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Monitoring and Controlling Of Power Transmission by PLC and Scads

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Abstract-- *In recent yearsmuch attention has been given to the use of PLCs (Programmable Logic Controllers) in substation and distribution automation application. The manufacturers of PLCs have responded by developing new products that meet the unique requirements of substation automation and SCADA applications. PLCs are very cost competitive with traditional RTUs and have many benefits in substation automation applications. This paper deals with PLC and SCADA system by using WPL software. The fault in substation can be diagonized and monitored easily. PLC is used to control the whole process in substations, fault can be monitored and diagonized by bypass circuit using SCADA.*

Index Terms--*PLC, SCADA, RTU*

I. Introduction

The PLC is a solid state electronic device designed in the early 1970s to replace electromechanical relays, mechanical timers, counters and sequencers. National Electrical Manufacturers Association, NEMA IA 2.1 standard, adopted from the Electro technical Commission, IEC 1131 standard. High speed manufacturing, as in the auto industry, required reliable control devices that were smaller, consumed less power, featured fast switching, and were quickly and easily changeable.

In the early days of data acquisition, relay logic was used to control production and plant systems. These relays allow power to be switched on and off without a mechanical switch. With advent of the CPU (central processing Unit) and other intelligent electronic devices, manufactures incorporate digital electronics into relays logic equipment. The PLCs is still one of the most broadly used control systems in industry.

Before the PLC,control sequencing and safety interlock logic for manufacturing automobiles was accomplished using relays, timers and dedicated closed- loop controllers. The process for the yearly model change-over was very time overriding and luxurious, as the relay systems needed to be rewired by skilled electricians.

The tradition way for distribution line fault management was trial and error method, in which the line is energized section by section until the protective relay trips the feeding circuit breaker. Once the faulty section was recognized, the remaining parts of the network were restored by line or sectionalizing switches. The operation of these was mostly manual [1].

After the introduction of numerical relays, more classy methods for fault location came available. Now it was possible to record the fault currents at the feeding substations, and by linking these values to the corresponding computed quantities, it was possible to produce a relatively good approximation for the fault distance.[1].

Today the application of information technology to the distribution network fault management is in a dynamic development phase. In this work there are largely speaking two competinglines. Some engineers have an opinion that the concluding decision of control actions must be inthe operators hands. This has led to the development of support software tools, which inference the possible fault locations, check the technical constraints and propose for corrective actions.

An alternative line is to let the computer system to do the whole job. Sofar these systems have been rare, however. The likely reason for this is the difficulty to adapt the automation system to the ever changing network conditions. In spite of these difficulties, it seems that there is a tendency towards fully automated switching systems[1]. In favour of this statement is the fact, that most SCADA systems nowadays support predefined switching sequences, which can be performed after the tripping ofa certain feeder circuit breaker, for instance. The disadvantage of these sequences is that the circumstances of the feeder concerned must be kept constant.

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network condition.As said before the disadvantages of the above system, PLC and SCADA is used to monitor and control the substation for the power transmission.

A. PLC

It is mutual to use relays to make simple logical control decisions. The growth of low cost computer has carried the most recent revolution the programmable logic controller (PLC).The start of the PLC began in the 1970s, and has become the most common choice for manufacturing controls.

A programmable controller is a digitally operated system, designed for use in an industrial atmosphere, which uses a programmable memory for the internal storage of user oriented instructions for implementing specific functions such as logic, sequencing timing, counting and arithmetic to control, through digital or analog inputs and outputs, various types of machines or processes[1].

A programmable controller is a computer in which control devices such as limit switches, push buttons, proximity or photoelectric sensors, pressure switches provides incoming control signals in to the unit[3].

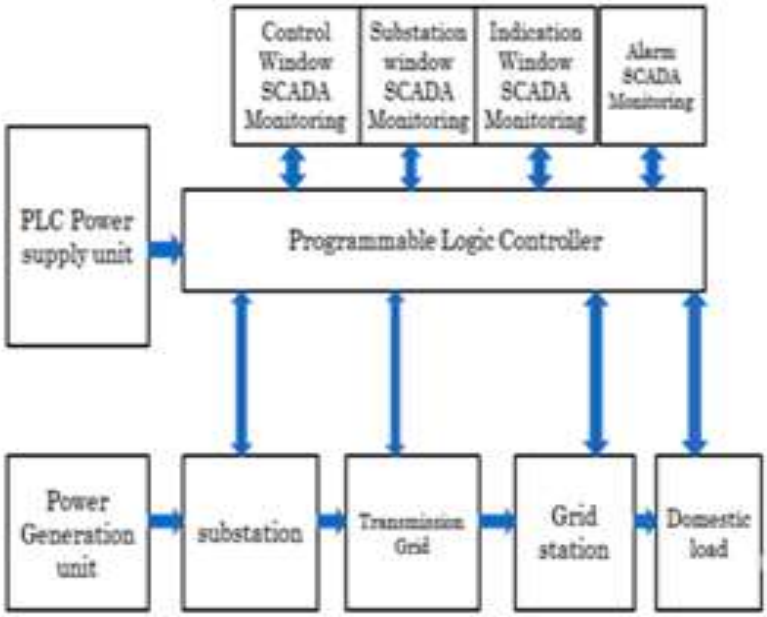

Fig 1 Block Diagram of Existing System

B. SCADA

The combination of telemetry and data acquisition is referred as SCADA(Supervisory Control And Data Acquisition system).The SCADA covers the collecting of information via RTU(Remote Terminal Unit) relocating it back to central site carrying out decisive rehash and control and then exhibiting that information on a number of operating screens or displays. SCADA systems are extremely distributed systems used to control geographically dispersed assets, often scattered over thousands of square kilometres, 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 centre does 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[2]. 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.

II. Existing System

An electrical grid is an interconnected network for conveying electricity from suppliers to consumers. It consists of generating stations that produce electrical power, high-voltage transmission lines that carry power from distant sources to demand centres, and distribution lines that connect individual customers. Power stations may be located near a fuel source, at a dam site, or to take advantage of renewable energy sources, and are often located away from heavily populated areas.

They are usually quite large to take advantage of the economies of scale. The electric power which is generated is stepped up to a higher voltage at which it connects to the transmission network. A substation receives its power from the transmission network,the power is stepped down with a transformer and sent to a bus from which feeders fan out in all directions across the countryside. These feeders carry three-phase power and tend to follow the major streets near the substation.

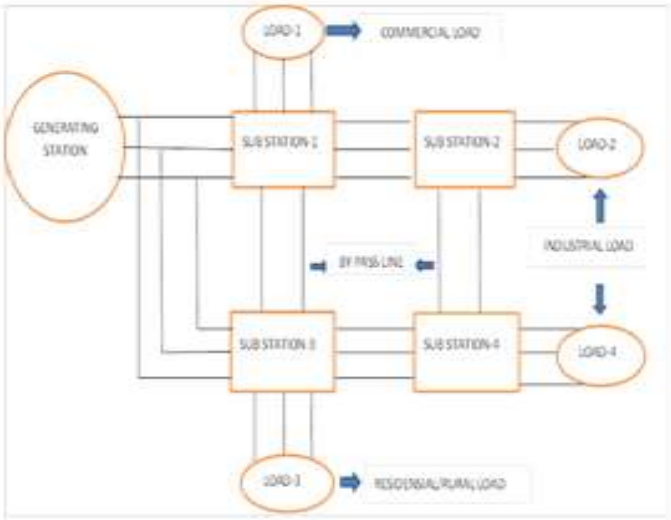

Fig 2 Block diagram of proposed system

In substation window, the connection of switches and circuit breakers are monitoring the operating status. In hint window, the circuit breakers are monitored independently. If there is any circuit breaker is trip, the corresponding switch is indicate through lamp by using indication window, we can find the fault location.

In alarm window, the low and high rating current and voltage each changes in substation. If we want to shut down the system, we can give command through SCADA.This SCADA is interface with PLC for control operation. The hardware switches are connected to PLC inputs based on their addressing[3].

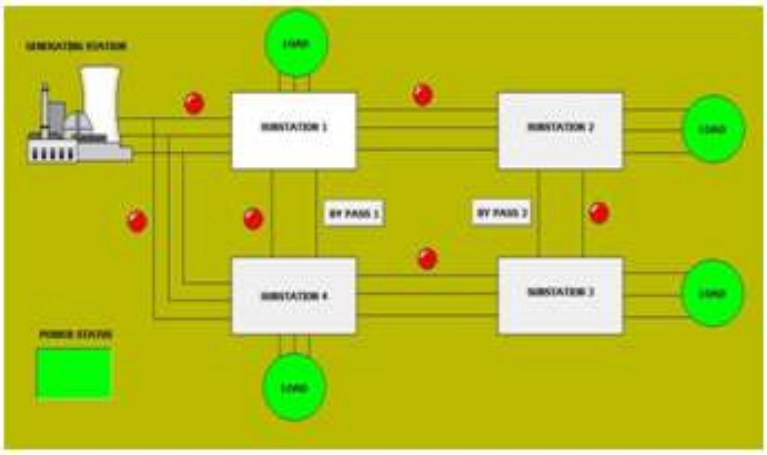

Fig 3 SCADA Control Window

III. Proposed System

Transmission lines are a vital component of power system. It is used in systems with LV, HV, EHV and even more amount of voltage levels. However, sometimes lines require outage because of various reasons like maintenance or fault. Mal-operation or a small mistake during outage process can be very dangerous. Currently a process carries outage where communication between operational engineers at two different substations plays a vital role in line outage. Miscommunication and human errors can be a threat to life of personnel involved and damage to equipment.

So to ensure a proper outage process using PLCa ladder logic is used which will check status of various equipment like circuit breakers, isolators and ground and perform sequential process of opening, isolating and grounding involved in line outage automatically. Operator now can see and check the position of whole process on SCADA screen as shown in Fig 3

Thistechnique in order to reach strong conclusion about their actual impact on the power grid monitoring and control without manpower. The basic idea behind substation control project is to monitor the switchyards in substation. In substation many relays and circuit breakers are used. When any one breaker is trip because of the problems, we can monitor and control through SCADA windows. In power management project, the computer is used for assigning the priority for various loads.

The signals are given to the computer of the electricity board where there is the electronic control unit which controls the sequence of disconnecting the load. Onbasis of controls from the computer the breakers are managed and in computer the SCADA system is installedwhich is used for monitoring and control. If there any problem occurs in plant, we can easily identify which part is trip.

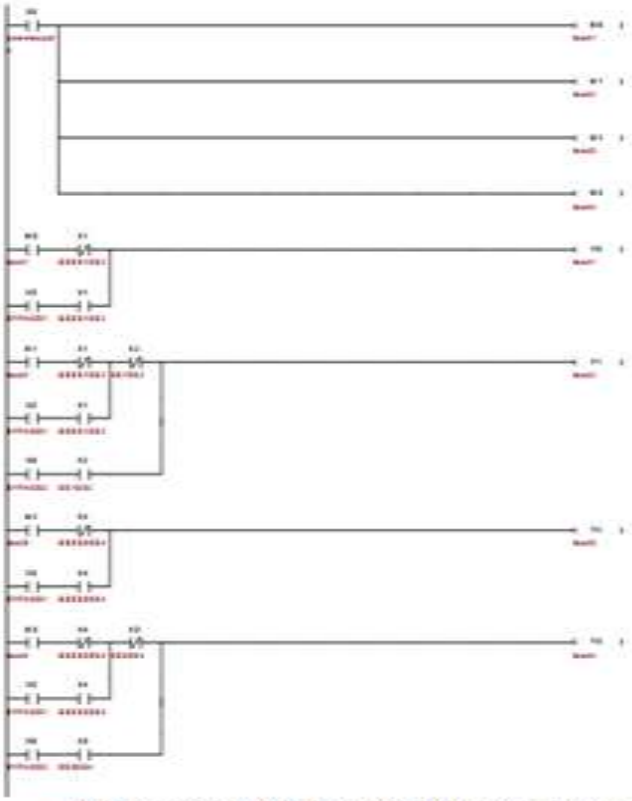

Fig 4 Ladder diagram of proposed system

After that we can troubleshoot the problem throughtheand monitor the substation. The block diagram of the Proposed System is shown in fig 2.

The advantages of proposed system is bypass circuiting without any interrupt, manpower is reduced, time delay is reduced, we can monitor the plant in control room itself and give commands through user, economical and safe operation, any modification and future extension we can easily update in PLC & SCADA,

cost effective for controlling complex systems, troubleshooting aids make program easier, it is flexible and can be reapplied to control other systems quickly and easily.

IV. Description

An electrical grid is an interconnected network for delivering electricity from suppliers to consumers. It consists of generating stations that produce electrical power, high-voltage transmission lines that carry power from distant sources to demand centres, and distribution lines that connect individual customers. Power stations may be located near a fuel source, at a dam site, or to take advantage of renewable energy sources, and are often located away from heavily populated areas. They are usually quite large to take advantage of the economies of scale.

The electric power which is generated is stepped up to a higher voltage at which it connects to the transmission network. A substation receives its power from the transmission network; the power is stepped down with a transformer and sent to a bus from which feeders fan out in all directions across the countryside. These feeders carry three-phase power, and tend to follow the major streets near the substation. As the distance from the substation grows, the fan-out continues as smaller laterals spread out to cover areas missed by the feeders .Power management is an important constraint in the design of various loads in industries for automation[7]. So if power consumption increases then the substation monitoring is very important for the purpose of controlling the hardware and software optimization with the help of PLC ladder logic system and SCADA were used.

V. Conclusions

The use of PLCs (Programmable Logic Controllers) in substation and distribution automation application has grown in recent years. The economics of PLC based solutions mean that substation automation and SCADA solutions can be applied even more widely. This will help the utilities respond to the challenges presented by deregulation.

As the use of PLCs in substation increases, the criteria for selection of control integrators, engineering firms and consultants will become extremely important factor in the success of PLC substation automation and SCADA projects. Hence the proposed model gives the continuous powerflow in a transmission line without any interruption using PLC and SCADA.

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