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PARAMETER MONITORING OF TRANSFORMER

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Abstract *- Switching of capacitor bank, reactor and transmission lines are essential in power system, but it creates transient over voltages during switching. These over voltage magnitudes can be controlled by opening or closing of circuit breaker at proper instant of AC wave. Controlled switching solutions are also called point on wave (POW) switching. Opening or closing of circuit breaker at required instant of AC wave can be possible, if Controller operation and circuit breaker operation synchronized to each other. Controller is an intelligent electronic device (IED) based equipment, so its operation accuracy is very high, but circuit breaker is electromechanical device, and its operation depends on various environmental factors as well as parameters like friction between components, gas pressure, and temperature and spring characteristics. One of the challenges in controlled switching application lies in the accurate prediction of the operating time, subject to the various affecting parameters at that instant. The success of controlled switching system depends on the consistency of circuit breaker operating time and reliability of controller to operate in high voltage environment.*

The work presented in the dissertation focuses on suitability check of the circuit breaker for controlled switching application from mechanical scatter point of view. The allowed circuit breaker scatter for various controlled switching application is discussed in the dissertation along with the system requirement simulation study.

Keywords: Controlled switching, Mechanical scatter, making window, making instant, Make suitable GCB for controlled switching.

1. INTRODUCTION 1.1 General

In electricity generation, a distribution transformer is a device that converts mechanical energy to electrical energy for use in an external circuit. Distribution transformers provide nearly all of the power for electric power grids. The major problems faced include the theft of fuel, the fluctuation of Temperatures, unnoticed fuel amount, fuse blown fault, under and over voltage and the technician's time management. The main aim of our project is for Maintenance, Safety & Security of DISTRIBUTION TRANSFORMER. Our project improves the performance ability of DISTRIBUTION TRANSFORMER. The temperature sensors will sense the temperature and if it rises above the threshold value then corresponding relay will be ON. Using wired network accompanied with temporary test unit and involving man into action here continuous monitoring is not possible all the time which may lead to malfunction or failure of distribution transformer. Our proposed system provides effective monitoring and protection of distribution transformer by measuring its oil level, oil quality, temperature and operating voltage without involving human interaction. The system includes a Current transformer for current sensing and potential transformer for voltage sensing.

1.2 Necessity

In the existing system monitoring of distribution transformer is done using wired network accompanied with temporary test unit and involving man into action here continuous monitoring is not possible all the time which may lead to malfunction or failure of distribution transformer. Our proposed system provides effective monitoring and protection of distribution transformer by measuring its oil level, oil quality, temperature and

2. LITERATURE REVIEW

Distribution transformer is an important asset in distribution network. Its operation and control are important aspects which determine the reliability and quality of power Supply A remote condition monitoring system for distribution transformer is discussed here. Different parameters are acquired and processed in remote terminal unit[1].

This communicates the data to the operator end using internet. According to parameter values, health index of a transformer is found out at the operator end interface. Analysis is basedon health index. This system is different from power transformer condition monitoring systems in condition monitoring techniques used and communication. A cheaper system is designed which precisely evaluates the health status of a transformer. [2]

To monitor the transformer parameters such as voltage, current, frequency and temperature and to control using microcontroller with the help of zigbee transceiver. It explains how to monitor the above parameters and isolate the power supply during emergencies.[3]

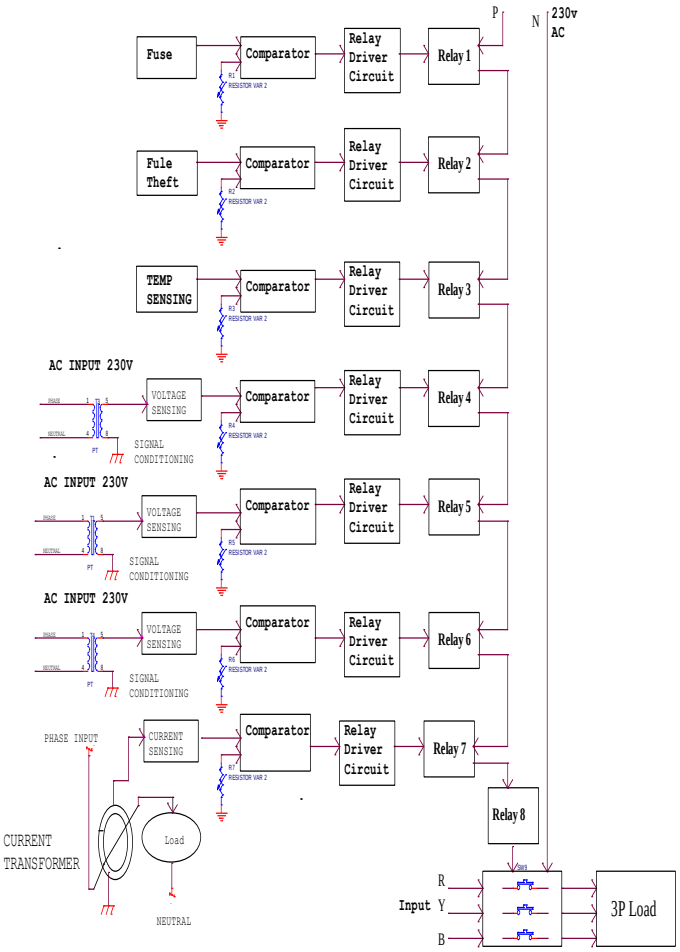
The paper include a protection system for 3-phase induction motor from single phasing, voltage, current, speed and temp.variations[4]

The distributed transformer networks remote monitoring system (DTRMS) is developed and constructed, for monitor and record the parameters like temperature,

oil level status, of a distribution transformer. Real time clock and data communication module which based on Zigbee protocol. [5]

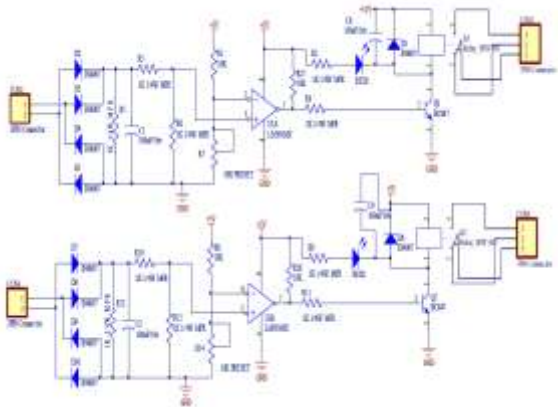
3. PROJECT METHODOLOGY

3.1 Block diagram



In power system the transformer is electrical equipment which distribute and transform the low voltage use us directly. The effective approach to prevent malfunctions of power equipment is the online monitoring. The main concern of transformer protection is protection of transformer against internal faults. The transformer failure occurs due to temperature rise, overload, low oil level, poor quality of cable and improper installation and maintains. Transformer, overheating, change in oil level etc. In this project, for sensing fault we used current transformer,.

3.2 Circuit diagram of the system



3.3 Hardware required

3.3.1 Power transformer:

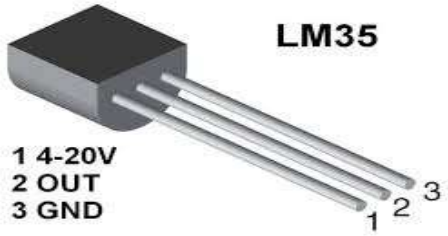
A voltage sensor is a device that detects electric voltage (AC or DC) in a wire and generates a signal proportional to it. The generated signal could be analog voltage or even digital output. It can be then utilized to display the measured voltage in ammeter or can be stored for further analysis in a data acquisition system or can be utilized for control purpose. It is coupled with input line in order to measure the voltage input to the transformer output of the transformer is amplified and fed to microcontroller .If the value that is being monitored increases beyond the rating of the transformer SMS is send to the control room and relay trips and alarm on. The voltage sensors have been developed primarily for medium-voltage switchgear in local network substations equipped with precision measurement technology. The focus is on network substations in urban, rural and industrial areas

3.3.2 Float sensor and Temperature sensor:

Float sensor is mounted inside the transformer tank immersed into the oil. As the level of the oil inside the tank decreases below 70% the signal is send to micro controller hence SMS is send to control room through GSM . To supply and reliability and assurance of accurate fuel readings sensors are being widely used because they operate reliably and accurately while presenting an economical solution

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1»4˚C at room temperature and ±3»4˚C over a full −55 to +150˚C temperature range. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1˚C in still air. The LM35 is rated to operate over a −55˚ to +150˚C temperature range, while the LM35C is rated for a −40˚ to +110˚C range (−10˚ with improved accuracy while the LM35C, LM35CA, and LM35D

are also available in the controlroom through GSM .If the temperature reaches the critical level alarm operates at control room.



Features

1. Calibrated directly in ° Celsius (Centigrade)

2. Linear + 10.0 mV/°C scale factor

3. 0.5°C accuracy guarantee (at +25°C)

4. Rated for full −55° to +150°C range

5. Suitable for remote applications

6. Low cost due to wafer-level trimming

7. Operates from 4 to 30 volts

8. Less than 60 μA current drain

9. Low self-heating, 0.08°C in still air

10. Nonlinearity only ±1/4°C typical

11. Low impedance output, 0.1 W for 1 mA load

3.3.4 Current transformer:

A current sensor is a device that detects electric current (AC or DC) in a wire and generates a signal proportional to it. The generated signal could be analog voltage or current or even digital output..If the value that is being monitored increases beyond the rating of the transformer SMS is send to the control room and relay trips and alarm on. The focus is on network substations in urban, rural and industrial areas. The measuring sensors are implemented in order to measure, monitor and also to detect short- circuitsor earth faults and to determine their direction.

3.3.5 Fuse:

A fuse is one type of over current device that is designed to be a sacrificial element in an electrical power system. Fuses are designed to open circuits when excessive currents are present due to overloads or faults and to

Prevent further damage to the system that might result if the fuse were not present. Fuse selection and device plays a predominant role in providing protection from short-circuit and other damages. It also works as a safety device in protecting human life and property. Safety by low voltage fuses and high voltage fuses in case of over currents,. It generates heat at a rate that is dependent upon its resistance and the load current. The heat generated by the element is absorbed by the filler and passed through the fuse body to the surrounding air.

3.3.6 Relay

The Single Pole Double Throw SPDT relay is quite useful in certain applications because of its internal configuration. It has one common terminal and 2 contacts in 2 different configurations: one can be Normally Closed and the other one is opened or it can be Normally Open and the other one closed. So basically you can see the SPDT relay as a way of switching between 2 circuits:

Terminal Pins

A Single Pole Double Throw Relay comes with five terminal points. The terminals are COIL, COIL, COM, and NO, and NC.

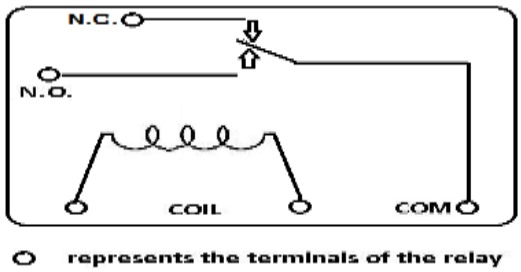


Fig.3.5 (a) Terminal pins of relay

Terminal Descriptions

1 COIL -

This is the other end of the coil. These are the terminals where you apply voltage to in order to give power to the coils (which then will close the switchPolarity only matters if a diode is used.

2 NO-

This is Normally Open switch. This is the terminal where you connect the device that you want the relay to power when the relay is powered, The device connected to NO will be off when the relay has no power and will turn on when the relay receives power.

3 NC-

This is the Normally Closed Switch. This is the terminal where you connect the device that you want powered when the relay receives no power. COM

Features

- MI-1 pole series relay cover switching capacity 10A.
- Slim type and small occupying area can offer high density P. C. Board technique.
- Insulation distance of 8mm min. is designed. By using insulation that meets JIS insulation class E, a dielectric strength of 5000V min. and surge resistances of 1000V min. are possible.
- Employment of suitable plastic materials to be applied to high temperature and various chemical solutions.

3.3.7 Comparator IC LM393

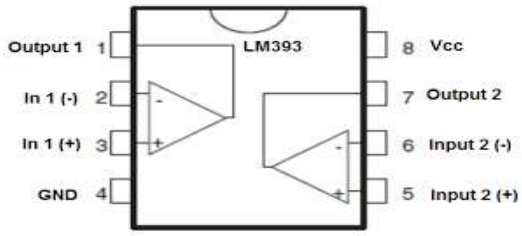


Fig.3.6 LM393

The LM193 series consists of two independent precision voltage comparators with an offset voltage specification as low as 2.0 mV max for two comparators which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage. Application areas include limit comparators, simple analog to digital converters; pulse, square wave and time delay transformers; wide range VCO; MOS clock timers;. When operated from both plus and minus power supplies, the LM193 series will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators.

Features

1. Wide supply
2. Voltage range: 2.0V to 36V
3. Single or dual supplies: ±1.0V to ±18V
4. Very low supply current drain (0.4 mA) — independent
5. supply voltage
6. Low input biasing current: 25 nA
7. Low input offset current: ±5 nA
8. Maximum offset voltage: ±3 mV
9. Input common-mode voltage range includes ground
10. Differential input voltage range equal to the power
11. Supply voltage
12. Low output saturation voltage,: 250 mV at 4 mA
13. Output voltage compatible with TTL, DTL, ECL, MOS and CMOS logic systems
14. Available in the 8-Bump (12 mil) micro SMD package

Advantages

1. High precision comparators

2. Eliminates need for dual supplies
3. Allows sensing near ground
4. Compatible with all forms of logic
5. Power drain suitable for battery operation

3.3.8 Potential Transformer

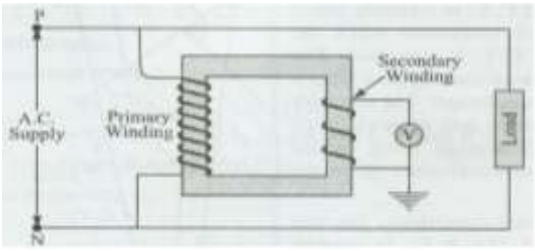


Fig.3.7Circuit of Potential Transformer

Potential transformer or **voltage transformer** gets used in electrical power system for stepping down the system voltage to a safe value which can be fed to low ratings meters and relays. Commercially available relays and meters used for protection and metering, are designed for low voltage. This is a simplest form of **potential transformer definition**.

Fig.3.7(a) Potential transformer

Ratio

The PT is typically described by its voltage ratio from primary to secondary. A 600:120 PT will provide an output voltage of 120 volts when 600 volts are impressed across its primary winding. Standard secondary voltage ratings are 120 volts and 70 volts, compatible with standard measuring instruments.

Burden and accuracy

Burden and accuracy are usually stated as a combined parameter due to being dependent on each other. Metering style PTs are designed with smaller cores and VA capacities than power transformers. This causes metering PTs to saturate at lower secondary voltage outputs saving sensitive connected metering devices from damaging large voltage spikes found in grid disturbances.

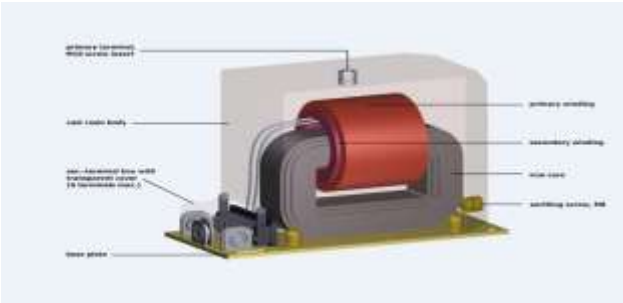


Fig.3.7(b) Internal View Of Transformer

A small PT (see nameplate in photo) with a rating of 0.3W, 0.6X would indicate with up to W load (12.5 watts) of secondary burden the secondary current will be within a 0.3 percent error parallelogram on an accuracy diagram incorporating both phase angle and ratio errors. The same technique applies for the X load (25 watts) rating except inside a 0.6% accuracy parallelogram.

Markings

Some transformer winding primary (usually high-voltage) connecting wires are of many types. may be labeled as H_1, H_2 (sometimes H_0 if it is internally designed to be grounded) and X_1, X2 and sometimes an X_3 tap may be present. Sometimes a second isolated winding (Y_1, Y_2, Y_3) (and third (Z_1, Z_2, Z_3) may also be available on the same voltage transformer. voltage equipment and for human safety.

Types of PTs

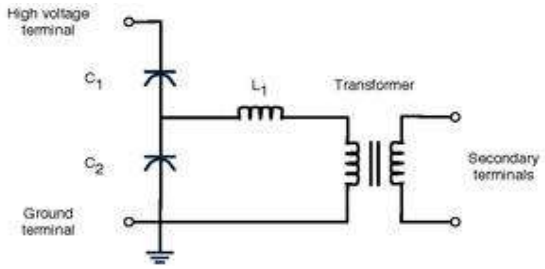


Fig.3.7(c)Simplified Circuit Diagram Of A CVT

There are three primary types of potential transformers (PT): electromagnetic, capacitor, and optical. The electromagnetic potential transformer is a wire-wound transformer. The capacitor voltage transformer (CVT) uses a capacitance potential divider and is used at higher voltages due to a lower cost than an electromagnetic PT. An optical voltage transformer exploits the Faraday Effect, rotating polarized light, in optical materials.

Current Transformer

Current transformers (CT's) provide a simple, inexpensive and yet accurate means of sensing current flow in power conductors. They are available in 3 basic configurations:

1. Ring Core CT's are available for measuring currents from 50 to 5000 amps, with windows (power conductor opening size) from 1" to 8" diameter.
2. Split Core CT's are available for measuring currents from 100 to 5000 amps, with windows in varying sizes from 1" by 2" to 13" by 30". Split core CT's have one end removable so that the load conductor or bus bar does not have to be disconnected to install the CT.
3. Wound Primary CT's are designed to measure currents from 1 amp to 100 amps. Since the load current passes through primary windings in the CT, screw terminals are provided for the load and secondary conductors.

Parallel CT inputs method is used at the input.

This method would require:

1. Balanced loads,
2. Same ratio CT's,
3. Paralleling at transducer only,
4. Grounding at transducer only,
5. Burden capability to be reduced by the number of CT's (e.g., 3 CT's give 1/3 capability),
6. CT's to be oversized so the total secondary current does not exceed the 5 amp rating, which reduces accuracy.

Since this method requires ideal conditions, it is generally better to use a summing transformer.

A CT is most accurate at rated current with a low burden (load). Accuracy decreases with increased burden (load) or

low line current. CT's are inexpensive, If properly sized and installed, they will give many years of trouble free service with no adjustments to make.

4. SOFTWARE REQUIREMENT:

1. ALTIUM for PCB making
2. OrCAD- For circuit diagram

4.1 ALTIUM:

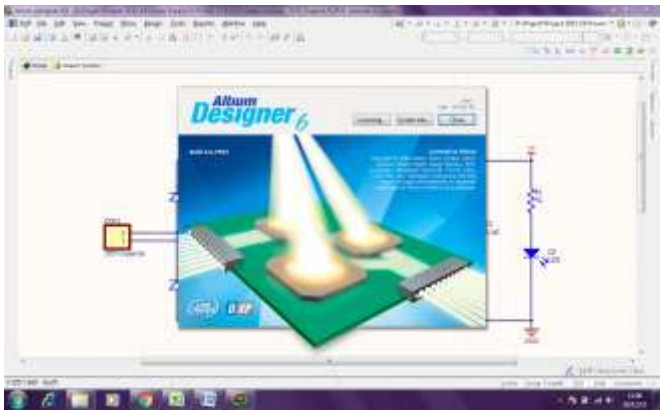


Fig.4.1 Screenshot of Altium software

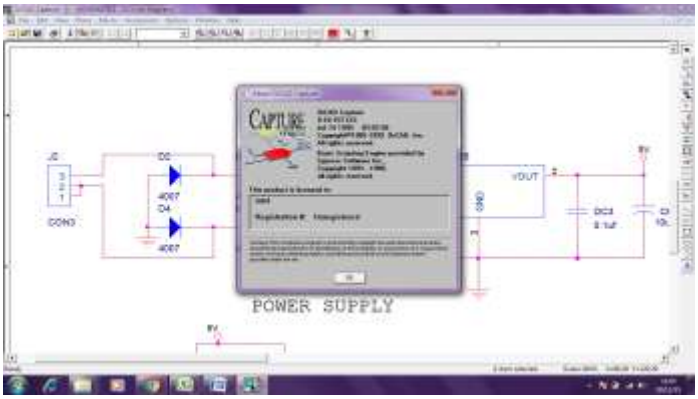


Fig.4.2Screenshot Of Orcad Software

5.2.7 Testing

Testing is nothing but the physical checking of the all components and all possible condition to avoid problem in the circuit functioning.

5.2.8 Bare Board Testing

In bare board testing we should have to check the following points

1. Continuity of the track
2. Over etching or under etching if any
3. Shorts if any
4. VCC and GND tracks

5.2. Trouble Shooting

After the PCB is prepared the conductivity test is carried out. First pin-to-pin conductivity is checked. The necessary IC interconnections are also checked. The resistance value of all the resistor are checked and then completed with the value denoted by color-coding is done.

5. FLOWCHART:

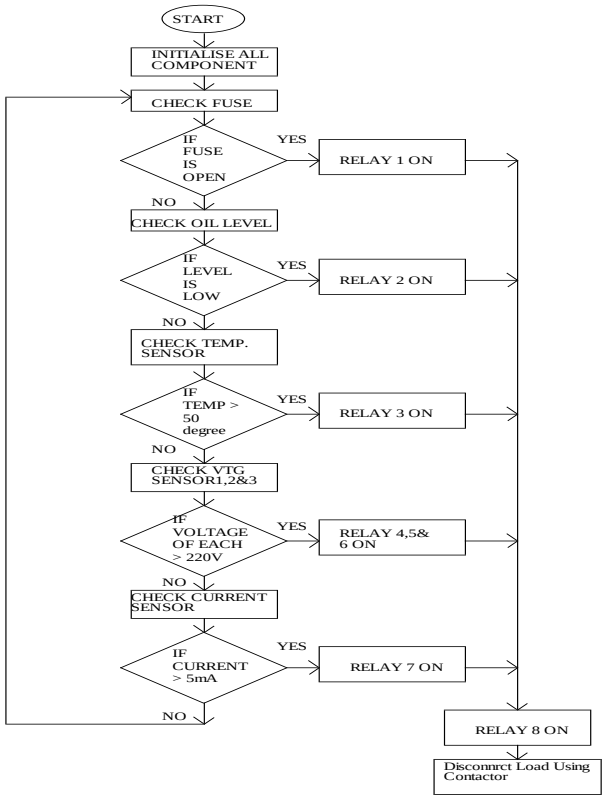


Fig.5.1Flowchart Of System

6.1 ADVANTAGES

1. This system we can analyze the fault occur in the transformer and find the root cause of the different faults. Therefore it improves the quality in the department.
2. If any fault occurs or all faults occur at a time .This system can be disconnect the load. Therefore trouble-shooting is easy.
3. Even if there is nobody for monitoring the system will automatically Disconnects.
4. Saves money.
5. Reduces manpower.
6. \Saves time

6.2 APPLICATIONS

1. Maintenance Department for troubleshooting fault.
2. Fault Analysis of BTS tower.
3. Quality Department for improvement Quality and find root cause of fault..

7. CONCLUSION AND FUTURE SCOPE

7.1 Conclusions

Three phase& single phase devices are used in the industries for various purposes, so it is very essential to protect them from various faults. From the above study we can conclude that this methodology gives the perfect solution for protecting the three phase & single phase devices from getting damage from the faults.

The system provide effective monitoring and protection of power transformer by its oil level, oil quality, temperature and operating voltage & current without involving human intervention.

7.2 Future Scope

- This is a very basic circuit and has many shortcomings. For example the system can be implemented by using microcontroller to improve the performance of the system.
- In this project with the help of GSM model we will send SMS
- Status of project will be shown with the help of 7 segment display.
- System can made battery operated.

8. REFERENCES

- **Papers**

1) Remote Condition Monitoring System for Distribution Transformer (IJARECE) volume 3,Issue 8, August 2013. (Avinash Nelson A Gajanan C Jaiswal Makarand S Ballal D. R Tutakne)

2) "Online Offsite Condition Monitoring Of Three Phase Induction Motor by Using GSM Technology", International Journal of Emerging Technology and Advanced Engineering Website:www.ijetae.com (ISSN 2250-2459), ISO 9001:2008 Certified Journal, Volume 3, Issue 4, April 2013) (N. B. Shaikh, S.S. Dhamal, S.S. Hadpe& K.P. Varade)

3) Embedded "System Integrated into a Communication system for the Monitoring of Induction Motor Parameters". Global Advance Research Journal of Engineering and Innovation (ISSN: 2315:5124) Vol 2(10)pp. 276- 283, November, 2013. (A Nadh, N. lakshmi Prabha and Dr. N.Stalin.)

4) "Fault Detection and Correction of 3 Phase Induction Motor", International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) volume 3, Issue 8, August 2014. (S. J. Patil, S. S. Patil, P. D. Patil)

5) Fail Safe Monitoring and Clock Frequency Switching Using the PIC16F684, website: www.microchip.com

- **Books**

[1] Basic Electrical – V.K. Mehta

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