

MODELLING OF NEXT GENERATION STANDALONE SOLAR POWERED MICRO GRID

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Abstract: French physicist “Edmund Becquerel” first discovered solar energy harnessed by the use of photovoltaic (PV) cells in 1839. This technology can be a single panel, or a string of PV panels, or a multitude of parallel strings of PV panels. Solar PV has no emissions and it is reliable and requires less 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 to where, the standalone Solar PV Power plant is transported and placed for power generation. The materials used for manufacturing PV cells include amorphous silicon, polycrystalline silicon, cadmium telluride, microcrystalline silicon and copper indium selenide.

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

1. Introduction

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 insolation and the surface temperature. The data for predicting the solar input is several years of measurements of irradiance on the proposed locator. 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. Siting 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

A design of a charge controller for a standalone photovoltaic (PV) system. It comprises of a battery to store the energy for eliminating intermittency in the electric supply, a boost converter solely operated to achieve MPPT and a bidirectional buck-boost DCDC converter for intriguing the philosophy of charge control. The charge control algorithm envisages controlling the charging and discharging action in all the three operating zones of the battery. The perspective owes to reduce the overall system cost through the use of a novel battery charging management technique and accomplish greater battery charge levels for increasing its life expectancy.

A new charge control algorithm suitable for the valve regulated lead acid battery has been suggested to support a standalone photovoltaic system. The scheme has been articulated to involve independent control actions for the MPPT and the charge control methodology. The charge control technique has been formulated with unique directive strategies for each zone of operation of the battery. The fulfillment of the design requirements in each zone has been outwitted to increase the lifetime of the battery. The simulation outcome have been projected to authorize the system design and verify its energy balance. The performance has been projected as a significant proposition to ensure the effective utilization of available PV power between load and the battery and seek a claim for the use of charge control mechanism in practice.

In grid connected mode of distributed generation applications, the elimination of line frequency transformer is possible without impacting system characteristics related to grid integration, ground leakage current, dc injection, safety issues etc. This paper presents the design, modeling, simulation and implementation of closed loop operation of a novel inverter topology suitable for transformer-less single phase grid connected photovoltaic systems. The control scheme ensures extraction of maximum power from the solar Photovoltaic (PV) source, synchronization with the grid and controlled active and reactive power transfer to the grid. Simulation results with both dc source and solar PV as input, incorporating MPPT, are discussed in the project.

The performance of the closed loop operation of a novel inverter topology suitable for transformer-less grid connected PV system is experimentally validated and results are presented. The procedure to obtain the small signal model of the inverter topology and the control design are described in detail. PR controller is used for current control to inject sinusoidal current in phase with grid voltage. The inverter is controlled using DS1103

controller board, using the Real Time Workshop (RTW) and Real Time Interface (RTI) features available in MATLAB/Simulink. The results are found to be in agreement with simulation and theoretical claims. Complete elimination of ground leakage current and comparable efficiency with other single phase transformer-less topology makes it a good choice for transformer-less PV-grid interface applications. Other advantages such as boosting capability and low dc injection have been experimentally verified. Complete hardware implementation of the proposed system at higher power levels with solar PV emulator as input source is underway.

The project presents the controller structure of high performance, double-stage three phase grid connected solar photovoltaic (PV) system with maximum power point tracking (MPPT). In, the proposed configuration, the solar energy, after MPPT tracking, is finally channeled into a three phase AC grid by first boosting up the DC voltage level and then converting the boosted DC voltage into three-phase AC by means of a grid-tie inverter. The control of the pulse-width modulated (PWM) three phase inverter is realized similar in line with field-oriented control of electrical AC machines, using dq transformation along with feed-forward compensation. The practical and effective design steps are clearly explained to find out the controller parameters. The displacement factor at grid end is maintained unity and distortion of the current, fed into the grid, is restricted as per the IEEE-1547 standard.

The control strategy of vector control of induction machines has been adopted here to control the performance of the inverter is controlled in order to feed only active power to the grid instantaneous reactive power flow controlled to be always zero to maintain unity power factor operation.

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.

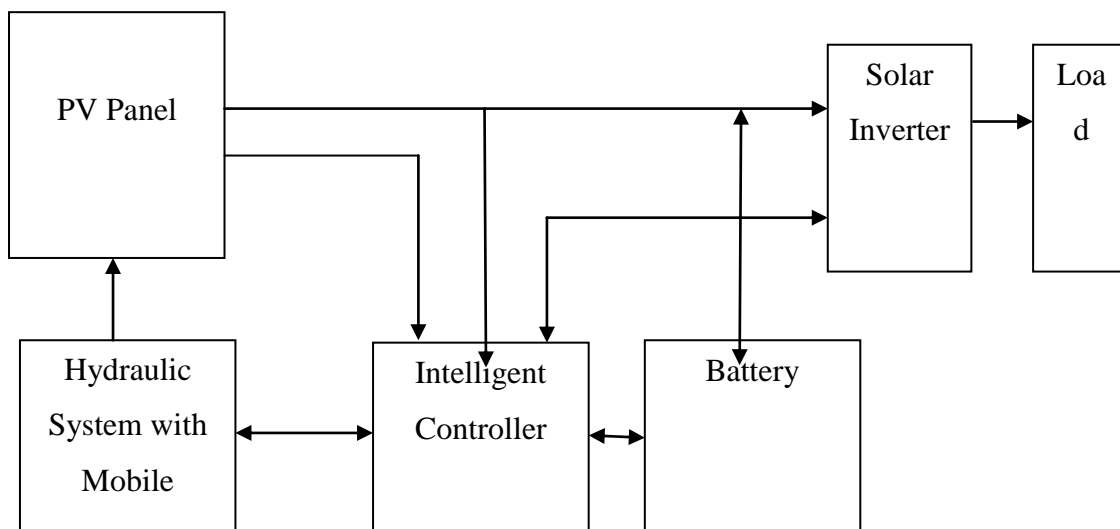


Fig .2 Block Diagram of Proposed Method

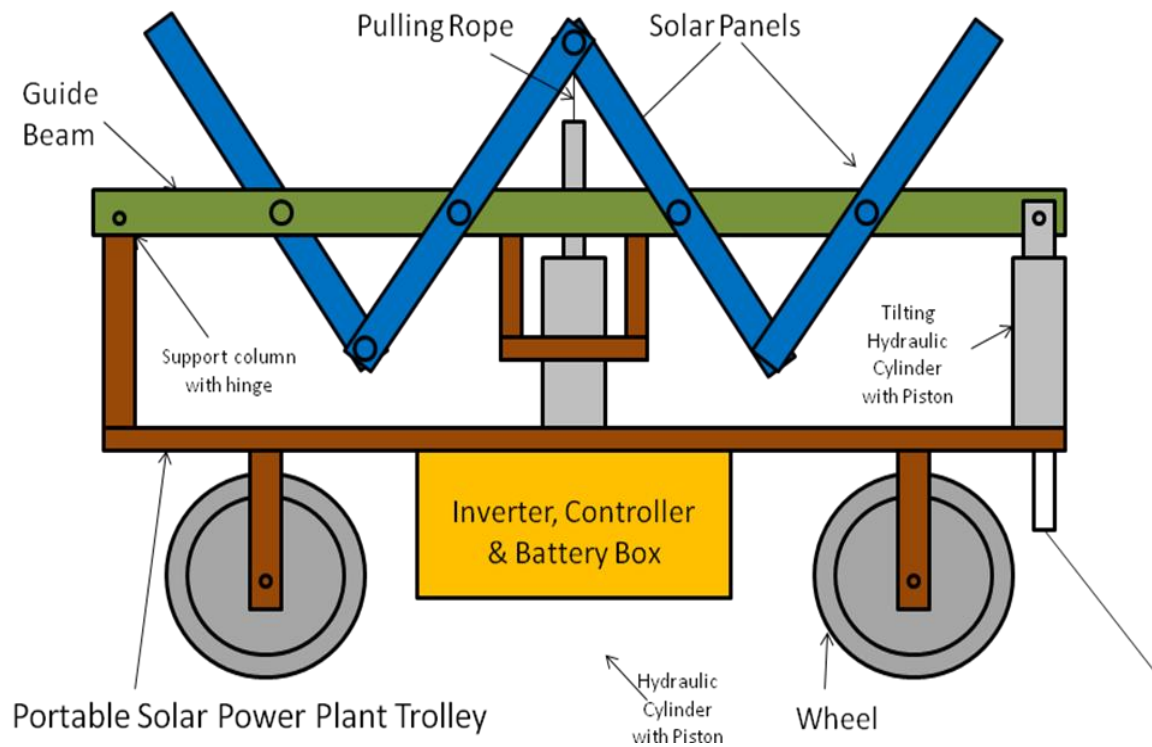


Fig.3 Semi Folded Positions

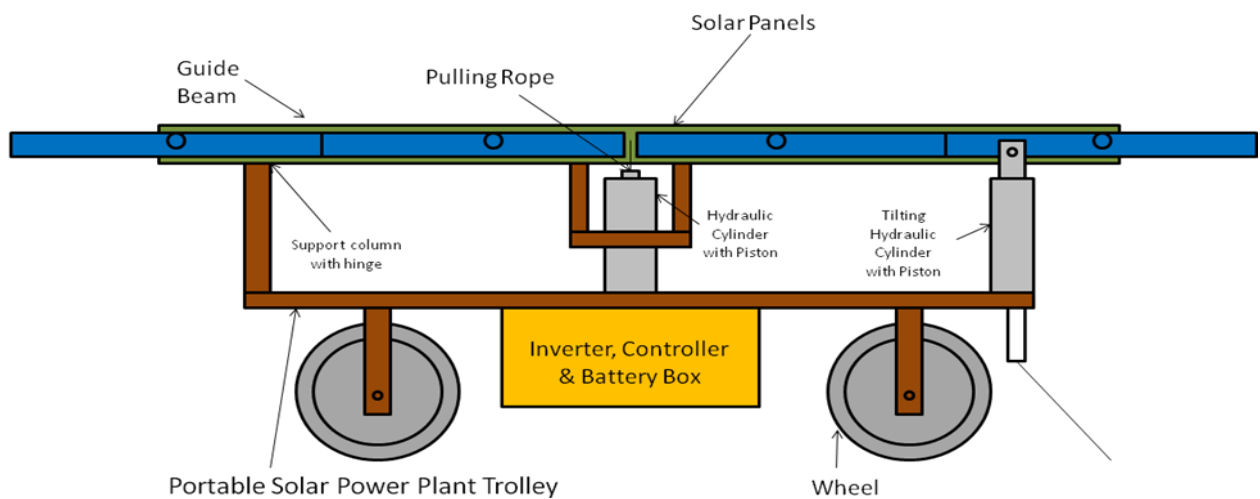


Fig.4 Unfolded positions

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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