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Monitoring and Control of Substation Using Programmable Logic Controller and Scada

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Abstract*: An electrical substation is a power transmitting and distribution system. In electrical network there are always possibilities of faults. Hence the current and voltage to a substation require regular monitoring and control. This project proposes a novel solution to both the above requirements. In this project & SCADA systems will be designed using RS VIEW 32, using which all the parameters of a substation like current, voltage, temperature and now of coolants in transformers etc can be monitored and automatically controlled from a distant location. These are contacted to a PLC at the substation

***Index Terms*: SCADA, PIC Sub-station.**

I. INTRODUCTION

The substation is a to be integrated system for the analog and digital automation of distribution system for customers and user functions .The over -current, earth leakage current and other disturbances will create interruptions due to faults in the system. To trace out the fault location it requires, more time and the fault has to be cleared either manual or automatic operations. To create PLC and numerical relays have to be improved the fault management system. On the off chance that it is acted quicker, the conceivable to record the blame flows at the supply circulations and substations.

A. Action of Programmable logic controller (PLC)

The PLC acts as a micro processed computer and carried out control functions. To monitor the process parameter, operations and controlled, a skilled person is to be employed. A person who knows the operating of the PLC draws the lines and ladder diagram and convert into machine language [7]. PLC can operate any system without devices than can go and off. The electricity is used for the control based on relays which can allow power switched on and off without mechanical switch [6]. To make simple logical control decisions. This has many applications and equipments needed to be embedded devices as interfaces and used in the substation which will control transformer, voltage regulation, auto transfer and reclosing schemes, remote control and diagnostics maintenance.

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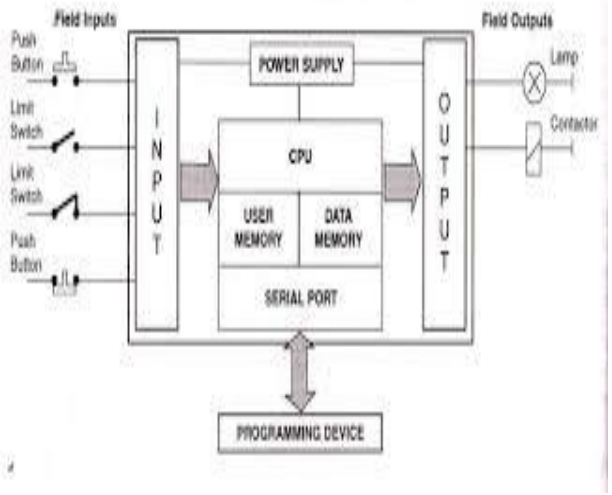

Fig. 1: Internal Block Diagram of PLC

B. Supervisory control and data acquisition (SCADA)

The SCADA is utilized as parameters of account, observing and control with information base. SCADA is having control programming and is application satisfying significant capacity on tab setting, information gathering and so on in SCADA framework, which is activators and investigation of information accumulation. The GSM provides a mobile communication [8] sending all alpha numeric messages to subscribers. SMS will deliver the all notifications and alerts to the subscribers with easer cost communication ability to get the return calls.

C. Basic structure of PLC and SCADA

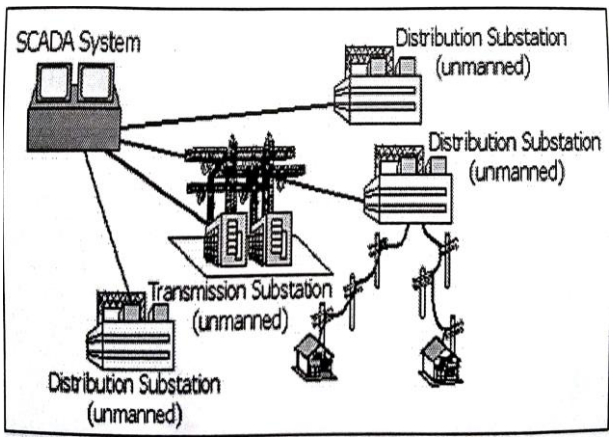

Fig 2 Basic Structure of SCADA system

II. METHODOLOGY AND IMPLEMENTATION

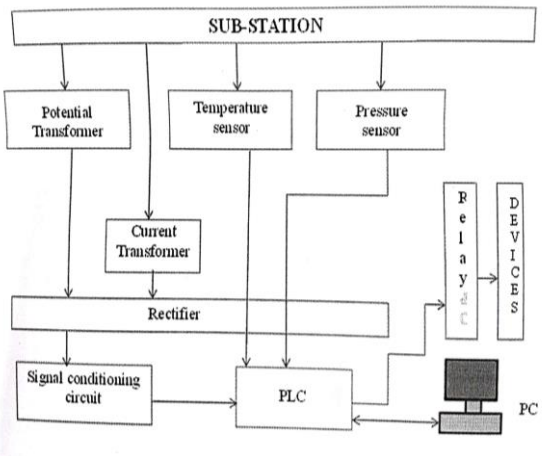

Fig 3 Basic Diagram of Automation of the Sub-Station

A. *Block Diagram Explanation*

Voltage from potential transformer and current from current transformer are given to the signal conditioning circuit where voltage and current signals are rectified and converted into required signal input for PLC Pressure and temperature signal [9] from pressure sensor and temp sensor respectively are directly given to the PLC. The signals are compared in the PLC & a connection from the PLC is given to the relay which switches the circuit us per requirement.PLC is interfaced with a computer where the real time and history data is observed and stored.

III. IMPLEMENTATION

In the circuit diagram the two instrumentation transformer are used in which one is potential transformer (above) and another one is current transformer (below) on the left side of the programmable logic controller (PLC).which are used to step down voltage 230 to 9V and current 3-4A magnitude values of the single phase 5OHz alternating current supply. Followed by the stepped down output of the instrumentation transformer are fed into the "bridge rectifier", where an alternating voltage and current are converting into the pulsating unidirectional direct current and then the pulsating D C is filtered using capacitor (63V, 1000µF for voltage & 25V 1000µF for current) filter which are connected across the bridge rectifier. Here the ripple of the pulsating D C is 80-90% is removed. Followed by the potentiometer are connected across the filter which can be used to vary or adjust the filtered one quantity and then the small value capacitor (104pF) are used across the potentiometer [10] to get smooth and noise free output and then a zener diode are connected in reverse biased mode across the PLC input terminal, which protect the signal conditioning circuit from the reverse current.

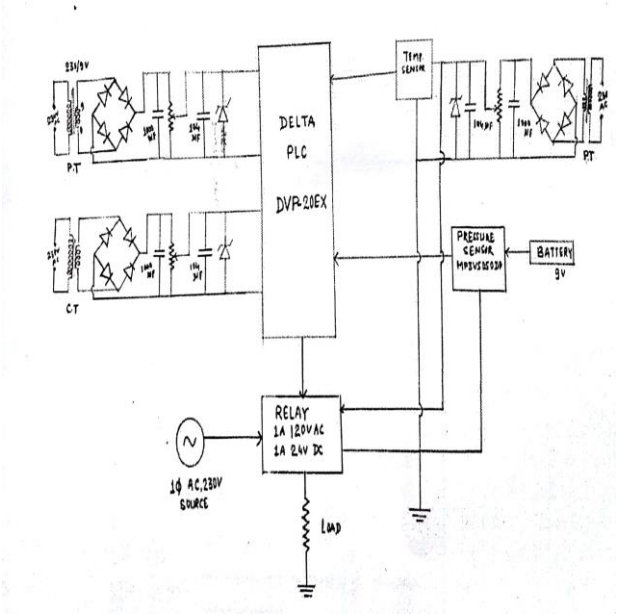

Fig 4 Circuit Diagram of Automation of the Sub-Station

One another rectifier and signal conditioning circuit is used with the same function and circuit clement, as explained above, to provide the working or biasing voltage (power) to temperature sensor (LM35) & relay circuit [11]. The 9V battery are used provide biasing voltage to the pressure sensor (MP3V5050). The all four inputs such as current, voltage, pressure and temperature are fed into the PLC, where PLC compares the real time data of all the inputs with the predefined values[16], which are set in the ladder diagram program and depending upon the programmed conditions the PLC generates the control output which is fed into the relay and relay trips it's coil (either closing or opening it's contact) in order to protect the devices (load, appliances) etc. which has to protect. The field signals are connected to the input module. At the output of input module the field status converted into the voltage level required by the CPU is always available [12]. At the beginning of each cycle the CPU brings in all the field input signals from input module & stores into its internal memory called as process image input. The programmable controller operates cyclically meaning when complete program has been scanned; it starts again at the beginning of the program.

IV. PLC HARDWARE

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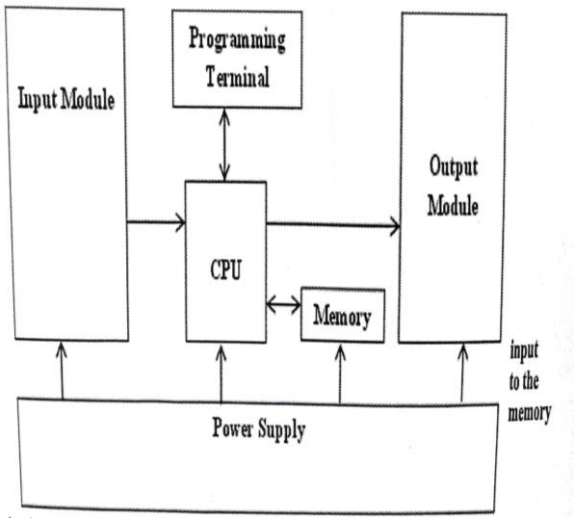


Fig 5 PLC Hardware Block Diagram

A. Working of PLC Block Diagram Explanation

The input modules are connected to the CPU which brings input signals with in to the memory as image of input module [13]. The programme is scanned and begins the program. Input module gets the field signals which convert the voltages as per requirement of CPU. At the starting input signals[15] stored which brings the field signals in to the internal memory. It can be scanned by PLC which acts as cycle.

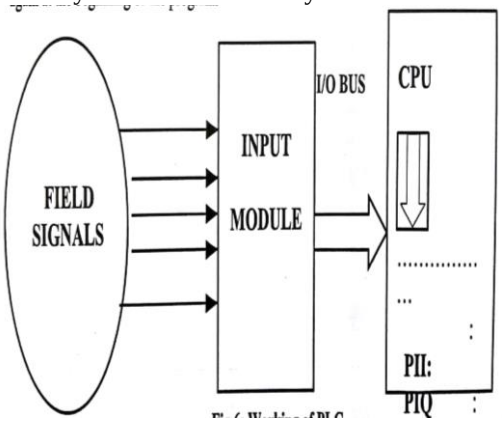


Fig 6 Working of PLC

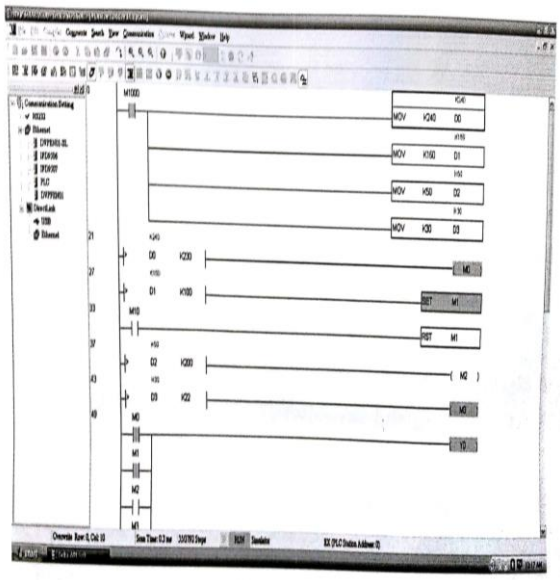
A PLC has got three important steps which can focus on the parts.

Step l - Check input status - First whether the PLC is in the on or off condition which means the senor is connected to input on and recorded for the next step.

Step 2 - Execute Program - PLC does it the program at a time. And then turn on the output. It can be decided based on the first input and stored in the results first input.

Step 3 - Update the output Status - To update PLC output based on the input the results starts from the step 2

V. RESULT & DISCUSSIONS



The controlling and monitoring of parameters like current, voltage, temperature, pressure etc could be done effectively .The process could carried out with low voltage (up to 24 V) with several system benefits, such as uninterrupted power supply, reduced man power, data storing and accuracy and even more and though the PLCs are developed to work out frequently [14] in even harsh environments. This can be operated according to the design and to the requirement of industry environment and can be applied in all functional areas to create and work it s function accurately.

VI. CONCLUSION

The applications of programmable logic controller are used for substation and distribution automation for the years which will responds are all challenges. The consultant is a important factor in PLC and SCADA systems which control system and can manage methodology in getting success of the projects.

REFERENCES

1. M. Y. Cho, member IEEE, "Development of Data Acquisition and Load Control System By Programmable Logic Controller for High Voltage Load consumer'", Department of Electrical Engineering National Kaohsiung Institute of Technology Kaohsiung, Taiwan, China.
2. M. M. Ahmed, W.L.Soo., "Supervisory Control and Data Acquisition System (SCADA) Based Customized Remote Terminal Unit (RTU) for Distribution Automation System ". 2nd IEEE International Conference on Power and Energy (PECon 08), December 1-3. 2008, Johor Baharu, Malaysia
3. Musse Mohamud Ahmed, Member, IEEE, "New Supervisory Control and Data Acquisition (SCADA) Based Fault Isolation System for Low Voltage Distribution Systems", ECE, Kulliyyah of Engineering IIUM. Gombak, Kuala Lumpur, Malaysia.
4. J. G. Gilberl, PE G. R. Delhi, "Application Of Programmable Logic Controllers To Substation Control and Protection", Pennsylvania Power& Light Company, Ahntown, PA.
5. Musse Mohamud Ahmed, Member, 1EEE, ECE, Kulliyyah of Engineering IIUM, Gombak, Kuala Lumpur Malaysia,
6. Jouni K. Pylvänšincnt, Kirsi Nousiainen, "Studies to Utilize Loading Guides and ANN for Oil-Immersed Distribution Transformer Condition Monitoring," TEEE Trans. Power Delivery, vol.22, no.1,Jan 2007.

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7. Leibfried, T, "Online monitors keep transformers in service", Computer Applications in Power, IEEE, Volume II Issue: 3, July 1998.
8. B.Berry, "A Fast Introduction to SCADA Fundamentals and implementation, DSP Telecom", retrieved on July 28,2009,from http://WWW.dpstelecom.com/wp
9. Electricity Company of Ghana (ECG),"'Automation of ECG's Power Delivery Process (SCADA)", retrieved on July 28,2009, http:/www.ecgonline.info/project/current project/ Engineering/project/ SCADA, 2008.
10. R Karthikeyan, GN Sachin Amreiss, PV Based Interleaved Boost Converter for Pumping Applications, Internationall Conference on Intelligent and Advanced System, https://doi.org/10.1109/ICIAS.2018.8540613 , Kuala Lumpur, Malaysia
11. Karthikeyan R, Chenthurpandiyan S, Generalized Space Vector PWM Algorithm for Minimizing THD in Hybrid Multilevel Inverters, International Review of Electrical Engineering, 6(5), 2011, 2094 - 2099.
12. K. Sundararaju, A. Nirmalkumar, February 2012,"Cascaded Control of Multilevel Converter based STATCOM for Power System Compensation of Load Variation", International Journal of Computer Applications,Vol.40,No.5,PP.30-35.
13. Jayakumar V, "Single Phase Fifteen Level Inverter using Seven Switches for Industrial Applications" Journal of Advances in Chemistry, ISSN 2321-807X, Volume 12 Number 21, pp 5355 – 5364, Dec 2016.
14. PL.Somasundaram, V.Jayakumar, "Computation of short run marginal cost in open access transmission system" Journal of chemical and Pharmaceutical Science, ISSN: 0974-2115, Special issue1, pp 275 -279, Feb 2017.
15. V.Jayakumar, GN. Sachin Amreiss "SVPWM Based Three Phase Inverter for Distribution Generation Using Renewable Energy Source" International Journal of Pure and Applied Mathematics, ISSN: 1314-3395, Volume 118 No. 20 2018, 2335-2346.
16. V. Jayakumar, PL. Somasundaram "Grid Connected Single Phase Improved Inverter Using Renewable Energy Source" International Journal of Pure and Applied Mathematics, ISSN: 1314-3395, Volume 118 No. 20 2018, 2183-2197

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