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IOT Based Transformer Monitoring System

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***Abstract* - Transformers are simple devices that transfer electricity by changing the induced current in one circuit to another. Step-ups and step-downs of current or voltage are frequently used to convert the induced current. This application principally concentrates on the three phase transformer which are utilized in between electric poles & power transformers. The basic features, such as temperature, voltage, and current, are controlled in real time. These characteristics are necessary for efficient power transfer and an industrial transformer's extended lifespan. The Arduino controller and sensor, which regularly monitor the transformer's voltage, current, and temperature, are used to complete the monitoring and control process. There are other ways to maintain transformers, however this project uses an Arduino Uno Controller to monitor and manage the transformer in real time, replacing large computers with an embedded system. Real-time control and monitoring of the transformer's temperature range and current voltage exceeded are made possible by the design, which senses the transformer's characteristics and sends the data to the processor on a regular basis. The IOT module on Things Speak will be used to update all data via a web server.**

Keywords: Transformer, Embedded System and Arduino.

I. INTRODUCTION

One of the most practical and beneficial forms of energy is electricity. It is becoming more and more important in our contemporary, industrialized culture. Electric power systems are tremendously large, complex networks that are highly non-linear. These electrical power systems are combined for operational, reliability, and financial reasons.

If distribution transformers are operated in favorable and rated conditions, their service life is prolonged. However, overloading them drastically shortens their lifespan, resulting in unanticipated malfunctions and a loss of supply to many customers, which affects system reliability. Distribution transformer failure is mostly caused by overloading and inadequate cooling. The Supervisory Control and Data Acquisition (SCADA) system is used by the majority of power companies for online power transformer monitoring; nevertheless, it is an expensive proposal to expand the SCADA system to online distribution transformer monitoring. Currently, distribution transformers are manually monitored, with a person visiting the transformer site on a regular basis to perform maintenance and note important parameters.

Information regarding occasional overloads and transformer oil and winding overheating cannot be obtained by this type of monitoring. These elements have the potential to drastically shorten transformer life. Based on online monitoring of important operational parameters of distribution transformers, our system can give utilities valuable information about the condition of their transformers, enabling them to make the best use of them and maintain the asset's functionality for a longer amount of time.

This method will enable us to identify issues before they become catastrophic failures, extending the transformers' lifespan. Since we are employing a microcontroller, as was previously said, this technique depends on embedded systems. Self-contained programs that are integrated into hardware are known as embedded systems. Another way to conceive of an embedded system is as a computing system that has been designed with maximum efficiency, enabling it to do specified tasks as fast as possible. Embedded systems are typically set to a specific task. It also offers the advantages of increased dependability, lower power usage, and significant cost savings.

II. LITERATURE REVIEW

Most power companies, for online monitoring of power transformers, use supervisory control and data acquisition (SCADA) system, but for online monitoring of power trans-former, the extending the SCADA system is an expensive proposition. Power transformers are currently monitored manually, where a person visits a transformer site, for maintenance and taking records purpose. But main drawbacks of these systems are, it cannot provide information about overloads (Voltage Current) and overheating of transformer oil windings. Due to these, the transformer life is reduced.

"Design and implementation of real-time transformer health monitoring system using GSM technology" by Sajidur Rahman, Shimanta Kumar Dey, Bikash Kumar Bhawmick, and Nipu Kumar Das. This project presents the design and implementation of moni- toring load currents, over-voltage, transformer oil level, and oil temperature [1].

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"IOT Based Transformer Health Monitoring System: A Survey" by Kalpana Hazarika, Gauri Katiyar, IJIRT159015 INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN TECHNOLOGY 379 Noorul Islam. This paper presents a review of IoT (Internet of Things) based electrical parameters monitoring and controlling technologyto avoid its successive catastrophic failures [2].

"IOT Based Distribution Transformer Health Monitoring System" by SUBHASH YADAO, SANKET THAKRE, RISHABH DARWAI. The main purpose of this system is to monitor and control distribution transformers through IOT. It also sends SMS to the control room for further processing [3].

"IoT-Based Transformer Monitoring System" by Rajesh, K., Reddy, G. P., and Reddy, B. S. This paper provides an overview of different techniques used for transformer health monitoring, including traditional methods, and modern approaches such as IoT-based systems. The authors also discuss this field's challenges and future research directions [4].

"Health Condition Monitoring of Transformer: A Review " by Patel, N., Vora, D., Basera, A. S. This paper is to convey the requirement for condition checking, the kinds of failure that can happen in transformers, and audit mitigation methods required to monitor distribution transformer health condition [5].

"Condition monitoring of power transformer: A review" by Dhingra, Arvind Khushdeep, Singh Deepak, Kumar. This paper introduces the various approaches adopted for the online monitoring of power transformers [6].

"A review on fault detection and condition monitoring of power transformer" by J Aslam M, Arbab MN, and Basit A et al. This paper audits constant methods utilized for condition-based observing of power transformers [7].

"Detection of internal winding faults in power transformers based on graphical characteristics of voltage and current," by Chenguo Yao and ZhongyongZhao and Yu Chen and Xiaohan Chen and Chengxiang Li and Wei Li and Jian Wang. This paper attempts to propose a recently evolved winding disfigurement internet observing strategy given the Lissajous graphical examination of voltage and current [8].

"IoT-based Distribution Transformer Health Monitoring System using Arduino, NodeMCU and Thin speak," by Biju Rajan B, Amanraj S, Akhil S, Nayana S. This paper proposed an IoT-based transformer monitoring system that can monitor the transformer's temperature, oil level, and vibration. The system uses wireless sensor networks and cloud computing technology to collect and analyse data [9].

From a worldwide perspective, the studies reviewed showcase the potential benefits of implementing IoT- based distribution transformer monitoring systems, including improved trans-former health and equipment failure prevention through the provision of real-time data and analytics to operators. Despite these advantages, challenges still exist in this field, such as ensuring data transmission and storage security and reliability, which require further research to overcome.

III. OBJECTIVES

- To improve quality of power remote sensing
- To maintain continuity of supply
- Real time monitoring.
- It can able to detect the faults due to over current, over voltage, increased temperature at real time.
- Monitoring multiple transformers sitting in an office is possible.
- Prefault condition is easily detected and cleared at same time to avoid system failure. Fault monitoring requires less time also use of wifi gives most accurate, fast response.
- This type of monitoring protects transformer and overall system so system reliability and stability increases

IV. METHODOLOGY

Over Voltage Protection: A microprocessor monitors the input of the pot used to generate the over voltage and takes appropriate action.

Over Current: A current transformer is used to detect overcurrent, which causes the relay to turn off whenever it is detected.

Temperature: Lm35 is frequently used to detect temperature rise faults, which are then transmitted to the microcontroller. The microcontroller may therefore be used to determine this, and it will be updated over IoT.

IoT module: The wifi module is utilized to update data, which we may graphically depict on the Thinkspeak online web server.

Buzzer: The buzzer will beep if any sensors are detected.

LCD Display: The LCD will show all of the information.

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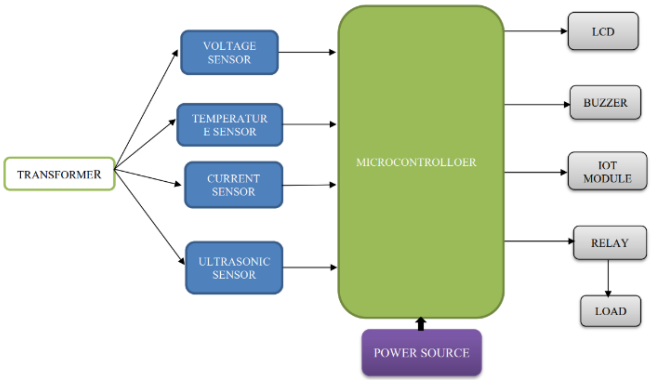

Figure 1: Block Diagram of Proposed Model

V. RESULT AND DISCUSSIONS

The findings of the suggested technique demonstrate that the protection strategy operates accurately and that it has a high sensitivity to anomalous and defective conditions. Transformer health monitoring will increase reliability and save a lot of money by assisting in the detection or recognition of unforeseen circumstances prior to any major breakdown. We can determine whether a transformer is in abnormal condition from any location. The transformer doesn't require human oversight. The transformer's details are automatically updated on the internet. DC voltage.

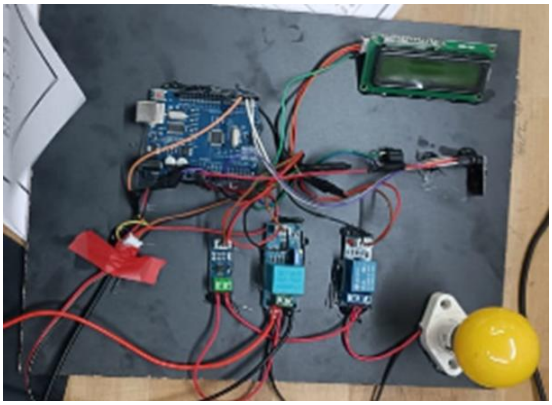

Figure 2: Hardware Setup

Figure 3: Voltage Graph

Figure 4: Current Graph

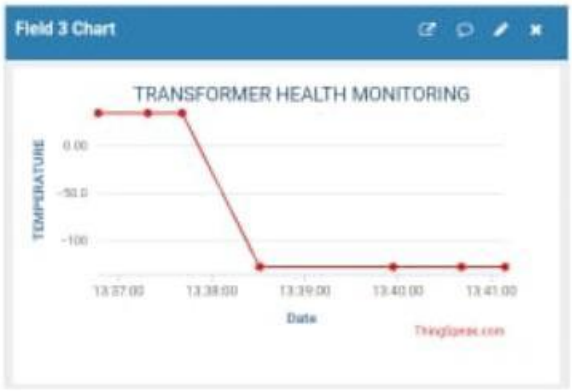

Figure 5: Temperature Graph

Figure 6: Oil Level Graph

VI. ADVANTAGES

- Devices can be operated from anywhere in the world.
- Efficient and low cost design.
- Low power consumption.
- Real time monitoring.
- Improve transformer reliability and minimize downtime
- Maximize transformer life with maintenance activity to address abnormal operation
- Provides true dynamic loading capability

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VII. CONCLUSION

This technology would provide efficiency and accuracy by doing away with the need for human labor. Since it's not always feasible to manually monitor load current and ambient temperature rise, IOT-based distribution transformer monitoring is dependable and somewhat helpful in comparison to manual monitoring. We will be able to act right away to prevent any disastrous distribution transformer failures as soon as we receive notification of any anomaly.

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