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Electrical Insulating Oil Breakover Test with Breakover Value Received by SMS (DEMO MODEL)

Shinde Akshay Surendra[1], Botalji Rahul Suryakant[2], Pore Girish Dhanaji[3], Kanap Pranavi Annasaheb[4], Prof. Shinde P.R[5]

[1,2,3,4] U.G. Students, Department of Electrical Engineering, Shree Santkrupa institute of Engineering & Technology, Ghogaon,.
[5]Assistant Professor, Department of Electrical Engineering, Shree Santkrupa institute of Engineering & Technology, Ghogaon, karad.
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ABSTRACT:

In olden times the Dc system used thoroughly was overtaken by Ac system hence Crucial parts of the grid "Transformers" came into account, with recent advances in each and all machine transformers have evolved to become an advanced and most crucial part of the grid, the insulating oil like mineral oil, nephapham oil, ester oil etc. These oils have become a very important part in cooling and insulating of electrical system.

These water-like liquids can insulate parts that have thousands of volts in them and is really magnificent. The conservation, care and maintenance of this oil is very crucial thing to do, with the breakover test machines available in market a small modification to get accurate voltage readings in digital form can help to decide whether the oil can sustain more work or needs to get replaced.

INTRODUCTION:

The power generated at generating stations such by use of thermal plants, nuclear plants, hydro plants , diesel plants is transferred to a long distance of thousands of kilometers, all this is possible with the help of transformers, so it is really important to maintain them in perfect condition as to get optimal and efficient energy transfer.

The insulating oil in Xmer's is tested for Breakover Voltages as per standards, the analog voltage meters on Breakover test machines may give accurate results but to read them is a tough job.

The era of digital world has brought us to digital voltmeters, having a digital voltmeter on Breakover test machines and getting the voltage readings with other live data to a mobile number could be an innovation, with the use of lcd display, zmpt101b sensor and Arduino these results can be achieved.

MODIFIED INSULATING OIL BREAKOVER TESTER:

In this Project we have created a working model of Breakover Test machine that uses a Zmpt101b voltage sensor that monitors the live voltage, the voltage sensor zmpt101b has 4 pins namely Vcc, Out, Gnd and Gnd, the pin Vcc and Gnd is supplied by 5V dc supply and pin Out is connected to Arduino pin A0.

To display the digital voltage from Zmpt101b an 16*2 Lcd display is used it contains 16 pins which connecting to Arduino becomes really bulky so with help of I2C interfacing circuit the Lcd 16 pins are connected to I2C 16 Pins and the I2C pins are connected to Arduino and 5V supply the I2C consist of a PCF8574 IC, the pins SDA and SDL are connected to pin A5 and A4 of Arduino and %v supply is provided to I2C converter pins Vcc and Gnd.

The GSM SIM800L is a modem used to connect with the network to provide voice, SMS services the pins TX and RX are connected to pin 7,8 of Arduino respectively, the relay module is used to connect or break supply for the indicators and zmpt101b voltage sensor. The dimmer is used to provide voltage to zmpt and the test machine both. as the voltage is increased using a dimmer, at one instant the 130 uf start capacitor charges for an instant using relay module that is controlled by Arduino & the dimmer is physically connected with the spheres in acrylic oil box.

The dimmer when reaches at a voltage where the spheres physically touch each other, the capacitor discharges with a spark and the max reached voltage on zmpt101b is sent to Arduino where Arduino sends the voltage readings to sim800L with a prewritten text, date and time to registered mobile number uploaded in Arduino code.

The objective of this demo model is to implement the Economically costed Zmpt101b and Arduino with GSM module Sim800L to achieve accurate readings of the Breakover Oil that is taken in manual mode by the authorized / Qualified personnel. Furthermore this kit can be installed in any Oil test

machine, and with some more improvements a thermal printer can also be implemented that can give print of the readings further reducing the human errors / mistakes that happen while taking the readings of the breakover voltages. All these components are powered by 5v and GND pin of Arduino and the Arduino type B cable is connected to 5V 3A mobile charger.

WORKING PRINCIPLE:

The Voltage from Oil test machine is received at Zmpt101b which is sensed by the transformer that converts it into analog waveforms and pass it to op amp which amplifies the signal and provide it further to the Arduino at pin AO.

The voltage is calculated as per the calculations and is displayed on Lcd display in digital form, also the sim800L modem connected to Arduino at pin 7 and 8 receives the voltage value which is sent to a mobile number as per the program set in Arduino, the voltage, date and time is received on the mobile phone.

COMPONENTS REQUIRED:

1) ZMPT101B Voltage Sensor

ZMPT101B is a single phase Alternating voltage sensor module that has a Zmpt transformer with turns ratio of 1000:1000, this voltage sensor is small in size and can provide Rms voltage readings when programmed and connected with Arduino / ESP8266 / Raspberry Pi.

The sensor has physical isolation from relay coil and the onboard ic using optocoupler and a jumper, the module can measure voltages up to 300 volts, the sensor has Wide Range of operation, High accuracy, Good Consistency.

The Out pin of Zmpt101b is connected to A0 pin of Arduino where we receive the voltage readings, the out pin of zmpt can have a supply of maximum 2mA. The sensor requires a supply of 5V that is provided on Vcc and Gnd pin through Arduino, the JDVcc and Vcc has a jumper in case you want to control relay coil and sensor both through same supply, but for safer reasons the JDVcc and Gnd can be connected on a separate 5V supply.

The Mains AC voltage Live and Neutral wires are connected to L and N contacts on the ZMPT101B AC voltage sensor using the terminal block, ZMPT101B can be used in various applications, such as power monitoring, smart home automation, energy management systems, and control systems. It is commonly utilized in projects where measuring the AC mains voltage is required for monitoring or control purposes.

2) GSM module SIM 800L

SIM800L Modem is a Quad Band GSM/GPRS based modem manufactured by SIMCOM Industries. The sim800L has 4 frequency bands of 850/900/1800/1900MHz. When connected to 5V 2A supply the SIM800L has constant Ring led and a N/W led that blinks once in 3 seconds when connected to network, the module requires a 2G compatible mini sim card, the sim800L is latest version from SIMCOM with compact size and has only 7 pins of which mostly 4 pins are used for general purpose when connected with Arduino.

The TX and RX pins are connected to digital pins of Arduino and baud rate is set at 9600. SIM800L is an ultra-compact and reliable module. This is a complete GSM/GPRS module in a SMT type and designed with a very powerful single-chip processor integrating AMR926EJ-S core, allowing you to benefit from small dimensions and cost-effective solutions.

3) Arduino uno Rev 3

The Arduino Uno Rev 3 is the latest microcontroller board based on the ATmega328. It has 6 Analog pins and 14 Digital pins from which 6 pins can be used for PWM (Pulse width modulation) the Arduino uno rev 3 consist of Atmega-382 microcontroller that can be directly connected to Laptop or Desktop without a USB to Serial driver chip requirement.

The Arduino uno rev3 has 6 ICSP pins it also has a reset button a TX, RX, on, reset led, the Arduino is connected using a type B to Usb cable, it also features a 12 v barrel connector to power from it, Arduino also features 5V and Gnd pin for supply input to it, Arduino is an opensource platform.

4) 16*2 LCD Display

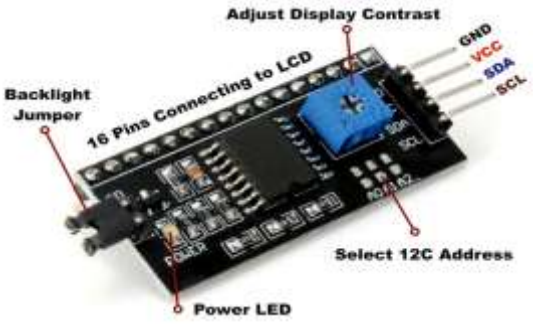
A 16*2 LCD Display contains 16 columns and 2 rows with total of 32 letters or numbers can be displayed in an instant, the lcd display has 16 pins and is connected with Arduino using I2C Converter to reduce the number of pins to 4.

The LCD Display is available in various shape and sizes, and the backlight color can be red, blue, green etc. the display words by using a backlight to display the words and light emitting diodes that produce the color or mono chromic text.

Now a Days Lcd displays are overtaken by Amoled and recently by Oled displays that Looks crispier and are more energy efficient than LCD and LED displays.

5) I2C Converter

Due to limited pin resources in a microcontroller/microprocessor, controlling an LCD panel could be tedious. Serial to Parallel adapters such as the I2C serial interface adapter module with PCF8574 chip makes the work easy with just two pins. The serial interface adapter can be connected to a 16x2 LCD and provides two signal output pins (SDA and SCL) which can be used to communicate with the Arduino and the Vcc and Gnd can be powered by 5V Dc supply.



6) Power supply

A power supply or a power adapter is an AC to DC with step down to required voltage. A 5V 3A supply from mobile adapter works perfectly for all the power requirements of the whole kit. Switching regulated 5VDC power supplies, sometimes referred to as SMPS power supplies, switchers, or switched mode power supplies, regulate the 5VDC output voltage using a complex high frequency switching technique that employs pulse width modulation and feedback.

ADVANTAGES, DISADVANTAGES AND APPLICATIONS:

Advantages

1. Correct Measurement of oil.
2. Easy operation.
3. Good Accuracy than Analog voltmeter.
4. Perfect for storing test data on mobile.
5. Oil Testing results are precise.

Disadvantages

1. Message is sent to number saved in Arduino.

Applications

Oil testing in Govt facility, oil filtration company, factories.

RESULTS:

1.ZMPT101B Voltage Accuracy

Input Voltage (Meco 72 Auto BL)	ZMPT101B Voltage	Error in Percentage
240 V	240.94 V	0.41 %
200 V	202.52 V	1.27 %
160 V	163.02 V	1.94 %
120 V	122.73 V	2.24 %
80 V	80.82V	1.01%

2. Arduino Total Delay

Oil Test Time (1 cycle)	Time Taken by Arduino to Send SMS	Total Time
1 Minute	30 Seconds	1 Minute 30 Seconds

CONCLUSIONS:

We can conclude that our machine is advantageous over the existing machines in the following ways:

1. The use of Arduino with message service on mobile phone is more accurate as compared to manual readings. energy

2. This innovative project can be implemented in any oil test machine available in markets

3. No space for mistakes with reading of the oil.

4. This innovation can potentially revolutionize the Oil test Industries.

5.. Data received of Oil test is easily accessible on mobile phone as is easily readable and user friendly.

FUTURE SCOPE :

It's a long way to go, the project was a very excellent journey, the biggest challenge that we faced was working with high voltage and isolating low voltage components from high voltage components, also providing enough power for sim800L was also a challenge.

Many other improvements needs to be done like attaching a thermal printer to get a print of the BDV voltage of oil. So we can say that our machine with further improvements will be more advantageous over the existing machines

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