IoT Based Distribution Transformer Condition Monitoring System

Kunal Sonigra[1], Prasad Patil [2], Pratik Chaudhari[3], Mangesh Moharkar[4], Manthan Ishi[5] Manish D Mahale[6]

[1, 2,3,4,5] Research Scholar, Bachelor of Engineering, Department of Electrical Engineering,
[6] Assistant Professor, Department of Electrical Engineering
G H Raisoni Institute of Business Management Jalgaon, Maharashtra, India

---

Abstract - *A Power distributions as well as any bulk energy consuming companies have a high demand for reliable power so far as revenue generation and production are concerned. Research will proof that transformer are good option to companies and therefore maintenance as well as replacement of the transformer is found to be a luxurious exercise for most of the company. Keeping that factor in mind, distribution transformer (IOT Based), Health condition monitoring system is developed to monitor the health conditions of distribution transformers remotely and at regular time intervals. Health has been determined on the base of change in values of current in the phases, oil level moisture content and load ability, which are measured using sensors.*

Key Words: Aurdino, Relay, LCD display, IOT software, P.T.

1.INTRODUCTION

In present Electrical Power System transformer is a crucial device of proper operation of grid network, i.e transformer is also called as heart of the power network. So to maintain the health of transformer we need to take necessary actions. It is very difficult; time consuming process to monitor the health condition of transformer manually. Every engineer faced difficulties to analyze the transformer system manually. So our idea is basically, that transformer health condition can be monitor in online mode/automatic mode by using Internet of Things(IoT). The simple system consists of Internet of Things (IOT), with single chip Arduino micro-controller, measuring instrument & sensors. It is installed. at the distribution transformer site. The required measurable values should be stored in the memory & values should be continuously monitored by the system with the help of programming. If any uncertain condition or abnormal condition occurs it will communicate with the serial communication. This system helps the power sector to continuously monitor the technical parameter of transformer in online mode and the system became flexible by the addition of IoT. It allows things to accessible from the internet that historically have not been. This system will helped the engineer to reduced the cost of transformer maintenance & increased the transformer life .Distribution transformers are sometimes heavily loaded without frequent monitoring of their Kilo Volt Ampere (KVA) demand, operating temperature, oil level and the moisture content developed in the transformer cooling medium, which leads the sudden breakdown & system will be get harmed. To overcome this problem we designed a system which can continuously monitors the parameters (oil level, temperature, current voltage) for transformer and increases its life.

2. LITERATURE SURVEY

Leny Thanigai, Prof. Dr. Chandrashekar Ramanathan, Lakshmi Sirisha Chodisetty proposed the architectural approach which merge the edge computing and intelligent agents and present the result by using PoC on Conditioning monitoring of distribution transformer in industrial sector. But this system has some challenges of handling the data and latency in decision[1].

Rohit R. Pawar, Priyanka A. Wagh, Dr. S.B.Deosarkar Presents the system which monitor the parameter of distribution transformer by using GSM/GPRS Module. The system consists of two unit one is remote terminal unit and other is monitoring unit [2].

3. LITERATURE SURVEY

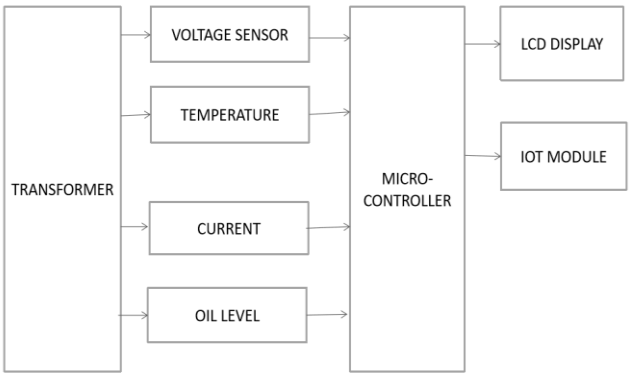

Fig -1: Block Diagram of System

The above figure shows about the block diagram of IoT Based system used for testing of transformer condition in online mode. The simple system consist of Current and

Voltage sensors i.e CT & PT for measuring the current and voltage parameter. To measure the oil level we used the oil level sensor & All these sensor is interface with the aurdino board. To measure the parameter we used the LCD Display which enhances the flexibility in work of engineer. The more detail explanation given below section:

3.1. POTENTIAL TRANSFORMER (PT)

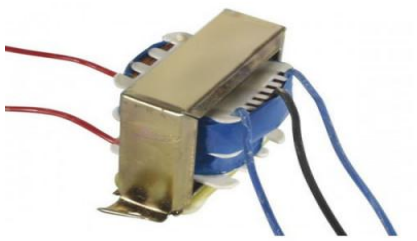

Fig -2: Potential Transformer

A potential transformer is primarily used for the measurement purposes and also it is use for the protection of the power system. An alternating voltage can be measured through the potential transformer. A Center Tapped Step Down Transformer (12-0- 12 500mA) is a common purpose for installing mains transformer. The Transformer has 230V primary winding and double-sided windows in the middle. Transformer has flying connectors with flying colors (Approximately 100 mm long). Transformer acts as a descending transformer reducing AC - 230V to AC - 12V. Transformer provides the output of 12V (12V and 0V). A transformer is a standalone electrical device that transmits energy by inductive integration between its compact circuits. The current fluctuations in the main rotation cause magnetic fluctuations in the transformer context and thus there is a magnetic fluctuation in the secondary turns. This variable magnetic field causes different electromotive forces (E.M.F) or voltage at secondary currents. The transformer has cores made of silicon metal that are very accessible. The metal has multiple access points for free space and the context thus helps to significantly reduce the magnetic field and block the flow in the the path along the coil.

Table -1: Specification of Potential Transformer

Input Voltage	230V
Output Voltage	12V or 0V
Output Current	750mA
Mount Type	Vertical Mount Type

3.2. CURRENT TRANSFORMER (CT)

Fig -3: Current Transformer

It is a transformer which is used to decrease or multiply an AC current. It generates the current in its secondary winding which is proportional to the current in its secondary winding.
Transformers are current sensor-powered units in the power system and are used in power stations, underground power stations, and in the distribution of industrial and commercial power.

Table -2: Specification of Current Transformer

Input	220V/240V AC
Output	0V to 12V AC
Output Current	1500Ma
Mount Type	Center tapped

3.3. TEMPERATURE SENSOR

The LM-35 is an accurate IC temperature sensor that emits in proportion to the temperature (in ^{o}C). The sensor circuitry is closed and therefore not subject to oxidation and other processes. With the LM-35, the temperature can be measured more accurately than any other thermistors. It also has a low temperature and does not cause temperatures above 0.1 ^{o}C in static air.

The operating temperature ranges from -55 ° C to 150 °C. The output voltage varies by 10mV in response to an increase in ^{o}C each ambient temperature, i.e., its rated is 0.01V / ^{o}C.

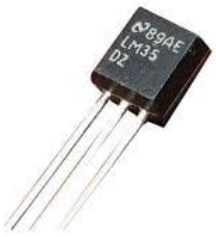

Fig -4: Temperature Sensor –LM-35

3.4. FLOAT SWITCH

In this project the float switch is used to measure the level of the oil. A Float switch is level measuring type of sensor which is used to measure a level of fluid in the tank.
A float switch is a machine switch that floats over a liquid surface. As the liquid level rises or falls, it moves up and down the liquid level. Depending on the pre-defined trigger, the mechanical switch on or off allows electrical energy to pass through it to the connected device. Normally, this connected device stops or starts to enter the liquid.
The float switch consists of an empty floating body and an internal switch, also it is called as a sensor. The most common internal change is reed change, so there are also magnets inside the body. It works like a ON/OFF Switching.Therefore, the machine switch creates an open or closed circuit.

Fig -5: Float Switch

3.5. LCD MODULE

LCD means Liquid Crystal Display which is generally used for display the various parameters in digital form.

In this system we used LCD to display various parameter of transformer like Current Voltage, Temperature and so on. Figure 7 shows the interfacing diagram of LCD Display with the Aurdino Board.

Fig -6: LCD Module

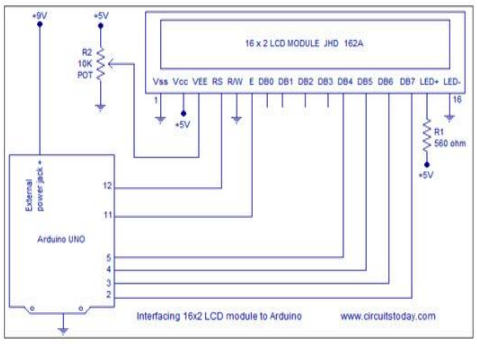

Fig -7:Interfacing Diagram of LCD Module

4. CONCLUSIONS

This paper describes the brief idea of IoT Based Transformer Health Monitoring system. Our main motto to design such device which reduces the human effort and to increase the efficiency of transformer. With real time monitoring system, analyze the electrical as well as physical parameter of transformer.

5. REFERENCES

[1] Leny Thanigai, Prof. Dr. Chandrashekar Ramanathan, Lakshmi Sirisha Chodisetty, Distribution Transformer Condition Monitoring based on Edge Intelligence for Industrial IoT, 2019 IEEE 5th World Forum on Internet of Things.

[2] Rohit R. Pawar, Priyanka A. Wagh, Dr. S.B.Deosarkar, Distribution Transformer Monitoring System Using Internet of Things (IoT), 2017 International Conference on Computational Intelligence in Data Science(ICCIDS).

[3] Buyung Sofiarto Munir, and Johan J. Smit, "Evaluation of Various Transformations to Extract Characteristic Parameters from Vibration Signal Monitoring of Power Transformer", 2011 Electrical Insulation Conference, Annapolis, Maryland, 978-1-4577- 02769-12/11/$26.00 ©2011 IEEE

[4] Drasko Furundzic, Zeljko Djurovic, Vladimir Celebic, and Iva Salom, "Neurel Network Ensemble for Power Transformers Fault Detection",11th sym posium on Neural Network Applications in electrical Engineering NEUREL-2012.

[5] D S Suresh, Prathibha T, and Kouser Taj " Oil Based Transformer Health Monitoring System", International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Impact Factor (2012): 3.358 Volume.

[6] E Kolyanga, ES Kajuba and R Okou, "Design and implementation of a low cost distribution transformer monitoring system for remote electric power grids", 978-1-4244-5586-7/10/$26.00

[7] Avinash Nelson A, Gajanan C Jaiswal, Makarand S Ballal, and D. R Tutakne," Remote Condition Monitoring System for Distribution Transformer", 978-1- 4799-5141-3/14/$31.00 ©2014 IEEE.

[8] SH.Mohamadi, and A.Akbari, "A new Method for Monitoring of Distribution Transformers", 978-1- 4577-1829-8/12/$26.00 ©2012 IEEE

[9] 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

[10] Guruprasad P. Sali, Mohini J. Deshmukh, Mrunalini S. Wankhede, Bipasa B. Patra, "Smart IOT Automation for Advanced Home Security", International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE), Vol 6, Issue 4, IFERP, April 2020, ISSN (Online) - 2395-2717, pp.1-6, doi: 01.1617/vol7/iss4/pid45820

[11] Sarang Malusare, Moin Kazi, Mohammad Abrar ,Shaikh Shahrukh, Manish Mahale, Iot Based Smart House & Short Circuit Protection & Detection System, International Research Journal of Engineering and Technology (IRJET),Volume7,Issue-7,July-2020

[12] B. Patra and P. Nema, "Analysis of Solar Integrated Multilevel Inverter for Smart Grid Power Filters," 2021 International Conference on Advances in Electrical, Computing, Communication and Sustainable Technologies (ICAECT), 2021, pp. 1-5, doi: 10.1109/ICAECT49130.2021.9392527.

[13] Patra, Bipasa Bimalendu. "Smart GridSustainable Shaping of the Future Smarter Nation." In International Journal of Emerging Technology and Advanced Engineering, First International Conference on Innovations & Engineering, vol. 8, pp. 101- 107.

[14] B. Patra, T. Patil, P. Nema, R. Vasave and S. Gawali, "Eleven-Level Inverter Topology with Photovoltaic Interface," 2021 IEEE 2nd International Conference On Electrical Power and Energy Systems (ICEPES), 2021, pp. 1-5, doi: 10.1109/ICEPES52894.2021.9699805.

[15] Patra, B. B. "Necessity for Future Smarter Nation with a Sustainable Trend-Smart Grid", BUSINESS AND TECHNOLOGY (IJSSBT), Volume 6, No. 2, September 2018 ISSN (Print) 2277-7261, 35.

[16] Bipasa Patra, Yogesh Girase, Mayur N Patil, " Smart electricity distribution control and relay synchronization system", International Research Journal of Engineering and Technology (IRJET), Volume 8 Issue 02 Feb 2021 pp. 1681-1685, p - ISSN: 2395- 0072.

[17] Bipasa Patra, "Smart Electricity Generation Trends with Solar Technology – A Transformation", International Journal of Engineering Research in Electronics and Communication Engineering, Volume 4 Issue 6, June 2017, pp 394-399, ISSN (Online) 2394-684.