCD Display is mainly used to display characters. It contains two rows each of which contains 16 bits. Hence totally two rows each of 16bits can be displayed. BIT 1 is ground, bits 7- 14 are the data bits, bit 15 is the back light anode and bit 16 is the back-light cathode. Bit3 is mainly used provide input voltage for LCD.

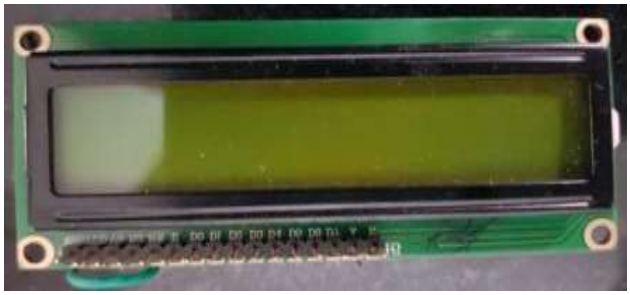

Fig 3. Liquid Crystal Display

2.5 GSM (Global Service for Mobile)

GSM mainly acts as an intermediate between the microcontroller and the user. The commands which come from other sensors are passed on to the GSM first and then GSM passes it to the microcontroller.

Fig 4. Global Service for Mobile

2.6 DC Relay

The relay is an electromagnetic device. It is used to separate two circuits electrically and connect them magnetically. Relays are very useful and makes it possible that one circuit can switch the other while both are not linked to each other. Relays are used mostly to combine an electronic circuit to an electrical circuit so that the electric circuit works at very high voltage. There are three contactors in basic relay: normally open (NO), normally close (NC) and common (COM). When there is no input state, the COM is connected to NC. When the operating voltage is applied to relay, the relay coil gets charged and energized and COM changes to NO contact. A relay runs by an electric current which is small and can turn on or off a much larger electric current. The core of a relay is an electromagnet.

Fig 5. DC relay

2.7 Temperature sensor

Temperature sensor is mainly used to detect the temperature or heat. LM35 is used as the temperature sensor.

Fig 6. Temperature Sensor

2.8 Oil Float Sensor

An oil float sensor is a device used to detect the level of liquid within a transformer.

Fig 7. Oil Float Sensor

III. BLOCK DIAGRAM

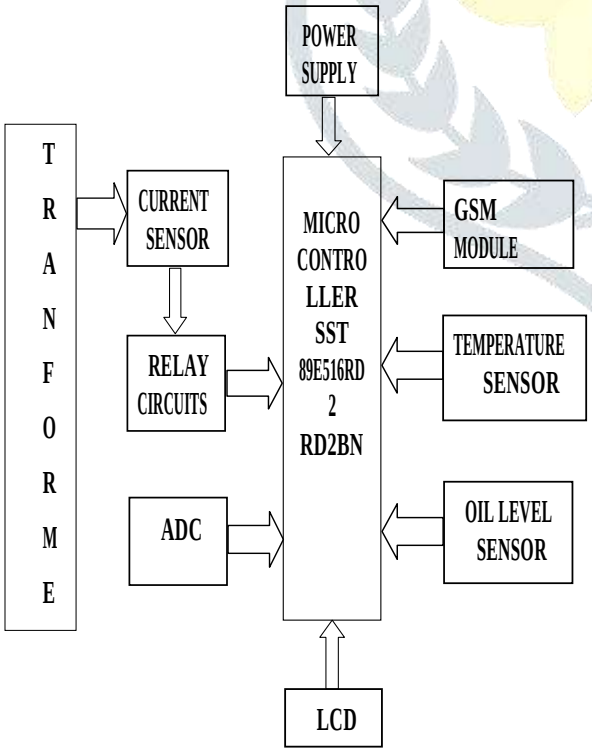

Fig 8. Block Diagram of Project

IV. METHODOLOGY

In this project we will use an IOT (internet of things) technology as well as GSM modem. Project describes the automatic Overloading (POWER THEFT) of transformer detection system. And the current sensor generates the pulses, and microcontroller read that pulses and count it and also watches a message from GSM module. If any message received from GSM, microcontroller processes the information according to program, the line is supposed to take specific load, if in case more load is drawn. It will send theft message to the concerned vigilance department. The message sent once received by the head it will convert the smartphone using ARM 11 processor from silent mode to general mode and gives announcement in a very high voice. Once he gets the intimation about the theft he can take global photos by sending photo message to the arm 11 device to the vigilance team mail id. He can register a online complaint to the police, through the device. Using solid state relay other sensors are used to protect transformers by sending appropriate messages [1].

Generally all transformers are oil type in nature. They require regular maintenance like oil check, temperature control, fire protection. We use different sensors to maintain this. Whenever the oil level is low, it will generate message and send it to the maintenance department. When the temperature of the transformer is going abnormal, it will intimate the maintenance team [3].

V. RESULT

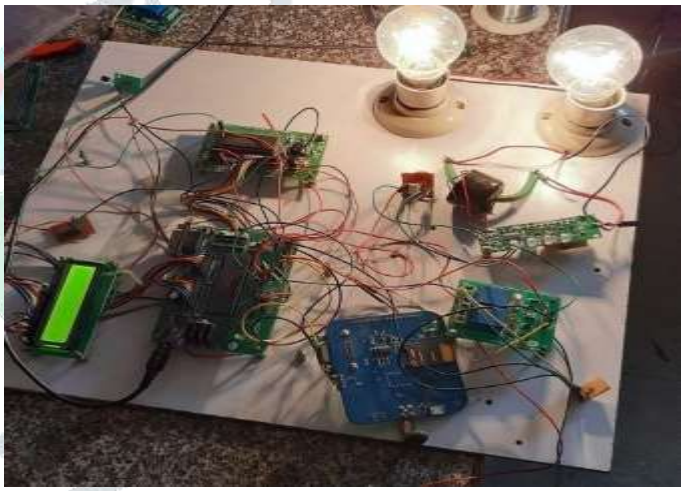

Fig 9. Hardware Model

VI. CONCLUSION

We all know that electricity is scarce and at such time we can't afford for Overloading (power being theft). In the era of smart city advancement, this project is concentrated on the connectivity & networking factor of the IOT. In this project, we are detecting the Overloading (POWER THEFT) of transformer, identifying faults and also tracking location of the fault area to take necessary measures. The proposed system provides the solution for some of the main problems faced by the existing Indian grid system, such as wastage of energy, power theft, and transmission line fault. If this system is implemented then the only the amount of power required will be consumed and there will be no wastage of power. And moreover even the money spent can be saved. Hence it will a way of helping in the economic growth of the country.

VII. REFERENCES

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