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Iot Base Distribution Transformer Monitoring System Using Arduino

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A B S T R A C T

Transformer or power transformer is most expensive and important part of electrical power system. As per the use of transformer some of transformers are used for distribution and transmission of electrical power and some transformer use for the measurement like current transformer and potential transformer. It is important that distribution transformer work properly in power system without any liability and if any fault occur in system immediately fault should be detected and preventive action to be taken to protect from failure of electrical power system so that electrical energy supplied smoothly.

In this paper we monitor the transformer on regular interval and if any faculty conditions face by the system then IoT based system control the fault.

Now a day due to wireless technology data acquisition, monitoring and controlling can be done remotely. This system record the some values of the transformer like voltage measurement, current measurement, oil level, gas test, temperature measurement. As this system is IoT based so we can store the data over the cloud and we can also real time data monitoring of distribution transformer. With these facilities data is to send the central control database via WiFi system. For the measurement of voltage, current, oil level, gas and temperature sensors are used that are located at the distribution transformer which read and measure the physical quantities if any of the value is crosses its fixed limit for the smooth operation of transformer it send alert signal to system. As this system use Arduinobased it can be program is such a way that alert signal send to control center, so that fault is clear and smooth flow of electrical energy can be achieved

Keyword: Transformer, IoT, Arduino, Wifi module.

1. Introduction

Using electromagnetic induction method transformer transfers energy between two or more circuit, without change in frequency. We know that transformer is static device, but all transformers require the regular maintenance and repair for the regular functioning up to industry and manufacturer's standards. As the transformer install at domestic and industrial places as the times goes on transformer ages increases likelihood of repairs and maintenance increases. Serious damages are to occur as a result to any kind of failure in transformer. Thus, failing becomes totally unacceptable with regard to the critical aspect of the transformers or power transformer. This failure may cause severe damage, not only to the asset itself, but also to the surroundings. Time based replacement is not the solution of the problem, to avoid the this replacement cost the preventive action is further more valuable by testing and regular monitoring of the transformer or power transformer, as like the human body check up on regular interval and collection of the data on that regular monitoring data. These types of data help us to know what type of regular maintenance and repair require to the transformer. Monitoring of transformer is more difficult during rainy and summer condition as weather also play important role on the transformer physical conditions. So, new technologies are used for collecting and monitoring the data. Automatic systems are implemented in modern power system also like microcontroller, microprocessor, Arduino etc. On-site tests on high voltage power transformers are of increasing interest as part of transformer commissioning, as a diagnostic tool for condition assessment and as an acceptance test just after transformer repair or refurbishment. A power transformer is one of the most important and expensive pieces of equipment in electric power systems. Economic operation of electrical energy generation, transmission and distribution is closely related to power transformers' reliability and availability. Due to all this condition, it is necessary to check the condition of the transformer regularly, hence it good to use such kit to reduce time and efforts too.

2. System Block Diagram

According to the IEC 60076-1 and IEEE standard C57.12.00 Standards transformer tests are classified into three categories

• Routine tests:

- Routine tests of transformer are mainly for confirming operational performance of individual unit in a production lot.

- Routine tests are carried out on every unit manufactured.
- Routine tests are tests required for each an individual transformer.

• Type tests:

- Type tests are conducted on a transformer which is representative of other transformers, to demonstrate that these transformers comply with specified requirements not covered by routine tests.

• Special tests

- Special tests of transformer are done as per customer requirement to obtain information useful to the user during operation or maintenance of the transformer.
- Special tests are tests other than type- or routine tests agreed to by the manufacturer and the purchaser.

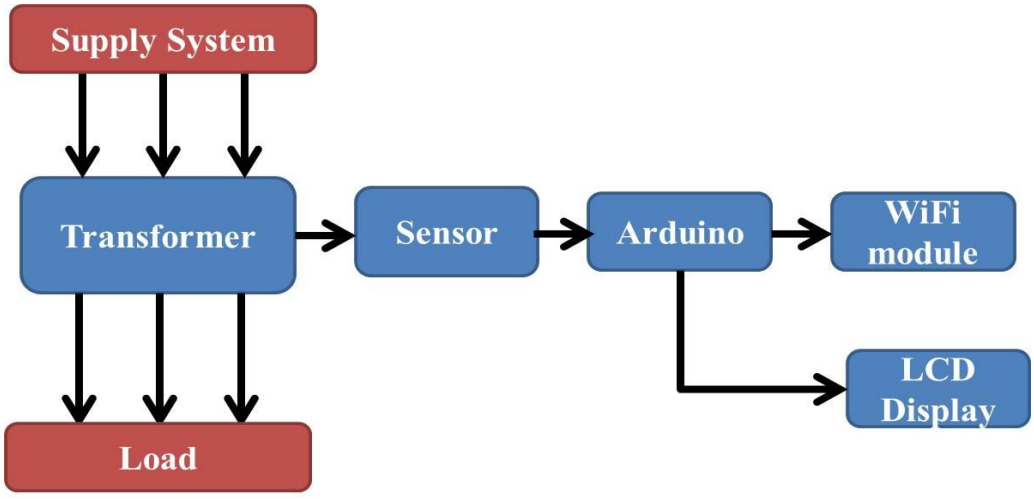

Fig.1) Block Diagram of distribution transformer monitoring system

The above block diagram shows the monitoring system of the distribution transformer with the different sensors. The sensors used in the above block diagram are voltage sensors, temperature sensor, gas sensor, oil level sensor which connected to the hardware. ArduinoATmega 328 uses in the kit, the sensors are connected to the transformer and send the data and the respective data is displayed on the LCD display and SMS will go to the control center via WiFi module. The components used in monitoring kit are Arduino, voltage sensors, current sensor, temperature sensor, gas sensor, oil level sensor and LCD display.

a) Arduino:

- It has 14 pin which is acts as input-output pins. Out of which 06 can be used as PWN outputs, 06 analogue pins as input, 16MHz crystal oscillator USB, a power jack and a reset button.
- It is the open source hardware so that as per the requirement developer can develop their own kit which is available as reference source.

Fig. 2) ARDUINO microcontroller

b) Voltage Sensor

- The use of Voltage sensor isto calculate and monitor the amount of voltage of the system.
- Voltage sensor can determine the AC voltage or DC voltage level.

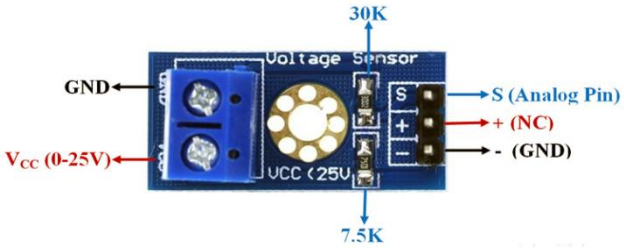

Fig 3) Voltage Sensor

c) Current Sensor:

- Current Sensor Module ACS712 is used in the kit which can sense up to 20A of current flow.
- This sensor can be used in different application also like over-current protection circuits, battery chargers, switching mode power supplies, programmable current sources etc.
- The reading sense by the current sensor is sending to input pin of Arduino.

Fig 4) Current Sensor

d) Oil Level Sensor:

- It is a float which is connected to the angular potentiometer.
- Float is immersed in the oil and its mechanical output is given to the angular potentiometer.
- The voltage is generated only when there is a mechanical movement in the float.
- With this value we can detect the oil level in the system.

e) Gas Sensor

- The MQ-6 gas sensor is used for detection or measure gases.
- The MQ-6 sensor modules have the digital pin which makes this sensor to operate even without a microcontroller and so that it becomes handy when you are trying to detect any particular gas.
- When it comes to measuring the gas in ppm the analog pin has to be used, the analog pin also TTL driven and works on 5V and hence can be used most common microcontrollers.

Fig 5) Gas Sensor

f) Temperature sensor:

- In this kit LM35 temperature sensor is used for the temperature measurement, which isthree pin semiconductor-based sensors.
- It is a low cost and also easily available sensor in market.
- The electrical output of LM35 is proportional to degree centigrade due to an integrated analogue sensor. The main advantage of LM35 is that it does not require any external calibration or trimming to provide typical accuracies.
- It has low output impedance, linear output, and precise inherent calibration make interfacing to redoubt or control circuitry especially easy

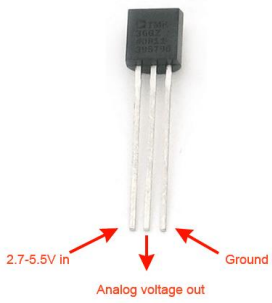

Fig 6) Temperature Sensor

g) LCD Display:

- The term LCD stands for liquid crystal display.
- These displays are mainly preferred for multi-segment light-emitting diodes and seven segments.
- The main advantage of this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.
- The LCD is 16 X 2 connected to the ARDUINO. That means 16 characters per line by 2 lines.

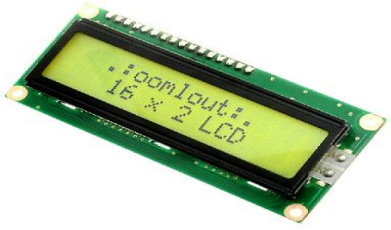

Fig 6) LCD Display

h) WiFi module:

- The Arduino with an integrated WiFi Module. The board is based on the ATmega328P with an ESP8266 WiFi Module integrated.
- The ESP8266WiFi Module is a self-contained SoC with integrated TCP/IP protocol stack that can give access to our WiFi network.
- This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.

Fig. 7) WiFi Module - ESP8266

3. Advantages of the kit:

a. Construction wise it is easy and simple.

b. It required less space.

c. Its maintenance is negligible.

d. This system is economical and save the time for data collection.

e. As it monitor the transformer the life of transformer increases.

f. It reduces costs on testing.

g. It is portable as its size is compact.

4. Conclusion:

As we know the transformers are important part of power system. For increase the reliability and stability of the power system network it is important transformer work properly and smoothly. It means that if the health of transformer is good the system become good. It not only the increase the reliability and stability but also save the time of maintenance of the transformer, energy and also reduce the effort. With the help of the kit we can not only monitor the transformer condition but also collect the data so that we can manufacture the transformer in such a way that fault condition can be reduced. As this kit is potable we can easily travel with this kit and we can easily install the sensor. Another advantage of the kit is that we can monitor the transformer condition from remote location also, so no need to visit the site on regular interval. If we increase the sensor the some more reading also collected form the transformer. By using this type of monitoring system it increase the life of transformer.

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