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IOT Based Transformer Monitoring System

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ABSTRACT

A distribution transformer is a transformer that provides the final voltage transformation in an electric power distribution system network. Because of, large of transformer and various components over a wide area in a power system, the data acquisition, condition monitoring are the important issues. The remote monitoring of transformer health over internet system is a system that could be used for the real-time data monitoring of transformer through internet of things (IOT). Also it proposed to send the central database via Wi-Fi module for further process. The real time monitoring system consist of embedded system. Wi-Fi and sensors are installed at transformer site which reads and measure the physical quantity from the distribution transformer and further it converts into the analog signal. As the parameters used it processed and records the data in system. In case of emergency situation at distribution transformer the obtained parameters sense the signal and it sends alert to the Android app regarding information about the parameter signals at distribution transformer according to the data occurred by the microcontroller. Arduino board designs use a variety of microprocessors and controllers the are equipped with a set of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits.

Keywords : Distribution Network, Distribution Transformer, Electrical System, Communication Technology

I. INTRODUCTION

Transformers are important equipments in power system network. A healthy power supply at the customer end mainly depends on the performance of the distribution transformer. The monitoring and control of distribution transformer is an important procedure for diagnosing the rapid alerts of the electrical network and also for the proper functioning of the electrical network.

The monitoring of distribution transformer is done by an electronic system with the capacity of sampling, storage, prosecution and mailing of information. If there is a real time monitoring or inspection of the system, so that we can prevent the sudden breakdown of the transformer that may lead to stop serving the electric power to several charges and produces serious affectations to the functioning of the electrical network. The monitoring of distribution transformer includes the measurement of transformer parameters like voltage, current, power and frequency. The important factor that necessary to consider is the inspected information regarding the distribution transformer should be transmitted properly by considering the coverage to the electrical network. So

it's necessary to select an energy efficient, reliable, low cost technology for the advanced monitoring of distribution transformer. The compiled information is very useful for studies of the electrical network and the planning of future enlargement in fact the common procedure is to substitute the transformer due to the aging of the transformer, which is a huge loss for the government. If we consider the solutions like smart inspection system of the distribution transformer frequently, may lead to increase in the life span of the distribution transformer. At present there are several methods for the monitoring of distribution transformer due to the advancement in the electronics and communication technology. By suitable implementation of varying technologies with the electrical service results in the vast development of power system and its proper management.

II. Literature Review

[1] Title: Design and implementation of real time transformer health monitoring system using GSM technology
Author: Sajidur Rahman; Shimanta Kumar Dey; Bikash Kumar Bhawmick; Nipu Kumar Das

Findings:

- This system can monitor the health status of the distribution transformer in real time aspect.
- Author presents design of a mobile embedded system to monitor load.
- This system integrates Global Service Mobile (GSM) Modem, with single chip microcontroller and sensors.
- The main drawback of the system is the use of GSM which makes it a costlier system to implement.

[2] Title: Health condition monitoring system for distribution transformer using Internet of Things (IoT)
Author: Rohit R. Pawar ; S. B. Deosarkar
Findings:

- This system monitor and record parameters of a distribution transformer like Current, Temperature, Vibration and Humidity.
- Remote terminal unit is installed at the distribution transformer site.
- Parameters are processed and recorded using-in-8-channel analog to digital converter (ADC) of the embedded system in the system memory.
- Due to the ADC, the system will take more time to process and communicate the data.

[3] Title: Designing and Simulation of Load Control & Monitoring System through Demand Side Management Technique
Author: Majid Ali ; Adnan Yousaf ; Fuad Usman
Findings:

- This system focuses on optimal utilization of available electricity during peak and off-peak hours, this helps to maintain consumer's load curve according to objective load curve.
- In this technique, we will analyze load curve of customer demand and then shift that load curve from peak load hours to off-peak hours using available resources.
- This system deals with the load balancing, which involves additional material cost for sub-transformer.

[4] Title: Transformer parameter monitoring system using PROTEUS software
Authors: Rashmi Ashok Panherkar ; Prajakta Vaidya
Findings:

- The main aim of this scheming the parameters through GSM Module.
- The scheming of transformer is ended by means of temperature detector.
- GSM and microcontroller which is wireless disclosure.
- The voltage, current, temperature of transformer is prohibited by using GSM module.
- Then throw SMS to the remote location.
- Use of GSM makes the system bit costly and less effective.

[5] Title: Design and simulation of centralized load

controlled automated power system network
Authors: Kazi Ahmed Asif Fuad ; Md. Maruf Ibne Hasan ; Laila Nawsheen Manzoor ; Mohammad Abdul Mannan
Finding:

- This system can monitor the health status of the distribution transformer in real time aspect.
- Author presents design of a mobile embedded system to monitor load.
- This system integrates Global Service Mobile (GSM) Modem, with single chip microcontroller and sensors.
- The main drawback of the system is the use of GSM which makes it a costlier system to implement.

[6] Title: Research and implement of cost-effective remote transformer monitor system
Authors: Qin Zhou; Zheng Cai Fu
Findings:

- This system is low cost, and achieve the remote centralized monitoring function.
- It has a feature-rich, friendly interface, real-time high, support configuration and so on.
- Currently, the system has been carried out in the project on-site operation and no real time implementation is available.

[7] Title: On-line Condition Monitoring of Power Transformers
Authors: Alfonso de Pablo ; Walter Ferguson ; Anatoliy Mudryk ; Dmytro Golovan
Findings:

- A transformer not properly working generates gases, catastrophic failure.
- To prevent the failur, this system is used for monitoring the hydrogen.

[8] Title: Design review as a diagnostic tool for power transformers — A case study
Authors: Chelladurai E. Denny ; Kumar A. Santosh ; Manish Yadav ; A. Venkatasami
Findings:

- This system could help in estimating the proper cause of the failure in the transformer system.
- Respective corrections in manufacturing practices can be incorporated.
- Does not have a mechanism for real time monitoring to avoid failure.

[9] Title: Research on Insulation Condition Monitoring System for Power Transformers
Authors: Shuangzan Ren ; Xu Yang ; Wenhu Yang ; Baofeng Xi ; Xiaolong Cao

- This system integrates online monitoring system, which contains the monitoring of gas-in-oil analysis (DGA), partial discharge (PD), and contamination of the bushing surface, the equivalent capacitance and dissipation factor (tan) of the bushing.

[10] Title: Transformer Condition Monitoring
Authors: V. Rusov, S. Zhivodernikov
Findings:

- Transformer Diagnostics Monitoring (TDM) system is described as system most fully assess condition all transformer parts.

Does not have any system to interpret the collected data.

III. OTHER METHODS OF MONITORING

We discussed several methods for monitoring distribution transformer. There are also other methods like Drasko furundzicet [11] proposed based on neural networks, which are widespread technique for transformer health monitoring system. Suraj Pardeshiet [12] proposed a method for the solution for monitoring and automatic voltage regulation . In this system they developed a modular and intelligent units result in cost effective solution for online monitoring transformer. Mallikarjun Sarsambaet [13] proposed a monitoring of load and power lines using sms based GSM technology. This system is designed and implemented using embedded system which detects the load fluctuations with respect to voltage and current in power lines. Satya Kumar Behera [14] implemented a system to detect the internal faults as well as the external faults of transformer. Such a system is implemented by automatic control used in

PLC system.PLC systems are designed to monitor the transformer parameters continuously.

Viswanath [15] presented a paper uses a temperature sensor , pic microcontroller, LCD display ,GSM board and Xbee which is used for send the message to the electricity board. This system is capable of detecting multiple faults in the three phase transmission lines. Mohamed Ahmed Eltayeb Elmustafa Hayatiet [16] have designed decision support system to grid operation engineers with information helps to estimate the loads, fix problems and identify week points in the grid. Distribution transformer monitoring is very important in the grid in fact its abnormality adversely affects the smooth functioning of the smart grid. In this paper they suggested and implemented a method to remotely monitor a group of distribution transformers. Here the microcontroller is used for data acquisition and transmission. There are articles analyses the economical aspects of distribution transformer with remote condition monitoring system which gives necessary information regarding operational status. Distribution transformer with and without condition monitoring is analyzed in terms of revenue loss to utility as well as consumers and economic life cycle.

The implementation of any of the efficient systems is very necessary for the better electrical network and to avoid unnecessary losses. In fact Research has shown that distribution transformer losses comprise a significant amount of the overall losses on a distribution and transmission system. Although some of the losses are considered the cost of operations, it may be possible to reduce the total losses associated with overloaded transformers depending upon the amount of overload and the efficiency of the replacement transformer. This can be identified by the establishment of suitable monitoring systems.

IV. CONCLUSION

For a healthy distribution network, the monitoring of distribution transformer is very vital. Any of the methods explained in the survey of different methods of monitoring is inevitable. The only factor that to be considered is solution must be energy efficient, low-cost and reliable. So the government of each country should have to provide technological support to utilities and industries for implementing advanced information and communication technology including sensor and control technologies by the support of educational institutions and researchers. The government may acquire the same from other countries by bilateral agreement. The utilities, industrialists and government in a county should be worked as a union to achieve the technology development for the implementation of monitoring systems for distribution transformers.

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