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Design and Implementation of Real Time Transformer Health Monitoring Using Iot

S.L.Lavanya[1], P.Karthik[2], J.Sandeep Kumar[3], S.Mani Kumar[4], K.Bhaskara Narayana Swamy[5], K.Yuva Sai Teja[6]

[1]Assistant Professor, Department of Electrical and Electronics Engineering, VSM college of Engineering, Ramachandrapuram, Andhra Pradesh, India
[2,3,4,5,6]UG Students, Department of Electrical and Electronics Engineering, VSM college of Engineering, Ramachandrapuram, Andhra Pradesh, India

Abstract
Generally, a Transformer is meant for distributing power up to certain region. That should be constantly distributing power up to certain extent of applying load on it. But whenever, the load will exceeds the limit automatically, the transformer will be brake down or it fails in transferring of power to the load. To avoid problem, we have develop a project called "Transformer Health Monitoring using IoT" . In this project we designed a system in such away that it will monitor the conditions of the transformer continuously and these parameters are displayed on the LCD display unit. In the display unit we can view the continuous information of transformer. due to what reason the transformer has been failed, when the power is resumed etc.,. With the help of this kind of system, the maintenance staff of the department can have a continuous vigilance over the transformer.

INTRODUCTION

Electricity plays an important role in our life. Every moment of our life depends upon electricity. Electricity has several components and equipment helping human to transfer and regulate the distribution according to usage. The most crucial equipment of 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 criterion 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 transformer under rated condition guarantees their long service life. However, their life is significantly reduced if they are subjected to overloading, 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 in different parameters like Winding temperature, Oil temperatures, Ambient temperature, Load current, Oil flow (pump motor), Moisture and dissolved gas in oil, 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 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, these all parts must be checked regularly to maintain the transformer in perfect operating conditions.

What is IOT?

Internet of Things (IoT) is an ideal buzzing technology to influence the Internet and communication technologies. IoT allows people and things to be connected anytime, anyplace, with anything and anyone, by using ideally in any path/network and any service.

The **Internet of things** (**IoT**) is the inter- networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items— embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society. " The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities.

"Things," in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, DNA analysis, devices for environmental/food/pathogen monitoring or field operation devices that assist firefighters in search and rescue operations. Legal scholars suggest to look at "Things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include home automation (also known as smart home devices) such as the control and automation of lighting, heating (like smart thermostat), ventilation, air conditioning (HVAC) systems, and appliances such as washer/dryers, robotic vacuums, air purifiers, ovens or refrigerators/freezers that use Wi- Fi for remote monitoring.

LITERATURE SURVEY

In most power companies, for online monitoring of power transformers, use supervisory control and data acquisition (SCADA) system, but for online monitoring of power transformer, 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.

Monika Agarwal et al This paper represents that they are designing a system where there exits communication between system and operator. For this we are using Transformer, microcontroller, logic level converter and GSM i.e. global system for mobile communication modem. This GSM modem helps to monitor transformer health by sending message to the system.

Hongyan Mao, et al This paper represents a large number of power distribution transformer stations and they are far away from city, wireless GPRS transmission provides a good communication solution to supervise power distribution transformer stations. The scheme of remote wireless monitoring system for power distribution transformer station based on GPRS wireless network was designed in this paper. A

control terminal system implement was mainly given, which adopted LPC2132 as main processor, GR47 as the date communication module. The monitor terminal software and flow chart were also designed. At last, the way of configuring the GPRS module to connect network is analyzed.

EXISTING SYSTEM

Earlier Transformer Health monitoring system was designed using PIC based Microcontroller and Coding this controller is a complex method. To sense the health of Transformer Vibration Sensor, Temperature Sensor, Ultrasonic Sensor and Current Sensor was used. As the Voltage Sensor was not used in this system, so we cannot measure the variable voltage output by the Transformer. To upload data to cloud, GPRS based GSM Modem was used in this System. Using this method, a dedicated SIM along with Recharge is required to upload data on Cloud.

Overloading, oil temperature load current and in effective cooling of transformer are the major cause of failure in distribution transformer. As a large numberof transformers are distributed over a wide area in present electric systems, it's difficult to measure the conditionmanually of every single transformer. So we need a distribution transformersystem to monitor all essential parameters operation, and send to the monitoring system in time. Earlier this system was monitored manually and tripped using manual ceramic fuse on failure.

PROPOSED SYSTEM

In this system, we have overcome the problems that are faced in Existing System. This Transformer Monitoring system, is designed using Arduino based Microcontroller Development board. User can easily reprogram this device using onboard USB programmer. Node MCU based Wi-Fi module is used for internet connectivity and upload the sensor data on cloud Blynk Server. Multiple sensor are used in this system, such as Metal Temperature Sensor, Voltage Sensor, Current Sensor and level sensor to monitor the Transformer health as well as Oil levels. This system is also equipped with Overload protection system, if any load draws over current than transformer will automatically trip off.

This Proposed project presents design and implementation of a IOT embedded system to measure load currents, over voltage, transformer, vibration, oil level and oil temperature. This is implemented by using on - line measuring system using Internet of Things (IOT), with single chip Arduino microcontroller and sensors. It is installed at the distribution transformer site. The output values of sensors are processed and recorded in the system memory. System programmed with some predefined instructions to check abnormal conditions. If there is any abnormality on the system, details are automatically updated in the internet through serial communication. This Internet of Things (IOT) will help the utilities to optimally utilize transformers and identify problems before any catastrophic failure occurs. Thus online measuring system is used to collect and analyze temperature data over time.

SOFTWARE

For developing this project, we mainly used software is Arduino IDE 1.8.19. The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

Get the latest version from the download page. You can choose between the Installer (.exe) and the Zip

packages. We suggest you use the first one that installs directly everything you need to use the Arduino Software (IDE), including the drivers. With the Zip package you need to install the drivers manually. The Zip file is also useful if you want to create a portable installation.

METHODOLOGY

In this project we designed a system in such a way that user can monitor the technical status of Power transformer such as Current and Temperature from anywhere in the world using IoT Technology. With the help of this kind of system, the maintenance staff of the department can have a continuous vigilance over the transformer.

In this project work, for the demonstration purpose a step-down transformer of 12V, is considered and these two parameters are carried over this transformer. These transformers are connected with the relay which is controlled by the embedded controller. The parameters Temperature of Transformer (Sensor LM35) and Current (Sensor ACS712) of the loads are measured, Level sensor is used to measure the oil level (H/L), Vibration Sensor to measure the Transformer Vibration and Humidity Sensor to measure the Humid condition around transformer. The Internal ADC is an analog to digital converter which converts the values of analog current and temperature value to the digital value. The values are compared with the preset values in the controller, if excess in any parameter occurs, the relay will trip the transformer upon exceeding the limit of load. The Temperature, Humid, Level and Current values are displayed on the LCD with Audio Buzzer Alert. Wi-Fi module is interfaced with this system to continuously transfer the Transformer parameters to IoT based Think Speak / Blynk based Cloud Server. User can monitor this data using Blynk Mobile Application. Thing speak / Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your Android device. After downloading the things peak/Blynk app, you can create a project dashboard and arrange widgets onto the screen.

ADVANTAGES

1. 1.No need to monitor from relay room.
2. 2.System can be monitor and control power transformer automatically
3. 3.Save time.
4. 4.Save men work.
5. 5.Can monitor from anywhere in the world
6. 6.Early detection of potential failures
7. 7.Preventative maintenance scheduling
8. 8.Improved grid reliability
9. 9.Reduced downtime
10. 10.Cost savings by optimizing asset utilization
11. 11.Remote monitoring capabilities.

APPLICATIONS

This Proposed project presents design and implementation of a IOT embedded system to measure load currents, over voltage, transformer oil level and oil temperature.

The major areas captured by it are:

1. Power grid

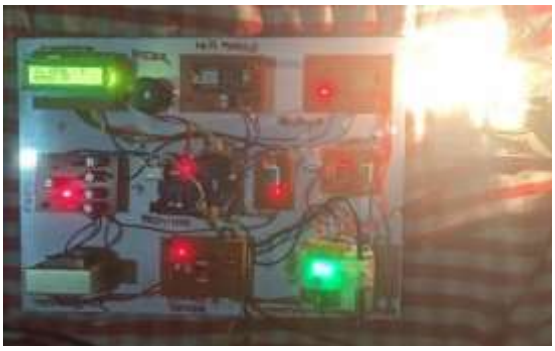
2. Factories.

EXPERIMENTAL RESULTS

A real-time transformer monitored using IoT technology results in a system that continuously collects and analyzes critical parameters of a transformer, like temperature, vibration, oil level, and current, allowing for early detection of potential faults and proactive maintenance, ultimately improving operational efficiency, reliability, and asset lifespan while minimizing downtime and costs.

BEFORE THE SUPPLY

AFTER THE SUPPLY



CONCLUSION

The transformers play a vital role in distribution part of power system. Therefore the monitoring and protection of transformer is very crucial. This system introduces a new and improved method of transformer health parameter monitoring using IoT. The sensors incorporated in the system collect the data of transformer health parameters such as voltage, temperature and current. These data are send to an IoT platform, Blynk using. Thus the real time data collection and monitoring of the transformer health parameters are possible with the system.

FUTURE SCOPE

Further this System can be implement with Multiple transformer monitoring System using Atmega 2560 Microcontroller and Send the Data to Remote Cloud. Multiple sensor can be used in this to enhance the accuracy of the transformer monitoring such as Vibration, Oil Level, Under voltage Protection etc. Remote Switch of Transformer can also be added for Emergency shutdown and Maintenance purpose.

REFERNCES

1. Abdul-Rahman AI-Ali, Abdul Khaliq & Muhammad Arshad GSM- Based Distribution Transformer Monitoring System, IEEE MELECON 2004, May 12- 15,2004, Dubrovnik, Croatia.
2. K. Sridhar, M. Assarudeen, J. Ranjith Kumar, E.Sarathbabu Transformer Health Monitoring And Control Through Arduino,IJAERD International Journal of Advanced Engineering and Research, vol. 5, Issue 04, 2018.
3. Monika Agarwal, Akshay Pandya, GSM Based Condition Monitoring of Transformer,IJSRD – International Journal for Scientific Research & Development, Vol. 1, Issue 12, 2014 , ISSN (online): 2321-0613.
4. A new Method for Monitoring of Distribution Transformers, SH. Mohamadi Department of Electrical Engineering K.N Toosi University of Technology Tehran, Iran.
5. GSM-Based Distribution Transformer Monitoring System. Abdul-Rahman AI-Ali, Abdul Khaliq & Muhammad Arshad School of Engineering, American University of Sharjah Box 26666, AUS, Sharjah, United Arab Emirate, IEEE MELECON 2004, May 12-15,2004, Dubrovnik, Croatia.
6. Prof. M. S. Sujatha & Dr. M Vijay Kumar, “On- Line Monitoring And Analysis of Faults in Transmission and Distribution Lines Using GSM Technique”, Journal of Theoretical and Applied Information Technology, ISSN: 1992-8645, E- ISSN: 1817-3195, 30th November 2011, Vol. 33 No.2.