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Monitoring of Transformer via Internet of Things Using GSM Technology

K. Banumathi[1], M. Grace[2], G. Kalaikaveya[2], S. Shobana[2]

[1]Asst.Professor, ECE Department, Panimalar Institute of Technology, Poonamallee, Chennai, Tamil Nadu, India

[2]ECE Department, Panimalar Institute of Technology, Poonamallee, Chennai, Tamil Nadu, India

ABSTRACT

In this work Transformer Health Monitoring System(THMS) has been Distribution of transformer in most of the vital aspect, an any electrical distribution network system and further it needs some special attentinon and care to monitor. This THMS monitor the health condition of the distribution transformer network in real time. The huge number of transformers are distributed over a large area it's difficult to control the system condition manually of each and every single transformer. So automatic data acquisition and transformer condition monitoring has been an important part. The implementation of a mobile embedded system to the monitor load currents, over voltage, transformer oil level and oil temperature. System on-line monitoring integrates Global Service Mobile (GSM) Modem, with the single microcontroller chip and sensors. It has been installed at the distribution of the transformer site itself. The output values of the sensors are continued to process and recorded in the system memory. System programmed with some special predefined condition to check abnormality automatically. If there is any abnormality on the system, the GSM module will track to send the short messages to the designated mobile containing information about the abnormality according to the predefined instructions. This mobile system network will help us optimally utilize transformer to identify the problems before any damage or failure has been occurs. This system will be an advanced step to move forwared an automation by shrinking the human value. As it is a wireless communication system, there is no need of large number of cables which are huge amount of cost. Thus THMS offers a more improved transformer monitoring.

Keywords : GSM, IOT, Transformer Health Care Monitoring.

I. INTRODUCTION

E Electricity play a major important role in our life. Each and every moment of our life depends upon the electricity. Electricity has several components and equipment helping human to transfer and regulate the distribution according to our usage. The most crucial equipment of the transmission and distribution of electric power is transformer. In power systems, an electrical equipment distribution transformer directly distributes power to the low-voltage users and its operation condition is an important criteria of the entire network operation. The majority of these devices have been in service for many years in different (electrical, mechanical and environmental) conditions. They are the main components and constitute a large portion of capital investment, Operation of distribution majority of these devices have been in service for many years in different (electrical, mechanical and environmental) conditions. They are the main components and constitute a large portion of capital investment. Operation of distribution transformer under rated condition (as per specification in their nameplate)

guarantees their long service life. However, their life is significantly reduced if they are subjected to over loading, heating, low or high voltage/current resulting in unexpected failures and loss of supply to a large number of customers thus effecting system reliability. Abnormality in distribution transformer is accompanied with variation indifferent parameters like Winding temperature, Oil temperatures, Ambient temperature, Load current, Oil flow(pump motor), Moisture and dissolved gas in oil, LTC monitoring, Oil level, Bushing condition. Overloading, oil temperature, load current and ineffective cooling of transformers are the major causes of failure in distribution transformer. When a transformer fails, an adverse effect to occurs in the continuity of transmission and distribution systems resulting in increase of power system cost and decrease of reliability in electric delivery. As transformer is a combination of many parts, this all parts must be checked regularly to maintain the transformer in perfect operating conditions. The monitoring devices or systems which are presently used for monitoring distribution of the transformer have many problems and deficiencies. According to the above system requirements, we need a distribution transformer in real-time for monitoring the system to control all essential parameters operation, and send to the information monitoring centre in time. It leads to the online monitoring for main functional parameters of distribution transformers which will provide necessary information and detail about the health of distribution transformers. This will help and guide to optimally use the transformers and keep this equipment in operation for a longer period. The online-monitoring system is used to collect and analyze temperature data over time . THMS will help to identify or recognize unexpected situations before any serious damage or failure which leads to a greater reliability and significant cost savings. Wide usage of mobile networks and GSM modems, have made them an attractive option both for voice media and wide area network applications. We also isolated our framework into three sections. These are information authority, information processor and imparting part. In this part we discusses the consolidated framework or control unit for transformer wellbeing checking framework.

II. METHODOLOGY

This paper is a presentation of the design implementation of Transformer Health Monitoring System (THMS) through GSM module .Cost effectiveness and remote location will be given priority to this project. In case of software driven system total system requires lot of connection and apparatus and technically skilled personnel . On the other hand, the designed system has less complexity to install and doesn't require any sort of skilled personnel and can be notified remotely. Automatic decision making is the main feature of THMS .At first all the sensors, processing controller, IOT and GSM modem initialization occurs. After the initialization process required data's are measured from sensors and some common used components simultaneously. Then the microcontroller starts to compare the incoming values with the saved values in the EEPROM memory. When there is at least one parameter's value denied the saved value, then the microcontroller takes action to send this message to the information monitoring [IOT].If there is no over rated values of current and voltage or oil level is in safer level or the oil temperature is in the predefined value range, then the microcontroller jumps back to the testing procedure .This process continues until the decision making logic's output is negative. When the decision making logic's output is affirmative, then instantly microcontroller will take action for further execution. After sending the information, the loop continues again.

III. SYSTEM OVERVIEW

We divided our system into three parts. These are data collector, data processor and communicating part. In this part we talks about the combined system

or control unit for transformer health monitoring system. The system hardware has four hardware units as shown in the figure[1]. The data collect or unit is actually different sensor modules which is located at the transformer site. It is utilized to acquire the continuous data from the transformer side. Then these data processed and measured in the microcontroller. In the communicating part GSM module is connected. This module is used for the data communication from transformer to the information monitoring unit .In the message receiving section an operator can take steps by reading the message about what fault occurs. Thus the controller can isolate the faulty transformer before any massive accident.

IV. SYSTEM DEVELOPMENT

A. Interfacing Module

The advanced THMS includes Microcontroller, PIC16F877A, current sensor, oil level sensors, temperature sensor, SIM 900GSM module, mobile phone and information monitoring. The THMS continuously measures the line voltage, line current, oil level and transformer temperature serially .System reads corresponding values for further calculation for monitoring purpose and does the functions according to the program loaded in it. GSM module sends data to Mobile Phone

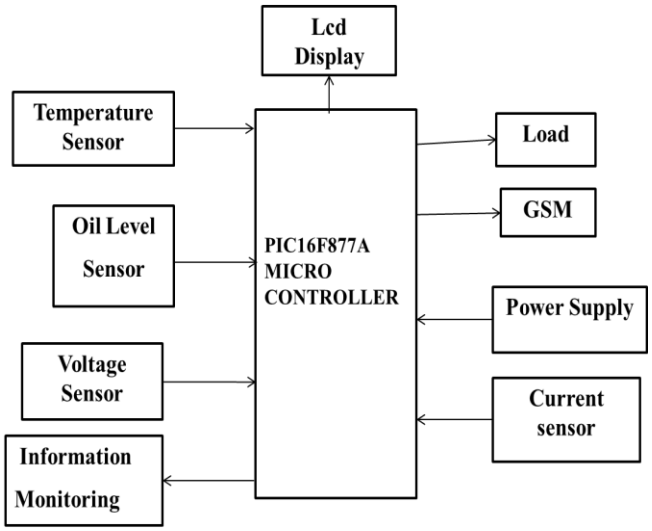

Figure 1. Block diagram of GSM based THMS system

The system starts with establishing a serial communication between the microcontroller and GSM modem, after a successful communication the system starts the check the parameters. Baud rate of the established communication was 9600 bps. To measure the voltage in primary side a capacitor divider was used and then the divided voltage converted to DC for measurement purpose and then through an ADC channel of microcontroller. As the measured value varies frequently a number of 1000 samples taken and the average value calculated and then multiplied with specific constant to get real AC RMS value.

B. PIC MICROCONTROLLER:

PIC16F877A used to measure current which provided an ADC value with proportional to the current through the line measured from another ADC channel. The measured data gives the instantaneous current value. By taking several samples and applying RMS formula to get average RMS current and then recorded.

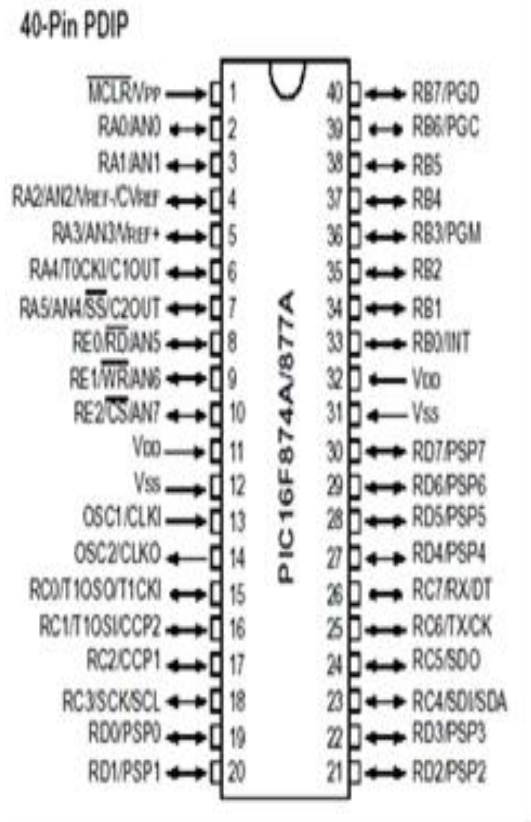

Figure 2. Pin Diagram Of PIC16F877A

Figure 3. Microcontroller PIC16F877A

C. TEMPERATURE SENSOR:

LM35 used as temperature sensor which also provides an ADC output as voltage varies 10mV for every degree Celsius change of temperature. Equation to measure temperature in Celsius unit

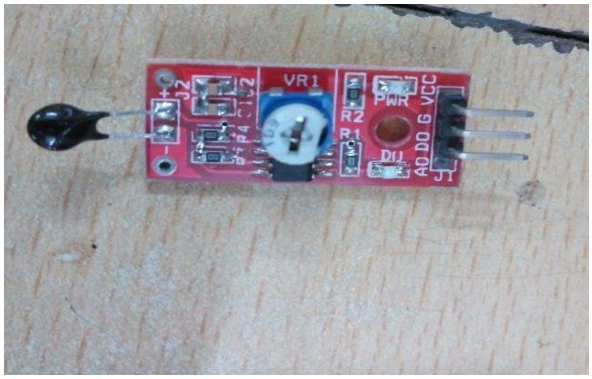

Figure 4. Temperature Sensors

D. OIL LEVEL TEMPERATURE:

Oil level measured using ultrasonic sensor, which provides pulse whose width varies according to the distance between head of oil level is shown in figure[5]. The pulse width of the received signal is measured using TIMER 0. Time measured by counting overflow then multiplying by the overflow time.

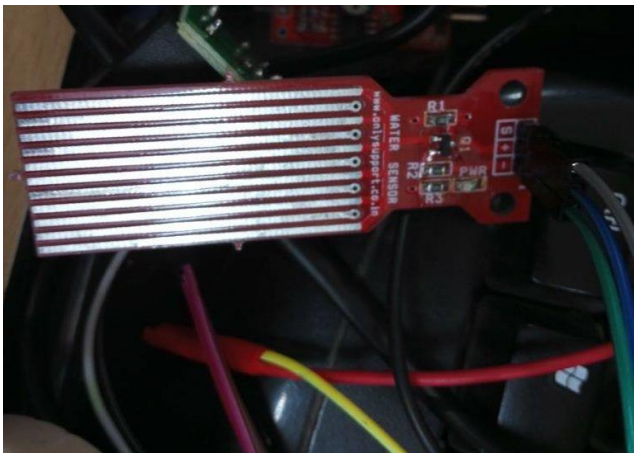

Figure 5. Oil Level Temperature

After measuring all four the system checks for the Conditioned applied. For transformer condition within the given range system remains checking again. In case of any fault condition microcontroller sends signal to the GSM modem providing the fault type and place by AT command and then modem sends a text message to a given authorized cell no to inform and to take necessary steps and modem does send this repeatedly until the fault is removed . After fault clearing the total system again starts to monitor the condition of the transformer.

V. CONCLUSION

The final stage of Electricity distribution is the delivery of electricity from generating power plants to end users. Distribution system's network carries electricity by the transmission system and delivers its load centres. Thus, it is very essential to have high efficiency, high reliability and high service quality in a distribution system. This study gives remedies from the difficulties of determining fault occurring causes in transformer and it overcomes the drawbacks of previous working methods. The project focuses mainly on the efficiency of monitoring process of the transformer by using wireless communication that eliminates the use of large cables which are of high cost, low reliability and maintenance. The GSM networking helps in

better way of communication which enhances the improvement steps in this process. So, use of PIC16F877A microcontroller makes the system real time embedded system and aids very much in industry needs. The designed system is connected to a distribution transformer and is able to send abnormal operation parameters information to a mobile device using a GSM network. The system hardware was constructed from the available components. The experimental results came out as expected.

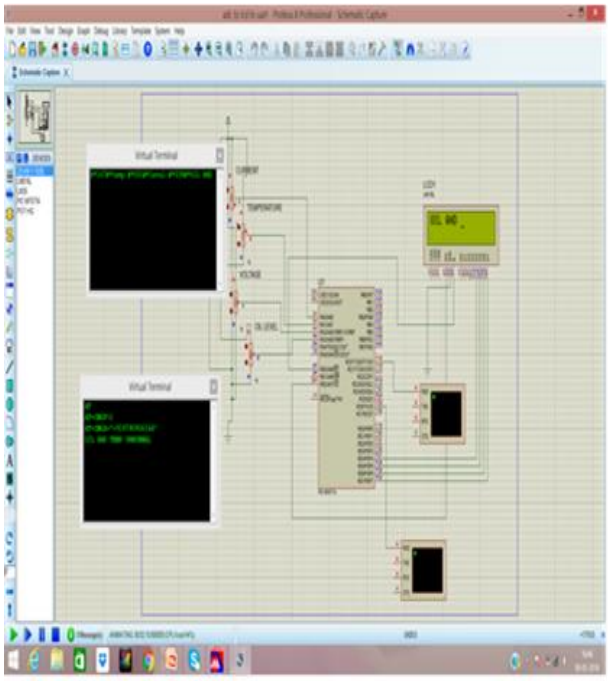

Figure 6. Output Data In Stimulation Of Mplab

VI. REFERENCES

[1]. W. H. Bartley, "Analysis of transformer failures." International Association of Engineering Insurers 36th Annual Conference, pp. 1-5, 2003

[2]. J. J. Kelly, "Transformer fault diagnosis by dissolved-gas analysis," IEEE Transactions on Industry Applications, no. 6, pp. 777-782, 1980.

[3]. W. Chen, Q. Zhou, T. Gao et al., "Pd-doped SnO2-based sensor detecting characteristic fault hydrocarbon gases in transformer oil," Journal of Nanomaterials, vol. 2013, Article ID 127345, 9 pages, 2013.

[4]. J. Dai, L. Zhu, G. Wang et al., "Optical Fibre Grating Hydrogen Sensors: A Review," Sensors, vol. 17, no. 3, pp. 577, 2017.

[5]. Y.-T. Luo, H.-B. Wang, G.-M. Ma et al., "Research on high sensitive D-shaped FBG hydrogen sensors in power transformer oil," Sensors, vol. 16, no. 10, pp. 1641, 2016.

[6]. H. Hayashi, M. Nakano, and J. Suehiro, "Detection of acetylene dissolved in insulation oil using pt-decorated ZnO gas sensor." Region 10 Conference (TENCON), 2016 IEEE. IEEE, pp. 1485-1488, 2016.

[7]. Z. Jin, H.-J. Zhou, Z.-L. Jin et al., "Application of nano-crystalline porous tin oxide thin film for CO sensing," Sensors and Actuators B: Chemical, vol. 52, no. 1, pp. 188-194, 1998

[8]. Z. L. Poole, P. R. Ohodnicki, A. Yan et al., "Potential to Detect Hydrogen Concentration Gradients with Palladium Infused Mesoporous-Titania on D-Shaped Optical Fibre," ACS Sensors, vol. 2, no. 1, pp. 87-91, 2017/01/27, 2017.

[9]. J. Tang, X. Zhang, S. Xiao et al., "Experimental Analysis of Modified CNTs-Based Gas Sensor," Electrochemical Sensors Technology: InTech, 2017.

[10]. J. Devkota, P. R. Ohodnicki, and D. W. Greve, "SAW Sensors for Chemical Vapors and Gases," Sensors, vol. 17, no. 4, pp. 801, 2017.