

Source Management Based on Priority of Sources According to Load Demand

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Abstract— India is a developing nation with growing energy demand. Day by day demand on grid is increasing. Also non-renewable energy sources are limited in nature and depleting rapidly. There are various renewable energy sources available which are inexhaustible in nature and also reduces demand on grid. So, in this research paper a source management system is designed in which as per availability and cost priority is defined for various sources connected to load. This paper focuses on source management based on priority of sources according to load demand. In this system five different sources are used which are solar energy, wind energy, fuel cell, batteries and grid and as per priority given the source will get connected to load. The LabVIEW software is used to design the system as well as for simulation purpose. Source management is the process of controlling various energy sources and priority is defined as per availability of sources and according to load demand. This paper proposes a method of source management using LabVIEW software. The proposed method can optimize the energy usage and minimize the cost of energy.

Keywords—source management, availability, priority, LabVIEW, Renewable energy.

I. INTRODUCTION

The demand for electricity has been increasing rapidly due to the growth of population and rapid industrialization. In recent years, there has been shift towards renewable sources of energy such as solar, wind etc. to meet the demand of electricity. However, integration of renewable sources into the grid poses challenge due to intermittent nature of these sources. Hence a system is developed which manages these various sources as per availability and load demand. The system under test in this research paper is a hybrid system that integrates different energy sources, such as wind energy, solar energy, utility supply, and storage system. The primary goal of this system is to optimize the demand for energy and achieve a balance between the demand and supply of energy. The renewable energy sources are utilized to implement this balance.

Source management is process of controlling multiple energy sources as the availability and priority. A source management system is designed to manage sources based on

priority given. The priority is defined as per availability of sources as well as per unit cost of these sources. According to load demand the sources will be connected and disconnected to satisfy the load demand.

The LabVIEW software is used to develop the source management system in this research paper. LabVIEW is a powerful software tool that allows for the development of custom test and measurement systems, making it ideal for implementing source management system in a hybrid energy system. It is also used to display simulation.

In summary, the research paper aims to achieve source management for various renewable energy sources. The LabVIEW software is used to develop such system and for simulation. By using source management technique multiple energy sources can be utilized efficiently and constant electricity supply is also maintained.

II. OBJECTIVES AND SYSTEM OVERVIEW

A. Objectives

1. To utilize various renewable energy sources.
2. Define priority as per availability and per unit cost of the source.
3. To switch from one energy source to another.
4. To maintain consistent electricity supply to various loads.
5. To make cost effective solution for integrating multiple energy source.

B. Block Diagram

Block diagram of the system is shown below. Multiple sources are connected to controller and lamp bank is considered as load. As per availability the priority will be defined and sources will be connected to provide supply to the load.

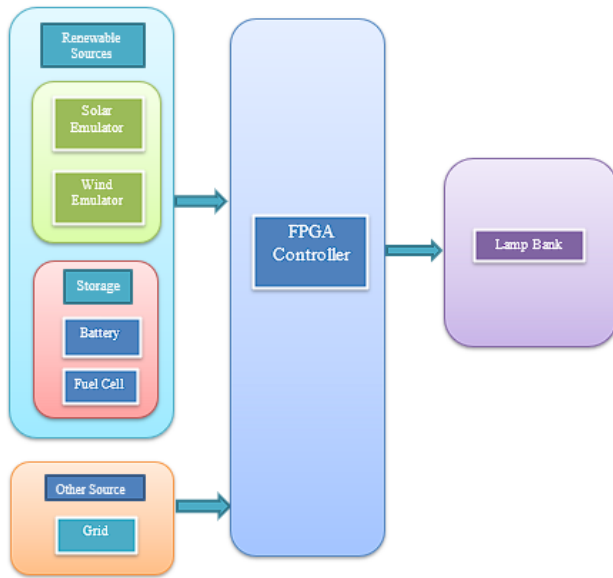


Fig.1 Block Diagram

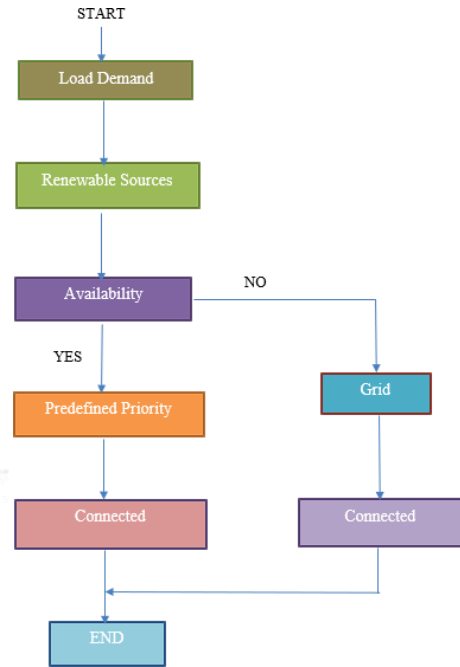


Fig.3 Flow Chart

C. Circuit diagram

The circuit diagram is shown below which consists various electronic circuitry.

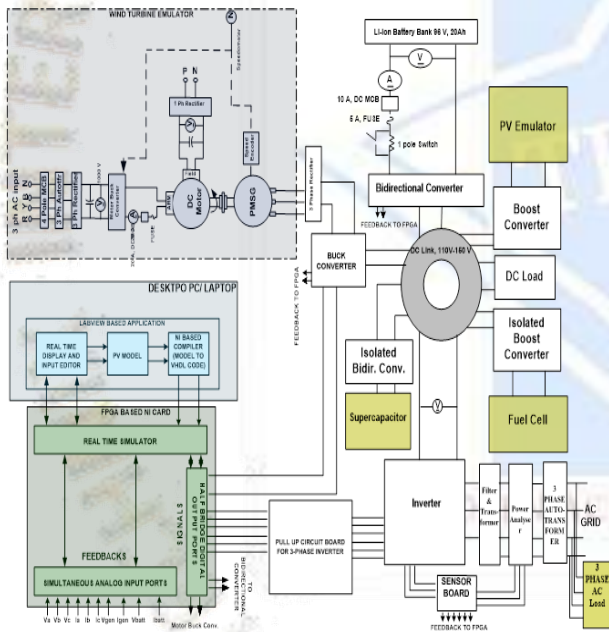


Fig.2 Circuit Diagram

D. Flow Chart of the proposed system

III. HARDWARE COMPONENTS

A) Wind Turbine Emulator

Wind turbine emulator is a complete stand-alone wind energy system that provides real time emulation of static and dynamic behaviour of wind turbine. Wind turbine emulator mimics the behaviour of wind turbine for hardware as well as software level simulations.

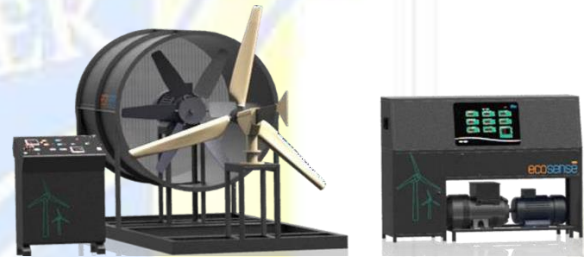


Fig.4 Wind Turbine Emulator

B) Solar PV Emulator

The solar PV emulator gives benefit of simulating the IV



Fig.5 PV Emulator

curve under varying environmental conditions without the requirement of an actual PV panel or an external setup for monitoring and data acquisition. The software for PV emulator is based on LabVIEW.

C) Fuel Cell

Dry hydrogen from hydrogen gas cylinder is given to the fuel cell and it generates electric energy. The power generated by fuel cell cannot be used directly hence its output is connected to charge controller which charges the battery and maintain output as per battery voltage.



Fig.6 Fuel cell

D) Lithium Ion Battery

Lithium-ion battery is used to store the electric energy. Lithium-ion battery performance can give better result with good efficiency.



Fig.7 Lithium-ion Battery

E) Power Supply from Grid

Single phase 230V supply is taken from grid.

IV. METHODOLOGY

The methodology of the Research paper involves a hardware- and software-based approach that is applicable to real network systems including consumers and utility systems. The research paper is based on source management system. It is used to achieve management and optimize the use of renewable energy sources such as wind and solar energy.

To implement the research paper, simulation using LabVIEW is used. LabVIEW is a software program that allows for the creation of virtual instruments for various testing and

Measurement purposes. The LabVIEW program design is used to create the necessary algorithms and control mechanisms required to manage the energy system. The Lab VIEW interface consists of two panels, namely the front panel and the block diagram. The front panel is used for all control and monitoring processes, while the block diagram is used for program design.

The research paper is performed on a test bench where all the sources are combined to form the test bench. This test bench is used to carry out the research paper work, including testing and validation of the system. The test bench allows for the simulation of real-world conditions and enables the research paper team to assess the feasibility and effectiveness of the implemented system.

Overall, the methodology of the Research paper involves a hardware-based and software-based approach that is based on source management technique and utilizes Lab VIEW for simulation and program design. The research paper is performed on a test bench, allowing for the simulation of real-world conditions and the validation of the implemented system.

A) Hardware based research paper

B) Based on source management system

The program designed to manage various sources as per availability and given priority.

C) Simulation using Lab VIEW

The system works using program design in the lab view, in lab view there are two panel (front panel and block diagram), from front panel all control and monitoring process carried out and in block diagram the program design work carried out

D) Performed on test bench

All sourced are combined and formed the test bench, using this test bench the research paper work is carried out.

V. SOFTWARE SYSTEM

LabVIEW software is used which is a graphical programming language and development environment developed by National Instruments. The front panel and program are developed by using the LabVIEW.

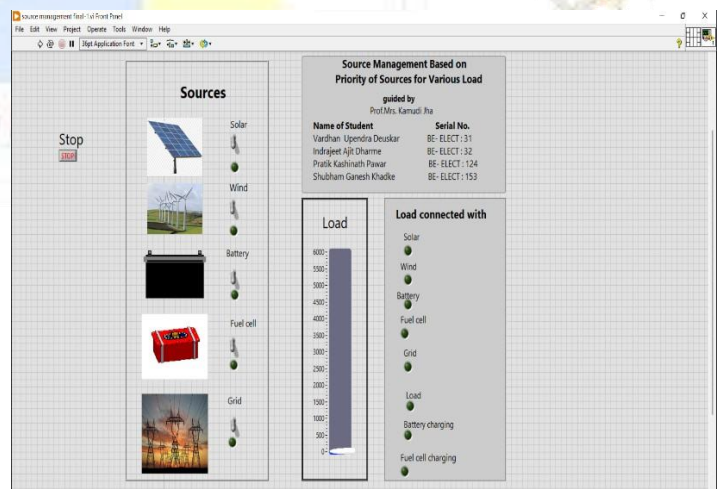


Fig.8 Front Panel

In front panel all the controls and indicators are placed in well manner. All sources are placed on the left hand side while the load is placed on the right hand side. Load can be increased or decreased using the control lever. The indication is provided to determine which sources are connected to the load on right hand side. The toggle switch is provided to switch on source manually according to demand.

The program done in the LabVIEW is shown below.

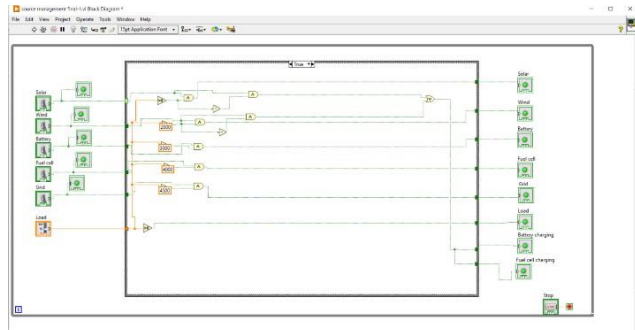


Fig.9 Program

Initially assuming all sources available, all sources along with are connected the load. Minimum power output obtained is about 4.5 KW.

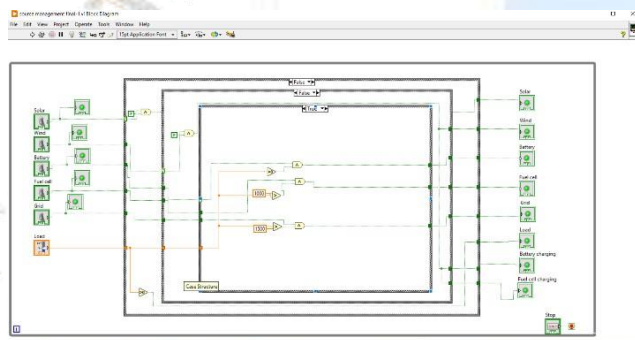


Fig.10 Program

If solar energy is not available then wind along with grid, fuel cell and battery are connected to the load and minimum power output obtained is around 2.5 KW. If wind is not available the remaining sources are connected and similar pattern goes on. If all the sources are unavailable then finally grid will be connected to the load.

VI. HARDWARE SYSTEM

Hardware system working is based on the software program installed in the FPGA controller. Hardware consists of wind emulator, PV emulator, Fuel cell, battery etc.



Fig.11 Hardware system

Energy sources and their ratings are given below.

Energy sources	
Wind Turbine Emulator	1kW, PMSG, 3 phase AC
PV Emulator	1Kw, 2 Channel
Fuel Cell	500Watts, PEM type Fuel Cell
Battery	96 V, 24 Ah
Grid	230 volt , 50 Hz , 1 phase

Table no.1

VII. SAMPLE RESULTS AND COMBINATIONS

Sample results and some source combinations are given below.

Source Combination	Load Demand (KW)	Per Unit Estimated Cost (Rs.)
Solar	2 kw	4/-
Wind	1 kw	6/-
Solar + Wind	3 kw	10/-
Solar + Wind + Grid	3+ kw	17/-
Solar + Wind + Battery + Fuel cell + Grid	4.5+ kw	20-25/-

Table no.2

VIII. CONCLUSION

In this research paper source management of various renewable sources is done as per availability of the sources and the priority is defined to optimize the use of these sources and to meet the load demand. The LabVIEW software is used to develop system and display the simulations. Hence a cost effective solution is obtained to handle multiple sources.

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