

# International Journal of Innovative Research in Science, Engineering and Technology

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## Real Time Transformer Monitoring System Using GSM

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**ABSTRACT:** Electricity plays an important role in our life. The most crucial equipment of transmission and distribution of electric Power is transformer. As a large number of transformers are distributed over a wide area in present electric systems, it is difficult to measure the condition manually of every single transformer. So automatic data acquisition and transformer condition measuring has been an important issue. This project presents design and implementation of a mobile embedded system to measure load currents, over voltage, transformer oil level and oil temperature. This is implemented by on-line measuring system using Wireless, with single chip Arduino microcontroller and sensors. The output values of sensors are processed and recorded in the system memory. System programmed with some predefined instructions to check abnormal conditions. If there is any abnormality on the system, details are automatically updated in the Mobile through Wireless communication. GSM will help to utilize transformers optimally and identify problems before any catastrophic failure occurs. Thus wireless-measuring system is used to collect and analyze temperature data over time, which has greater reliability and significant cost savings.

**KEYWORDS:** transformer oil, temperature, arduino microcontroller, GSM, sensor.

### I. INTRODUCTION

A monitoring system can only monitor the operation state or guard against to steal the power, and is not able to monitor all useful data distribution transformers to reduce the costs. If the temperature rises higher than the desirable temperature, the monitoring system will protect the distribution transformer from problems. According to the above requirements, we need a distribution transformer real-time monitoring system to detect all

operating parameters and sends information to the monitoring centre on time. which provides useful information about the health of transformers which helps optimally to use their transformers and keep the asset in operation for a longer period. This will help to identify problems before any serious failure which leads to a significant cost savings and greater reliability.

The Equipment used for transmitting and distributing electric power is transformer. It is difficult to measure the condition of every single transformer. power transformer plays vital role in power system operations[1]. Its proper maintenance is very important to provide reliable and uninterrupted power supply at utility end. Most of the power transformers are filled with mineral oils. It serves as a dielectric and cooling medium in a transformer and offers oxidation stability, preventive properties of chemical attack.[2]. Under low temperature, solid cellulose materials such as paper and pressboard used in a transformer absorb water available in the transformer oil. The voltage divider sensor measure the voltage consumption in the transformer, current sensor measure the current consumption in the transformer, temperature sensor measure the temperature of the transformer and the ultrasonic level sensor measure the oil level in the transformer[3].

However, irrespective of ambient condition, the transformer oil has to work within the hotspot temperature. Again, different moisture contents have to be investigated to study the effect of temperature on transformer with a lower cost

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alternative to other sensors.

- If transformer is in abnormal condition we can know from anywhere.
- No human power need to monitor the transformer.
- Details about the transformer are automatically updated when the transformer is in abnormal condition.
- Reliability.

## II.LITERATURE SURVEY

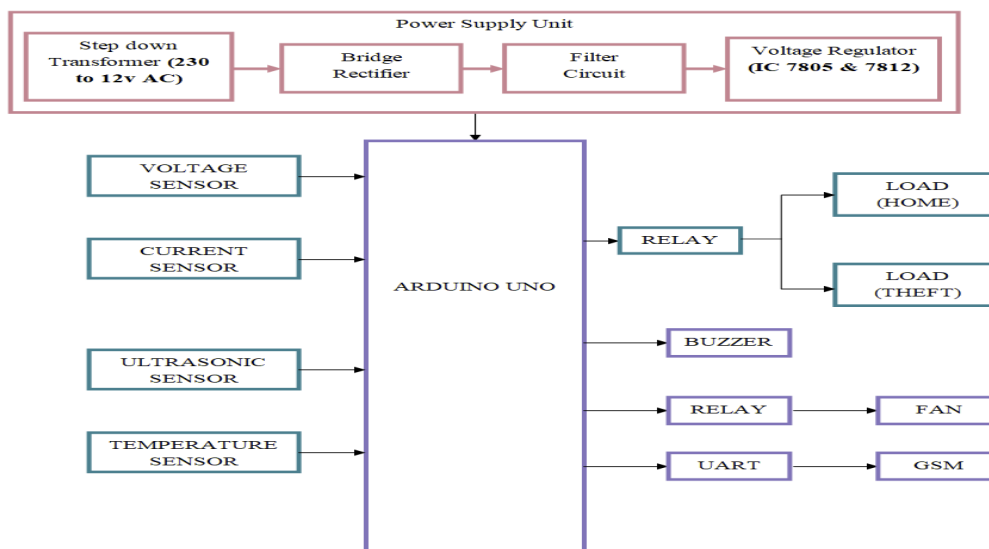
In [1] S Vadirajacharya, K. Ashish kharche, Harish kulakarni, Vivek landage proposed a method that,Transformers are a vital part of the transmission and distribution system. Monitoring the transformers is useful to find the failure, before they occur and can prevent faults that are costly to repair and result in a loss of service.

In [2] Rahul proposed that,The main aim of the paper is to acquire real-time data of transformer remotely over the internet,falling under the category of Internet of Things (IOT). Then the values of all the sensors are sent sequentially as per the frequency of multiplexing of the ADC by Microcontroller. They are then sent directly to a Wi-Fi module under TCP IP protocol to a dedicated IP that displays the data in real-time chart form in any web connected PC / Laptop for display in 3 different charts. The real-time data is also seen at the sending end LCD display interfaced with the microcontroller.

In [3] Ms. V. A. Patil, Ms. Namrata s. Kumbhar, Ms. Shital s. Patil proposed a system that,An innovative design to develop a system for monitoring the voltage, current and temperature, oil level, theft of a distribution transformer in a substation and to protect the system from the mentioned parameters based on GSM that is used in this paper. Providing the protection to the distribution transformer can be accomplished by shutting down the entire unit with the aid of the Radio frequency Communication.

## III.PRINCIPLE OF OPERATION

Fig.1. BLOCK DIAGRAM



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## IV. MODULE DESCRIPTION

### POWER SUPPLY UNIT



Power supply unit is a source of electrical power. The input of the step down transformer is 230v AC supply. It converts 230v AC to 12v AC. In Basic power supply, the input power transformer has its primary winding connected to the mains (line) supply. A secondary winding, coupled in an electro-magnetically way but it was electrically isolated from the primary. In bridge rectifier, because of high efficiency it converts 12v AC to 12v pulsating DC. The filter can split the circuit into two parts, one is the capacitor and another is the low pass filter. A filter circuit used to get pure DC supply, here we use capacitor to convert 12v pulsating DC to 12v DC supply. Then, the capacitor filter can get DC and blocks AC. Voltage regulator Integrated Circuits are available in both fixed and variable output voltages. It converts 12v DC to 5v DC supply, because the Arduino board needs a 5v supply.



Fig. 1. Power Supply Unit

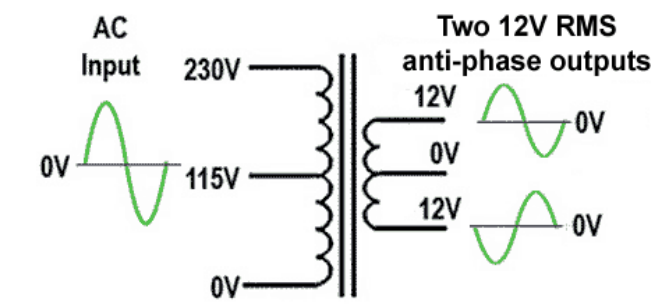


Fig.2. Step Down Transformer

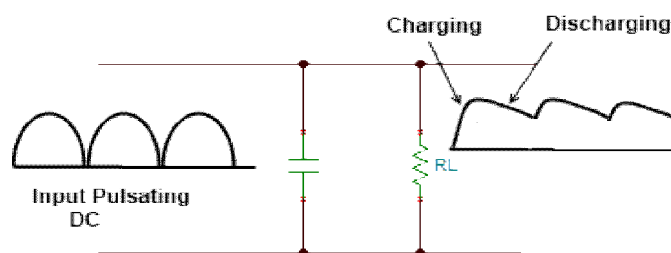


Fig.3. Filter Circuit

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## **ARDUINO UNO**

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328p microcontroller and developed by Arduino.cc The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. The **Arduino** programming environment is easy-to-use for beginners, yet flexible enough for the advanced users .

## **FAN**

The heat is mostly occurred in core and winding of the transformer. To maintain the temperature of the transformer constantly, we use coolant fan where the heat sinks. A fan is a machine used to create flow within a fluid, typically a gas such as air. The fan consists of a rotating arrangement of vanes or blades which act on the fluid. Through this, the heat can be controlled.

## **CURRENT SENSOR**

A current sensor is a device that detects electric current (AC or DC) in a wire, and generates a signal proportional to it. The current sensor module used here is ACS712 (Amps current sensor module). This sensor requires 30 amps. It is the generated signal that could be analog voltage or current or even digital output. It can be then utilized to display the measured current in an ammeter or can be stored for further analysis in a data acquisition system and can be utilized for control purpose.



Fig.4. Current Sensor

## **ULTRASONIC SENSOR**

The HC-SR04 ultrasonic sensor includes sonar to determine distance between sensor and objects. Ultrasonic ranging distance sensing module gives 2cm - 400cm non-contact measurement function, the ranging distance accuracy can reach up to 3mm. The modules include ultrasonic transmitters, receivers and control circuit.

It has a four pins vcc with 5v, trigger, echo and ground. Trigger acts as input and echo acts as output pin. Trigger also acts a transmitter, it sends a signal of high frequency sound, if the signal finds any object, the signal will be reflected. The second pin is echo that also acts as a receiver, that receives a sound signal.

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Fig.5.Ultrasonic sensor

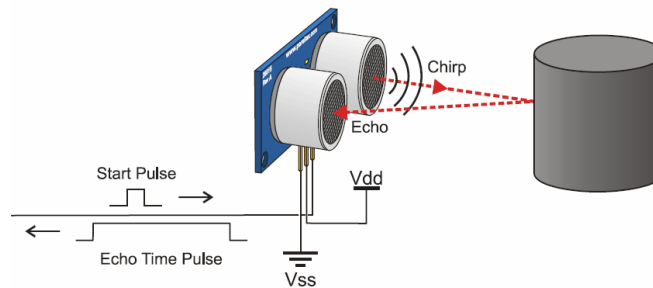


Fig.6.Working Principle

When the frequency enter in to the oil tank,it reflects back as the output frequency.By this, we can determine the wavelength,

$$\Lambda(\text{wavelength})=c/f$$

$$C=3*10^8$$

$$\Lambda(\text{wavelength})= (3*10^8)/\text{frequency}.$$

## RELAY

The Relay can be used to control a circuit.The signal can be used to control a circuits like motors, fan and 230v Bulb.Relay is used for the protection of transformers from the faults,it occurs inside the transformer. Short circuit faults such as inter turn faults, incipient winding faults, and core faults may occur due to the impulse breakdown of the insulating oil or simply the transformer oil.

## VOLTAGE SENSOR

The voltage Sensor here we used is AC voltage sensor.The home receives 230v AC supply.The mobile Charger Adaptor work is to limit 100 to 240v.If it exceeds the limit,we can place the voltage sensor in the circuit to manage the excess power & to prevent from mobile bursting. It has two input and one output,if two of the inputs are zero,then the output will be in OFF condition.If both the inputs are one,the output will not switch ON.If the one input is zero and the other is one,then the output will be in anticlockwise direction.If the input is viceversa,then the output will be in clockwise direction.

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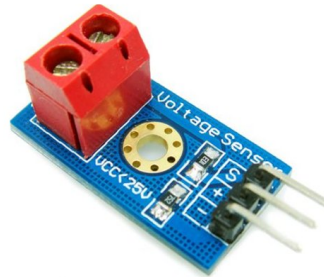


Fig.7.Voltage Sensor

## **TEMPERATURE SENSOR**

Transformer failure happens due to overheating that occurs in core and windings of the transformer. Temperature sensor (LM35) placed near the core to prevent heating and if it exceeds 100 degree, coolant will automatically turn ON and maintains the temperature level of the transformer.

## **BUZZER**

A buzzer is an audio signaling device for alert system. The buzzer takes some arrangement of input and emits a sound in. If the temperature level increases in the transformer and if the voltage exceeds the limit in the circuit, the buzzer will turn ON and it alerts us.

## **UART**

The Universal Asynchronous Receiver/Transmitter (UART) controller is the key component of the serial communications subsystem in a computer. UART is also a common integrated feature in most microcontrollers. The UART takes bytes of data and transmits the individual bits in a sequential order. A computer component can handle asynchronous serial communication, that component contains a UART to manage the serial ports and some internal modems have their own UART.

## **GSM**

GSM is a mobile communication modem; it stands for global system for mobile communication (GSM). GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. Bluetooth, Wifi, Zigbee, GSM, Lifi are some of the wireless technologies to transfer information. Bluetooth provides only short distance, Zigbee can connect only through the system, Lifi means light fidelity. The light and photodiode should travel in a straight line. GSM is of two types 1.Active GSM, 2.Passive GSM. Here we use passive GSM because the message will receive only through the server. But the active GSM is used only for the people personal use.

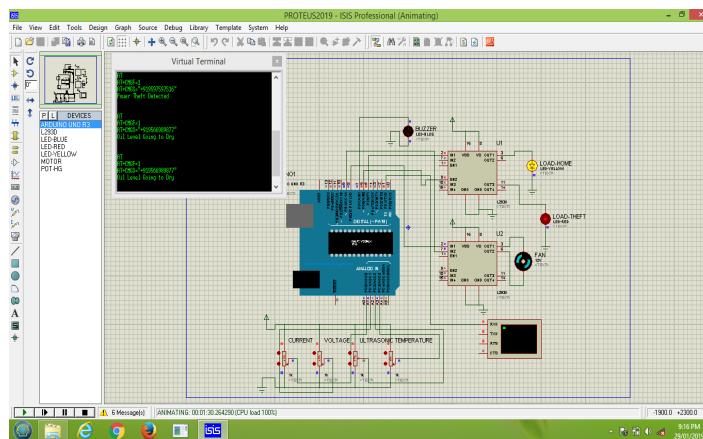
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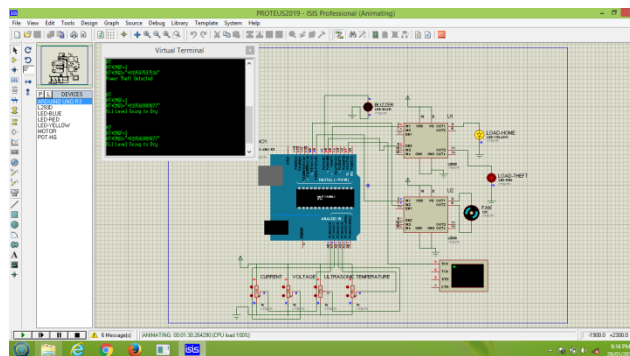
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## V.RESULT



### CURRENT SENSOR:

- At first step,if the current flow increases ,it detects the current theft and the led will turn ON automatically .
- Then the notification visible in virtual terminal as “current is thieved”.



### VOLTAGE SENSOR:

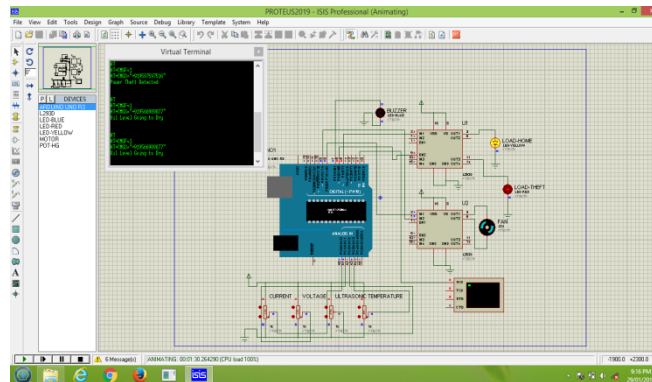
- Next,when the voltage is increasing, it detects if the voltage exceeds 240v then the buzzer will turn ON.
- It provides awareness before any serious issue happens.

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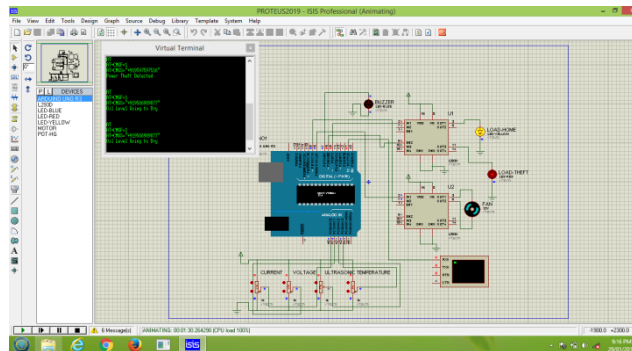
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## ULTRASONIC SENSOR:

- When the oil level becomes low in the oil tank, the ultrasonic sensor detects and it will turn ON the buzzer. The notification will show in virtual terminal as “oil level going to dry”.



## TEMPERATURE SENSOR:

- The coolant fan will turn ON, if the temperature increases above 100 degree.

## VI. CONCLUSION

The progress in technology about electrical distribution network is a non stop process. In the present work, wireless meter reading system is designed to continuously monitor the meter reading whenever the consumer fails to pay the bill. It provides efficient meter reading, avoids the billing error and reduces maintenance cost. Displays information on android mobile for user notification. This gives information to utility engineers to immediate shut-down the transformer to prevent further deterioration. Therefore, it could be concluded that the proposed instrumentation system can be used as a real-time monitoring system for the purpose of current theft, mobile burst, oil level, temperature level measurement of the transformer.



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## REFERENCES

- [1] Anurudh Kumar, Ashish Raj, Abhishek Kumar, Sikander Prasad & Balwant Kumar, "Method for Monitoring of Distribution Transformer", Undergraduate Academic Research Journal (UARJ), ISSN: 2278 – 1129, Volume-1, Issue-3,4, 2018.
- [2] Abdul Rahman, Ai Ali, Abdul Khaliq & Muhammad Arshad, "GSM-Based Distribution Transformer Monitoring System", IEEE MELECON, May 12-15, 2018, Dubrovnik, Croatia.
- [3] S. Dharanya, M. Priyanka, R. Rubini & A. Umamakeswari, "Real time monitoring and controlling of transformers", Journal of artificial intelligence 6(1):33-42, 2018, ISSN 1994- 5450/DOI: 10.3923/jai.2013.33-42.
- [4] Zhang Xin, Huang Ronghui, Huang Weizhao, Yao Shenjing, Hou Dan & Zheng Min, "Real-time Temperature Monitoring System Using FBG Sensors on an Oil-immersed Power transformer", DOI: 10.1336/j.1003-6520.hve. 2014.s2.048, Vol.40, Supplement 2: 253-259v, August 31, 2018.
- [5] N. Nagaraju & M. S. Kiruthika, "Fault Sensing in a Remote Transformer Using GSM", Vol. 2, Issue 10, October 2018.
- [6] Vivek Landage, Ashish Khsrche, Vadirajacharya. K, Harish Kulkarni, "Transformer health condition monitoring through GSM Technology", International Journal of Scientific & Engineering. Research Volume 3, Issue 12, December 2017, ISSN 2229-5518.
- [7] Prof. M. S. Sujatha & Dr. M Vijay Kumar, "On-Line Monitoring and Analysis of Faults in Transmission and Distribution Lines Using GSM Technique", Journal of Theoretical and Applied Information Technology, ISSN: 1992- 8645, E-ISSN: 1817-3195, 30th November 2017, Vol. 33 No.2.
- [8] Sh. Mohamadi & A. Akbari, "A New Method For Monitoring of Distribution Transformers", 978-1-4577-18298/12/\$26.00 ©2017IEEE.261.
- [9] Chan, W. L., So, A.T.P. and Lai, L., L., "Interment Based Transmission Substation Monitoring", IEEE Transaction on Power Systems, Vol. 14, No. 1, February 2017, pp.293298.
- [10] Par S. Tenbohlen, T, T. Stirl, M. Rösner, "Benefit of sensors for on-line monitoring system for power transformers"
- [11] Ansuman Sharma, Rajesh Behura; "GSM based Distribution Transformer Monitoring System", May 2017.
- [12] Adejumobi, I.G. Adebayo and A.J. Olanipekun. "Development of Microcontroller-based Electric Power Distribution Automation System", Journal of Innovative Researching Engineering and Sciences, Vol. 2, Issue 1, pp.10-28, March 2017.