WIRELESS EXPOUNDING OF VOLTAGE,CURRENT,TEMPERATURE,GAS IN TRANSFORMER

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Abstract— **High voltage power transformer is extensively operated in the generation of electrical energy in either voltage stepping up or stepping down condition. The additional attachments namely breather, cooling fan, bushing, differential relay, Buchholz relay are synchronized with the transformer operation. It is essential to estimate the troubles occurring in it and to expound them as soon as desirable, so the high cost transformer does not get destructed and also helps in maximum use of it. Here it targets how to decrease and determine them in effective way. In this paper a tryout has been made of detailed use of system and wireless automated transmission system for guarding and ideal use of High voltage transformer. Programmable logic controllers (PLC) can be serviced for supervision & wireless transmission of transformer. The important logic is cost constraint and smarter use. Programming the PLC helps in achieving the various functions and controls. PLC can be used for complete wireless power plant control including superintending and auto-operation that includes cooling fan, transformer oil leakage and oil level control, automatic ON/OFF of pump, restoring of Buchholz relay by pressure sensor control, ON/OFF of secondary systems, and protection etc. Tasks other than supervision like continuous analyzing, data report, instrumentation and stability can also be achieved. For inaccessible working, transmission with PLC can be implemented. For uninterrupted monitoring purpose, a PC can be linked with PLC and connected data can be monitored regularly.**

Keywords—PLC,SCADA,ZIGBEE.

I. INTRODUCTION

To solicit a precocious version of the extant system adopting the pertinence of computer and neoteric mechanization system for ageis and peerless use of high efficiency AC machine .It reduces human effort and improve accuracy It is mainly used in industrial monitoring stations, Substations, supervisory and control applications, corporate and government power generation plants.

The monitoring and control of the transformer is done using ARM7 processor .The sensors which check level of gas, aging oil, overload and maintain temperature carried out by regular observation uses wireless communication that is by means of RF transmission[2]. The inverse over current relay types are associated with operation time which is inversely proportional (in certain degrees) to the over current ratio[1]. A low cost portable ,reliable, fast screening technology propone the usage of gas and optical sensing technology for the testing of transformer oil [3].

The process control and protection of Power transformer is fully automatic. This process proposes the use of PLC for automatic control where it avoids the manual operation. It reduces the human effort and also reduces the usage of wires using ZigBee. Reduction in the wastage of power in the protection system is the main advantage. Fast observation and protection under any internal fault condition. A single PC is used to operate all the conditions. Therefore this method has reduced maintenance, operating and protecting cost for transformer. It can do excellent use of the transformer and other related device. Augment the life of the transformer. Amelioration in the performance and Safe operation of the transformer.

This paper is proposed to use wireless communication but this may cause signal interference so further studies need to be conducted to avoid this issue. In the future more parameters should be controlled. For the control of distant devices a system referred as SCADA (supervisory control and data acquisition) is operating with coded signals over communication channels .

II. SYSTEM LAYOUT

The proposed block diagram shown in fig 1 shows the entire system layout.The main transformer is the high voltage transformer that has to be protected. There are four parameters present ie voltage, current, gas & temperature for the monitoring purpose in the system. The CT (current transformer) is used to calibrate the current value coming from the supply and send it to the PLC. The PT (potential transformer) is used to calibrate the voltage value coming from the supply and send to the PLC. During fault condition in voltage and current the signal from the PLC is sent to the relay and the main transformer is disconnected. Gas sensor is provided to detect the gas produced in the main transformer. Generation of gas inside the transformer is a big issue which is developed due to atomization of oil, corona, overheating, arcing in the transformer, etc; all this transformation of instruction will be constantly monitored by the gas sensor and

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signal sent to the PLC and exhaust fan will be switched on. The part of the scheme complication clear away the heat In larger transformers. If under any prospects temperature increases above the particular level which consequently will alert the transformer performance. The temperature sensor gives the data to the PLC and the suitable operation is carried out according to the requirement such as cooling fan, sprayer & oil pump. In fig 2 ZigBee technology is used to make the communication between PLC & PC wireless and compact.

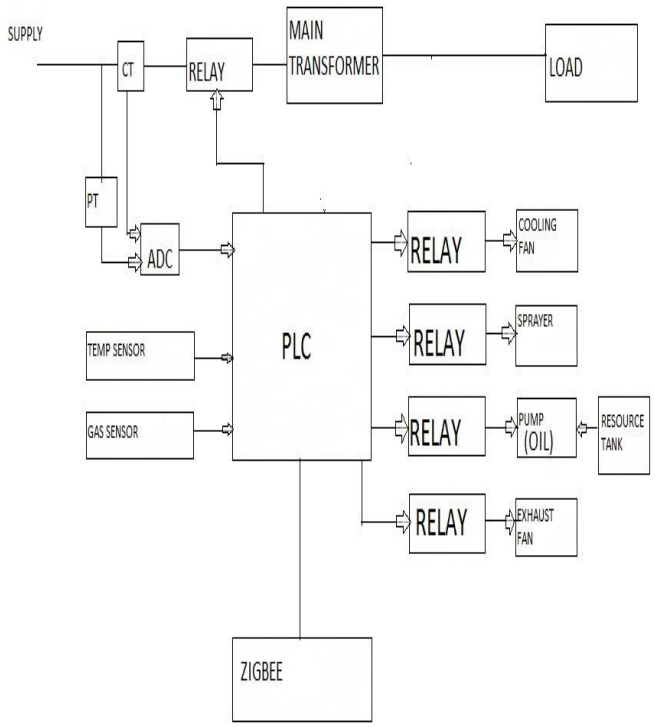

Fig. 1. Proposed block diagram of system

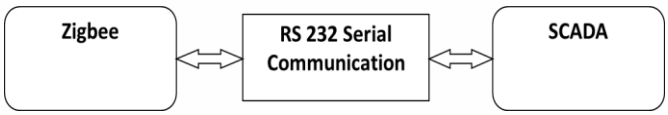

Fig. 2. Block diagram of receiving area

LM35 can measure temperature more accurately than a using a thermistor.The sensor circuitry is impenetrable and not subject to rust, etc.The LM35 generates output voltage.

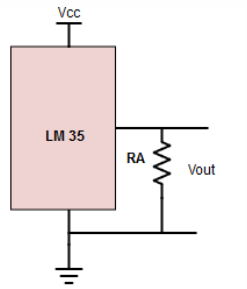

Fig. 3. Wired LM 35

III. SIMULATION

A. Ladder Diagram

Ladder logic is the important design mechanism used for PLC's. Ladder logic has been formed to mimic relay logic. The arrangement to use the relay logic outline is a vital one. By nominating ladder logic as the important design mechanism, the extent of practice desired for engineers and trades people was greatly economised.

Ladder diagram is an automated manipulation diagram language that orginated during World War II. At first, it just has basic segments, such as A junction (normally open), B junction (normally close), output coil, timer, counter and etc. (The power panel is made up of these basic components) .It has more functions, differential contact, latched coil and the application commands, addition, subtraction, multiplication and division computation, that traditional power panel can't make since PLC is developed. The operation of the traditional Ladder Diagram and the PLC Ladder Diagram are identical to each other; the only unlikeness is that the symbols for the traditional ladder diagram are expressed in the format that are close to its primary substance, while those for the PLC ladder diagram employ the symbols that are more explicit when being used in computers or data sheets. In the Ladder Diagram Logics, it could be divided into the Combination Logics and the Sequential Logics, and is described in figure4.

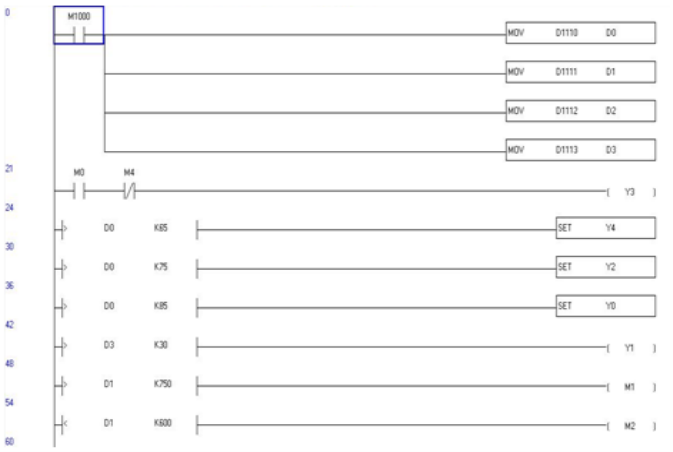

Fig. 4. Screenshots of the ladder logic simulation of this working model

The following example is the combination logics that show in figure 5 and 6 are traditional diagram and PLC ladder

diagram. Figure 7 shows the Simulation for temperature fault condition above 65 EU.

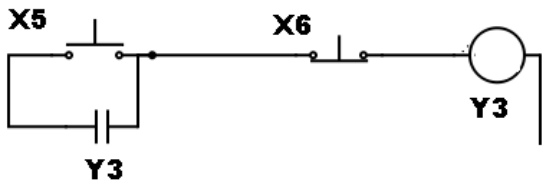

Fig. 5. Traditional Ladder Diagram

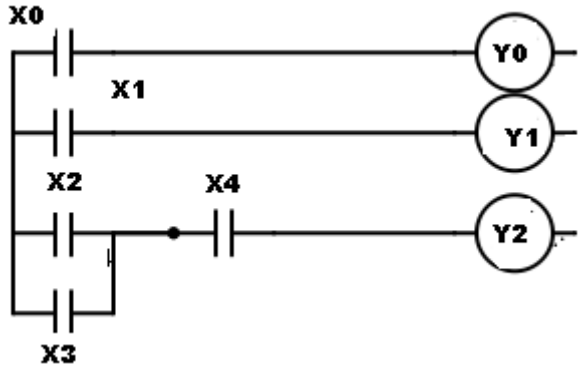

Fig. 6. PLC Ladder diagram

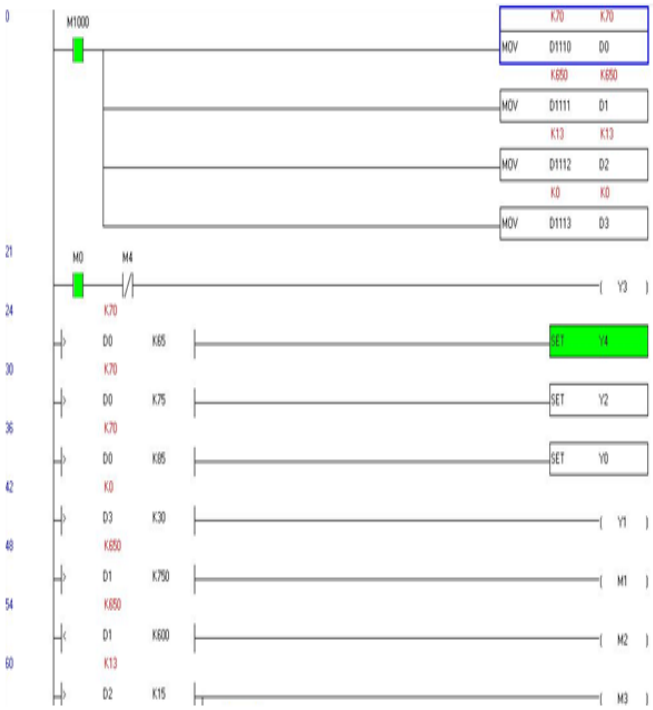

Fig. 7. Simulation For Temperature Fault Condition Above 65 EU

B. *SCADA OUTPUT*

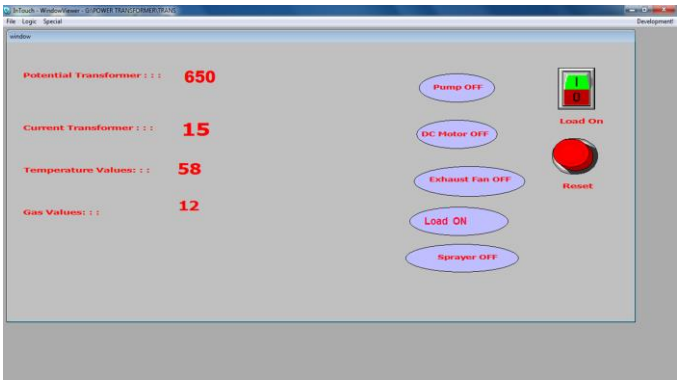

Fig. 8. Scada output normal condition

In fig 8 we show the screenshot of the SCADA output of the model . The readings of PT , CT , temperature sensor and gas sensor are shown There is a switch provided on the screen to turn ON and OFF the model . There is a Reset button provided to redo the operation . The different indications such as working of Pump , fans , sprayer etc are shown and they work automatically as per the logic . Thus we use this for monitoring as well as controlling purpose

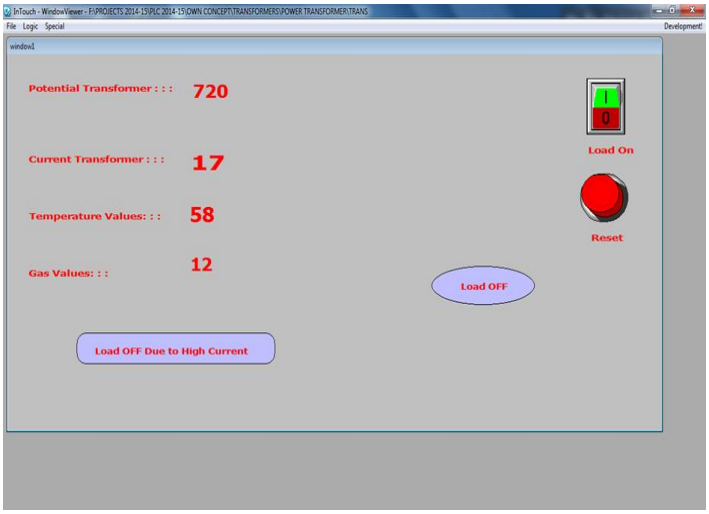

Fig. 9. High Current

In fig 9 the output screenshot is shown for high current in the supply. Thus the supply to the transformer is disconnected . Hence the condition " Load Off due to high current" is indicated. Similarly for high current, the supply to the transformer is disconnected. Hence the condition "Load Off due to lower voltage" is indicated

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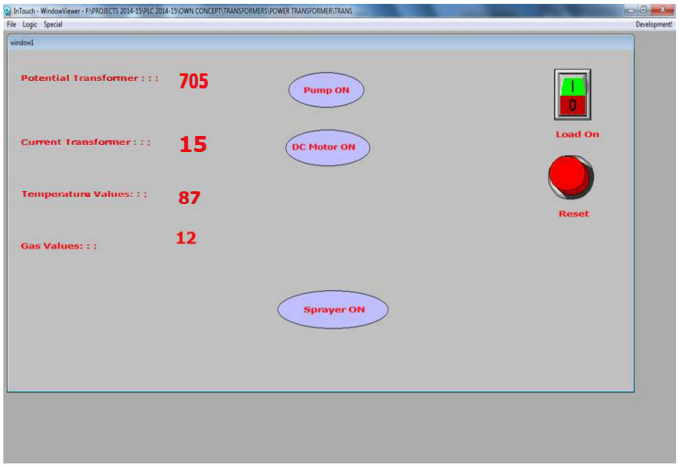

Fig. 10. Temperature Stage

In fig 10 the temperature is 92 EU . Thus as per the condition provided in the ladder logic the cooling fan,sprayer and oil pump is ON. The fault condition due to the presence of gas value is 35 EU. Thus exhaust fan is ON

IV. HARDWARE IMPLEMENTATION

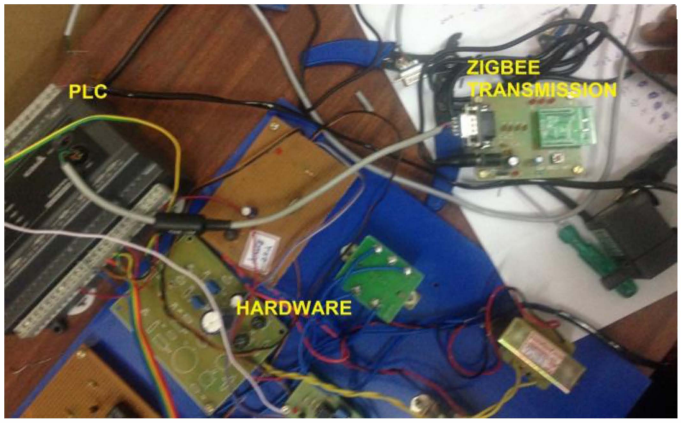

Fig. 11. PLC connected to the hardware

The fig 11 is the circuit diagram that explains the operation of different relays. The different features ie DC motor ,sprayer , pump , exhaust fan and disconnection of supply are provided . The fault condition is detected and the data provided in PLC is compared and the signal is provided to the required condition. The fig 12 shows the monitoring and controlling using pc, the data processed from zigbee receiver.

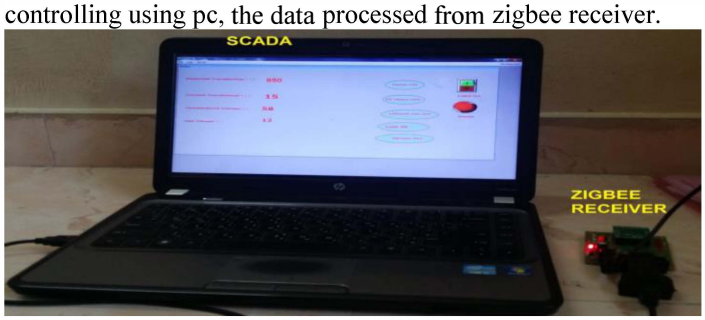

Fig. 12. Monitoring and Controlling using PC

The readings of PT , CT , temperature sensor and gas sensor are shown in Table I. There is a switch provided on the screen to turn ON and OFF the model . There is a Reset button provided to redo the operation . The different indications such as working of Pump , fans , sprayer etc are shown and they work automatically as per the logic . It is used monitoring as well as for controlling purpose .

TABLE I. ENGINEERING UNITS

Controlled Parameters	Voltage (Volts)	EU - Ladder Value	OUTPUT	Effect of Devices
Temperature (Celsius) 40	0.401234568	65	Y4	Cooling fan ON
46	0.462962963	75	Y4,Y2	Cooling fan and Sprayer ON
52	0.524691358	85	Y4, Y2, Y0	Cooling fan , Sprayer and Oil pump ON
Gas(PPM) 130	0.185185185	30	Y1	Exhaust Fan ON
PT	4.62962963	750	M1	Disconnect the supply
	3.703703704	600	M2	Disconnect the supply
CT	0.092592593	15	M3	Disconnect the supply

V. CONCULSION

Thus this system gives counter step from the misconduct appearing in transformer and it swamped the impediment of antecedent functioning methods. Here usage of CT and PT are done . So the monitoring of current and voltage values is done and accordingly supply is disconnected from the load . Thus the transformer is disconnected .We demonstrate the automatic operation of various features depending on the values provided by the temperature sensor. Working of exhaust fan, cooling fan and sprayer takes place using PLC and computer. Also the presence of gas in the transformer is detected by the gas sensor and the working of the exhaust fan takes place .We can program the PLC using ladder logic as required and monitor using SCADA. The ZigBee technology helps in update of transmission which increases the promotion in steps in this process.So, usage of DELTA DVEX2 PLC is highly beneficial in reducing human effort. This system can also be used to handle several number of transformers in the industry.

REFERENCES

[1] Mudhafar A. Al-Nema, Sinan M. Bashi, And Abdulhadi A. Ubaid," Microprocessor-Based Overcurrent Relays", Ieee Transactions On Industrial Electronics, Vol. Ie-33, No. 1, February 1986

[2] S.Dharanya,M.Priyanka,R.Rubini and A.Umamakeswari "Realtime Monitoring and Controlling of Transformers".Journal of Artificial Intelligence,ISSN 1994-5450,2012.

[3] Yusuf Amrulloh, Udantha Abeyratne, Chandima Ekanayake,

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"Gas and Optical Sensing Technology for the Field Assessment of Transformer Oil" International Journal of Emerging Electric Power Systems Volume 11, Issue 4 2010

[4] D. L. Ayers, D. White, T. Wright" Development of a Low Noise FOA Transformer Cooler Part I: Fan and Heat Exchanger Design" R. C. Settembrini, Member, IEEE

[5] Cao, J., S. Qian, H. Hu and S. Yang, 2008. Wireless monitoring and analysing system of dissolved gases in the transformer oil. Proceedings of the 7th World Congress on Intelligent Control and Automation, June 25-27, 2008, China, pp: 5152-5157.

[6] E. Howells, M. Zahn, S. R. Lindgren" Static Electrification Effects In Transformer Oil Circulating Pumps" Ieee Transactions On Power Delivery, Vol. 5, No, 2, April 1990

[7] Girish R. Kamath" An Electrical Circuit based 3-D Steady State Thermal model of a Fan Cooled 60 Hz, 20 kW 3-Phase PlasmaCutting Power Supply Transformer" 0197-2618/07/$25.00 © 2007 IEEE

[8] Kouzou, A., M.O. Mahmoudi and M.S. Boucherit, 2010. Apparent power ratio of the shunt active power filter under balanced power system voltages. Asian J. Applied Sci., 3: 363-382.

[9] Krishna Prasad Bhat, Kwang W. Oh, Douglas C. Hopkins" A MEMS Sensor for Gas Detection in High Voltage Oil Filled Equipment" D.Hopkins@IEEE.Org

[10] Maik Koch1*, Stefan Tenbohlen2, Michael Rösner3" Mositure Ingress in Free Breathing Transformers" Beijing, China, April 21-24, 2008

[11] Sun, J., S. Hu, C. Hou and Y. Wang, 2011. Monitoring and control system of transformer temperature rising test. Proceedings of the International Conference Electrical and Control Engineering, September 16-18, 2011, Yichang , China, pp: 2365-2367.

[12] Zhao, W.B., G.J. Zhang, Y. Sun, Z. Yan and D.K. Xu, 2004. Online multisensor monitoring system for insulation condition of oil immersed power transformer. Proceedings of the IEEE International symposium on Electrical Insulation, September 19-22, 2004, Indianapolis, USA., pp: 89-92.

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