

Renewable Energy Micro-Grid Control Using Microcontroller in LabVIEW

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Abstract : The power systems are transforming and becoming smarter with innovations in technologies to enable embark simultaneously upon the sustainable energy needs, rising environmental concerns, economic benefits and quality requirements. The advantages provided by inter-connection of renewable energy resources are becoming more viable and dependable with the smart controlling technologies. The limitation of most renewable resources have their diversity and intermittency causing problems in power quality, grid stability, reliability, security etc. is being cured by these efforts. A necessitate of optimal energy management by intelligent Micro-Grids at the distribution end of the power system has been accredited to accommodate sustainable renewable Distributed Energy Resources on large scale across the power grid. All over the world Smart Grids are emerging now as foremost concern infrastructure upgrade programs. The hardware setup includes NI cRIO 9022, Compact Reconfigurable Input Output microcontroller board connected to the PC on a LAN router with three hardware modules. The Real-Time Embedded Controller is reconfigurable controller device consisting of an embedded real-time processor controller for communication and processing, a reconfigurable chassis housing the user-programmable FPGA, Eight hot-swappable I/O modules, and graphical LabVIEW system design software. It has been employed for signal analysis, controls and acquisition and logging of the renewable sources with the LabVIEW Real-Time applications. The employed cRIO chassis controls the timing for the module and handles communication with the PC over the USB, Ethernet, or 802.11 Wi-Fi buses. It combines modular I/O, real-time processing, and NI LabVIEW programmable. In the presented setup, the Analog Input Module NI 9205 five channels have been used for input analog voltage signals from renewable energy sources and NI 9227 four channels have been used for input analog current signals of the renewable sources. For switching actions based on the programming logic developed in software, a module having Electromechanical Relays (single-pole single throw) with 4-Channels, electrically isolated and LED indicating the state of that channel have been used for isolating the renewable Sources on fault occurrence, which is decided by the logic in the program. The module for Ethernet based Data Acquisition Interface ENET 9163 Ethernet Carrier, which is connected on the LAN Router for data acquisition from a remote source over Ethernet also has the module NI 9229 installed. The LabVIEW platform has been employed for efficient data acquisition, monitoring and control. Control logic utilized in program for operation of the hardware switching Related to Fault Relays has been portrayed as a flowchart. A communication system has been successfully developed amongst the sources and loads connected on different computers using Hypertext transfer protocol, HTTP or Ethernet Local Stacked area Network TCP/IP protocol. There are two main I/O interfacing clients controlling the operation of the switching control of the renewable energy sources over internet or intranet. The paper presents experimental results of the briefed setup for intelligent control of the micro-grid for renewable energy sources, besides the control of Micro-Grid with data acquisition and control hardware based on a microcontroller with visual program developed in LabVIEW.

Keywords : data acquisition and control, LabVIEW, microcontroller cRIO, Smart Micro-Grid

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