A REVIEW ON HEALTH CONDITION MONITORING OF DISTRIBUTION TRANSFORMER

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Abstract

This review paper presents, design & implementation of a mobile embedded system to monitor & record the operation of a transformer, like over voltage, over current, three-phase voltage & current, fall of Oil level, temperature, & total power of the transformer. We are introducing the system, because when operator is actually not present at the transformer site, then through using GSM modem the operator can ask any related parameters value of transformer health by sending SMS to the system . This system is developed to send SMS alerts, whenever transformer health related parameters value exceeds the pre-defined limits. Arduino microcontroller & GSM device are used for monitoring the operating point of three phase generator remotely. Also these all proposed parameters are displayed an 16*2 line LCD display. Actually the main aim of these system is to acquire data of transformers remotely by GSM modem. This GSM modem helps to monitor transformer health by sending SMS to the system .This system will help the transformers, to operate smoothly & to detects the problems before any failure. The main objective is, to develop a real time monitoring, health conditions of transformer using GSM technology to prevents failures of transformers & improve reliability of services of the customers.

Keywords: GSM modem; Transformers; Arduino Uno ; LCD display; Sensors

I. INTRODUCTION

Transformers have a long life, if they are operates under good conditions. In case they are overloaded then their life is significantly reduced. Overloading and ineffective cooling of transformers, are the main causes of failure, in transformer. All such type of factors can reduce the transformer life. The main concern with transformers protections is protecting the transformers, against internal faults & external faults. If transformer becomes overloading, it causes a rise in temperature of transformer oil and windings. If winding temperature of transformer is increased, as compared to transformer limit then insulation will deteriorate. The transformer protection scheme, need to protection against transformers overload, transformers faults, as well as protection against internal fault. Remote monitoring system is one of the most important developing technology, which is used for many industrial applications. This proposed system, becomes a compact design & development of remote monitoring system for a three-phase transformer. Transformer is essential part of power transmission system. The main aim of, to develop these system is, to monitoring the real status of the transformer, and also to reduce cost, efficiency and improve services to customers.

A power transformer consist of, a set of windings around magnetic cores. The windings are insulated from each others. Overloading transformers can caused failures of the transformers winding insulations and cores. As we know, transformer is a most important part of power system and its correct functioning is vital to system operations. To reduce the risk of unexpected failures and the ensuring unscheduled outage, online monitoring has become the common practice to assess the condition of the transformer. Transformer is the key equipment in power system, to ensure its safe and stable operation is important. Transformer either raise a voltage to decrease losses.it is very difficult and expensive to construct the communication wires to monitor and control to the transformer station.

II. LITERATURE SURVEY

In most power companies, for online monitoring of power transformers, use supervisory control and data acquisition (SCADA) system, but for online monitoring of power transformer, the extending the SCADA system is an expensive proposition. Power transformers are currently monitored manually, where a person visits a transformer site, for maintenance and taking records purpose. But main drawbacks of these systems are, it can not provide information about overloads (Voltage & Current) and overheating of transformer oil & windings. Due to these , the transformer life is reduced.   Abdul Rahman Al-ali et al. [1] This paper presents design and implementation of a mobile embedded system to monitor and record key operation indictors of a distribution transformer like load currents, transformer oil and ambient temperature. The designed system is connected to a distribution transformer and is able to record and send abnormal operating parameters information to a mobile device using a GSM network .

Buyung Sofiarto Munir et al.[2] In this paper several methods are evaluated to determine which method is better in provides consistent and reliable parameters to be used for transformation condition. Basically there are two evaluated methods are used with vibration signals taken sequentially. First used is fast Fourier transform(FFT) which is used to compute discrete Fourier transform. Second evaluated method is Hilbert Huang Transform(HHT) which is used for to separated vibration signal into a finite and a small number of intrinsic mode functions(IMF).   Xiao-hui Cheng et al.[3] Here compares many combinations ways of internet of things and power, the oil based transformer monitoring system is analyzed, but it has high cost, loss data and feedback control of function. This system uses a single bus multi point temperature measurement method and GSM network remote control and data processing combined, so that speed of the temperature and its analysis becomes improved also accuracy of system is also improved, reducing the cost of temperature monitoring system and using the remote control module to avoid the failure of transformer.   Drasko Furundzicet al.[4] Neural networks are widespread technique for transformer health monitoring system. Neural networks ensembles are the most advanced neural technique ,that improve the accuracy and reliability in the transformer health and failure prognosis. This paper describes the technique to identify causal relation of dissolved gases in transformer oil and current state of the transformers health   .
Suraj Pardeshiet al.[5]It is solution for monitoring and automatic voltage regulation. It concluded that by developing modular and intelligent units results in cost effective solution for online monitoring of transformer card for processing various algorithms and taking control actions. This paper discuss about the combination of online monitoring and control. D S Sureshet al. [6] have discussed about insulating oil in a transformer which can explain about the actual state of transformer and its longevity. This proposed work mainly forces on condition monitoring transformer oil by using PLC, SCADA with sensors for sensing parameters of oil like moisture , and temperature can be found. Also to monitoring of transformer is done using PLC system and wireless technology for sending the information through   GSM Mallikarjun Sarsambaet al.[7] have presented a monitoring of load and power lines using SMS based GSM technology. This methodology is design and implementation using embedded system to monitor and record load fluctuations with respect to current and voltage in power lines and it breaks the power lines during high loads. It provides flexible control of load

accurately and also provides information about any abnormality in power lines using GSM networks. Monika Agarwal et al.[8] have discussed about and design and implementation of a mobile embedded system to monitor and record distribution transformer parameters like over voltage, over current, temp and fall of oil level. Use of a GSM technique provides speed of communication with distance independency and also it enables bidirectional communication as a message. To reduce the risk of unexpected failure and unscheduled outage   .

Satya Kumar Behera et al.[9]have discussed about a implementation of automatic control circuits which is used in PLC system to monitor the condition of transformer like load current, voltage, and transformer temperatures. This PLC monitoring system will help to detect the internal faults as well as external faults of transformer. The PLC system is used to monitor and control the voltage current and temperature of a distribution transformer. The PLC system is designed to monitor the transformer parameters continuously throughout its operation.   Vishwanath R,et al.[10] have presented, this paper uses a temperature sensor ,pic microcontroller ,LCD display GSM board and xbee which is used for send the message to electricity board. By Using this system we can detect multiple faults of three phase transmission lines which one can monitor the temperature , voltage, current by GSM modem. In this paper a system is develop to monitor the transmission line faults using GSM network.   Pathak A.K et al.[11] have discuss about an idea of online monitoring system integrates the GSM modem with a single chip microcontroller and sensors. It is implemented at the distribution transformer side. If any emergency situation can occurs the system sends the SMS to the mobile phones containing information about the abnormalities according to instructions which are programmed into microcontroller. Also this system to protect distribution transformers from overheating and overloading.   .

Mohamed Ahmed Eltayeb Ahmed Elmustafa Hayatiet al. [12] have designed decision support system to grid operation engineers with information helps to estimate the loads , fix problems and identify week points in the grid. This paper suggested and implemented a method to remotely monitor a group of distribution transformers. This method was accomplished by design an interface circuits and software program. System is designed based on pic microcontroller which acts as a data acquisition and transmission system.

Ravishankar Tularam Zanzad et al.[13] This paper presents design and implementation of a system to monitor and record operations of a distribution transformer like over voltage, over current, temperature ,rise or fall of oil level. This system is implemented at the distribution transformer site and measuring above parameters it will help to optimize transformers and identify problems before it failures. Kathe Mohan et al.[14] This paper discuss about to develop low cost solution for monitoring health conditions for remotely located transformer using GSM technology to prevent failures of transformer and improving reliability of transformer. We need not have to check all transformer and phase current and voltage and also recover system in less time. The time for receive MSG vary due to public GSM network traffic, still it is more effective than manual monitoring. Sachin Kumar B S et al.[15] have discuss about it proposes a compact design and development of remote monitoring system for a three phase transformer. Arduino microcontroller and zigbee based wireless device are used for monitoring the operating point of three phase transformer remotely. The arduino microcontroller helps in monitoring the three phase current, voltage, temperature, and power of the transformer. The processed parameters are displayed on LCD which makes the system user friendly. All sensors required to monitor three phase parameters by single microcontroller, which makes the system compact.

Table: Analysis Of The Health Condition Monitoring Of Distribution Transformer

Ref. No	OBJECTIVE	AUTHORS	YEAR	MAJOR CONTRIBUTIONS
1	GSM-Based Distribution	Abdul-Rahman Al-Ali,	2004	Discussion On send abnormal

	Transformer Monitoring System	Abdul Khaliq and Muhammad Arshad		operating Parameters information to a mobile device using GSM.
2	Evaluation of various transformation to extract characteristic parameters from vibration signal monitoring of power transformer	Buyung sofiarto munir, Johan J, Smit	2011	Discussion about there are two evaluation methods like FFT and HHT.
3	The remote monitoring system of transformer fault based on the INTERNET OF THINGS	Xiao-huiCheng,Yang Wang	2011	Discussion about here uses a single bus multipoint tem. measurement method &combine data processing & GSM network.
4	Neural Network Ensembl	Drasko Furundzic,	2012	Discussion about the

	e For Power Transformers Fault Detection	Zeljko Djurovic,VladimirCelebic, Iva Salom		technique to identify causal relation of dissolved gases in transformer OIL.
5	Multiprocessor Based Architecture For On line Condition Monitoring Of transformers	SurajPardeshi, RamakantMahajan, Uma Pasumarthi, RohitArora	2012	Discussion on the product developed, which is combination of online monitoring & control of transformer.
6	Oil Based Transformer Health Monitoring System	D.S.Suresh, Pratibha T, Kouser Taj	2012	Discussion about condition monitoring of transformer OIL by using PLC, SCADA and sensors.
7	The Load Monitoring and Protection On	MallikarjunSarsamba, PrashantSangulagi,	2013	Discussion about to monitoring of loads and

	Electricity Power Lines using GSM Network	Dr.raju Yanam shetty		power lines based on GSM Technology.		Condition Of Transformers Incipient Fault Diagnosis Based On GSM & XBEE	ha V Shetty, PoonamShamilli, M Thanuja		GSM, & XBEE Technology & to monitor condition of transformer.
8	GSM Based Condition monitoring Of Transformer	Monika Agarwal, Akshay Pandya	2014	Discussion about to design & implementation of a mobile embedded system to monitor operations of transformer like over voltage, current, temp, fall of oil level.	11	GSM Based Distribution Transformer Monitoring And Controlling System	Pathak A.K, Kolhe A.N, Gagare J.T, Khemnar S.M	2016	Uses AT89C52 microcontroller, & to protect distribution transformer from overheating and overloading.
9	A Review Of Transformer Protection by Using PLC System	Satya Kumar Behra, Ravi Masand, Dr.S.P. Shukla	2014	Reviewed on the PLC system & discussion about diagnose condition of transformers like load current, temp & voltage.	12	Design And implementation of Low Cost SMS Based Monitoring System Of Distribution Transformers	Mohamed Ahmed Eltayeb Ahmed ElmustafaHayati, Sherief F.babiker	2016	Uses PIC18f4550 & acquire the electrical signals from transformers like voltage,current,power& temp.
10	A New Approach to Monitor	Vishwananth R, Akshat	2015	Uses pic 16f877A microcontroller,	13	ZIGBEE Wireless Transformer Monitoring protection And	RavishankarTularamzanzad, Nikita Umare, GajananPatle	2016	Uses SCADA system & to monitor over voltage,current,te

	control System			mp.,fall of oil level.
14	Transformer Health Condition Monitoring Using GSM technology	U.V.Patil, Kathe Mohan, Harkal Saurabh, WarhadeNilesh	2016	Uses PIC18F4520 & GSM technology to prevent failure of transformer & improve reliability.
15	Simulation And Analysis Of Compact Remote monitoring System	Sachin kumar B S, Dr.NageshPrabhu	2016	Uses Arduino &Zigbee technology. An alerts, if load current is greater than full load capacity of transformer.

III.   PROPOSED SYSTEM

Normally the transformer failures occur due to the over voltage fluctuations and over current fluctuations, overheating and spark etc. So that purpose we can develop these system to reduce the faults respectively. The parameters of the generator like voltage fluctuations, current fluctuations,   Temperature, oil chamber moisture, spark, Gas are monitored remotely through GSM network. The sensors sense the change in current levels, voltage levels , temperature, Oil level and send the signal to the microcontroller. This analog values are taken from the sensors to an arduino kit, through an ADC. The arduino sends the signal to a GSM modem and display on LCD respectively. At the same time values of temperature, current, voltage, Tem, Oil level of the transformer are displayed on the LCD. Arduino checks the

levels of Oil level, current ,voltage, temperature,status of the transformer. Alert pin of the arduino is activated, if load current is more as compared with transformer capacity, at that time buzzer will generate beep sound.
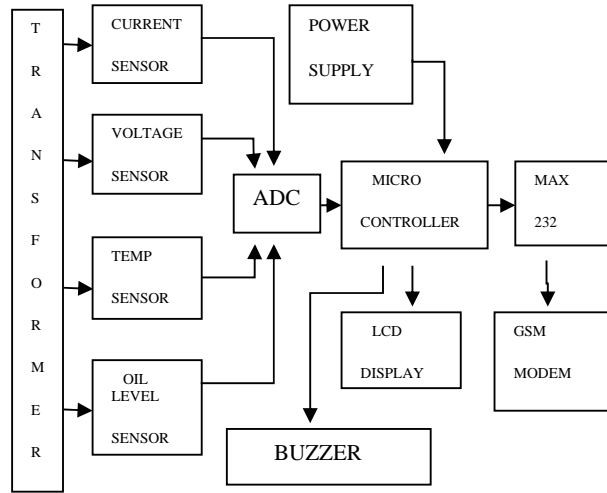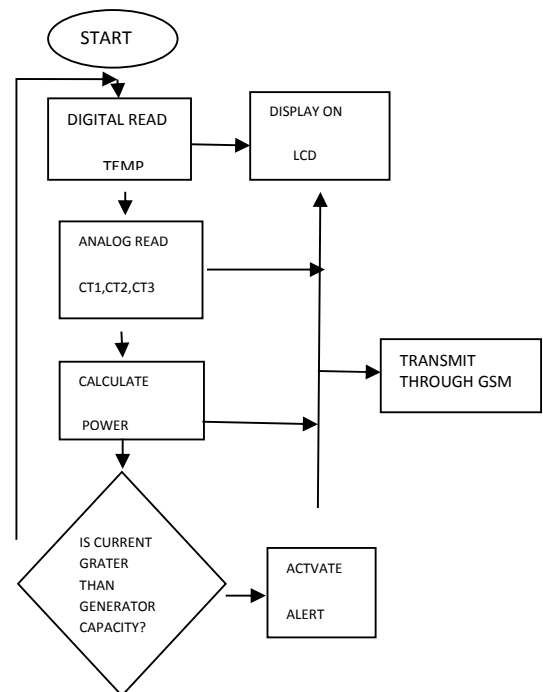

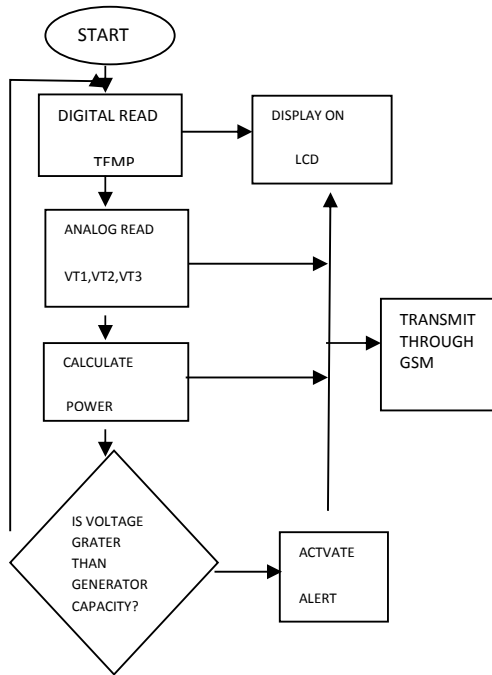Fig: Basic architecture of health condition Monitoring Of Distribution transformer

PROTOTYPE MODEL DEVELOPMENT (FLOWCHART)

(**a**) Fig:- Flowchart for measure current in the transformer system device.

(b)Fig:- Flowchart for measure voltage in transformer system device

IV. CONCLUSION

The GSM based monitoring of transformer health is quite useful as compared to manual monitoring and also it is reliable as it is not possible to monitor always the oil level, oil temperature rise, ambient temperature rise, load voltage, load current manually. After receiving of message of any abnormality we can take action immediately to prevent any catastrophic failures of transformer. The system is develop for a maximum load of 1.5Am. If load current increased above 1.3Am by using different loads the system will trip and for lower values of current the system works normally, this information conveyed to operator and if any problem arises during this monitoring process then sending SMS through the GSM network.

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