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IoT based monitoring of distribution transformer

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Abstract

As transformer does not have any rotating parts hence it is called as static device, therefore it does not have mechanical losses, but internal stresses arose from abnormal system conditions like Over currents due to overloading on Transformer and short circuits, The faults can cause mechanical and thermal stresses inside the transformer winding and its connecting terminals. Thus transformer must be protected from above stresses. The aim of this project is to obtain real time data of transformer from remote places with the help of Internet of Things[IOT] and then designing and implementing a Global system of Mobile communication [GSM] based technology to measure overvoltage, load current, and winding temperature. By measuring the condition of Transformer will help us to point out an any abnormalities before any serious damage that in turn leads to a greater credibility and significant cost savings

Keywords: Internet of Things (IOT); Global system of Mobile communication [GSM]; Distribution; Transformer

1. Introduction

Transformer is a device which transforms the electrical energy from one electrical circuit to another without any change in frequency through the phenomenon called electromagnetic induction. i.e., the transfer of energy from one circuit to another takes place with the help of mutual induction that is flux induced in the primary winding gets linked with the secondary winding. Transformers are used to increase AC voltage called step-up or decrease called step-down in electric power applications, transformers are also used to couple stages of signal-processing circuits. Transformers are very essential for the transmission, distribution, and utilization of alternating current electric power. A large range of transformer designs are came across in electronic and electric power applications. The size of Transformers from less than a cubic centimeter in volume, to units weighing in terms of hundreds of tons i.e., from RF transformers to the transformers which interconnect the power grid. To maintain the reliability in grid operation it is important to monitor real time transformer health. We know the importance of transformers in electricity distribution and transmission. They are the main components and constitute the sizable portion of capital investment of the distribution grid. Real time transformer health monitoring systems help to replace the equipment before failure and hence uninterruptable supply will be maintained. Distribution Transformers are monitored physically where a man visits the Transformer site and analyses the parameters incidental overloading and overheating of transformer oil and windings. If not monitored Properly these parameters can decrease the transformer life which is unachievable by the current operation system. A single transformer parameter is generally detected. It takes too long for the parameter operation and testing pace is dull. A monitoring system is not able to monitor all useful data of distribution transformer to reduce costs, but can only monitor the operating state. Favorable detection data will not be sent to observing centers in time .Detection system is not up to the mark. The main principle execution is the device itself instability, poor anti jamming capability, low measurement accuracy of data.

In existing power systems, the distribution transformer's function is to distribute the power to the low-voltage consumers directly. Conventional transformer measuring system generally detects parameters, such as power, current,

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voltage, and phase. In some other ways could detect multi parameter, the time of accession and operation parameters are longer duration, and testing speed is little bit slowly. Detected data on real-time could not send to monitoring centers in accurate time. Most of monitoring systems utilizes power carrier communication to send data, but they have some demerits such as serious frequency interference, because of increase in distance the signal attenuation serious, load variation brings larger electrical noise. Hence power carrier communication cannot be used to send data, as the real-time data transmission, reliability cannot be assured.

2. Methodology

2.1. Block Diagram

Here, the voltage is step down from 230V to 110V using step down transformer. The LM35 temperature sensor senses if temperature exceeds 85 C0 .The buzzer will be on and the relay will be in the off condition and LCD displays that the frequencies is more. A fixed output voltage is generated of a preset value by voltage regulator which remains constant regardless of changes to its input voltage or load conditions. A pot is used as a switch to turn on and turn off the respective load condition. Using the current sensor current is monitored, when the current is increases above 1A the buzzer will be in ON condition. When power is applied, current passes through the coil inside the buzzer, which produces a magnetic field. Since it is a fluctuating magnetic field, thereby vibrates the disk. This movement makes the buzzer sound. Current sensor operates, when current was passing through the conductor, and it creates a proportional magnetic field around the conductor. The output of sensor is a certain voltage or current which read by meter connected to the sensor. Here the voltage sensor of the voltage is above 230V or below 180V is used. The pot will be in off condition and the buzzer will siren up, then the load is disconnected from the supply. Since the temperature sensor is used. If the temperature is above 30C0 below the buzzer will be on. The Bridge Rectifier of four diodes is used as full wave Rectifier converts the AC supply voltage to a DC supply voltage. The output signal of that type of circuit is always of the similar polarity regardless of the polarities of the input AC signal. Relays are switches that open and close the circuits electromechanically or electronically. Relay is installed between the power source and the electrical accessories requiring on/off power. When the relay is energized, the high current to operate the accessory flows from the power source, through the relay, and directly to the part. The current will travel through the load resistor via the two forward-biased diodes. Arduino receives the input from different sensed parameters from different sensor and it processes and displayed on LCD

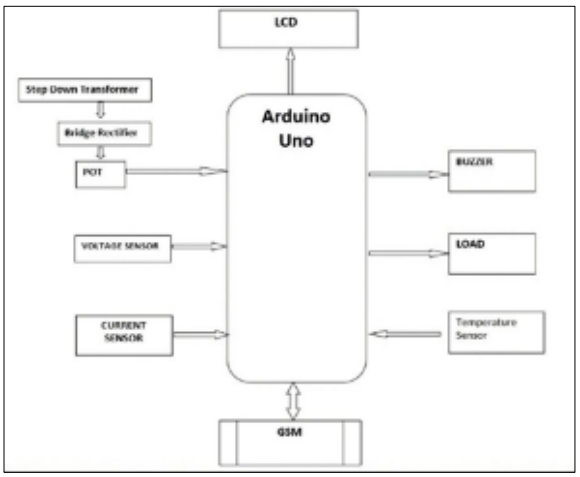

Figure 1 Block Diagram

2.2. Circuit Diagram

The Aurdino sense the different parameters of Transformer and displays on the LCD. If the value increases above the rated value the system automatically turn off and send a message to the relevant person.

2.3. Description

In both the local center and the server, the data receive is constantly monitored. The program is set up in the Arduino for continuous data processing, and then the processed data is transferred to the server. When the supply switch is turn on, the supply chamise is through transformer first of rating 0-12V/750 mA and latch it is fed to voltage regulator of 12

volts which is utilized to regulator the supply from AC to DC hence the whole prototype is operated on DC power supply. Here we use two of these regulators to modify if a twice from 12 volts to 5 volts if is done through 7812 ICA and 7805 ICA. A capacitor of rating 1000 µF 470 µF and 22 µF is connected in parallel with these regulators. The capacitor have excellent frequency response and they do not become prone to parasitic effect is dielectric offer the high capacitance needed for power supply smoothing and decoupling their have low equivalent series resistance that is good ripple resistance capabilities. A DTH 11 sensor is wanted in series with the resistors it has rating 3V 5V and 1/0 and maximum current capacity of 2.5 mA. If it is good for 20-80% humidity readings with the 5% accuracy good for 0-50 C0 temperature readings + or - 2 C0. A manually varying pot is fitted in register with this DTH 11 sensor to vary the voltage magnitude. Arduino uno is mounted parallel to all these sensors DTH 11, pot and regulators .LCD is series with Arduino. A relay of 0 to 12V, is mounted on PCB where both the transformers is connected primary transformer and current transformer. GSM is a fixed a next to LCD display. Buzzer- is a piezo dielectric material. Relay is a high capacity loaded switching the power supply system. PCB-relay and incandescent bulb

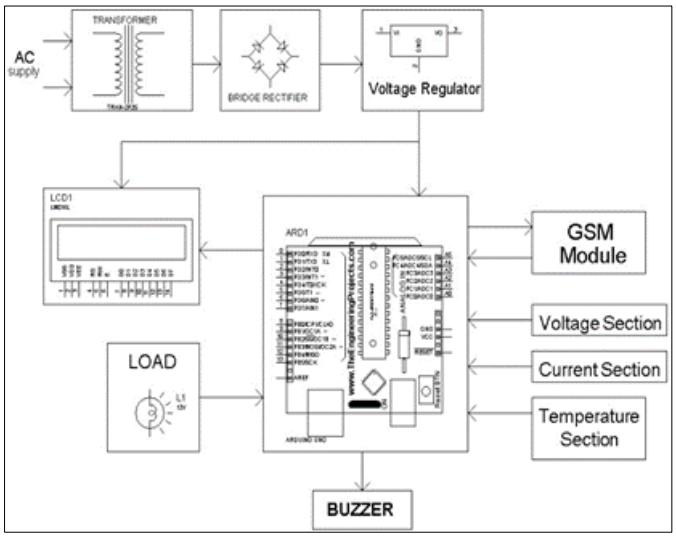

Figure 2 Circuit Diagram

3. Results and discussion

#Include< liquid crystal.h>

liquid crystal LED (4,2,5,6,7,8);// RS,EN,D4,D5,D6,D7 pins initialisatio

2. A signing variable name to analog input pins and digital pins of Arduino count int analog in pin0= A5;//same for both A4 and A5 pin And

int REDZ=9;//same for pins 10 and 11

3.setting up LED and Aurdino pins mode

void setup()

LED.begin(16,2)

Serial.begin(9600);

pinmode (REDZ,output);// using 9th digital pin of Arduino as output pin and same for// 10th under 11 pin

Voltage sensor(A0); // senor connected to A0 pin in Arduino

Void setup()

```
{Serial .begin(9600);

// calibrate() method calibrates zero point of sensor

// ensure that no current flows through the sensor at this moment

Serial.printIn ("calibrating . . .");

Voltage sensor.calibrate(); //start calibration

Serial.printIn("Done");}

Void loop()

{//To measure voltage/current we need to know the frequency of voltage/current

//By default 50Hz is used,

//get voltage ac and get current ac()

Float U=voltage sensor.getvoltageAC();

Serial.printIn(string("U = ")+ U+"V");

Delay(1000); //start over again after one sec }

DHT 11 temperature sensor(A0); // DHT 11 sensor connected to A0 pint of Arduino

Void setup ( )

{Serial.begin(9600);

// calibrate ( ) method calibrates zero point of sensor

//ensure that current flows through the sensor at this moment

Serial.printIn("calibrating . . .");
```

4. Conclusion

The proposed design makes the distribution transformer more efficient against some key power quality issues which make the voltage, current or temperature to peak. Detect faults in remote transmission lines. Immediately transmit any fault information to multiple people including line man, power house, and Electric Board office etc .Transfer data through a wireless medium such as GSM using existing mobile phone towers. The final stage of electricity distribution is the delivery of electricity from generating power plants to end users.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Reference

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