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DESIGN OF INTELLIGENT CONTROLLER FOR A HYDRAULIC SOLAR PV SYSTEM

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Abstract: The technology can be a single panel, a string of PV panels, or a multitude of parallel strings of PV panels. Solar PV has no emissions, reliable and its minimum maintenance. This project work is to model a standalone solar powered micro grid with an intelligent controller for controlling a hydraulically operated Solar PV System, which helps in unfolding the PV panels at site where the standalone Solar PV Power plant is transported and placed for power generation.

Keywords— Remote Area operations, Portable Electricity, Green Energy.

1. Introduction

The data for predicting the solar input is several years of measurements of irradiance on the proposed locator. Solar power technology enhances PV output by focusing solar panel direct to the sunlight by means of a tracking system. PV output is a variable due to the relationship between the solar isolation and the surface temperature. These statistical measures may be estimated from meteorological data available from the site. From a nearby site having similar irradiance, or from an official solar atlas or database. Sitting and sizing of PV uses classical and computational intelligence methods that involve decisions based on real time data.

The aim of this project work is to model a standalone solar powered micro grid with an intelligent controller for controlling a hydraulically operated Solar PV System, which helps in unfolding the PV panels at site where the standalone Solar PV Power plant is transported and placed for power generation. The Intelligent controller is monitoring the available quantum of solar energy and orient the PV panels so as to get more solar energy (Solar tracking system). It also helps in monitoring the Solar power being generated etc. The above system is built around the following components.

1) Solar Panels
2) Solar Inverter

3) Battery Set
4) Mobile trolley
5) Hydraulic system
6) Intelligent Controller and accessories.

2. Literature Survey

This project proposes a novel robust & adaptive sliding mode (SM) control for a cascaded two-level inverter (CTLI)-based grid connected photovoltaic (PV) system. The modelling and design of the control scheme for the CTLI-based grid connected PV system is developed to supply active power and reactive power with variable solar irradiance. A vector controller is developed keeping the maximum power delivery of the PV in consideration. Two different switching schemes have been considered to design SM controllers and studied under similar operating situations. Instead of the referred space vector PWM technique, a simple PWM modulation technique is used for the operation of the proposed SM controller. The performance of the SM controller is improved by using an adaptive hysteresis-band (HB) calculation. The controller performance is found to be satisfactory for both the schemes at considered load and solar irradiance level variations in simulation environment.

The present work employs a novel and robust SM controller for CTLI based grid connected system. Here the performance of the CTLI is found out to be satisfactory for two different control schemes of SMC.The scheme-I and scheme–II, respectively, consider hysteresis modulation and zero average current error technique to produce the gate signals. Both of the active and the reactive power delivery, in the presence and absence of solar irradiance, are found to be achieved successfully. The controller is shown to extract maximum power from the solar PV modules by maintaining the dc-link voltage at the desired level for both the schemes. The performances under deviations in the input power to the inverters, due to changes in the availability of the solar irradiance, and under 50% increment in load, are found to be satisfactory in nature. The THD of the grid-connected PV system has been studied and found to be considerably within the limit. It is interesting to note that in the absence of solar irradiance, both the control schemes acting distribution STATCOM mode supplying reactive power to the grid, maintaining the dc-link voltage level as well. This ensures the utilization of the PV system for both active and reactive power delivery with the proposed SM controller. The SMC is implemented successfully for the PV based power supply scheme in real time through dSPACE 1104.

This project focuses on the development of a methodology for sizing and optimization of four hybrid systems (PV/wind/diesel/battery, PV/wind/diesel, PV/diesel/battery and wind/diesel/battery). This approach makes use of the Dividing Rectangles (DIRECT) algorithm to suggest, among a list of commercially available system devices, the optimal numbers and types of system components ensuring that the total cost objective function is minimized. These four hybrid systems are assumed to be installed at the city of Le Havre (France), with the collection of hourly environment data (solar radiation, wind speed and ambient temperature) for a period of 5-year.

Design, modeling, optimization and simulation of a combined hybrid PV/wind/diesel/battery system are presented in this paper. First, the hybrid system which consist of PV modules, wind turbines, battery banks and diesel generators is proposed in order to supply the power demand of the consumers. Then, a methodology for optimum sizing and analyzing of four hybrid systems (PV/wind/diesel/battery, PV/wind/diesel, PV/diesel/battery and wind/diesel/battery) is described by using the DIRECT algorithm. Finally, this developed methodology was applied to simulate and optimize the number and the type of each system component, the most economic cost of the hybrid system.

This project presents a hydro-PV-wind-battery-diesel based hybrid power system to show the economic viability of an off-grid isolated renewable energy system for remote area. Global warming problem, due to man-made greenhouse gases (GHGs), appear to be a major concern of the world. Current power generation causes 25.9% of global carbon emissions; due to the fast depletion of fossils fuels, direct and indirect GHGs emission from thermal power plants renewable energy (RE) resources are emerging as a realistic means to solve the global warming problem.The main objective of the present study is to determine the optimum size of the hybrid power system able to fulfill the requirements of 166 kWh/day primary load with 21kW peak load for 100 households for a remote area. In this study we have considered a village in the remote area Cox's bazar, Bangladesh. There is a good potential for wind and solar energy and also some potential for hydro energy. Battery and diesel generator is considered to increase the reliability of the system.

The proposed hybrid model is able to fulfill the load demand of the village under investigation with cost of energy (COE) 0.188$/KWh with operating cost 7,761$/yr., which is economical than the diesel and battery only system. The analysis also indicates that about 66% of the total energy is coming from the renewable energy sources, which reduces the CO2 emissions to 35,743 kg/yr., compared with the diesel and battery only system. The energy modeling software for renewable energy based hybrid energy systems, HOMER, is used to carry out the analysis.

The proposed hybrid system is able to integrate 66% of renewable energy for electricity generation, which reduces huge amount of CO2 emissions annually that is necessary for safer world and better life for all the living beings of the world.

3. Existing Method

During past photovoltaic systems where used to generate electricity to pump water, light up the night, activate switches, charge batteries, supply power to the utility grid, and much more. Nowadays, solar PV systems are used to generate electricity and supply to the grid during daytime only with absence of storage batteries and including nights also with storage batteries. The most of the PV systems based electricity are fixed and not movable ones.

Fig.1 Solar PV system

4. Proposed Method

This is a proto type standalone solar powered micro grid consisting of 0.2 KW PV panels, IGBT based inverter,100 AH lead acid battery, intelligent controller, hydraulic system and a mobile trolley aimed to fulfill the following

1. To have Portable Electricity.
2. To Facilitate poor at remote areas.
3. To Utilise water available at rare resources by pumping.
4. To have Entertainment activities in places where electricity is not available.
6. To facilitate government to conduct medical camps etc… at remote locations.
7. To facilitate Military surveillance.
8. To facilitate public during occurrence of disaster.

Block diagram:

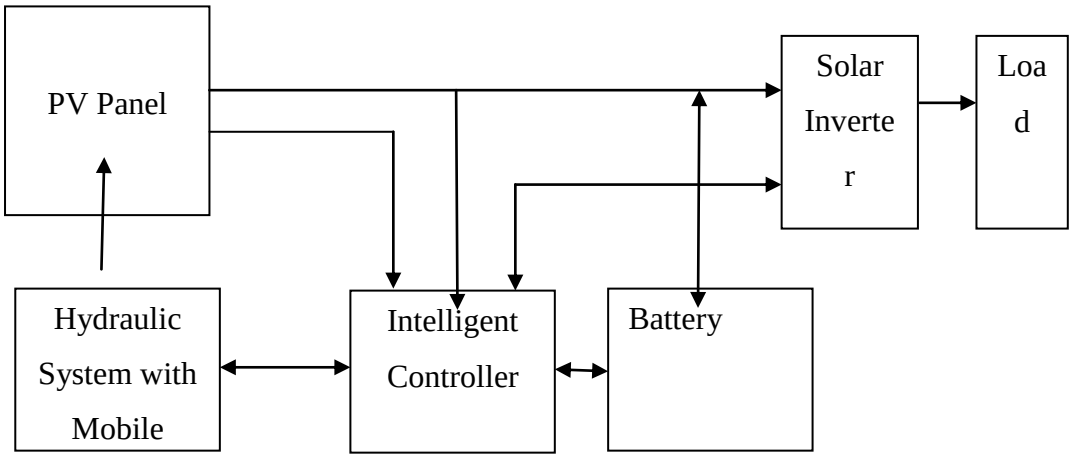

Fig.2 Block Diagram

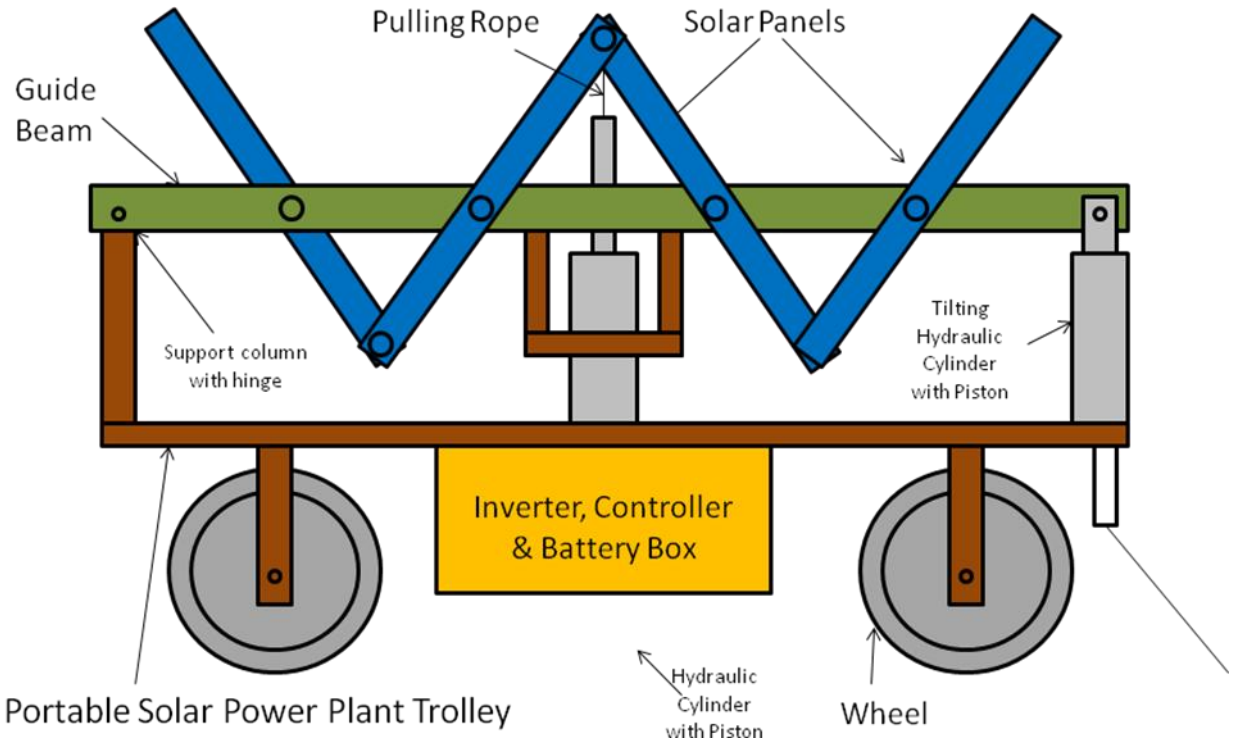

Fig.3 Typical Diagram of Semi Folded Position

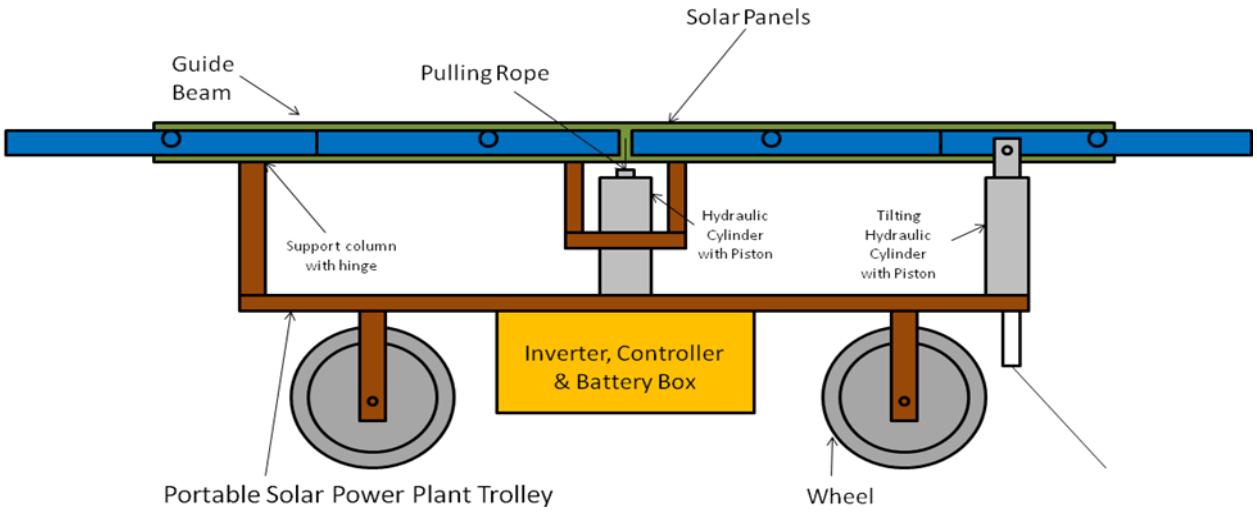

Fig.4 Unfolded Positions

5. Conclusion

Different techniques for standalone solar powered microgrid have been surveyed. Different author gives various techniques with block diagram, methodology and their explanation with proper layout of successful execution with adequate strengths and weaknesses. All systems are designed in this surveyed papers are designed and tested practically. Main purpose of this method of implementation is that all to minimize energy consumptions and carbon emission, reduce the energy wastage, save electricity, time, money.

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