IoT Based Transformer Monitoring System
Rohan Paspallu\textsuperscript{1}, Aditya Cholkar \textsuperscript{2}, Abel Varkey\textsuperscript{3}, Pradeep Laxkar\textsuperscript{4}, Rahul Patel\textsuperscript{5}

\textsuperscript{1}\textsuperscript{2}\textsuperscript{3}Final Year CSE, ITM Universe, Vadodara
\textsuperscript{4}Head of Department CSE, ITM Universe, Vadodara
\textsuperscript{5}Assistant Professor ECE, ITM Universe, Vadodara

Abstract— There is a need for transformer monitoring because there are around 1.2 lac transformers which are currently being operated under the MGVCL company and maintaining each one of them is a very difficult task considering there are various types of transformers with different capacities. So maintaining all the transformers and letting engineers know the faults is a very much time consuming and tiresome. Thus the engineer would virtually be monitoring all the transformers. We have proposed a software and hardware based solution in which an android application which will notify the users which type of fault has occurred in the transformer from the hardware device which is attached to the transformers. The main goal is to reduce the efforts and the time required to analyze the faults & handle it.

I. INTRODUCTION

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. A varying current in one coil of the transformer produces a varying magnetic field, which in turn induces a voltage in a second coil. Power can be transferred between the two coils through the magnetic field, without a metallic connection between the two circuits. Faraday’s law of induction discovered in 1831 described this effect. Transformers are used to increase or decrease the alternating voltages in electric power applications.

There are a huge number of transformers which have to managed by the transmission companies which is very cumbersome and time consuming. Moreover there is a requirement of huge manpower for maintaining the transformers. Thus, the project aims at providing information regarding current status of the transformer and continuously monitoring it which comes under the concept of IoT. For this purpose, there are hardware modules which are needed to be attached to the transformers which consist of different types of sensors and modules and the android application which receives the values from the sensors on the mobile devices so that it can directly be handled and managed.

II. LITERATURE REVIEWED

In this paper, [1] authors present an intelligent transformer management system (TMS) to monitor the overloading condition of the transformer and to support demand response function. A transformer terminal unit (TTU) is developed by the authors so that when an abnormal operation conditions such as overloading, high oil temperature and electricity tampering is noticed then the TMS will report the event through the power line carrier communication and display on the digital mapping system to provide an indication of a developing fault and the network connectivity of the distribution transformer. It is also designed to support the customer load control.

In this paper, [2] authors demonstrate an approach to perform distribution transformer management with multiagent technologies. The distribution transformer’s loading level is kept below a certain value by dynamically allocating the transformer’s demand limit (DL). For each home it takes into account, its load profile (kW), electrical panel size (A), expected instantaneous demand (kW), and homeowner’s preferences. The proposed set of algorithms is developed in multi-agent system (MAS) and implemented in Java Agent Development Framework (JADE). In this paper, [3] authors monitor the operation condition of distribution system. This system integrates many functions, such as transformer supervision, electricity stealing prevention, measuring, communication, etc. In this paper, the monitoring system of an application in the utility transformer low voltage side integrates many functions, which not only completed the electricity stealing prevention, while monitoring the operational status of the distribution transformer, but also has the active power, reactive power of the record and sub-period billing and other functions. By using the GPRS communication networks, the monitoring system can realize three remote controls, in which electricity stealing prevention has good application in practice.
In this paper, [4] the authors present an overview on the optimal management of a power transformer fleet. This review is focused on a methodological scheme oriented to the assessment of the transformer risk index and its two main components: the probability of failure index and the post-failure consequence index.

In this paper, [5] the authors propose an implementation of a mobile embedded system to monitor and record key operation indicators of distribution transformers like load currents, transformer oil and ambient temperatures. The system uses a GSM modem with microcontroller and sensors. If there is any abnormality or an emergency situation the system sends SMS (short message service) messages to designated mobile telephones containing information about the abnormality according to some predefined instructions and policies that are stored on the embedded system.

III. PROPOSED SYSTEM

![Figure 1: Flow Of Transformer Monitoring System](image)

HARDWARE:

Step 1:

In the first step, we selected the microcontroller NodeMcu (ESP8266) which is the latest microcontroller and provides the function of transfer the data from the sensors to any remote device.

Step 2:

Now, we use DHT11 module which is used for sensing the temperature and humidity of the transformer. Here the positive end of the DHT11 is connected to 3V input of the NodeMcu, whereas the negative end of it is attached to the ground G. Moreover, the out pin of DHT11 is connected to D5 (GPIO14).

Step 3:

Next, we use ultrasonic sensor for measuring the oil level in the transformer. Here the Vcc pin of ultrasonic sensor is to be given 5V DC supply. The Ground of the sensor is connected to the G pin of NodeMcu. Whereas, the Trig and Echo pin are connected to D1 and D2 pins respectively.

Step 4:

Lastly, we measure the voltage from the input source (230V for experiment purpose) and convert it to 5V DC. For this we need a Step Down Transformer which converts 230V AC to 12V AC which is then sent to the N4007 diodes which converts 12V AC to 12V DC. Now, we use 470 microFarad capacitor and 0.1 microFarad capacitor for removing the ripples and then send it to IC 7805 which converts 12V DC to 5V DC.

Step 5:

Finally, as NodeMcu only accepts 3V DC as input, we convert 5V DC to 3V DC by using voltage divider and then the two ends from the voltage divider are connected to A0 and G (ground).
SOFTWARE:

Step 1:

First we started making the login page of the application which contains one image view, one textview, two edittext views(username and password) and two buttons(login and register). This page is used by the employee to login or register in the application.

Step 2:

The second page that was created was the register page which contains one textview, seven editttext views(employee id, employee name, designation, mobile number, email-id, password, re-enter password) and two buttons(submit and reset). This page is used by a new employee to get registered in the application.

Step 3:

The third page that was created was the home page which contains one text view, one horizontal scrollable image view and seven buttons(logout, add complaint, notification, transformer, about us, contact us and history). This page provides the employee with various kinds of information about the transformer and also if there is any kind of fault in any transformer then the employee has the option to register a complaint regarding that particular transformer. The employee also gets the notification alert about any fault in the transformer if it occurs. The employee can also refer to any previously lodged complaint about the transformer in the history page and the employee can also contact us by referring to all the details mentioned in the contact us page.

Step 4:

The fourth page that was created was the complaint page which contains one textview, two spinners, one edittext view and a button(submit). Basically this page can be used by the employee to register a complaint regarding any faulty transformer. This page provides the employee with two spinners where the first spinner is used to select the type of the transformer(amorphous or CRGO) and the second spinner is used to select the capacity of the transformer(11kv, 25kv etc). And lastly the employee has to briefly describe the fault that has occurred in the transformer and then finally submit the details.

Step 5:

The fifth page that was created was the transformer page which contains information about the transformer such as its model number, build number etc.

Step 6:

The sixth page that was created was the about us page which contains information about the company itself. If any employee wish to gain a brief knowledge about the company he/she can refer to this page.

Step 7:

The seventh page that was created was the contact us page which contains the contact information of the authorised personnel.

IV. HARDWARE IMPLEMENTATION

![Figure 2: Hardware Arrangement](image-url)
V. CONCLUSION

We can conclude that we can receive the current status of a transformer through the various sensors which can provide timely updates and can help in detection of conditions which may result in fault in the transformers and try to avoid the faults. Moreover, there is an android application which helps in the monitoring of the transformers on any remote machine.

References


