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Real Time Energy Management and Load Forecasting in Smart Grid using CompactRIO

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Abstract

The energy management is the process of monitoring, controlling, and conserving energy in building or organization. In this paper a real time energy management and load forecasting in smart grid based on the NI CompactRIO platform is done. A console is created to monitor the electrical load connected with the smart grid. The CompactRIO used here is to get the real time data from different electrical loads and the data is transferred and stored through console via Ethernet. Load forecasting is done by past and present data of electrical load connected with the grid using artificial neural networks.

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Keywords: Load forecasting; Smart Grid; Monitoring; CompactRIO; Artificial neural networks.

1. Introduction

The National Instruments CompactRIO system consist of an embedded controller for communication and processing, a reconfigurable chassis, the user programmable FPGA, hot-swappable I/O modules and graphical LabVIEW software for real time monitoring and programming the FPGA. The monitoring system as developed in LabVIEW graphical environment. Monitoring system will displays voltage, current, power factor, frequency, and power of different connected loads of smart grid and these values continuously stored in TDMS format for analysis.

Load forecasting is a method which is used to predict the future load consumption. With the advancement in technology in soft computing, Neural Networks have been a Powerful tool in such prediction of load.

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This paper aims at forecasting the electrical load consumption in smart grid, using Artificial Neural networks in Matlab where the neural network train initially by using the real time training data stored in the console and it is fed to the neural network that makes it to get trained with the presence and repetition of a pattern present over a long run of data collection, so that prediction will be effective with less error and better accuracy. This prediction and monitoring system can help us get aware of the power needed to full fill the demand in the smart grid so whenever the load necessity is low, demand can be switch over to renewable power sources and the electricity get conserved.

2. Basic Structure and Specification of the System Design

The compactRIO and real time module which is used to measure the data through FPGA. With the help of LabVIEW program, programming and monitoring the compactRIO FPGA and storing the data into TDMS storage (Traditional Approaches to Measurement Data Storage). Using neural network in matlab for load forecasting. The System overview is shown in the flow chart given in Fig.1. (a).

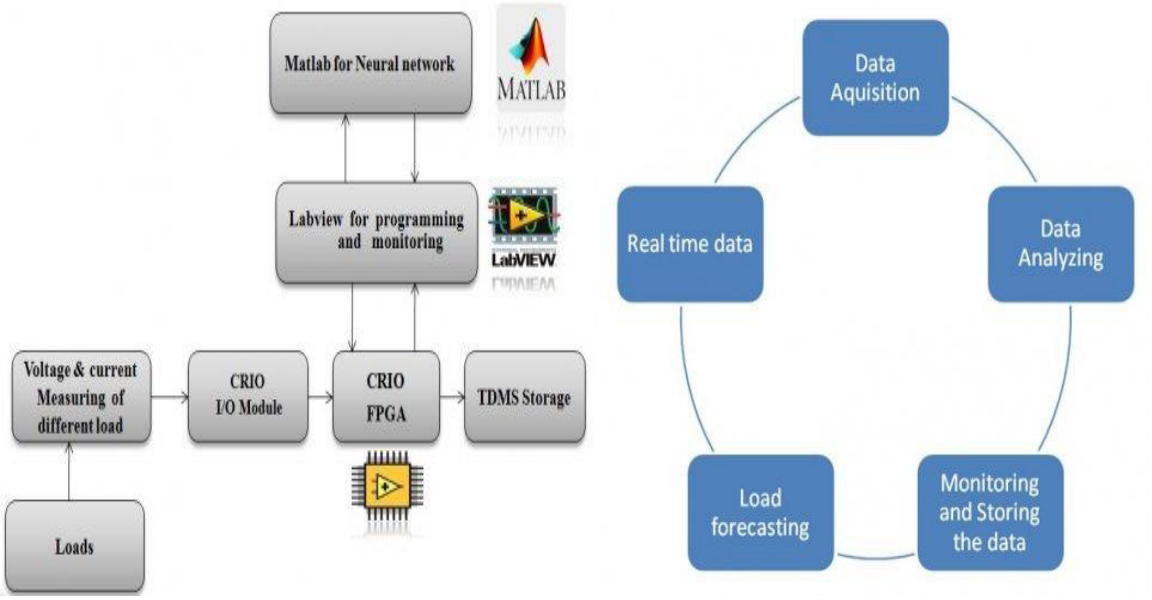

Fig. 1. (a) A block diagram for System overview flow chart; (b) Data flow chart

The data flow in this structure is shown in the Fig.1. (b).First step is acquiring real time data by CompactRIO. Second step is analyzing the acquired data using LabVIEW programming. Third step is analyzed data is displayed on front panel and stored. Forth step is forecasting the load by stored data.

3. Implementation

The following section discussed about the hardware and software implementation of the real time data monitoring and storing.

3.1 Hardware Implementation

The CompactRIO 9076 system consist of an embedded controller and reconfigurable chassis. The controller has execution of LabVIEW real-time applications. The chassis is at the centre of the system because it contains the I/O FPGA core.