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IOT BASED TRANSFORMER MONITORING AS A SPECIFIC INSTANCE OF INDUSTRIAL AND MACHINERY MONITORING

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Abstract – *Monitoring of geographically & spatially distributed assets like Power & Distribution transformers, Motors & other Electrical Equipment, Industrial machinery & equipment is a very challenging task since local monitoring is usually manual and high cost resulting in inconsistent performance and higher failure rates. Specifically, Transformer is one of the most important equipment in power transmission &distribution. They have a long life of 25 to 30 years. However, they underperform and fail in large numbers, within 3 years of commissioning, due to various reasons, causing huge economic and service impact on the transmission &distribution utilities as well as the power consumers. This project is aimed at designing & developing a Low Cost IOT based remote monitoring of power & distribution transformers through GSM and storing the measured data in the cloud. This system can measure, record & analyze various Transformer parameters like Oil Temperature, Winding Temperature, Oil level, current, voltage etc. This allows continuous real time monitoring of Transformer parameters with an ability to identify performance, detect abnormalities like overloading, out of limits operation, etc., ensure safety and predict remaining life, preventive maintenance alerts, etc.*

We demonstrate this design with implementation of IOT based system that measures temperature, current & voltage and transmits the measured data with date & time through GSM to a remote location where the data is stored in the cloud. The microcontroller receives the sensors input and processes the measured data. The measured data is displayed on a LCD display and relays are provided for Alarm, Trip & other functions. The microcontroller also drives the GSM module to transmit the data over cellular network to remote areas where the data is stored in IOT based cloud storage.

***Key Words*: IOT, GSM, Transformer Monitoring, Remote Monitoring, Winding Temperature, Transformer Temperature measurement, Internet Of Things.**

1. INTRODUCTION

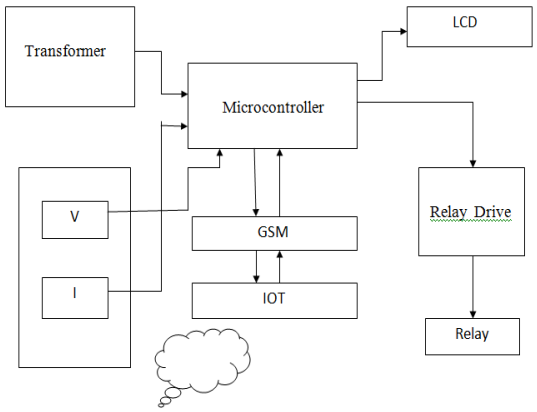
Transformer is the heart of any power system. Hence preventive maintenance is always cost effective and time saving. Any failure to the transformer can critically affect the functioning of the whole power system. With the limited failure records and the age censored transformer population, any traditional statistical analysis of the failures cannot be used to predict the end-of-life and future transformer reliability. This is because the failure data are limited and most transformer failures up to the present are caused by randomly occurring power system transient fault events. Ageing equipment is the major factor contributing to poor system reliability and high operating cost in many utilities. The decision on transformer replacement is important, however it is technically difficult to determine. The monitoring data, operational experience and deterioration knowledge are not straightforward to understand and transform to useful information. There are various causes of transformer failures - prolonged over loading, single phase loading, low line voltage, unbalanced loading, lightning strikes, power theft, faulty design, poor workmanship, vandalism, oil leakage and internal defects. In the current pole mounted transformer installations, there is no clear indication of the cause of transformer failure and which transformers are overloading. Laboratories tests and analysis must be carried out to establish the root cause of the failure. With a correct monitoring system, most of above causes can be prevented; if not, they can be predicted prior to occurrence. Transformer end of life modeling using real loading profiles will enable us to capture the operational stresses to determine the transformer remaining life.

A Transformer Monitor can be used to collect pole mounted transformer parameters. The devices will measure in near real-time the loading on distribution transformers, provide outage monitoring and provide useful information for day-to-day operations. The measured data is transmitted through GSM to a Remote location for data storage in the Cloud storage and data analysis. This device will provide information about transformer load management. With this the utility provider will be in position to know which transformers are overloaded and calculate where the equipment has reached the end of its lifespan. In turn, this allows the utility provider to upgrade equipment before it fails and helps to improve service reliability. In addition, the data will provide an insight on revenue losses per transformer.

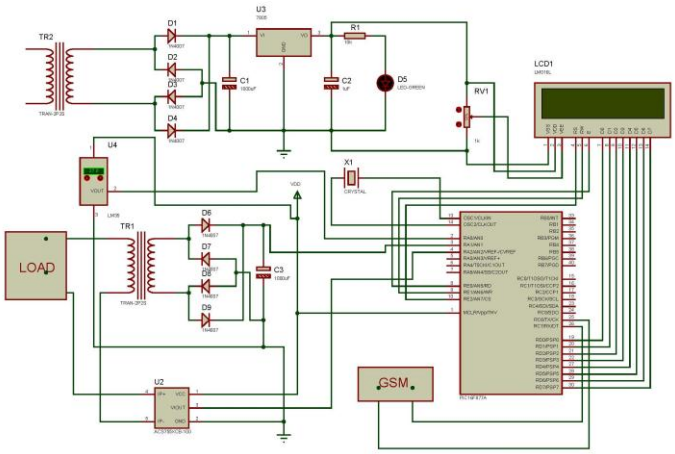
2. PROPOSED TRANSFORMER MONITOR

In this paper, we provide the design of an IOT Based Transformer Monitor that measures transformer parameters like Oil Temperature, Winding Temperature, Load current, etc using various sensors. This measured data is acquired and processed by a microcontroller. This data is then provided to a LCD for display and can also drive relays for Alarm, Trip operations. The data will be sent to GSM modem that transmits this data over GSM to a remote location and uploading the data in the cloud for data storage.

2.1 BLOCK DIAGRAM



2.2 CIRCUIT DIAGRAM

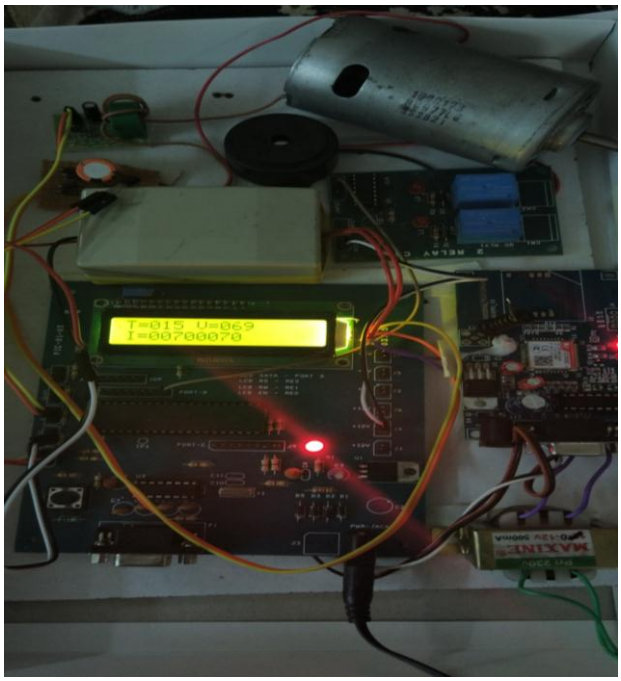


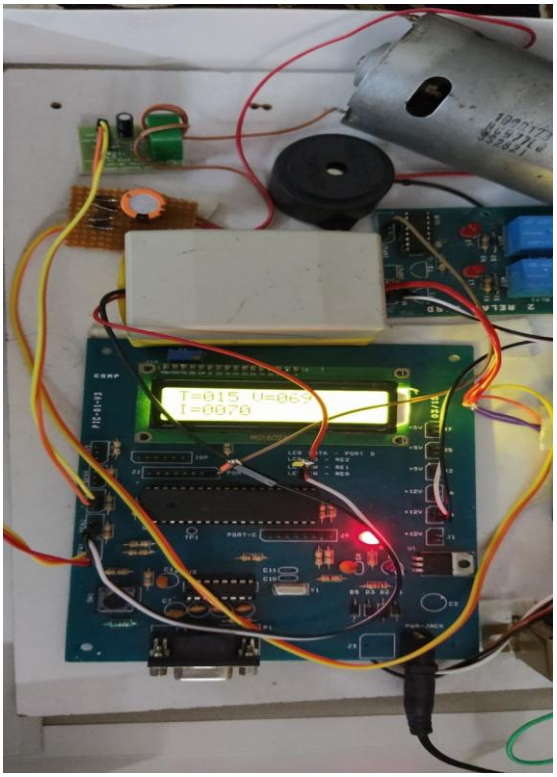
2.3 IMPLEMENTATION

The design of the IOT based transformer monitor has been demonstrated with a PIC16F877A Microcontroller, LM35 temperature sensor to show temperature data measurement, ACS75x current sensors, SIM 800C GSM Module for data transmission over GSM/GPRS to a remote location, 16X2 LCD module for data display and Cloud based data storage.

2.4 KIT IMPLEMENTATION

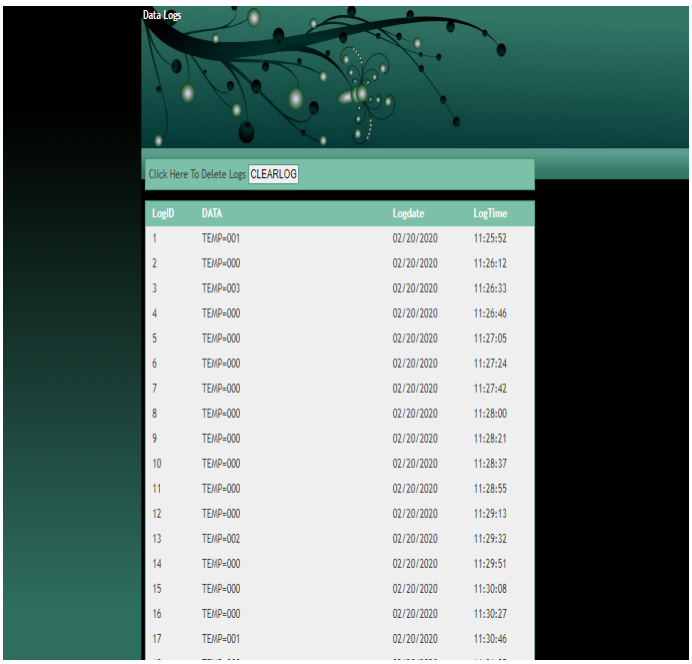
The design is demonstrated in the kit shown. The measured temperature and current data is processed by the microcontroller and transmitted by the GSM module to a remote location for cloud based data storage. The module performance is shown in the pictures below





2.5 DATA STORED IN CLOUD

The measured data is transmitted to a remote location over GSM/ GPRS and data is stored in Cloud based data storage. The measured data is displayed in the cloud as below.



3. CONCLUSIONS

Thus, in this project, we have provided the design of a low cost IOT based remote Transformer Monitoring system with GSM and cloud based data storage. This design can be implemented for Remote real time monitoring of various other spatially distributed Industrial equipments.

This project has demonstrated the design with a practical kit implementation with temperature, current & voltage sensing, PIC16F877A microcontroller based data acquisition & processing, LCD & relay output drivers, GSM module for remote data transmission, and IOT Cloud based data acquisition and data logging.

The normal sensing techniques will support the data monitoring. Our proposed model will show the real time values as the data. We have backup of the situation based database management by uploading the data in the cloud.

REFERENCES

1."Chan, W. L, So, A.T.P. and Lai, L., L.; "Internet Based Transmission Substation Monitoring", IEEE Transaction on Power Systems, Vol. 14, No. 1, February 2014, pp. 293-298.

2. Performance Monitoring of Transformer Parameters in (IJIREEICE) Vol.3, Issue 8, August 2015.

3. GSM based transformer monitoring in International Journal of Advance Research in Computer and Communication Engineering", Vol.2, Issue3, JAN 3.

4. "Distributed Transformer Monitoring System" International Journal of Engineering Trends and Technology (IJETT) - Volume4 issue5- May2013.

5. "Microcontroller Based Substation Monitoring and Control System with GSM Modem'' IOSR Journal of Electrical and Electronics Engineering (IOSRJEEE) ISSN: 2278-1676 Volume 1, Issue6 (July-Aug. 2012).

6. Ravishankar Tularam Zanzad, Prof. Nikita Umare, and Prof Gajanan Patle "ZIGBEE Wireless Transformer Monitoring, Protection and Control System", International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization), Vol. 4, Issue 2, February 2016.

7. N Maheswara Rao, Narayanan R, B R Vasudevamurthy, and Swaraj Kumar Das, ''Performance Requirements of Present–Day Distribution Transformers for Smart Grid'', IEEE ISGT Asia 2013 1569815481.

8. Mohamed Ahmed Eltayeb Ahmed Elmustafa Hayati, and Sherief F.Babiker, ''Design and Implementation of Low-Cost SMS Based Monitoring System of Distribution Transformers'', 2016 Conference of Basic Sciences and Engineering Studies (SGCAC).

9. Leibfried, T, "Online monitors keep transformers in service", Computer Applications in Power, IEEE, Volume: 11 Issue: 3, July 1998 Page(s): 36-42.