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Smart GSS using PLC

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ABSTRACT

The project "Smart Grid Controlling by using PLC" is a combination of both hardware and software. This project shows the smart grid substation controlling by taking the two generating sources, one is solar energy and another one is main power supply from thermal power plant.

In this project we are try to make an interconnected smart grid so that we can improve the accuracy, reliability, easy fault reduction of electric lines. By using PLC we trace the location of fault and also monitor the power consumption at load side. In this project we monitor the line to ground fault's location at the lines of the rating of 230 V and 30 V. The main advantage of interconnected system is that, the system is never shut downed, if a fault occur in a line then We can take supply from another line so that, the supply of Power transfer will make continuous.

***Keywords*—** PLC=programmable logic controller (device used for controlling system)

I. INTRODUCTION

The term ―Smart Grid refers to a reworking of electricity infrastructures-encompassing technology, policy, and business models—that is under way globally. Substantial amounts of government investment in several countries and regions have been devoted to smart grid research, development, and deployment.

A smart grid is an electrical grid which includes a variety of operational and energy measures including smart meters, smart appliances, renewable energy resources, and energy efficiency resources. Electrical power conditioning and control of the production and distribution of electricity are important aspects of the smart grid The aim and objective of this project to understand the power system's power transmission on a working model and analyze the parameter, reducing the fault and the most important thing is to make grid which is smart in working condition by using PLC controller cum with SCADA for monitoring the data and load record at distribution end.

The objective of this project is to understand how a smart grid is developed by using PLC and SCADA efficiently. For fulfil this purpose we are using two sources one is renewable source solar energy and another one is the conventional electrical energy taken by thermal power plant.

II. METHODOLOGY

Literature survey: The approaches to develop the Smart Grid are as follows:

PLC (Programmable Logic Controller):

Introduction:

A **programmable logic controller**, **PLC**, 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 machines, in many industries. PLCs are designed for multiple arrangements of digital and analog inputs and outputs, 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. A PLC is an example of a "hard" real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.

Features:

- PLCs are armored for severe conditions (such as dust, moisture, heat, cold), and have the facility for extensive input/output (I/O) arrangements.
- PLCs read limit switches, analog process variables (such as temperature and pressure), and the positions of complex positioning systems.
- PLCs operate electric motors, pneumatic or hydraulic cylinders, magnetic relays, solenoids, or analog outputs. The input/output arrangements may be built into a simple PLC, or the PLC may have external I/O modules attached to a computer network that plugs into the PLC.

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III. PRIOR APPROACH

Objectives

The main objective of Smart G.S.S is to monitor and control our G.S.S in highly efficient way. It is very efficient technique to reduce the losses inherited by the transmission as well as distribution substations. The SCADA (Supervisory Control And Data Acquisition) provides us a graphical representations of the substation and gives the idea of present scenario of substations (transmission & distribution). SCADA also provides us the security by implementing various protocols. We can control the Grid Substation from any part of the world.

Work Plan

- **1st Month-** Developing the structure of the GSS in project lab.
- **2ndMonth-** writing codes in PLC and installation of it.
- **3rd Month-** designing the SCADA system for GSS.
- **4th Month-** Implementing the codes and testing of it

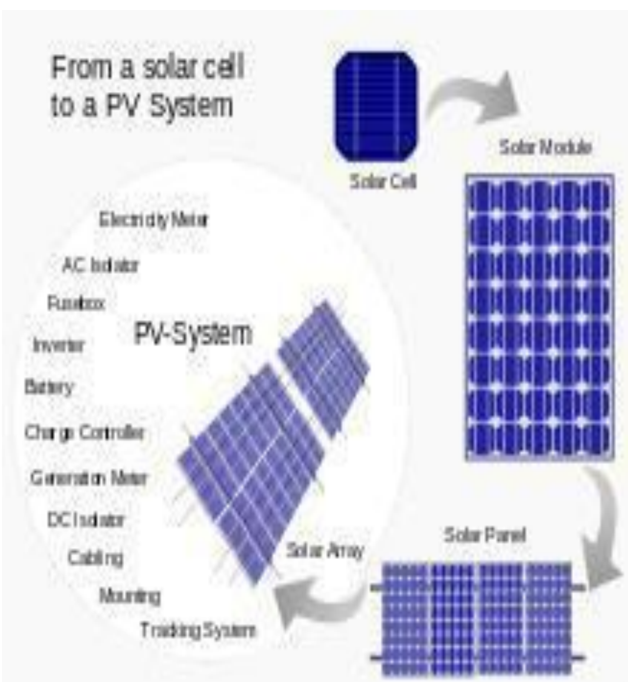

Figure 1: Existing Mechanisms for Smart GSS

Overview

A **programmable logic controller** (**PLC**), or **programmable controller** is an industrial digital computer which has been ruggedised and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.

They were first developed in the automobile industry to provide flexible, ruggedised and easily programmable controllers to replace hard -wired relays and timers. Since then they have been widely adopted as high –reliability automation controllers suitable for harsh environments . A PLC is an example of a "hard" real-time system since output results must b e produced in response to input conditions within a limited time, otherwise unintended operation will result.

The deficiencies described above show that the current caching mechanisms will not be sufficient for all applications. Instead application-specific consistency protocols are required. Clients of applications require flexibility in how they interact with an underlying caching system in order that they can optimize performance regard to individual resources. Support for a wider variety of protocols could be provided by extending HTTP horizontally, e.g., by adding resource-driven invalidation of caches to the protocol but, as we have argued previously, improved functionality can better be introduced though the use of object-oriented technology. In the next three sections we shall describe first an overview of the WWW Object technology and then our implementation of open caching within the WWW Object project.

History

2.2.1 PLC Histor :

Allen Breadly PLC (Micro Logix 1000) PLC development began in 1968 in response to a request from an US car manufacturer (GE). The first PLCs were installed in industry in 1969.

Communications abilities began to appear in approximately 1973. They could also be used in the 70's to send and receive varying voltages to allow them to enter the analog world. The 80's saw an attempt to: standardize communications with manufacturing automation protocol (MAP), reduce the size of the PLC, and making them software programmable through symbolic programming on personal computers instead of dedicated programming terminals or handheld programmers.

The 90's have seen a gradual reduction in the introduction of new protocols, and the modernization of the physical layers of some of the more popular protocols that survived the 1980's. The latest standard ―IEC 1131-3‖ has tried to merge plc programming languages under one international standard. We now have PLCs that are programmable in function block diagrams, instruction lists, C and structured text all at the same time. Processor unit

(CPU), Memory, Input/Output , Power supply unit, Programming device, and other devices.

IV. OUR APPROACH

4.1 Introduction

The project ―Smart Grid controlling by PLC & SCADA‖ is just an advanced hybrid model of future power plants and grid sub-stations. This project is basically consist of hardware and software components. In this chapter we tell about the description of all hardware components which are use in this project.

4.2 List of Hardware Components

- AllenBreadly PLC (micro Logix 1000)
- SMPS
- Relays
- Solar PV Module
- PWM Charge Controller
- Battery
- MCB
- Inverter
- Step Up Transformer
- Step Down Transformer
- Toggle Switch
- Rectifier

4.2.2 PLC Communication

4.2.2.1 Extension modules

PLC I/O number can be increased through certain additional modules by system extension through extension lines. Each module can contain extension both of input and output lines. Extension modules can have inputs and outputs of a different nature from those on the PLC controller.

4.2.2.2 Cables

Twisted-pair cabling, often routed through steel conduit. Coaxial cable enables higher data rates to be transmitted and does not require the shielding of steel conduit. Fiber optic cabling has the advantage of resistance to noise, small size and flexibility.

4.2.2.3 Parallel communication

Parallel communication is when all the constituent bits of a word are simultaneously transmitted along parallel cables. This allows data to be transmitted over short distances at high speeds. Might be used when connecting laboratory instruments to the system.

4.2.2.4 Serial communication

Serial communication is when data is transmitted one bit at a time. A data word has to be separated into its constituent bits for transmission and then reassembled into the word when received. Serial communication is used for transmitting data over long distances. Might be used for the connection between a computer and a PLC.

4.2.2.5 PLC I/P

Example of input lines can be connection of external input device. Sensor outputs can be different depending on a sensor itself and also on a particular application.

In practice we use a system of connecting several inputs (or outputs) to one return line. These common lines are usually marked ―COMM on the PLC controller housing.

4.3 SMPS

A switched-mode power supply (switching-mode power supply, switch-mode power supply, switched power supply, SMPS, or switcher) is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently.

Like other power supplies, an SMPS transfers power from a source, like mains power, to a load, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low -dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy.

Ideally, a switched-mode power supply dissipates no power. Voltage regulation is achieved by varying the ratio of on-to-off time. In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. This higher power conversion efficiency is an important advantage of a switched-mode power supply.

4.4 Relays

Compact DC Power Relays Capable of Switching 400 V, 15 A DC loads

- Actualize a high capacity interruption through the function of extinction of magnetic arc by adopting high-efficiency magnetic circuit.
- Actualize improvement of inrush-withstand performance and a long-life by adopting Omron's own contact driving system.

 Actualize the power saving.
 Small and lightweight type. Size: H31 mm × W27 mm × L44 mm, Weight: approx. 45g.

V. CONCLUSION

5.1 Result

The key finding result of smart grid substations are distributed according to the parameters and these are:

5.1.1 Distributed energy resources

The ability to connect distributed generation, storage, and renewable resources is becoming more standardized and cost effective.

While the penetration level remains low, the area is experiencing high growth. Several other concepts associated with a smart grid are in a nascent phase of deployment these include the integration of micro grids, electric vehicles, and demand response initiatives, including grid-sensitive appliances.

5.1.2 Electricity infrastructure

Those smart grid areas that fit within the traditional electricity utility business and policy model have a history of automation and advanced communication deployment to build upon. Advanced metering infrastructure is taking automated meter reading approaches to a new level, and is seen as a necessary step to enabling dynamic pricing and consumer participation mechanisms. Though penetration of these systems is still low, the growth and attention by businesses and policymakers is strong.

Transmission substation automation remains strong with greater levels of information exchanged with control centers. Cost/benefit thresholds are now encouraging greater levels of automation at the distribution substation level. While reliability indices show some slight degradation, generation and electricity transport efficiencies are improving.

5.1.3 High-tech culture change

A smart grid is socially transformational. As with the Internet or cell phone communications, our experience with electricity will change dramatically. To successfully integrate high levels of automation requires cultural change. The integration of automation systems within and between the electricity delivery infrastructure, distributed resources, and end-use systems needs to evolve from specialized interfaces to embrace solutions that recognize well-accepted principles document as a template. Use this document as an instruction set.

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