ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 8, August 2018

Novel Design of Buchholz Relay by Implementation of Capacitive Liquid Level Transducer

Yuvraj U. Rathod[1] , Mithun M. Bhavsar[2], Swapnali R. Borade[3], Rohit A. Shejul[4], Pallavi N. Bhume[5], Deepak N. Shinde[6]

Head of the Department, Dept. of EE, MGM's Polytechnic, Aurangabad, Maharashtra, India[1]

Lecturer, Dept. of EE, MGM's Polytechnic, Aurangabad, Maharashtra, India[2]

Student, Diploma in Electrical Engineering, MGM's Polytechnic, Aurangabad, Maharashtra, India[3]

Student, Diploma in Electrical Engineering, MGM's Polytechnic, Aurangabad, Maharashtra, India[4]

Student, Diploma in Electrical Engineering, MGM's Polytechnic, Aurangabad, Maharashtra, India[5]

Student, Diploma in Electrical Engineering, MGM's Polytechnic, Aurangabad, Maharashtra, India[6]

ABSTRACT:Transformer is an costly and one of the most essential electrical machines. A Buchholz relay is used to monitor large transformers for oil loss or insulation breakdown. The location of relay is in an inclined pipe between the transformer and its oil conservation tank (located above the transformer). The Buchholz Relay is used as a protective device sensitive to the effects of a dielectric failure inside the equipment. However, the Buchholz relay has a few disadvantages. The relay produces a trip signal during earthquakes and is costly as well. Thus it is generally used only in the protection of power transformers. This paper suggests modern and adaptive methods which are cheaper, efficient and robust. An additional merit is the Control signal (it can be controlled directly from the control room). In this method we are implementing capacitive liquid level sensor to sense fault in transformer which having interfacing with 8051 microcontroller that will give command to relay. The main advantage of these methods is that the relays are easy to manufacture for different sizes of transformers and controlling in this method are outside the chamber containing the oil.

KEYWORDS:FSTP, capacitor, harmonics, induction motor, phase generation

I.INTRODUCTION

The Buchholz relay was developed in 1921 by Max Buchholz, Oberrat (senior councilor) at PreußischeElektrizitäts-AG (Prussian electricity supply company) in Kassel. The Buchholz Relay is used as a protection purpose which is sensitive to the effects of dielectric failure inside the equipment. In Buchholz relay there is a hollow space or chamber which is placed between the main transformer tank and the conservator. When the transformer is heated or when any fault occurs, a flammable gas (DGA) is produced which tries to occupy the upper space of the chamber containing the oil. The occupation of the flammable gas in the upper space will be possible only when the level of transformer oil goes down. When a small fault occurs then the level of transformer oil slightly goes down.

When the level of oil goes down, the mercury switch connected to the alarm switch goes down and gets connected with the conductive hinge which is just beside the mercury switch. Alarm sounds on completion of the circuit through conductive hinge and arcing is produced. In the same way when a large fault occurs, the level of transformer oil goes down considerably due to occupancy of a large amount of flammable air in the upper section of the chamber. Consequently, the mercury switch connected to the trip circuit goes down. Due to this it touches the hinge which is beside that. This results in the completion and activation of the trip circuit causing arcing and tripping of the transformer. Hence the above method protects the transformer from Buchholz relay faults. In Buchholz relay, the upper

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 8, August 2018

part of chamber having one test cock which is used to check the quality of air produced by heating of the transformer. This helps to measure the quantity of methane, ethane and many several components by which we analyses the condition of the transformer. One drain valve is also present in lower part of chamber to take out the transformer oil in case of fault and emergency.

However, in Buchholz relay the disadvantage is that generally it produces a trip signal in minor earthquakes and it is costly. Thus Buchholz relay is only used in power transformer protection. Presently automated systems are being used to control from a single place (Control room). We propose three methods which are cheaper than Buchholz relay. The construction of Buchholz relay is more complicated than our methods. These methods are easy to repair, more robust and efficient. The controlling part like alarm circuit and trip circuit is always outside of the chamber which is easy to handle.Hence manufacturing for different sizes of transformer becomes simpler.

In this method we are using capacitive liquid level sensor to sense fault in transformer which having interfacing with 8051 microcontroller that will give command to relay circuit . The main advantage of these methods is that the relays are easy to manufacture for different sizes of transformers and controlling in all these three methods are outside the chamber containing the oil & which is very cost effective.

II. DESIGN COMPONENTS OF BUCHHOLZ RELAY

A. Capacitive liquid level sensor

Different methods have been used to state real time liquid level height in water or oil containers, but recently, capacitive sensing has gained popularity due to the accuracy and resolution of the measurements. The capacitive technique has certain boundaries with raggedness since any external interference (for example – a human hand) causes capacitance drifts. This design demonstrates an alternative approach to the conventional capacitive sensing technique for liquid level. It justify the necessary obstacle to minimize any interference to maximum the signal to noise ratio and overall robustness of the system. The technique relies on a symmetrical sensor layout as well as using the shield drivers in a unique way to stabilize measurements. allows the user a simple and rapid way to prototype and evaluate this liquid level technique. Level Height Calculations

B. Ratio metric measurement

Liquid level sensing is based on the theory of a ratio metric measurement, using three sensors as shown in Figure

1. LEVEL OR HEIGHT – The capacitance of the LEVEL electrode is proportional to the liquid height (hw).It has to be as high as the maximum (MAX) allowed liquid level.

2. REFERENCE LIQUID (RL) OR INITIAL POINT – The REFERENCE liquid electrode accounts for the incremental unit measurements of the level electrode. The liquid level has to be higher than the RL height in order to have a liquid and temperature independent measurement system.

3. REFERENCE ENVIRONMENT (RE) OR ADAPTIBLE INTIL[AL STAGE – A second (optional) reference electrode accounts for container properties. It has to be placed above the highest allow level of liquid to isolate it from the liquid level, allowing it to track environmental factors rather than the primary target (the liquid in the buchholzrealy).

$\boldsymbol{Cmeas \propto hw\varepsilon w} + (\boldsymbol{hL} - \boldsymbol{hw})$a

h_L = maximum height of the liquid or oil level

h_w = height of liquid or oil

ε_w = dielectric of liquid or oil

ε_a = dielectric of air which is constant

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 8, August 2018

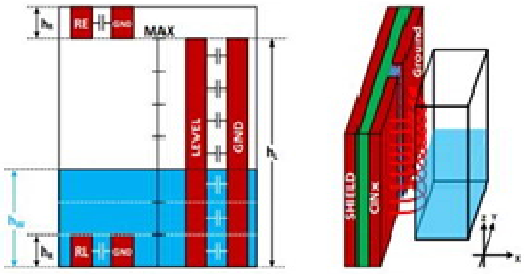

Fig.1 ratio metric measurement

C.8051 Microcontroller

The 8051 Microcontroller was designed in 1980's by Intel. Its basically was on Harvard Architecture and was developed principally for initially into play in Embedded Systems. At first it was invented by means of NMOS technology but as NMOS technology needs more energy consumption to function therefore Intel re-intended Microcontroller 8051 employing CMOS technology and a new version came into introduce with a letter 'C' in the title name, for illustration: 80C51. These advanced Microcontrollers need fewer amount of power consumption to function in comparison to their forerunners.

There are two buses in 8051 Microcontroller one for program and other for data transfer function . As a result, it has two storage rooms for both program and data of 64K by 8 size. The microcontroller comprise of 8 bit accumulator & 8 bit processing unit to process instructions. It also having 8 bit B register as majorly functioning blocks and 8051 microcontroller programming is done with embedded C language which utilizeKeil software. It also has a number of other 8 bit and 16 bit registers.For internal functioning & processing Microcontroller 8051 comes with integrated built-in RAM. This is prime memory and is employed for storing temporary data storage. It is unpredictable memory i.e. its data can get be lost when the power supply to the Microcontroller switched OFF be realized by employing a Gm-C circuit.

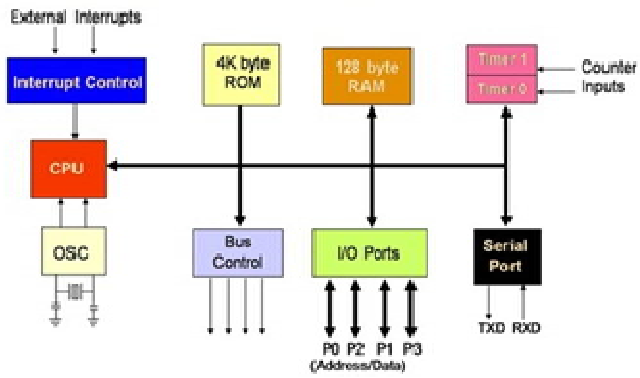

Fig.2 Block diagram of 8051 microcontroller

III. ARCHITECTURE BUCHHOLZ RELAY

Capacitive liquid level sensor to sense fault in transformer by variation in transformer oil level which having interfacing with 8051 microcontroller that will give command to relay. The main advantage of these methods is that the relays are easy to manufacture for different sizes of transformers and controlling in all this method are outside the chamber containing the oil.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 8, August 2018

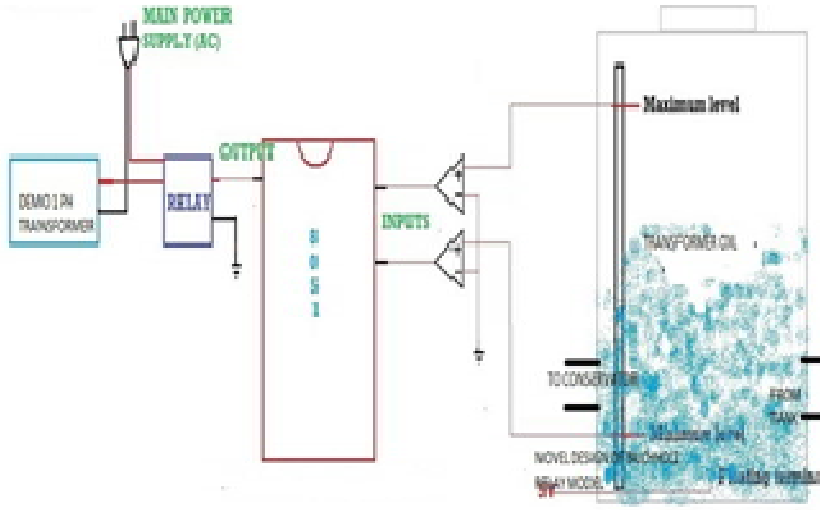

Fig. 3 Block diagram of novel design of buchholzrealy Block Diagram of 8051 Microcontroller

IV.INTERFACING WITH 8051 MICROCONTROLLER

A. Interfacing with 8051 microcontroller

Level Controller using 8051 Microcontroller project will help in automatically controlling the oil level by sensing the oil level in a relay. This article explains you how to detect and control the oil level in an overhead relay or any other container. This system monitors the oil level of the tank and automatically switches off supply of transformer during fault condition. Here we are designing the circuit which is used to detect and control the oil level automatically in relay using 8051 microcontroller.

In this system, oil sensing can be done by using a set of 4 wires, which are placed at various levels in buchholz relay. DC supply probe is placed at the base of the relay.

The heart of the oil Level Controller using 8051 Microcontroller project is the AT89C51 Microcontroller. The oil level probes are connected to the P0.0, P0.1 and P0.2 through the transistors (they are connected to the base of the transistors through corresponding current limiting resistors). P0.0 for lower level indication purpose, P0.1 for half Level indication and P0.2 for high Level indication. The Collector terminals of the Transistors are made connected to VCC and the Emitter terminals are connected to PORT0 terminals (P0.0, P0.1 and P0.2) for level detection data transfer purpose.

PORT1 of the microcontroller is connected to the data pins of LCD and the control pins RS, RW and EN of the LCD Display are connected to the P3.6, GND and P3.7 respectively.

For demonstration purpose, we have used a simple 1ph transformer. It is connected to the Relay and the input to the relay is fed from P0.7 through a transistor.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 7, Issue 8, August 2018

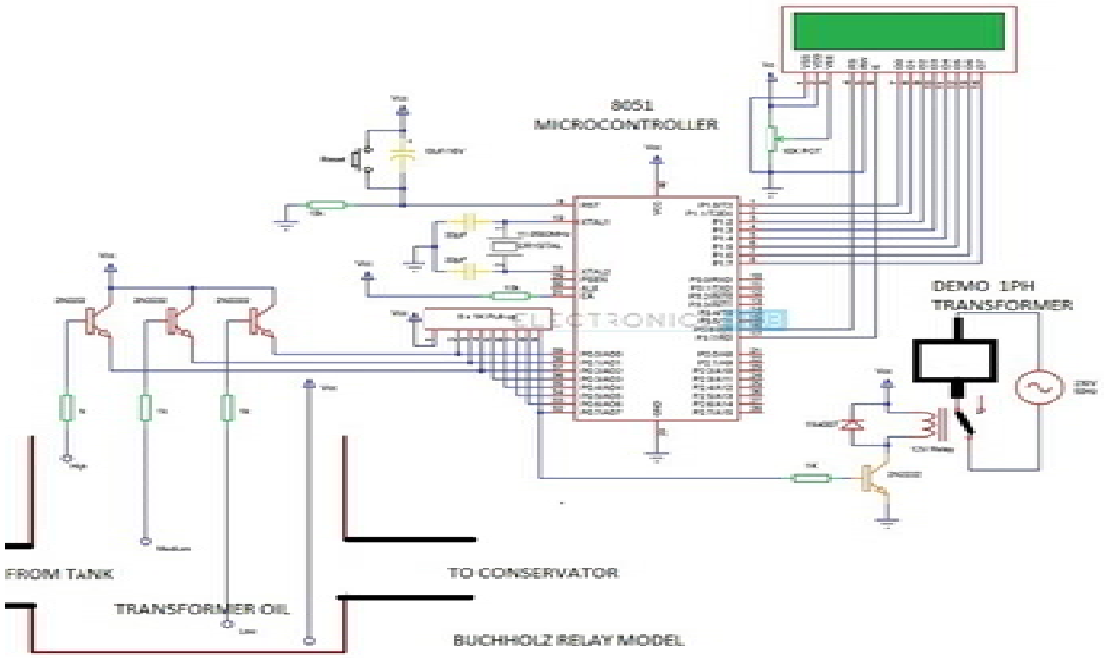

Fig. 4 Interfacing with 8051 microcontroller

V.CONCLUSION

In proposed system we are providing an alternative for traditional buchholz relay by designing on whole new concept & method. Traditional buchholzrealy only implemented for power transformer but our relay system can be implemented for transformer having lower rating. This method is very cost effective method & sensitivity level of relay is much more as compared to conventional relay. .

REFERENCES

1] IEEE Standard association "C57.104-1991 - IEEE GUIDE FOR THE INTERPRETATION OF GASES GENERATED IN OIL-IMMERSED TRANSFORMERS" IEEE Standard
[2] Sitemason "TRANSFORMER OIL VOLUME CONVERSION TABLE", www.sitemason.com/files/.../transformer%20oil%20volumes.pdf
[3] Elektromotoren und GerätebauBarleben GmbH "TRANSFORMER PROTECTION RELAYS"EMB
[4] H. C. Hitchcock," BUCHHOLZ RELAYS, SUPPLY WAS RESTORED IN A MATTER OF MINUTES" THE 1968 INANGAHUA EARTHQUAKE AND ELECTRICTY SERVICES
[5] Ben Coxworth "SUPER-BUOYANT MATERIAL INSPIRED BY WATER STRIDERS" American chemical society.
[6] Chih-yi Lin "DESIGN AND ANALYSIS OF PIEZOELECTRIC TRANSFORMER CONVERTERS" July 15,1997 Blacksburg, Virginia.
[7] PZT Application Manual "THE PIEZOELECTRIC EFFECT" www.aurelienr.com/ electronique/piezo/piezo.pdf.
[8] E. Takahashi K. Tanaka K. Toda M. Ikeda T. Teranishi M. Inaba T. Yanari, "DEVELOPMENT OF LARGECAPACITY GAS-INSULATED TRANSFORMER" IEEE Transactions on Power Delivery, Vol. 11, No. 2, April 1996.
[9] M. Duval, J. Aubin, Y. Giguere, G. Pare and Y. Langhame, "OIL ADDITIVES FOR THE EVALUATION OF HOT SPOT TEMPERATURE IN POWER TRANSFORMER DURING OVERLOADING " IEEE Transactions