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PLC AND SCADA BASED DISTRIBUTION AND SUBSTATION AUTOMATION

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Abstract-- *Electricity is the booming wonder in modern society. Without electricity we can't do anything in the world. The generating stations, transmission lines and distribution systems are the main components in power system. So, it requires a knowledge of load flows which is impossible without careful planning, controlling and monitoring .Also, the system needs to operate in such a way that the losses and in turn the cost of production are minimum. Each process will also have a separate data acquiring and controlling mechanism for each individual system that controls the process and also monitoring the multiple parameters in a substation is done using supervisory control and data acquisition (SCADA). This paper provides a good combination of various protocol implementations in creating a PLC based unit and usage of an advanced GUI in process control. This project replaces large control panels that are placed in large rooms. Everything is brought under a single PC (lab-VIEW) making it highly dynamic at the same time cost effective. Monitoring of multiple parameters available in a substation is done using supervisory control and data acquisition. Hence there is no mechanical wears.*

Key words*: *PLC, SCADA, lab-VIEW, GUI.

1. INTRODUCTION

Switchyard is monitor in the substation. In substation many relays and circuit breakers are used. If any problem occurs in the plant, we can identify which part is trip by using SCADA window and troubleshoot the problem through man power[1]. The objective is to transform manual control system to automated control system. The monitoring system can be accomplished with the use of GUI. The used can easily control based on this GUI software environment[2]. The objective is to transform manual control system to automated control system. This control system can be accomplished by using PLC ladder diagram[3]. In electrical distribution system voltage, current and power factor are monitored and controlled if any fault occurs with the help of computer (PC) by using SCADA software [4]. In generating station various function and control can be achieved by programming the PLC. They can be use for full plant automation. Function other then control like continuous monitoring, data recording and protection can also be performed [5]. The main objective this paper is large control panels that are replaced from large rooms and distribution substation is monitored. In these processes there is a dedicated PLC that performs data logging and control operations. Further all the obtained data and the control data are displayed on the PC through Lab-VIEW. The temperature system has a temperature monitoring sensor attached to a PLC and the appropriate controlling relays for maintaining the temperature. Similarly voltage sensing unit and current sensing unit are used to sense the voltage and current respectively.

2. PROPOSED SYSTEM

SCADA based system is employed for proper functioning of individual systems and also for the coordination between them. In these processes there is a dedicated PLC that performs data logging and control operations. Important concept of SCADA based systems is that each system can function independent of each other and hence other systems can be shut of when not in use. The paper provides a good combination of various protocol implementations in creating a PLC based unit and usage of an advanced graphical user interface in process control. This paper replaces large control panels that are placed in large rooms. Everything is brought under a single PC making it highly dynamic at the same time cost effective. Monitoring of multiple parameters available in a substation is done using supervisory control and data acquisition. Further Interlinking gives a very easy way to access data and provide control from a common point. Hence it reduces manpower and time delay.

In control room it monitors the plant and gives command through user. It is Economical and safe operation. If there is any modification and future extension, we can easily update in PLC and SCADA. In substation, many switches are used, if there occurs trip in one switch, we can easily identify the particular area. Automatic monitoring and controlling the power system parameters. In this paper used in virtual instrumentation and Graphical interface unit.

3. IMPLEMENTATION OF SUBSTATION AUTOMATION

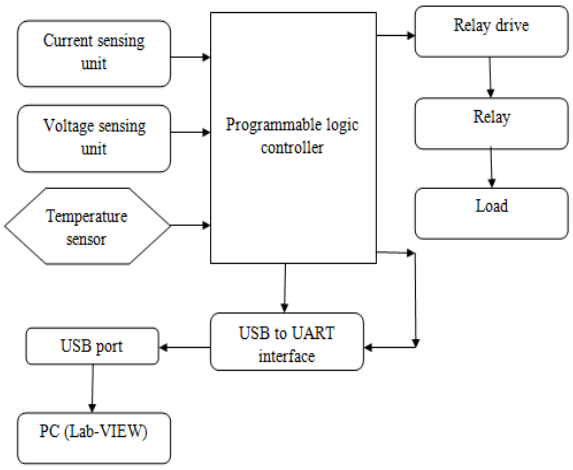

Fig 3: Block diagram

3.1 PLC

Programmable Logic Controller or programmable controller is a digital computer used for automation of typically Industrial electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLCs are used in many industries and machines. PLCs are designed for multiple analogue and digital inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory. The functionality of the PLC has evolved over the years to include sequential relay control, motion control, process control, distributed control systems and networking. The data handling, storage, processing power and communication capabilities of some modern PLCs are approximately equivalent to desktop computers. The main difference from other computers is that PLCs are armored for severe conditions (such as dust, moisture, heat, cold) and have the facility for extensive input/output (I/O) arrangements.

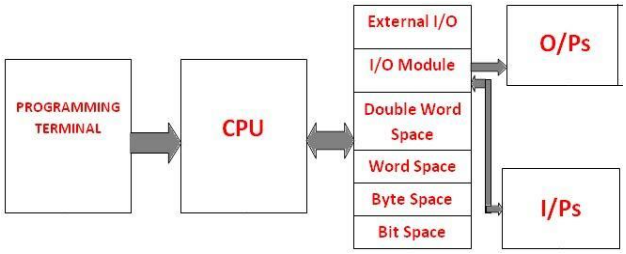

Fig 3.1: PLC

The above figure shows basic block diagram of PLC (Programmable Logic Controller). The CPU of PLC is programmed using a programming terminal usually through personal computers or dedicated HMIs. Basic Modules associated with the CPU are external modules and I/O modules along with bit, byte, word and double word addressable memory locations. A PLC is an example of a hard real time system since output results must be produced in response to input conditions within a bounded time.

3.2 SCADA

The combination of telemetry and data acquisition is referred as SCADA(Supervisory Control And Data Acquisition system).The SCADA encompasses the collecting of information via RTU(Remote Terminal Unit) relocating it back to central site carrying out decisive rehash and control and then displaying that information on a number of operating screens or displays. SCADA systems are highly distributed systems used to control geographically dispersed assets, often scattered over thousands of square kilometers, where centralized data acquisition and control are critical to system operation. They are used in distribution systems such as water distribution and wastewater collection systems, oil and gas pipelines, electrical power grids, and railway transportation systems.

A SCADA control center performs centralized monitoring and control for field sites over long-distance communications networks, including monitoring alarms and processing status data. Based on information received from remote stations, automated or operator-driven supervisory commands can be pushed to remote station control devices, which are often referred to as field devices. Field devices control local operations such as opening and closing valves and breakers, collecting data from sensor systems, and monitoring the local environment for alarm conditions. A SCADA system gathers data from sensors and instruments located to remote sides. Then, it transmits data at a central site for controller monitoring process. Automation systems are used to increase the efficiency of process control by trading off high personnel costs for low computer system costs. These automation system are often referred to as process control system (PCS) or supervisory control and data acquisition (SCADA) systems, and the widespread use of such systems makes them critical to the safe, reliable, and efficient operation of many physical processes.

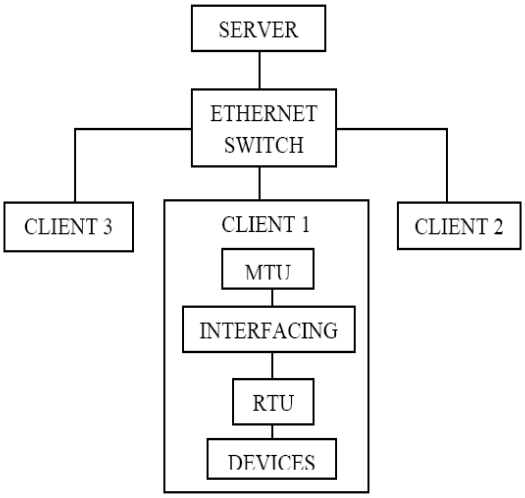

Fig 3.2 : SCADA

The broad architecture of a SCADA involves physical equipment such as switches, pumps, and other devices able to be controlled by a Remote Telemetry Unit (RTU). The dual roles of the master computers are to provide the information such as meter readings and equipment status to human operators in a digestible form and to allow the operators to control the field equipment the master computers, and interface with the system using operator consoles which communicate with the master computers over a network.

***Master Terminal Unit (MTU)*:** Allows operators to view the state of any part of the plant equipment and drives most operator interaction with the by alarms. It provides displays of process status information, including alarms and other means.

Interfacing: Allows communications equipment from different manufacturers to be connected together. The RS-232 or RS-485 interface is designed for the connection of two devices. Two devices called: DTE (Data Terminal Equipment) communicates with a DCE device and transmits data and receives data and DCE (Data communications Equipment) transmits data between the DTE and a physical data communications link.

***Remote Terminal Unit (RTU)*:** Means a microprocessor to connect data input streams to data output streams. RTU may include a battery or charger circuitry. It is accomplished by using an isolated voltage or current source. In SCADA system, RTU is a device that collects data, codes the data into a format that is from the master device and implements processes that are directly by the master. RTUs are equipped with input channels for sensing or metering, output channels for control.

Intelligent Electronic Devices (IEDs): Includes electronic meters, relays and controls on specific substation equipment. It has the capabilities to support serial communications to a SCADA sever and reports to modern RTU via communication channels. It performs all functions of protection, control, monitoring, metering and communication. SCADA systems used for monitoring and controlling the power. Traditionally, SCADA systems have made use of the Public Switched Network (PSN) for monitoring purposes.

4. SIMULATION TOOLS

***PLC*:** Ladder logic is used to develop software for programmable logic controllers (PLCs) used in industrial control applications.

Each device in the relay rack would be represented by a symbol on the ladder diagram with connections between those devices shown.

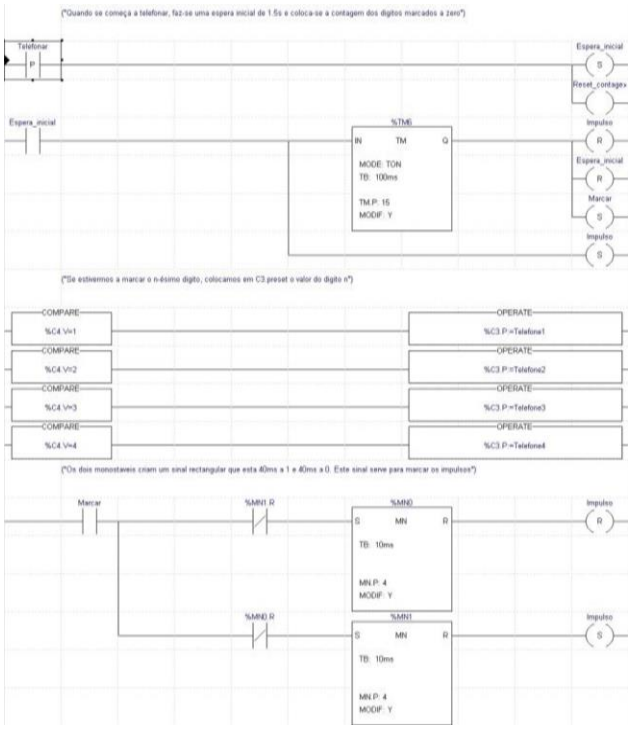

Fig 4(a): ladder diagram

Lab-VIEW: Lab-VIEW is a highly productive development environment for creating custom applications that interact with real-world data or signals in fields such as science and engineering.

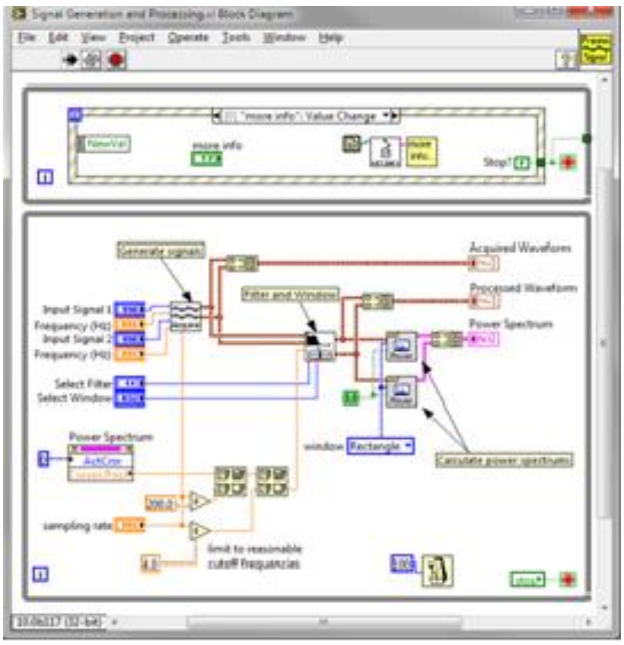

Fig 4(b): lab-view

5. RESULT

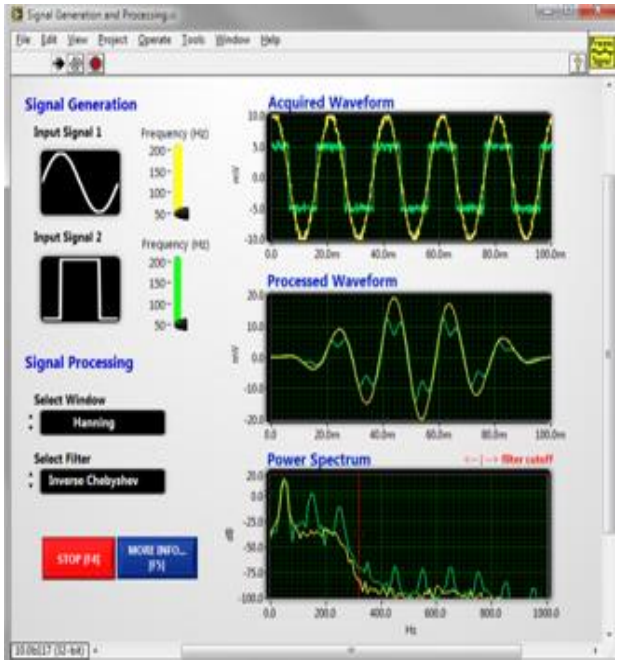

Fig 5:Result

A considerable amount of effort is necessary to maintain an electric power supply within the requirements of various types of consumers without failure of system.

6. CONCLUSION

In this proposed system, we are using much type of components for controlling and monitoring purpose. This type of components is more efficient and it is cost effective. It is very easy to interface. With the help of Substation Automation we can improve reliability, Power Quality & power handling and distribution capacity/management. The implementation of automation is very costly & complex procedure with increasing use of power electronics & electronics equipment, for implementation in practical existing field. After investing more equity for automation we can achieve a lot from the system.

7. REFERENCES

[1] International Journal of Innovative Science, Engineering & Technology "Automation based power transmission control station using PLC and SCADA", T.Vignesh, J. Kirubakaran.

[2] International Journal of Electronics and Computer Science Engineering 254 "Design And Implementation Of SCADA System Based Power Distribution For Primary Substation(monitoring system)", Aye Min Zaw 1, Hla Myo Tun 2.

[3] International Journal of Electronics and Computer Science Engineering 254 "Design And Implementation Of SCADA System Based Power Distribution For Primary Substation (control system)". Khin Thu Zar Win 1, Hla Myo Tun 2.

[4] Multidisciplinary Journal of research in Engineering and Technology "PLC SCADA based distribution monitoring and control", Santhosh B.Belekar.

[5] International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) "Generation of Electricity by Renewable Energy Sources & Transmission of Energy Production Units using PLC & SCADA", Rahul N.