

# HV Transformer Breather Monitoring System

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**Abstract:** - Transformer is a most used and useful equipment used in the industry. The breather which is used in the Power transformer plays an important role in the contamination of moisture. In a breather silica gel is used for absorb the moisture. A model for estimating moisture content in silica gel and in the atmosphere inside the breather in different mode of working condition is presented in this paper. The failure of the silica gel consists in breather producing abnormal water content inside the transformer. The model is based on relation of the moisture concentration between environment of breather and silica gel. The transient that take place until the steady state equilibrium is reached. We made the system for the breather to monitor the status and SMS will be send if the silicon moisture goes high level. There are different methods to find out the moisture of breather. One of the method is by measuring the moisture level or capacitance measurement method.

**Index Terms – Transformer, Breather, GSM, Arduino, Solar Cell**

## I. INTRODUCTION

A power transformer is a key component of power system, which consists of major capital cost in any power network and for continuous operation of this asset, it is very important to make timely decisions related to maintenance, utilization and replacement of this accessory. The maximum utilization of transformer capabilities without compromising its insulation integrity is the biggest challenge now a day for the utility transformer. A transformer life depends upon the life of its insulation paper. The grid transformer having moderate temperature change and heat recovery system suffers from the high water contamination. Due to assembled heat recovery system in the grid transformer, it suffers from high temperature change that causes around 16 kg/annum moisture contamination through breather that makes it the major source of water contamination in transformer

We are using ATmega328 Microcontroller and GSM module to design our prototype for the breather. As per the block diagram below, it consists of the Breather with Silica crystals and we have to put a sensor in such a way that we can measure the capacitance. The controller is ATmega 328 and we are using Arduino to program it. The level is set in it to measure the level and if the level goes high then SMS will go the respective person.

## THEORY: -

A transformer is a static machine used for transforming power from one circuit to another without changing frequency. This is a very basic definition of transformer. Since, there is no rotating or moving part, so a transformer is a static device. Transformer operates on an ac supply. A transformer works on the principle of mutual induction.

Generation of electrical power in low voltage level is very much cost effective. Theoretically, this low voltage level power can be transmitted to the receiving end. This low voltage power if transmitted results in greater line current which indeed causes more line losses. But if the voltage level of a power is increased, the current of the power is reduced which causes reduction in ohmic or  $I^2R$  losses in the system, reduction in cross-sectional area of the conductor i.e. reduction in capital cost of the system and it also

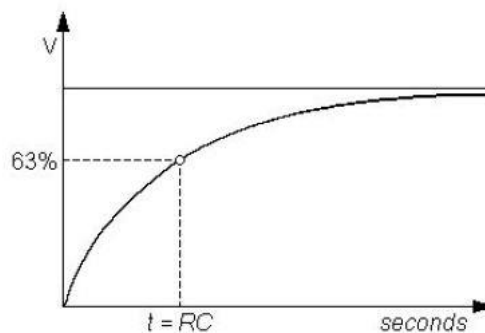
improves the voltage regulation of the system. Because of these, low level power must be stepped up for efficient electrical power transmission. This is done by step up transformer at the sending side of the power system network. As this high voltage power may not be distributed to the consumers directly, this must be stepped down to the desired level at the receiving end with the help of step down transformer. Electrical power transformer thus plays a vital role in power transmission.

Whenever electrical power transformer is loaded, the temperature of the transformer insulating oil increases, consequently the volume of the oil is increased. As the volume of the oil is increased, the air above the oil level in conservator will come out. Again at low oil temperature; the volume of the oil is decreased, which causes the volume of the oil to be decreased which again causes air to enter into conservator tank.

The natural air always consists of more or less moisture in it and this moisture can be mixed up with oil if it is allowed to enter into the transformer. The air moisture should be resisted during entering of the air into the transformer, because moisture is very harmful for transformer insulation. A silica gel breather is the most commonly used way of filtering air from moisture.

### The Capacitance Measurement or the Breather

Each Arduino capacitance meter relies on a property of resistor capacitor(RC) circuits- the time constant . The time constant of an RC circuit is defined as the time it takes for the voltage across the capacitor to reach 63.2% of its voltage when fully charged:



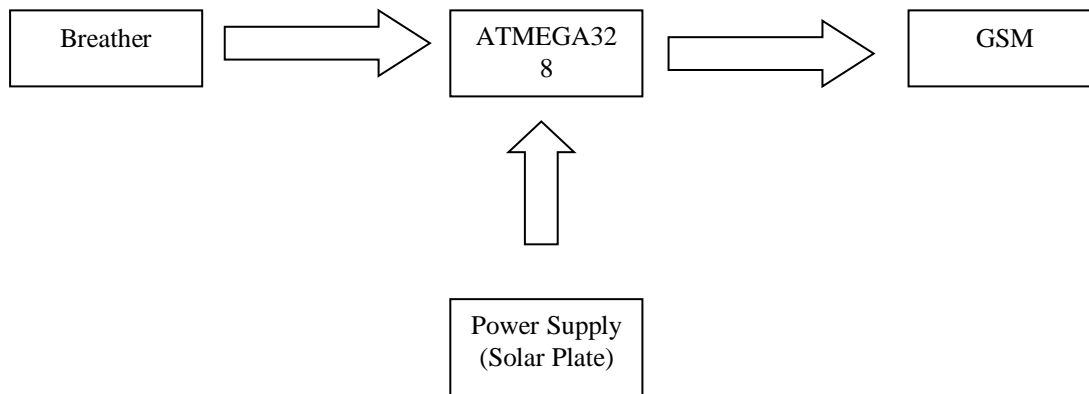
Larger capacitors take longer to charge, and therefore will create larger time constants. The capacitance in an RC circuit is related to the time constant by the equation:

$$TC = R \times C$$

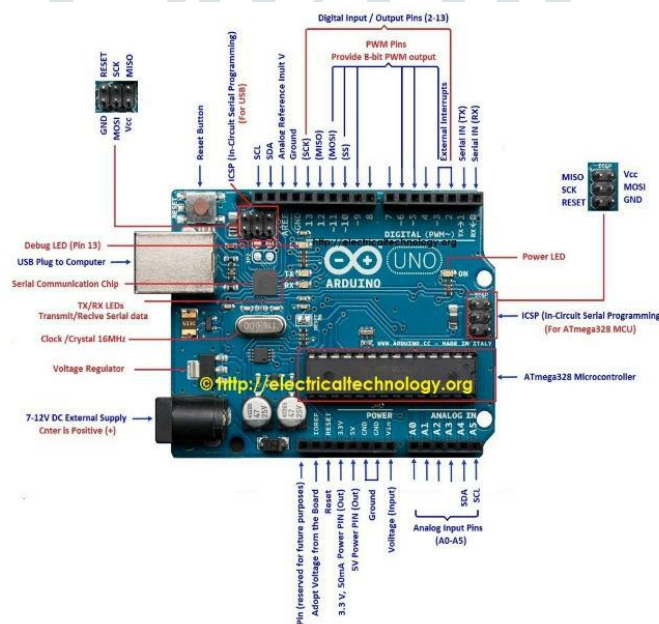
TC = Time constant of the capacitor

R = Resistance of circuit

C = Capacitance of Capacitor

**BLOCK DIAGRAM:-****HARDWARE:-**

- Controller ATmega328:- Arduino Uno is used for implementing the digital controller. Arduino Uno is an AVR based upon microcontroller board.



- Transformer Breather for testing : - Breather is basically a cylindrical vessel in which silica gel (Best adsorbent) is present through which non-moist air flow occurs in the transformer .
- GSM SIM800 Arduino Module for SMS alert:- Mini GSM / GPRS breakout board is based on SIM800L module, supports quad-band GSM/GPRS network, available for GPRS and SMS message data remote transmission.
- LCD 16x2 for display: LCD is used to show all result on screen. Most common LCDs connected to the microcontrollers are 16x2 and 20x2 displays.
- 9V Solar panel: - Solar panels are devices that convert light into electricity.

**WORKING: -**

- In the old times, the operator had go to several times to check whether the silica gel inside the transformer is useful or not.
- To overcome this drawback, now a day's silica gel breather monitoring systems are available.
- We will monitor the breather by using capacitance measurement method.
- The silica of the breather will get moisture and the capacitance will change.
- We have to monitor the capacitance by using arduino kit.
- When the capacitance will change the colour of silica gel will be change.
- When the colour of silica gel get change the arduino kit will send the SMS by using GSM.
- Transformer breather is embedded with the capacitance sensor and capacitance is measured by the microcontroller.
- If the capacitance is changes as per the threshold value set SMS will throw to the registered mobile number.

**Result: -**

The moisture of breather is always should be more than 65 microfarad. Otherwise breather is not useful for transformer.

**Conclusion: -**

From this project by calculating the breather capacitance value we can find the moisture content of the breather.

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