CONDITION MONITORING OF POWER TRANSFORMER USING MULTIPLE SENSING METHODS

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Abstract

Transformers which works under the principle of mutual induction of two coils forms the major component of transmission and distribution system. The health monitoring of transformers for fault occurrence can prevent cost of replacing the equipment.Currently available systemsonly monitor the health of the transformer on basis of the parameters. In order to monitor the health of the transformer, this paper analyzes the on-line monitoring and fault recognition technology of power transformer. The paper mainly completes the hardware and software design of the intelligent measurement and control terminal for on-line monitoring of state parameters, which includes transformer voltage, current, oil temperature, oil level. The current location can be detected with the help of GPS. The state of all parameter values will be send to the EB office with the help of Zigbee communication.

Keywords—Distribution transformer,Health monitoring system, Microcontroller,Sensor.

I. INTRODUCTION

The requirement of electrical energy is abandon in our day-to-day life. The power transformer plays a major role in the transmission and distribution of an electrical supply. The major operation of power transformer involves stepping up or stepping down of supply voltage. The step down operation is used for domestic and industrial purpose which involves stepping down of supply voltage in distribution transformer. Since the life of the transformer depends upon the health of the transformer, it is necessary for monitoring the health of transformer to improve efficiency and lifetime of the transformer.

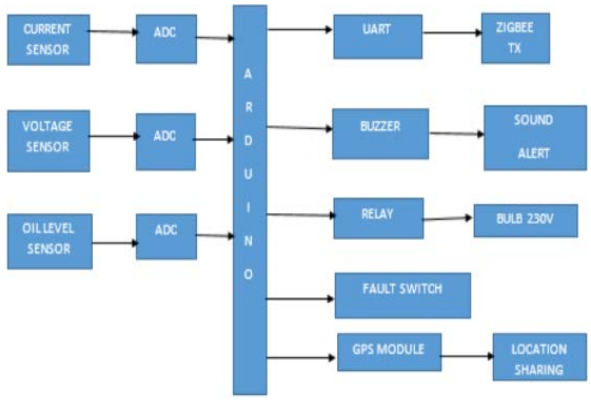
The normal operating condition gets affected by the various factors it includes over loading, demand of supply, low voltage, losses of power supply etc. These conditions cause heating of transformer, overburden, reduction in oil level, insulation failure and so on. Earlier in distribution network the health monitoring system and the fault is detected only after the complete blackout. Due to the presence of faults in distribution system the loss rate gets increased hence the lifetime of the transformer is reduced.

As per the above mentioned requirements the monitoring of the system is necessary to analyze real time data associated with the distribution transformer along with the location and current operating performance. This in turn will facilitate the services to use the transformer in efficient manner. The fault detecting services and oil monitoring, provides greater reliability and stability.

II. BLOCK DIAGRAM

The fig: 1 represents the block diagram that is used in the transmitting part. The different parameters for monitoring the health of the transformer are represented in the block diagram in the form of blocks. In addition to voltage sensor, current sensor and temperature sensor we use oil level sensor, Zigbee transmitter and Zigbee receiver. For the use of Arduino UNO, a power supply for supplying power has been used. Fig: 1 show the different modules used in transmitting part.

Transmitter Unit



Receiver Unit

III. COMPONENTS

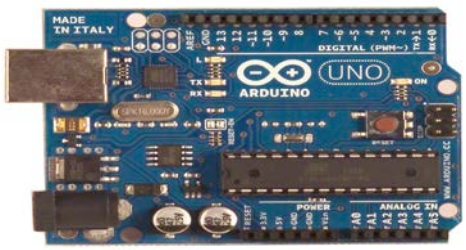
A. Power Supply

Power supply is an important aspect in the circuit which has its reference from power supply unit. The power supply unit is defined as the device or system inwhich any type of energy is given to an output load or group load. Power supply unit is given by the term PSU.Electrical supplies have a greater accountability regarding PSU than mechanical ones.

Based on power electronics power supply can be divided as linear and switched mode. In linear supply lower efficiency can be achieved by changing the voltage. When compared to switched mode supply linear supply is simple in design, but if high current is required the supply can be increased. Comparing to linear supply switched mode supply is complex but has higher efficiency.

B. Arduino

The Arduino Uno functions as a microcontroller board based . It comprises of 14 digitalinput/output pins in which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It can be connected to a USB cable or power it with a AC-to-DC adapter or battery to get started.



The Uno stands unique in such a way that it does not use the FTDI USB-to-serial driver chip.The versions of Arduino can be referenced by UNO and version 1.0. TheUno forms the latest in a series of USB Arduino boards, and the reference model for the Arduino platform comparison with previous versions.

C. Power

The Arduino Uno can be powered with a USB connection or with an power supply. The power sources is selected automatically. The power can be used either AC to DC adapter or battery.the power jack is connected to a adopater and plugging point.leads from a battery can be connected with the Gnd and Vin pin headers of the power connector.The board can be operated at a 6 to 20volts supply .the supplied is less than 7v,and the 5v pin has less than 5v at the time board can be unstable .the voltage regulator may overheat and damage on the above 12v.T

D. Transformers

Transformers is a passive elecrtical device transfer the electrical energy from one circuit to another circuit that convert AC electricity from one voltage to another voltage. Transformers work only with AC because main reason is a transformer needs an alternating current that will create a changing magnetic field. A magnetic field is changed also induced voltage is changed. The DC current should be constant there is no alternating current should be create the magnetic field. The step up transformer is used to increased voltage and step-down transformer is used to reduce the voltage. The step-down transformer to reduce the high voltahe (230) to low coil. There is no eletrical connection between the two coils because of the alternating magnectic field created in the soft-iron core of the transformer.the transformer is power losses should be less.voltage is decrease and current is increased.step-down transformer is at high turn ratio.The turn ratio is a ratio ofnumber of turn in the primary swinding into the number of the secondary winding.High number df turns on the primary coil of input voltage and small number of turns on the secondary coil to give a low output voltage .

Turns ratio = Vp/Vs = Nn/Ns

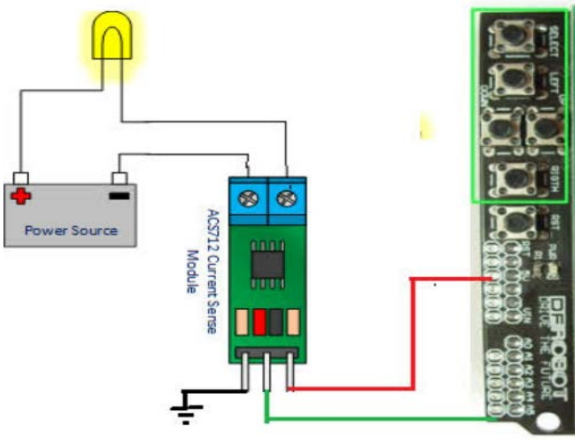
Power out = Power in = Vs * Is = Vp * Ip

Vp = primary (input) voltage
Np = primary coil
Ip = primary (input) current
Vs = secondary (output) voltage
Ns = secondary coil
Is = secondary (output) current

The low voltage AC output is used for lamps, heaters and special AC motors. It is not used for rectifier and a smoothing capacitor (power eletronic devices)

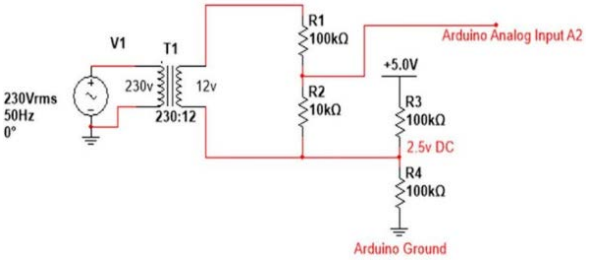
E. Current Sensor

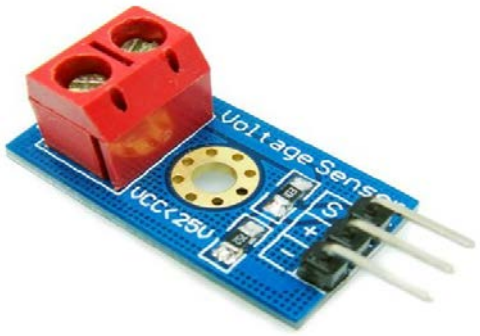
A current sensor is a device which is used to detect the alternative or direct current in the transformer. The reference value of current is compared with the generated signal. The generated signal could be either analog voltage or current or even digital output. The generated signal can be stored by data acquisition system for further analysis. The generated signal can also be used for control purpose.



F. Voltage Sensor

When power quality issues occurs the voltage sensors is used to monitor the voltage levels. The voltage sensor is used to identify the overvoltage and undervoltage concerns. It helps to protect the critical motors and electronics. Thus the voltage sensor is used for real-time monitoring and reporting.



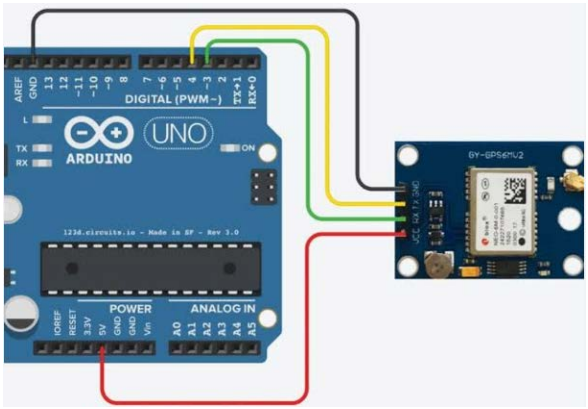


G. Global Positioning System

The GPS is a satellite-based radio navigation system. The location and time information is send to the GPS receiver. The GPS does not require the user to transmit the data and it operates independently. In this system the GPS is used to track the location of the transformer since the distribution transformer is located at different areas. When the oil level of the transformer is decreased it provides the information to the nearby substation along with its location by means of GPS tracking system.

IV. WORKING

This paper describes the operation and function of power transformer. It implements the wireless communication. It reduces the manpower and operates in accurate manner. In this method the monitoring and detection of fault is taken place. The system contains various sensors like voltage sensor, current sensor and oil level sensor for monitoring the current, voltage and oil level of the transformer. The Zigbee technology is used to transfer the data that is the parameters which are obtained the various sensors to EB office. During any occurrence of fault the alarm will be set ON. The two sensors such as voltage sensor and current sensor monitor the voltage and current parameters change. In our proposed system we have included oil level sensor. The transformer must have 90% of oil content. Whenthe oil level gets reduced the information will be send to the EB office. It is in the form of notification. Here we have connected a Bulb with the help of relay. It will be always glowing. When any fault is detected in that line the Bulb will automatically turn OFF. The GPS is connected to find the current location in case of any fault in the transformer.



V. CONCLUSION

The proposed system consist of an open global standard wireless technology called Zigbee. Employing the system for real time monitoring of power line using Zigbee module helps to reduce the costs and condensed power consumption. By using Zigbee protocol for monitoring different parameters of distribution transformer, human labor will be minimized and the data can be saved for forecasting as well as for any electricity theft.

The advantage of using Zigbee protocol is that any changes in the transformer such as current, voltage, oil level can be detected and the information is sent to the EB office. Any transformer issues can be found with the help of GPS present in the system. Hence by monitoring the health of the transformer the life of transformer can be improved.

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