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Integrated PV and Battery Energy Conservation of Stand Alone System with MPPT and Power Quality Improvement Features

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ABSTRACT: This paper review on Integrated PV and battery energy conservation of stand alone system with MPPT and power quality improvement features. Grid integration of photo voltaic (PV)/Battery hybrid energy conversion system with MPPT tracking performance of high gain integrated cascaded bidirectional dc-dc Converter with quadratic gain and less current ripple are presented in this paper. The PV side HGICB Converter is controlled by P&O MPPT algorithm to extract the maximum power from the variable solar irradiation. The Charge Controller is a switching device that can connect and disconnect the charger to the battery and it will take control over charging and to stop charging at the correct voltage. This will protect the batteries from damage from over-charging and regulate the power going from the solar panels to the batteries. This paper proposes a modified Instantaneous symmetrical components theory to use in micro-grid applications with following intelligent functionalities (a) to feed the generated active power in proportional to irradiation levels into the grid or connected load (b) compensation of the reactive power, (c) load balancing and (d) mitigation of current harmonics generated by non-linear loads, if any, at the point of common coupling (PCC), thus enabling the grid to supply only sinusoidal current at unity power factor. The battery energy storage system (BESS) is regulated to balance the power between PV generation and utility grid. A new control algorithm is also proposed in this paper for the battery converter with tight DC link voltage regulation capability. A hybrid PV Energy Conversion System is studied and simulated in MATLAB/SIMULINK environment.

KEYWORDS:PV (photo voltaic) Source , maximum power point MPP, (P&O) perturbation and observation, DC-DC converter, Solar Photo voltaic (SPV).

I.INTRODUCTION

Among various renewable energy resources, PV power are most rapidly growing renewable energy sources. The PV source is a nonlinear energy source and direct connection of load will not give optimum utilization of the PV system. In order to utilize the PV source optimally, it is necessary to provide an intermediate electronic controller in between source and load under all operating conditions. Using this electronic controller it is possible to operate the PV source at maximum power point (MPP), thus improving the energy efficiency of the PV system. Many control algorithms have been in the literature to track maximum power from the PV arrays, such as incremental conductance (

INC), constant voltage (CV), and perturbation and observation (P&O). The two algorithms often used to achieve maximum power point tracking are the P&O and INC methods Many DC-DC converter topologies are available to track the MPP in PV generating system. Cascade connection of conventional converters provides wider conversion ratios. Cascade connection of conventional converters provides wider conversion ratios. One of the major advantages of these converters is a high gain and low current ripple. However, this configuration has a drawback that the total efficiency may become low if the number of stages are high, owing to power losses in the switching devices. A quadratic converter configuration is also available that uses single switch and achieves quadratic gain. An interesting attractive converter topology is a high gain integrated cascaded boost converter having n-converters connected in cascade using a single active switch The instability caused by the cascade structure is avoided, when compare with the conventional cascade boost converter This class of converters can be used only when the required number of stages is not very large, else the efficiency will be reduced. However, this class of converters for PV applications are not reported in the technical literature..

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II. LITERATURE SURVEY

.Sun.l, Zhang. Y Zing and J.M.Guerrer; "A distributed controlled strategy base on DC bus signalling for modular photo voltaic generation system with battery energy storage" wind turbines, fuel cell, tidal energy, PV is one of the most important resources of renewable energy because of sustainability of solar radiant energy, widely available and completely free of charge. However, the generated output power from PV is intermittent, energy storage systems (ESS) have to be integrated to ensure continuous output power. Batteries are used with PV system as a conventional ESS.

B. Subudhi and R. Pradhan; "A comparative study on maximum power point tracking techniques for photovoltaic power systems," Many control algorithms have been reported in the literature to track maximum power from the PV array.

W. Li and X. He; "Review of non isolated high-step-up dc/dc converters in photovoltaic grid connected applications," The DC/DC converters are widely used in regulated switch mode DC power supplies. The input of these converters is an unregulated DC voltage, which is obtained by PV array and therefore it will be fluctuated due to changes in radiation and temperature. In these converters the average DC output voltage must be controlled to be equated to the desired value although the input voltage is changing.

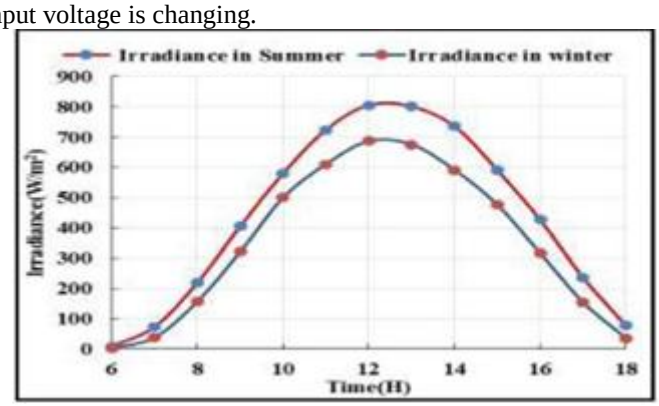

Fig.1. MPPT characteristic

M. de Brito, L. Galotto, L. Sampaio; "Evaluation of the main MPPT techniques for photovoltaic applications," In order to utilize the PV source optimally, it becomes necessary to use techniques to extract the maximum power from these panels, in order to achieve maximum efficiency in operation. Under uniform solar irradiation conditions, PV panels exhibits a unique operating point where PV power is maximized. The PV power characteristic is nonlinear, as shown in Fig. considering a single PV cell, which varies with the level of solar irradiation and temperature, which make the extraction of maximum power a complex task, considering load variations. Thus, in order to overcome this problem, several methods for extracting the maximum power have been proposed in the literature it is necessary provide an intermediate electronic controller in between source and load under all operating conditions Using this electronic controller it is possible to operate the PV source at maximum power point (MPP), thus improving the energy efficiency of the PV system.

J. Rocabert, A. Luna, F. Blaabjerg; "Control of power converters in ac microgrids," Micro-grid power converters can be classified into (i) grid feeding ,(ii) grid-supporting, and (iii) grid-forming power converters the efficient extraction of electrical energy from Solar Photovoltaics (SPV). system is being presented. The efficiency of the SPY system may be substantially increased by using Maximum Power Point Tracker (MPPT).

R. Kadri, J.-P. Gaubert, and G. Champenois; "An improved maximum power point tracking for photovoltaic grid-connected inverter based on voltage-oriented control," There are many control schemes reported in the literature such as synchrounous reference theory, power balance theory, and direct current vector control.

S. Zhang, K.-J. Tseng, D. Vilathgamuwa; "Design of a robust grid interface system for pmsg-based wind turbine generators ".

A. Chatterjee, A. Keyhani, and D. Kapoor; "Identification of photovoltaic source models," The envisaged system consists of a PV/Battery hybrid system with the main disconnecting to non-linear andunbalanced loads at the PCC.

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III. PROPOSED SYSTEM DEVELOPEMENT

A practical PV array consists of several connected PV modules formed by Ns solar cells connected in series and Np cells connected in parallel. Therefore, which presents a single PV module should be amended into to obtain the PV array current. where M_s is the number of PV modules connected in series and Mp is the number of PV modules connected in parallel.

$$I_{pv}=M_pI_{ph}-M_pI_0\left[exp\left(\frac{V_{pv}+\left(\frac{M_s}{M_p}\right)R_sI_{pv}}{\alpha M_sV_t}\right)-1\right]-\frac{V_{pv}+\left(\frac{M_s}{M_p}\right)R_sI_{pv}}{\left(\frac{M_s}{M_p}\right)R_p}$$

Utilization of renewable energy resources is the demand of today and the necessity of tomorrow. Due to the electric power crisis globally, it is to be thought about the optimized utilization of these resources. In this paper, the efficient extraction of electrical energy from Solar Photo voltaic (SPV).system is being presented. The efficiency of the SPY system may be substantially increased by using Maximum Power Point Tracker (MPPT). MPPT is a power electronic system which tracks the maximum power point on the characteristic curve of PV module throughout the day in varying solar insolation. Basically MPPT is a highly efficient DC-DC converter. which is controlled by A typical Photovoltaic (PV) system consists of a PV module and some electrical load. This may also have a Power conditioning unit (PCU) which may comprising of a Inverter (to convert dc into ac), charge controller (to prevent reverse flow of current during dark) and most importantly from the efficiency point of view the Maximum Power Point Tracker (MPPT).In this paper, the MPPT is emphasized for better efficiency of PV system by using improved MPPT with advanced P&O algorithm. Description of opto-isolator.

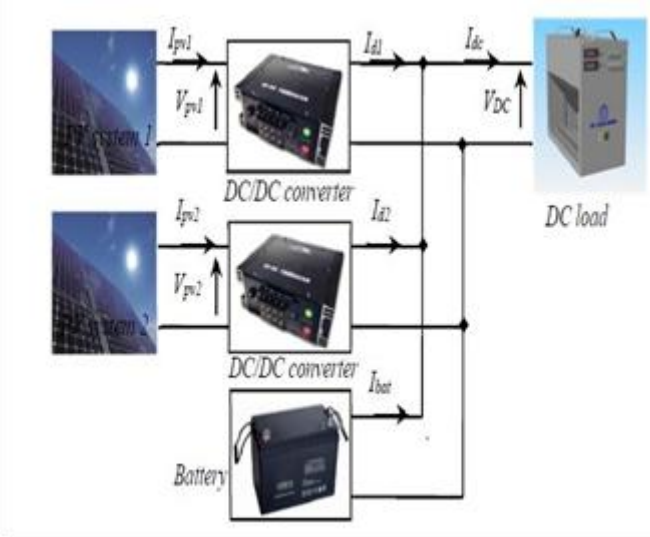

Fig.2. Configuration of proposed system

Make sure that the system operates close to the MPP when it is subjected to changing in environmental conditions. Provide high conversion efficiency. It maintain tracking for wide range of variation in environmental conditions. Provide an output interface compatible with the battery charging requirement .It instantaneous PV voltage and current and provides the reference current.

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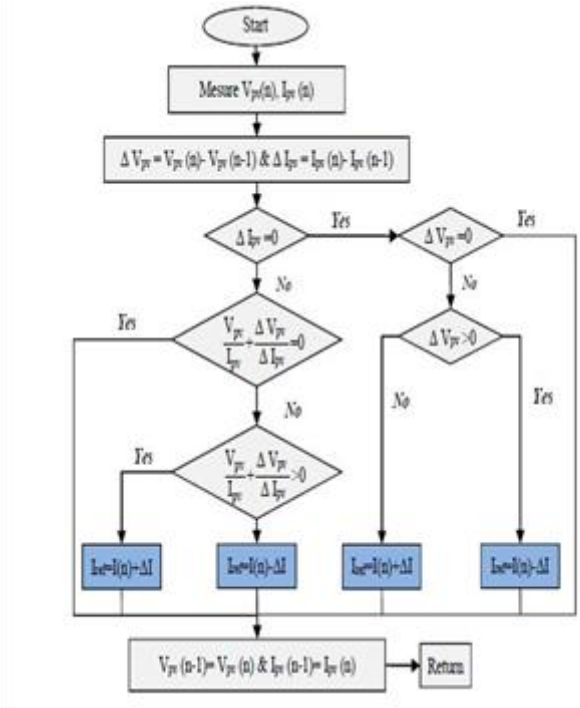

Fig.3. INC method flowchart

A solar charger employs solar energy to supply electricity to device or charger batteries. They are generally portable. A series of solar cells are installed in a stationary location and can be connected to a battery bank to store energy for off-peak usage. Most portable chargers can obtain energy from the sun only. The Charge Controller is a switching device that can connect and disconnect the charger to the battery and it will take control over charging and to stop charging at the correct voltage. This will protect the batteries from damage from over-charging and regulate the power going from the solar panels to the batteries. A microcontroller in the circuit will read the level of thebatteries and then cut off the source of the solar panels to the batteries, once it sees the battery is at the fully charged state. If this was not in place, the solar panels would keep feeding the batteries energy and the batteries would become overheated and damage the internal components. The advantage to have a microcontroller in the system is that it will open a variety of features to add to the system. For example the microcontroller will be programmed to control and display the battery level of the system.

IV. CONCLUSION

In this review paper we discussed about types of various types of inverters with different PWM techniques are analysed. The THD value is reduced to 33.02% with load for SVPWM technique when compared with RLC load which is having THD value of 47.15%. The THD value is reduced to 36.75% for single phase bridge inverter when compared to two level twin bridge inverter with THD value of 70.43% while using SPWM technique. As seen from the above comparison the SVPWM technique is a better option for the application of inverters with different industrial loads.

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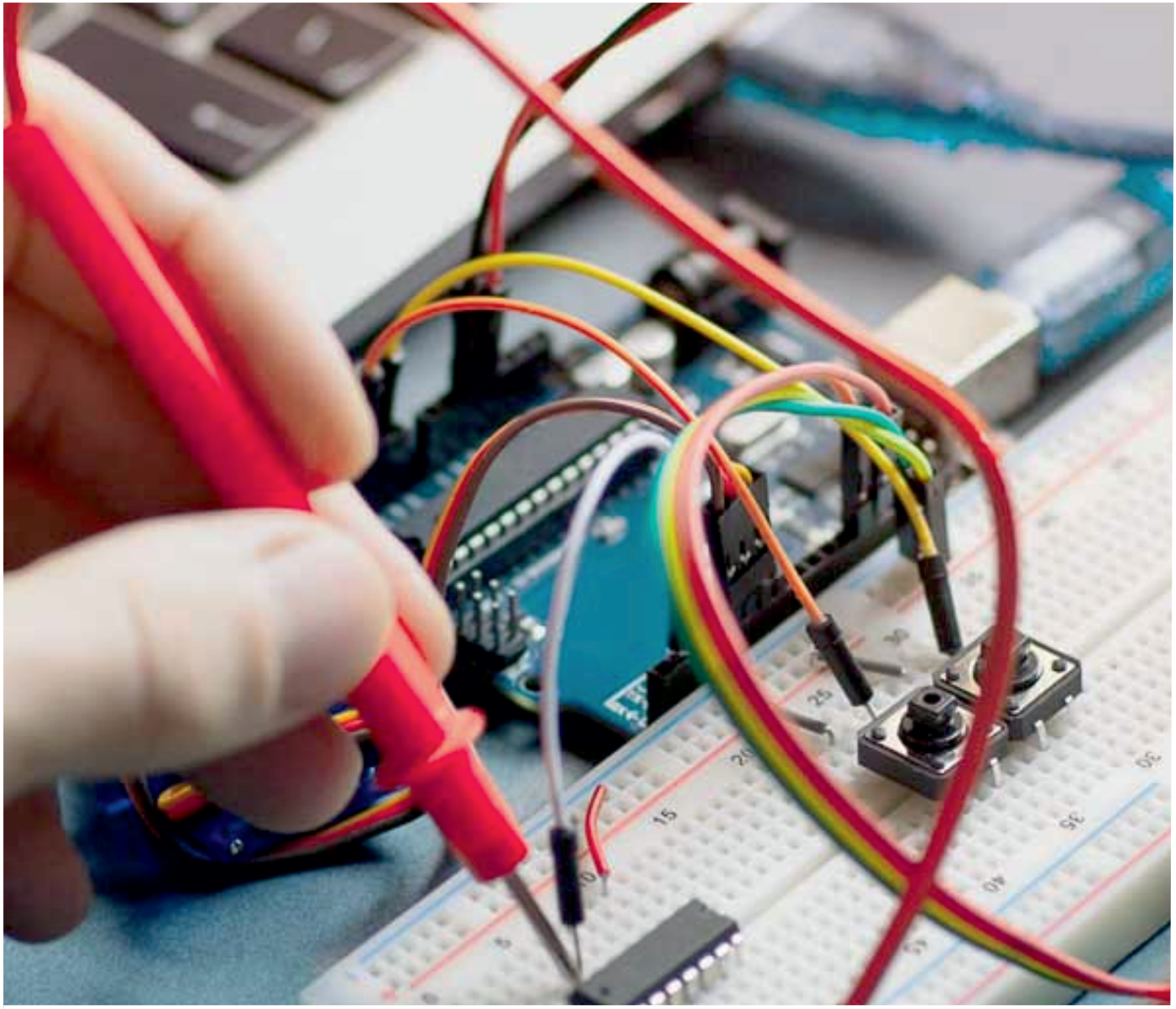

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