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Real-Time Transformer Health Monitoring using IOT

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Abstract: ***This paper focuses on real-time transformer monitoring. Due to various reasons there is an damage to the internal and external components of the transformer it will lead to many problems. Maintaining and replacement of transformers, is found to be an expensive for all companies. Because of this factor, the IoT based transformer monitoring system is developed to monitor the health conditions of transformers at regular intervals. Whenever there is a change in Voltage, Current, Temperature variations, and load ability,it indicated a change in transformer. Which is measured using various sensors, if any one of the value gets into the critical point the information would be sent to an ESP8266 module under HTTP protocol to an IP that displays the data in real-time chart form in any web-connected mobile or Laptop. It is programmed with some predefined instructions to verify abnormal conditions. It helps us to identify or recognize unexpected situations before any serious failure which leads to greater reliability and significant cost savings.***

Keywords: Transformer, IoT, critical point, Wi-Fi, ESP8266.

I. INTRODUCTION

When we look towards our daily routine we can say that electricity is the major part of our life and transformers plays the role of electricity carrier to us from stations. Transformer plays an vital role in electricity distribution system. Maintaining a transformer and controlling it is very risk. The demand for power is very high. Transformers get overloaded due to the use of electricity. Overloading affects the efficiency of the transformer and gives an drawback in electricity distribution system. It is mandatory to avoid problems in the transformer due to overloading.

II. LITERATURE SURVEY

Many companies for online monitoring of transformers, the use Supervisory Control and Data Acquisition system, which is an expensive proposition. Many transformers are currently monitored manually, where a person goes and sees transformer and maintains the records. Biju Rajan B, et al. [1] the paper explains about monitoring the health condition of Distribution transformer using IOT technology.

The recorded data are sent using Wi-Fi module and accessed from anywhere around the world using HTTP protocol. Rohit R. Pawar, et al. [5] there are two units which are remote terminal unit (RTU) and monitoring unit. Remote terminal unit consist of analyzing parameters such as current, temperature , rise and fall in oil level, vibration and humidity with the help of PIC 18F4550. All monitoring parameters are processed and if any abnormality occurs, the system sends messages to the mobile phones. All values are sent to monitoring node through GPRS. Similarly on webpage we can get alert about it through GPRS. Near remote terminal unit buzzer will beep and LCD gives notification about emergency condition. An engineer at transformer cannot continuously keep an eye on transformer therefore given proposed system does communication with us at emergency conditions of distribution transformer through GSM/ GPRS module.

III. PROPOSED SYSTEM

The proposed project is about monitoring real time data of transformer health parameters and then controlling it. Temperature, voltage, oil level, current, moisture and vibration condition of transformers are monitored and sent over internet .The live tracking of these parameters can be done using IOT technology. It is cost effective in nature. Thus the authority can access information on any failure or maintenance. The data can be accessed by an android application via Adafruit IO. When the sensor values exceeds above the critical point then the buzzer will generate a beep sound and optical alert is given with different color led.

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IV. BLOCK DIAGRAM

The block diagram represents how the proposed system has been executed

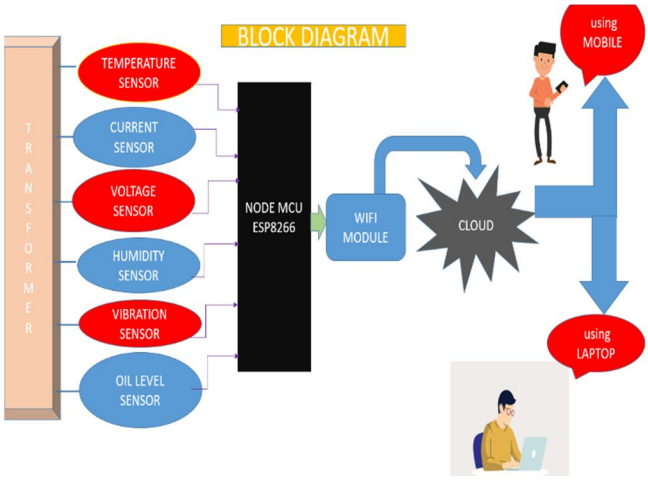


Fig.1 Block Diagram of the Proposed System

V. HARDWARE REQUIREMENTS

A. Temperature Sensor

LM35 measures temperature of a distribution transformer. The Voltage value starts to increase when the temperature in the transformer is increasing due to heat produced when it is working. This sensor can measure the transformer temperature ranging from -55°C to 150°C.

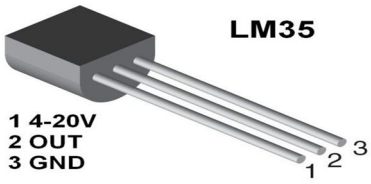


Fig2. Temperature sensor (LM35)

B. Voltage Sensor

We selected this sensor because it is small in weight and size, then to find the voltage values. Personnel safety is high, Degree of accuracy is very high, it is non-saturate, wide dynamic range, Eco-friendly.

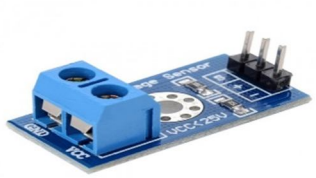


Fig3.Voltage sensor

C. Current Sensor

ACS712 is an sensor to find the current present, in the transformer. Here ACS712 sensor is used to measure the current in transformer. Current sensor used here is ACS712, 5 Ampere. There are many modules with different sensitivity.

30A Module
SENSITIVITY- 66mV/ Amp

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Fig4. Current sensor (ACS712)

D. Humidity sensor

Relative humidity is sensed here , where it measures both air and moisture. It has an advantage of measuring both temperature and humidity. Relative humidity is defined as the ratio of moisture present time to the total amount of moisture present in air. The Humidity range of DHT11 sensor is 20-95% with an accuracy of +/- 5%.



Fig5. Humidity sensor(DH11)

E. Vibration Sensor

On the basis of 3 main parameters displacement, velocity and acceleration, the component has tilt or not can be identified. Vibration switch is used for detecting vibrations with comparator. Vibration switch is noted as vibration sensor because it has high sensitivity in it.

F. Buzzer

A buzzer is an device, which acts like an alarm . Buzzers and beepers can are found in alarm devices and timers. The beep sound arises whenever the threshold value is increased.

VI. SOFTWARE REQUIREMENT

Here the software side requirements are:

A. NodeMcu

It is an open source comes under IOT development board of 24GHz. It depends on ESP-12E.

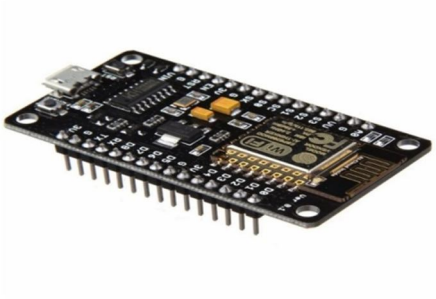


Fig.6 NODEMCU

The projects are based on Arduino and the projects using board for development require input/output pins, It is easy to supplement some of the features are:

1) The foundation of Nodemcu is mature ESP8266 technology.
2) It has ESP-12E a Wi-Fi module which is inbuilt with it, this part is called as ESP8266.
3) NodeMcu has CP2102 USB to TTL serial circuits that are reliable

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B. Arduino

Arduino is a platform where we can fetch ur code and simulate it. We can feed all the data easily and we can find our output values in serial monitor.

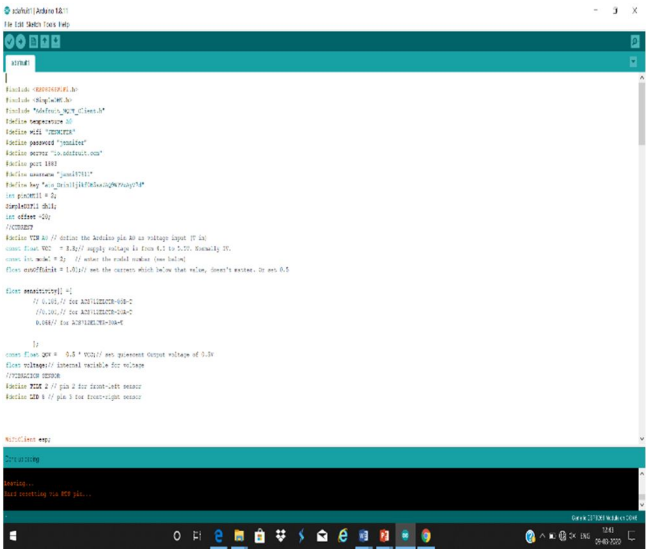


Fig7. Running code

C. IOT

IOT is a platform to share sensor data through cloud and can be analyzed. The advantage in IOT platform it has different interface with smart-phones, human machines etc.. The IOT systems are more efficient, accurate, economical and reliable.

D. Adafruit IO

It is an website used to display the data in real-time. The webpage is internet-connected , can control and read sensor data, that we have fetched and more. In this project feeds for our monitoring and dashboard is created. Then we can monitor the sensor data in both feed page and dashboard.

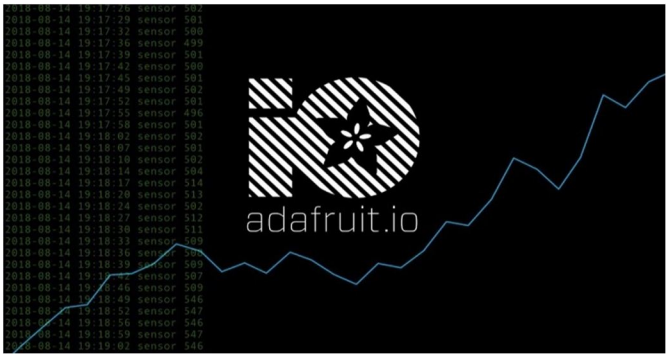


Fig.8 ADAFRUIT IO

VII. WORKING

A. Connection is given between the sensor and the transformer, with an supply.

B. The sensors are interfaced with Node MCU, based on the analog and digital pins to read the data.

C. An embedded C program is loaded in the Node MCU to read the sensor values.

D. Monitoring and analyzing is done based on the critical values of individual sensors which is coded in Arduino.

E. The values are been sent to the cloud ADAFRUIT IO, with the help of user id and password so that we can view the real time transformer monitoring.

F. When the sensor value reaches the critical point then it alerts with buzzer sound and can be controlled with the help of relay (on/off).

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VIII. RESULTS

The dashboard is created for all the sensors going to be monitored, under one feed name Transformer health monitoring. The dashboard will display all the sensor blocks created. It displays the values of the sensors to be monitored.

Dashboards are created for

A. Temperature Sensor
B. Current Sensor
C. Voltage Sensor
D. Humidity Sensor
E. Vibration Sensor

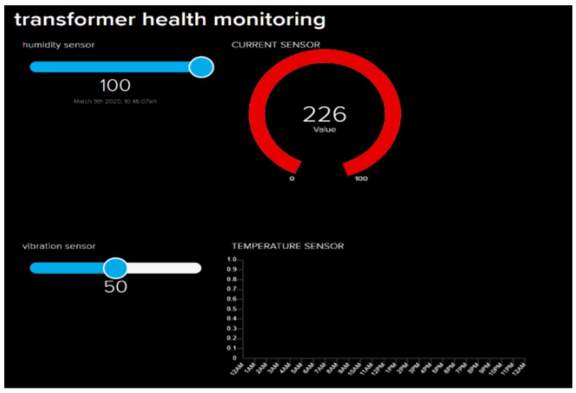


Fig.9 Dashboard of transformer health monitoring

For example, here the current sensor value is measured and shown in a graph format. In the same way all the sensor values can be monitored.

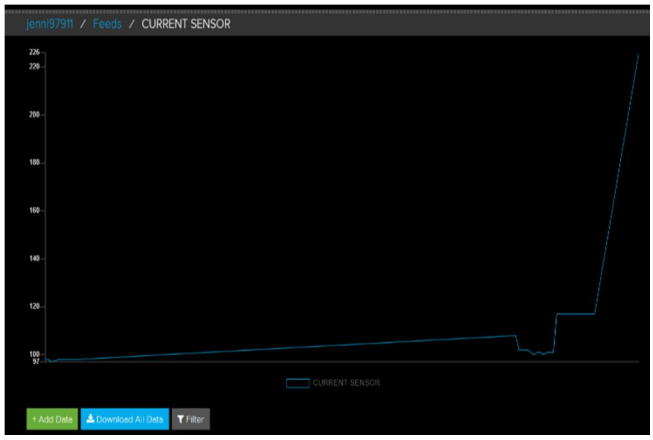


Fig.10 Current sensor values of transformer

IX. CONCLUSION

The conclusion of the proposed system is that it is intelligent in detecting the faults in transformer and we can take some preventive action. This IOT based monitoring of transformer health is quite efficient than manual monitoring. The details about the transformer are been updated automatically in Ad fruit webpage, when the transformer is in abnormal condition.

X. FUTURE SCOPE

This process can be further continued to 3-phase transformer. In future, this system will be implemented as power consumption and saving of our country, a huge amount of money can be saved that is spent on the replacement of transformers.

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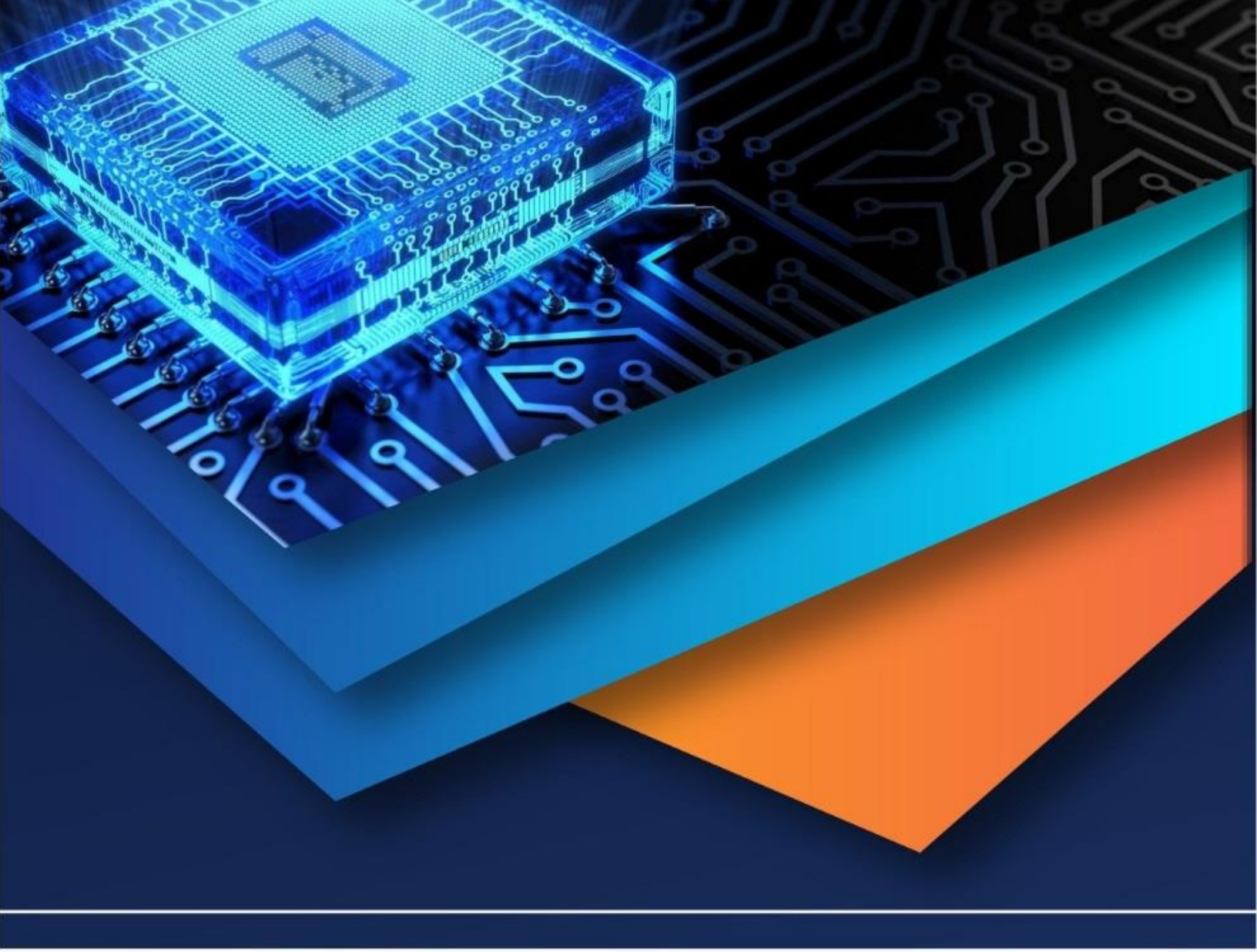
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