

Design and implementation of PLC program for real time automatic switching control of different power sources

ISSN - 2319 - 7757



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Abstract : This paper presents a real time design and implementation of automatic control system for electricity from different power sources to the load in building, using Allen Bradley MicroLogix 1100, 1763-L16BBB Programmable Logic Controller (PLC). The design deals with developing the ladder diagram control program for automatic switching between mains grid, solar power and diesel generator power supply. Whenever there is a failure in mains power supply, the control program switches immediately to 1kW solar power source without interrupting power to the load and simultaneously it triggers the 63kVA diesel generator to start. When stable output of the diesel generator is sensed by the PLC input, power source changes from solar power to diesel generator power. If mains power supply arrives then immediately diesel generator power changes to mains grid.

Keywords : Diesel generator supply, Electricity control system, Ladder diagram program, Programmable Logic Controller, Solar power supply.

INTRODUCTION

To provide continuous power supply to the building in case of sudden mains power failure, it is required to arrange alternative energy sources, such as solar power supply and power from diesel generator. However there will be a delay in providing power to a load from alternative energy sources due to manual switching or/and switch over delay. To avoid this break of power there is a need to design a control program for real time automatic electronic circuit using industry standard programmable control device. Programmable Logic Controller (PLC) is such an electronic control device and is used in automation.

There are various design approaches in electrical energy efficient buildings, which require additional processing power at all the times to control electricity using energy sources. Ezema L.S et.al [1] designed an automatic change over switch for generator control mechanism. Ravi Kumar et.al [2] operated and monitored a small hydropower plants using computer based control techniques. P. K Bhowmik et.al [3] designed the automatic operation and control of two diesel generator sets using Moeller PLC. M.G Joao [4] controlled distributed energy production for the management of solar power supply using Siemens PLC. J.S Kadadevarmath et.al [5] presents a simulation program for the design and implementation of electricity control from solar and diesel generator supply during mains failure, using Allen Bradley PLC. R. Bhowmik et.al [6] presents office automation

system for the control of lighting, heating, security and alarming using ARM 11 controller. R.V Sakhare et.al [7] reported on the power management from utility station to the end devices using ZigBee wireless protocol and ARM 7 microcontroller.

In this paper, real time design and implementation of automatic control system is discussed for electricity from three different power sources – Mains power supply, solar power supply and diesel generator power supply to the load in building, using Allen Bradley MicroLogix 1100, 1763-L16BBB PLC. Programming is performed by using Rockwell Software Logix 500, which supports ladder diagram program [8, 9]. The alternate power supplies are used to provide energy to the load, during mains power failure. Discussion on these lines is compiled in five sections. In section 1 introduction is presented. Section 2 presents adopted methodology for the electricity control which includes hardware design interface to a PLC and the description of solar and diesel generator supply. Section 3 presents the development of ladder diagram program. Section 4 discusses the results and section 5 gives the conclusion.

PHYSICAL SET UP DESIGN

The block diagram of the electricity control system is shown in Fig.1. The design approach involved in our system includes effective utilization of mains, solar and diesel generator supply sources as per the demand response in small office building and

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