Power Monitoring System Using XC1 PLC

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***Abstract*—** In this project we are going to show, how to switch the power to different types of consumers like domestic, industrial and agricultural fields from various substations as per the schedule from remote place by using SCADA system i.e. without using any man power. We also identify the disconnection or breakage of transmission lines which are caused due to heavy rains, wind or might be any other reason. We can trace the exact location of fault by using PLC and SCADA system.
We also identify voltage drops, tripping conditions at substations, transformers.

Keywords- *Tripping conditions, PLC and SCADA*

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I. INTRODUCTION

As the use of PLCs in substation automation applications increases, and the demand for substation and distribution automation increases, utility engineers are seeking ways to implement applications Because of the reason of quick resident's expansion at the cities and multi-stored buildings, the want of elevators is being improved. By means of the increasing life values and consideration to human and with the technologic advancements[3].With deregulation, utilities are decreasing engineering staff levels. Utility engineers are required to field more projects with fewer resources .

II. PROGRAMMABLE LOGIC CONTROLLERS

PLCs (Programmable Logic Controllers) are the control hubs for a wide variety of automated systems and process. They contain multiple inputs and outputs that use transistors and other circuitry to simulate switches and relays to control equipment. They are programmable via software interfaced via standard computer interfaces and proprietary languages and network options[1].
Available inputs for PLC include DC, AC, analog, thermocouple, RTD, frequency or pulse, transistor and interrupt inputs[2].
Figure i shows the picture of XC1-24R-E type of PLC in which R represents that it is of relay type & 24 give the total number of Input & Output points available with the PLC

Fig i. XC1 PLC Model

CPU Description	Specification
Power Supply	AC POWER (230V)
Programming mode	Instruction, ladder Diagram
Operation speed	0.5µs
Data register(D)	150
Digital I/O	12/12
Analog I/O	None
Timer	80
Counter	48

Outputs for PLCs include DC, AC, relay, analog, frequency or pulse, transistor and triac. Programming options for PLCs include front panel, hand held as well as computer. PLCs can also be specified with a number of computer interface options, network specifications and features, in addition to controlling output functions, PLCs are good for compiling data from many sources and uploading this data into a computer network. PLCs are generally more durable and less expensive, than computer systems and as a result can be placed in remote or rugged industrial locations and perform at a high level for many years.

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III. BLOCK DIAGRAM OF PLC

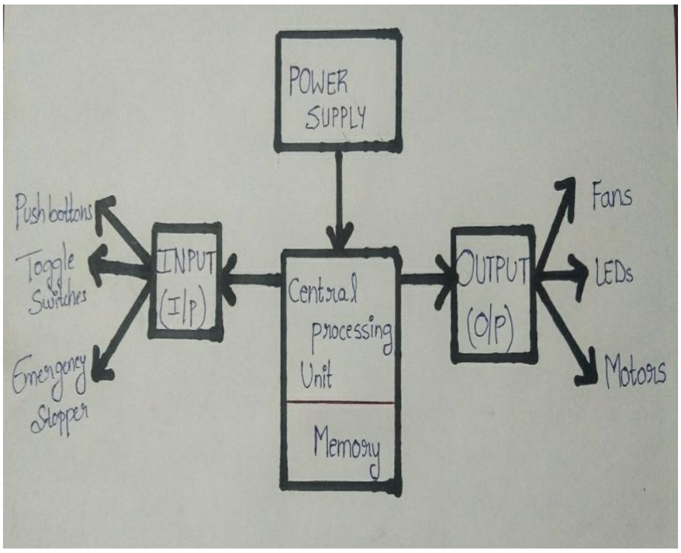

fig. ii. Block diagram of PLC

IV. MODEL WIRING

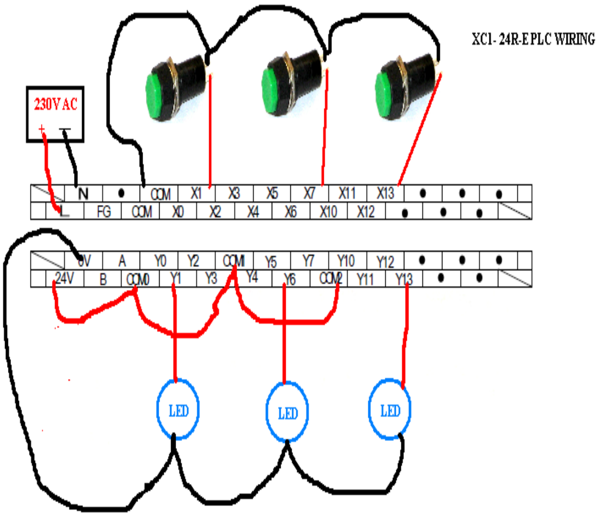

Fig. iii. Model Wiring of XC1 PLC

V. SCADA (SUPERVISORY CONTROL AND DATA ACQUISITION)

Supervisory control and data acquisition (**SCADA**) is a control system architecture that uses computers, networked data communications and graphical user interfaces for high-level process supervisory management, but uses other peripheral devices such as programmable logic controllers and discrete PID controllers to interface to the process plant or machinery[5]. The operator interfaces which enable monitoring and the issuing of process commands, such as controller set point changes, are handled through the SCADA computer system[6]. However, the real-time control logic or controller calculations are performed by networked modules which connect to the field sensors and actuators.

VI. SCAN CYCLE OF PLC

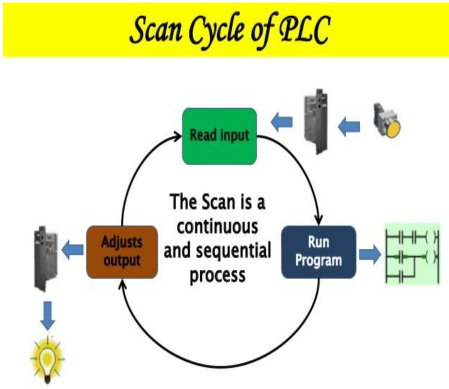

Fig. iv. Scan Cycle of PLC

Because of this practical programming, PLC has many rewards in excess of the embedded system which are as follows: smaller material size than hardwire solutions, more elasticity, also have incorporated analysis and, prevail functions. Analyses are centrally presented and utilization can be straight away acknowledged and duplicated in it whereas, SCADA is used to control and manage the functioning of the power system due to its capability of data acquisition. It, also, generates solutions for the upcoming troubles and fault which may affect in the programming .

VII. SAMPLE PROGRAMMING

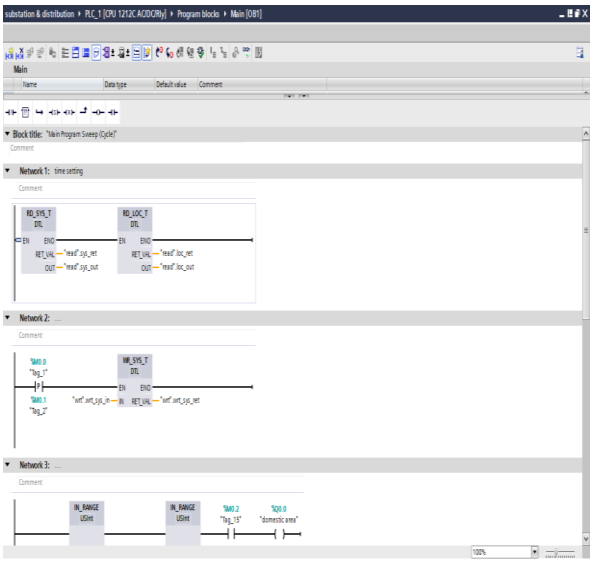

Fig. v.(a) Sample programing

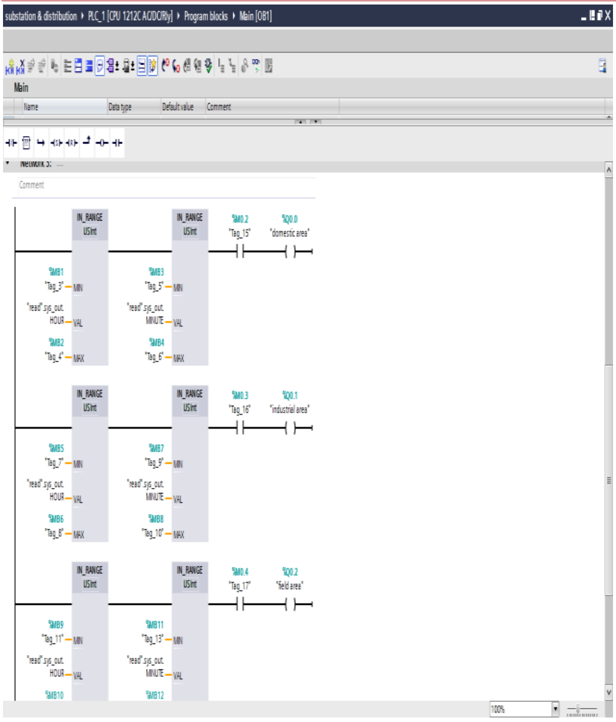

Fig V(b)

Fig vi Pictorial View of Designed Hardware Kit

VIII. INPUT ADDRESSING OF XC1 PLC

S.No	Inputs	Operation
1	X0	Emergency Stop
2	X1	Start Push Button
3	X2	Stop Push Button
4	X3	Domestic Loads Mains Toggle Switch
5	X4	Domestic Load Lane 1 Control Switch
6	X5	Domestic Load Lane 2 Control Switch
7	X6	Domestic Load Lane 3 Control Switch
8	X7	Industrial Load Control Switch
9	X10	Agriculture Load Control Switch
10	X11	Hydel Power Control Switch
11	X12	Thermal Power Control Switch
12	X13	Wind Power Control Switch

IX. BENEFITS OF USING PLC IN SUBSTATION AUTOMATION

- Provides graphical user interface for control monitoring, and device settings.
- Reduces time.
- Improves productivity.
- Produces quality output.
- Increased accuracy and speed[3].

X. APPLICATIONS FOR PLCS IN SUBSTATION AUTOMATION

There are many applications of PLCs in substation automation, distribution automation and SCADA systems.

- ❖ RTU (Remote Terminal Unit) emulation and replacement
- ❖ Protection and control
- ❖ Automatic switching
- ❖ Voltage regulation management
- ❖ Transformer management
- ❖ Automation system diagnostics
- ❖ Maintenance and safety
- ❖ Station HMIs – Graphical User Interface (GUI)
- ❖ Remote control
- ❖ Demand control
- ❖ Synch check and generator synchronization

XI. CONCLUSION

The total process automated, so that the entire process is controlled and automated from substation.

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XIII. BIBILOGRAPHY

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