POWER TRANSFORMER COOLING SYSTEM AND PROTECTION CONTROL USING PLC LOGIC

Mr.Rajesh Kumar.K[1], Arun.D[2], Vignesh.V[3], Yazhini.A[4],Infant Raj.A[5]
[1]Assistant Professor, Dept. of EEE, krk.ssec@gmail.com[2] UG Student, Dept. of EEE, arun06960@gmail.com
[3]UG Student, Dept. of EEE, leninvicky98@gmail.com[4]UG Student, Dept. of EEE, yazhinidigital1@gmail.com
[5]UG Student, Dept. of EEE, infant9899@gmail.com
SreeSakthi Engineering College, Coimbatore, India.

Abstract---*Our project deals with the Power transformer (shortly called G.T) located between Generator and Grid through suitable switch-gears. Here temperature of oil and winding plays the major role and has to be controlled within the limit of PLC may be introduced in the place of present control logic - to start cooling fans (Forced Air Cooling), Oil pumps (Forced Oil Cooling), to monitor oil level, Oil Flow, Buchholz relay – thereby initiating Alarm and Trip signals for related operation and maintenance convenience.*

Keywords: PLC, temperature, Power transformer, Buchholz relay ,GT

I. INTRODUCTION

Transformer performs a critical function in transmission and distribution system. The transformer being the most important part of electrical electricity transmission has to be included from damage. A sure quantity of energy loss could be happened by using the transformer in particular that that's converted to warmth, because it is not perfect. Copper loss or I^2R loss is the critical source in warmness era. It is vital to govern the temperature inside permissible restriction by reducing thermal degradation of its insulation gadget to make certain the lengthy life of transformer. The dissipation price of heat of transformer is increased by way of the use of outside transformer cooling gadget in electric power transformer. The temperature of the unit determines the scores of the transformer because it coordinates with the operating cooling device. The cooling gadget has the function to increase the transformer ability in order that the transformer ought to deliver load without accomplishing the hotspot temperature. The proposed model focuses on the usage of a logic controller that's the main feature of the cooling system. The problem of manual transformer cooling control has been removed by using PLC based cooling system for automatically switching between the radiator banks. The cooling system comprised of two radiator banks with fans and pump. The traditional mode of controlling transformer cooling system cannot meet the ever-increasing new demand. Faults can be detected in transformer operation by on-line monitoring through internet. The fault probability can be reduced and the damaged instrument can be replaced or repaired with minimum cost. The ladder diagram used for controlling the cooling machine of transformer the use of PLC is dependable, price-effective and automated Generating Transformer quickly called G.T is a Power Transformer with a potential of 250 MVA. It plays a chief role in any of the Power Stations to step up the generating voltage to grid presented stage of both 230 KV or 400 KV.

In Thermal Power Stations, apart from Boilers, Turbine and their accessories, next major equipment is Generator and Generator Transformer. Of course, this latter equipment are the key machineries to pump out power to Grid. Generators terminal voltages, now-a-days, are of the order of 10KV to 25KV. The generators are of 15.75 KV and the capacity is 210 MW. The G.T is used in between the Alternator and Grid- through necessary switch-gear elements like Circuit Breaker and Isolators. When the transformer is not working properly, the transmission will be affected and hence revenue loss will occur for the power station.

II.PROPOSED METHODOLOGY

A. Block Diagram

The figure 1 shows the cooling and protection system. It is done by the help of PLC, the major components in this diagram is PLC, Buchholz relay, centrifugal pump,Mulsifyre. The output of the PLC is connected to the Unit Control Board (UCB). If the temperature exceeds the limit the contact of the mercury switch is getting closed the fan series will be ON condition. In case if additional cooling is required the oil pump series will be ON.

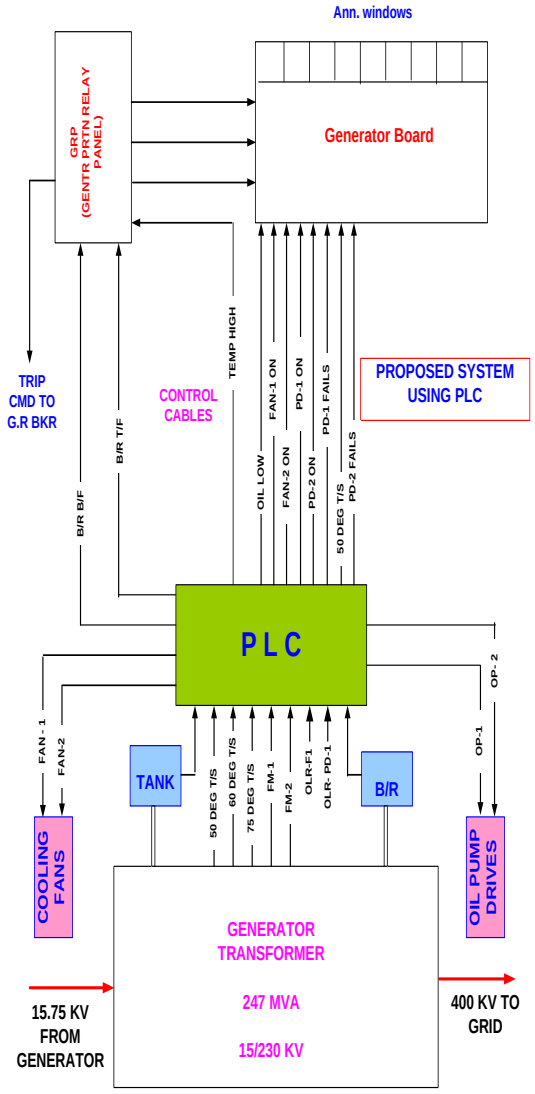

Figure 1. Block diagram

B. PLC

A PLC (i.e. Programmable Logic Controller) is a tool that was invented to update the vital sequential relay circuits for machine manage. The PLC works via searching at its inputs and depending upon their us of a, turning on/off its outputs. The patron enters software usually thru software that offers preferred outcomes. It can be correctly predicted that with a firm statistics of these instructions you likely can remedy greater than 80% Of the application in lifestyles of route we are able to analyse those commands to help you resolve nearly all our functionality PLC programs.

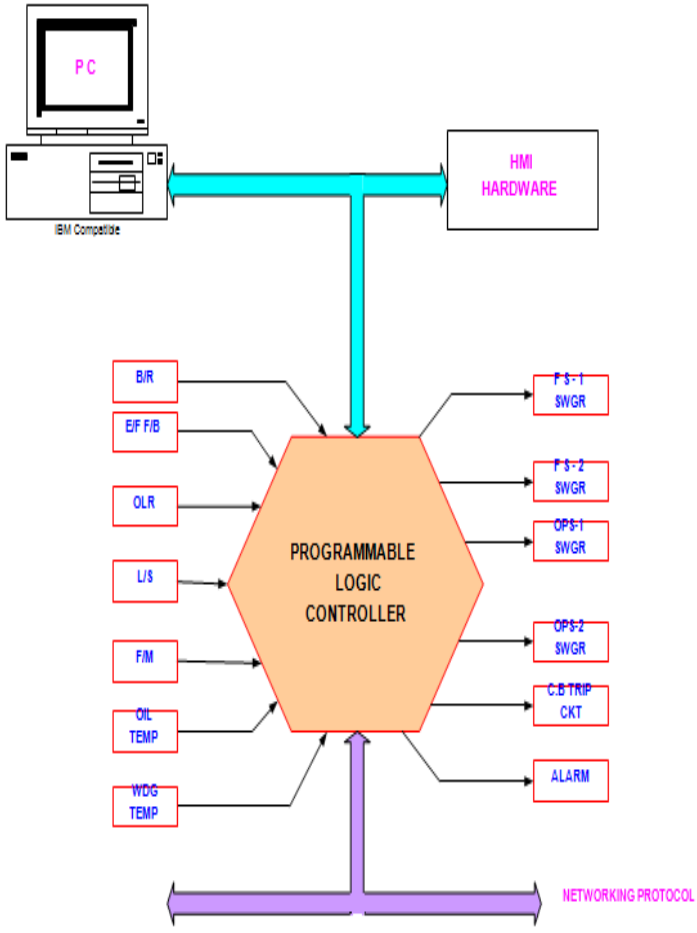

Figure 2.PLC Scheme

C. Buchholz Relay

Buchholz (gas operated relay) is a mechanical fault detector for electric faults used in oil immersed transformers. The Buchholz relay is a fast and

touchy fault detector. It works impartial of the number of transformer windings, tap changer function and device transformers. It is positioned within the piping among the oil conservator and the transformer fundamental tank. The conservator pipeline should be willing barely for reliable operation.

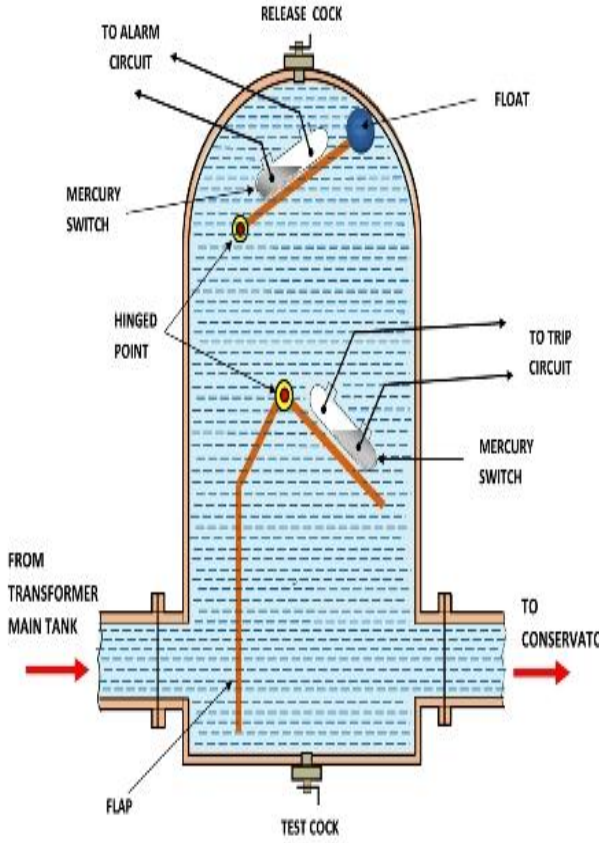

Figure 3.Buchholz Relay

D. Mulsifyre System

Mulsifyre framework is there in the cooling arrangement of Generator Transformers. This will monitor the outside temperature of the transformer. Right now sensors of extraordinary kind with delicate glass called sprinklers, are fixed in aircraft which encompasses over the transformer and cooling blades. Another layer of water line with spout plan runs over the highest point of GT and balances.

Figure4.Mulsifyre System

At whatever point the outer temperature arrives at 63.4˚F, the sensor will break. Causing pressure drop in aircraft distinguished by a weight switch (Deluge valve) in the carrier. This start order to begin the Mulsifyre Pump-by a similar time Deluge valve likewise opened providing tremendous measure of water to move through spouts to cool and safe-watch GT from outside fire assuming any. The schematic sketch of GT cooling framework is demonstrated as follows. Right now line shows the carrier wherein fire sprinklers are set and pink line demonstrates the waterline.

Figure5.Deluge Valve

III. LADDER LOGIC DIAGRAM

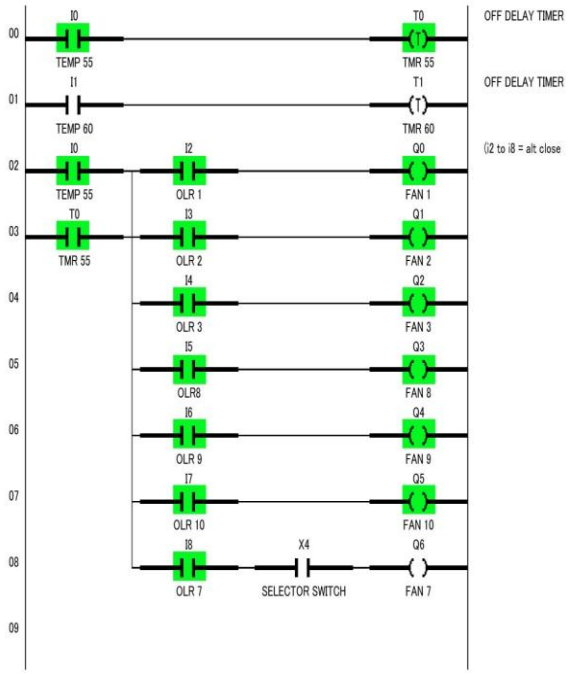

Figure 6.1Ladder logic for fan series 1

The above fig 6.1 shows that ladder logics for fan series 1, in this logic T0 act as an OFF Delay Timer. The fan series 1 consists of 6 fans such as F1, F2, F3, F8, F9 and F10. When the Temperature attains to 55˚C the fan series 1 will operate.

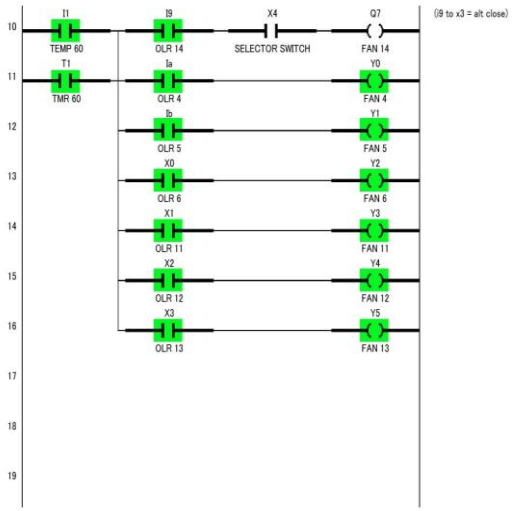

Figure6.2Ladder logic for fan series 2

The above fig 6.2 shows that ladder logic for fan series 2, in this logic T1 act as an OFF Delay Timer. The fan series 2 consists of 6 fans such as F4, F5, F6, F11, F12 and F13. When the Temperature attains to 60˚C the fan series 2 will operate. If additional cooling is required turn ON the reserved fans F7 and F14.

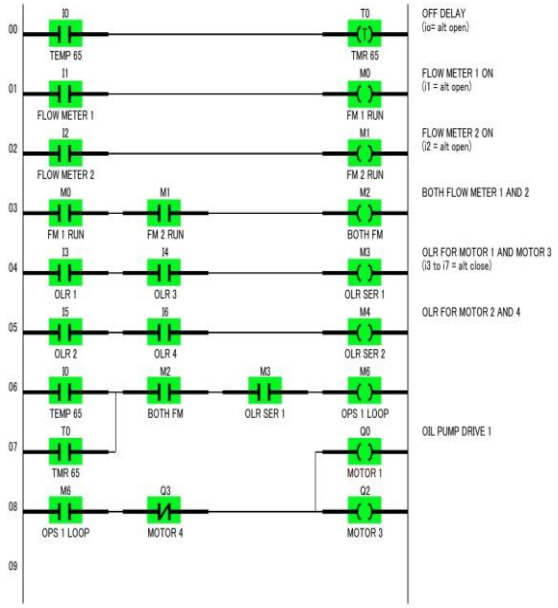

Figure7.1Ladder logic for oil pump drive 1

The above fig 7.1 shows that Ladder logic for oil pump drive 1, in this logic T0 act as an OFF Delay Timer. The oil pump drive 1 consists of 2 pumps such as pump1 and 3. When the Temperature attains to 65˚C the oil pump drive1 will operate.

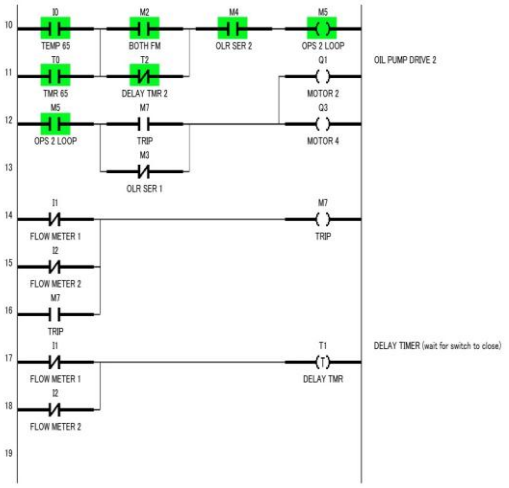

Figure7.2Ladder logic for oil pump drive 2

The above fig7.2 shows the Ladder logic for oil pump drive 2, in this logicthe oil pump drive 2 consists of 2 pumps such as pump2 and 4. When the oil pump drive 1 fails automatically the oil pump drive 2 will operate.

III. RESULT AND DISCUSSION

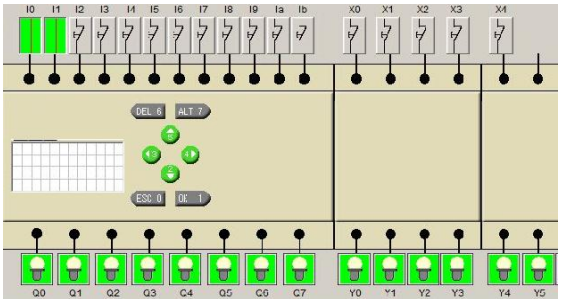

Figure8.Simulation of output of fan series 1 & 2

Normally these mercury switches are set to activate for rise in Oil temperature from ambient to **55˚C, 60˚C, 65˚C, 90˚C and 120˚C.** For 55˚C feedback from mercury switch, the hard-wired logic wired in the way to start six number of 3 phase fans. For 60˚C feedback hard-wired logic will be triggered to start the remaining 6 number of fans, while the series-1 fans were in service already.

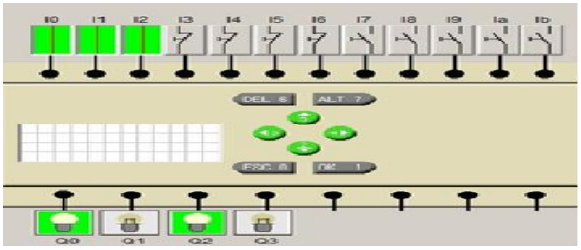

Figure9.Simulation of output of oil pump drive

Likewise, for 65˚C, the circuit should start oil pumps (1&3) to transfer oil at a faster rate. At this condition if any one pump fails to start due to fault, the circuit monitors for preset time, if it does not start, issue command for another pair (2&4) to start. The fault status of the pump is informed through annunciation at UCB (Unit Control Board) for further follow-up

IV. CONCULSION

The goal of our venture is to screen the GT cooling procedure based on PLC. The reasons for monitoring the GT cooling system is temperature of winding and oil performs the primary role and needs to be managed inside restrict. Since the Generator Transformer is Power Transformer, monitoring the temperature of winding and oil may be crucial and most required one. By introducing PLC into motion the procedure turns into extra bendy, dependable and PC pleasant. The manage technology is truly transformed to software right here makes even complicated technique to easy one. Trouble shooting experience will become simpler now in comparison to current generation. With this updated technology, we screen and manipulate even trouble shoot our GT tracking sports proper from UNIT CONTROL BOARD (UCB). The modular PLC may be effortlessly interfaced with different G.T's also from a unmarried grasp PLC there by means of tracking all G.T's through a unmarried MASTER is viable. So we select PLC for the actual time monitoring of GT cooling techniques than the other to be had control technologies. We have complete confidence and pleasure of our assignment, did in an awesome manner and gathered lot of technical records. The performance of the device became discovered pleasant.

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Arun.D Currentlypursuing B.E final year under the stream of Electrical and Electronics at SreeSakthi Engineering College Coimbatore affiliated to Anna University Chennai.

Vignesh.V Currentlypursuing B.E final year under the stream of Electrical and Electronics at SreeSakthi Engineering College Coimbatore affiliated to Anna University Chennai.

Yazhini.A Currentlypursuing B.E final year under the stream of Electrical and Electronics at SreeSakthi Engineering College Coimbatore affiliated to Anna University Chennai.

Infant Raj A Currently pursuing B.E final year under the stream of Electrical and Electronics at SreeSakthi Engineering College Coimbatore affiliated to Anna University Chennai.