Smart PV Tied Leakage Free Inverter

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Abstract- *In this project utilization of a modified Single Ended Primary Inductance Converter (SEPIC) for control of photovoltaic power using Maximum Power Point Tracking(MPPT) control Mechanism is presented. The main aim of this project is, SEPIC converter is to be used along with a Maximum Power Point Tracking control mechanism. The MPPT is liable for extracting the maximum possible power from the photovoltaic and feed it to the load via the SEPIC converter which steps up the voltage to the required level. Voltage multiplier technique is applied to the SEPIC converter. The multiplier technique provides new operation characteristics and a high static gain. The theoretical analysis, design procedure and simulation results are shown in this paper. GWO based global MPPT algorithm is used to track the Maximum power and three phase inverter will convert the DC voltage into AC voltage for load. The hardware is developed with DSPIC30F2010.*

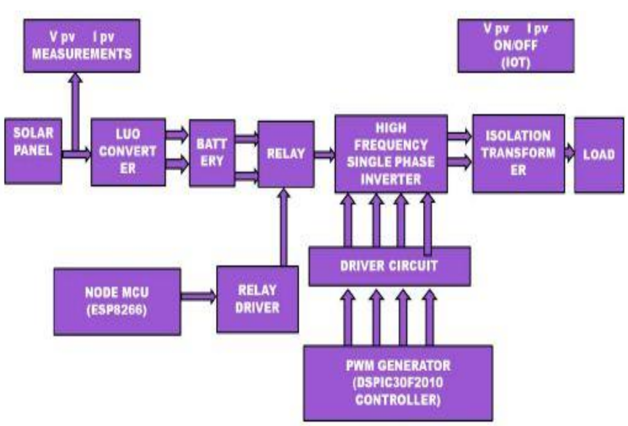
I. INTRODUCTION

Due to the critical condition of industrial fuels which include oil, gas and others, the development of renewable energy sources is continuously improving. This is the reason why renewable energy sources have become more important these days. Few other reasons include advantages like abundant availability in nature, eco-friendly and recyclable. Many renewable energy sources like solar, wind, hide and tidal are there. Among these renewable sources solar and wind energy are the world's fastest growing energy resources. With no emission of pollutants, energy conversion is done through wind and PV cells. Day by day, the demand for electricity is rapidly increasing. But the available base load plants are not able to supply electricity as per demand. So these energy sources can be used to bridge the gap between supply and demand during peak loads. This kind of small scale stand alone power generating systems can also be used in remote areas where conventional power generation is impractical. Hybrid generation systems that use more than a single power source can greatly enhance the certainty of load demands all the time. Even higher generating capacities can be achieved by hybrid system. In stand alone system we can able to provide fluctuation free output to the load irrespective of weathers condition. To get the energy output of the PV system converted to storage energy, and constant power delivered by the wind turbine, an efficient energy storage mechanism is required, which can be realized by the battery bank

II. LITERATURE REVIEW

An Efficient Wind-Photovoltaic Hybrid Generation System Using Doubly Excited Permanent-Magnet Brushless Machine (C. Liu, K.T. Chau, X. Zhang, 2010) In this paper due to PMBLDC machine efficiency of the AC source system is high. Also copper losses are very less because of permanent magnet nature. The hybrid energy is fed to the DC to DC converter and the voltage is given to the load. The load voltage is almost constant because of the hybrid system. The PMBLDC output is not sinusoidal nature due to permanent magnet. It requires sensor alignment. Power quality issues are not considered in this paper clearly. Boost converter is used so still ripples and THDs are high. Permanent Magnet Synchronous Generator-Based Standalone Wind Energy Supply System (C. N. Bhende, S. Mishra, Siva Ganesh Malla, 2011) In this paper the PMSG provides constant voltage to the load through three phase uncontrolled rectifier. Additional boost DC to DC converters are not required in this concept. Here the load is stand alone load because of this load compensation is not required. Only wind generation is included in this topology, due to this it required additional capacitor bank to store the energy. Power qualities problems are not compensated so performance of the system is poor .Only stand alone systems are discussed. A Comparative Study on Maximum Power Point Tracking Techniques for Photovoltaic Power Systems (B. Subudhi, R. Pradhan , 2013) 8 In this paper solar output is given to the DC to DC converter, because of this it provides constant voltage to the load. Different MPPT techniques are compared in this paper, finally hills clamping algorithm extracts maximum power from the panel. Without DC to DC converter it is not a efficient one also its ripple factor is high. Only solar network is not sufficient to provide voltage to the grid. Experimental Implementation Techniques of P&O MPPT Algorithm for PV Pumping System (NajetRebei, RabiaaGammoudi , Ali hmidet 2013) In this paper, a high-performance stand-alone PV generation system for water pumping application is successfully developed. Perturb and observe algorithm has been used for maximum power point tracking. It is a particularly valuable application from an educational perspective due to the challenges associated with designing a system that involves direct interfacing of photovoltaic panels to a load without the inclusion of energy storage. P&O algorithm does not provide constant voltage. Boost converter is not enough to improve the power factor of the system, need higher value of inductance. Analysis of Unified Output MPPT Control in Subpanel PV Converter System (Feng Wang, Student Member, IEEE, XinkeWu, Member, IEEE, Fred C. Lee, Fellow, 2014) In this paper explores the benefits of distributed MPPT solution through the use of SPMC structure, which can be seen as the reduced version of the current PV optimizer, connecting each PV cell string with a Buck converter. The simulation and experimental results verify that the proposed SPMC with unified output MPPT control solution exhibits good performance under inhomogeneous and homogeneous irradiations with an enhancement rate of about 20% in power harvest. Buck converter has discontinuous mode of operation. So losses are high. Grid compensation not included. 9 Design and Implementation of PV System using Quasi Z-Source Inverter for Distributed Applications (Prof.K.Eswaramma, 2014) In this paper presents detailed analysis on Z-source inverter control to study its transient behavior. The analysis is done using both shoot through mode and non shoot through mode for Z-Source and Quasi Z-Source separately. Based on the dynamic model, the two-stage control method for QZSI operating in both output voltage control and current control modes has been presented and the comparison between various parameters is shown. Shoot through duty cycle is high. Additional control techniques are necessary to control the output voltage. Inverter for Advanced Power Conditioning Of Renewable Energy Systems (C.Dinakaran, Abhimanyu Bhimarjun Panthee, Prof.K.Eswaramma, 2014) In this paper is emphasized the use of Quasi Z-Source inverter for advanced power conditioning of various renewable energy sources using distributed generator. This system can provide a better operation with lower cost, higher reliability and higher efficiency. Along with this, the proposed system is highly immune to EMI Noise. Large impedance networks are needed. Does not having mppt algorithm, so real power extraction is very less. Design Optimization of Transformerless Grid-Connected PV Inverters Including Reliability (Eftichios Koutroulis et al., 2013) Targeting at cost-effective deployment of grid-connected PV systems, a new methodology for the optimal design of transformerless PV inverters has been presented in this paper. Optimal switching frequency as well as the optimal values and types of the components comprising the PV inverter is calculated such that the PV inverter LCOE generated is minimized. In this paper separate boost converters are not used. Here there are no additional current control techniques, so the current harmonics is too high. 10 Novel Transformerless Grid-Connected Power Converter with Negative Grounding for Photovoltaic Generation System (Jia-Min Shen , 2012) This paper proposes a novel transformerless grid connected power converter with negative grounding for a photovoltaic generation system. The salient features of the proposed power converter are that some power electronic switches are simultaneously used in both the dc–dc power converter and dc–ac inverter Switching losses are too high and boost ratio is very less in this paper. Then grid compensation is not implemented. Simple Technique Reducing Leakage Current for H-Bridge Converter in Transformerless Photovoltaic Generation (RadoslawKotet ,2016) Given their structural arrangement, photovoltaic (PV) modules exhibit parasitic capacitance, which creates a path for high-frequency current during zero-state switching of the converter in transformerless systems. Both goals of this study are achieved by employing an appropriate hybrid modulation that reduces switching losses. In this paper separate boost factor is less also single order filter is used. This control technique does not maintain the power compensation. Design and Implementation of an Intelligent Energy Saving System based on Standby Power Reduction for a Future Zero-Energy Home Environment (JinsungByun, Sunghoi Park, Byeongkwan Kang, Insung Hong, and Sehyun Park, 2013) Energy saving has attracted great attention as a global issue because of recent environmental problems. As a part of energy saving efforts, governments are operating policies that encourage the distribution of energy saving systems. Also, individual households are voluntarily installing energy saving systems to reduce electric power consumption. However, due to fixed system architecture, the existing systems have a disadvantage, lacking in scalability and usability. In addition, the existing systems bring up immense inconvenience as it returns to 11 standby mode after automatic standby power cut-off. Therefore, we propose an intelligent energy saving system to solve these problems. Flexible Microgrid Power Quality Enhancement Using Adaptive Hybrid Voltage and Current Controller (Jinwei He, YunWeiLi, FredeBlaabjerg , 2014) To accomplish superior harmonic compensation performance using distributed generation (DG) unit power electronics interfaces, an adaptive hybrid voltage and current controlled method (HCM) is proposed in this paper. It shows that the proposed adaptive HCM can reduce the numbers of low-pass/ bandpass filters in the DG unit digital controller. Moreover, phase-locked loops are not necessary as the microgrid frequency deviation can be automatically identified by the power control loop. Grid Synchronization Systems of Three-Phase Grid-Connected Power Converters: A Complex-Vector-Filter Perspective (Weiwei Li, XinboRuan, ChenleiBao, Donghua Pan, Xuehua Wang, 2014) Due to the significance of extracting the grid voltage information, the grid synchronization system plays an important role in the control of grid-connected power converters, and various grid voltage synchronization schemes have been proposed. This paper adopts the complex-vector-filter method (CVFM) to analyze the grid synchronization systems. With this method, the pairs of scalar signals, for example, α-and β-axis components in the stationary α−β frame, are combined into one complex vector. As a consequence, the grid synchronization systems can be described with the complex transfer functions, which is very convenient to evaluate the steady-state performance. A Novel Hybrid Isolated Generating System Based on PV Fed Inverter-Assisted Wind-driven induction Generator (S. Arul Daniel, N. Ammasai Gounden 2004) 12 Isolated renewable energy systems based on hybrid wind-solar sources are considered as feasible and reliable options instead of wind-diesel systems. An isolated hybrid scheme employing a simple three-phase square-wave inverter to integrate a photovoltaic array with a wind-driven induction generator has been proposed for the first time. A dynamic mathematical model of the hybrid scheme with variables expressed in d -q synchronous reference frame has been developed. The model is implemented in the power system blockset platform and a comparison has been made between transients simulated and transients obtained in an experimental prototype. Comparison of Direct-Drive and Geared Generator Concepts for Wind Turbines (HenkPolinder, Frank F. A. van der Pijl, Gert-Jan de Vilder, Peter J. Tavner, 2006) The objective of this paper is to compare five different generator systems for wind turbines, namely the doubly-fed induction generator with three-stage gearbox (DFIGURE3G), the direct-drive synchronous generator with electrical excitation (DDSG), the direct-drive permanent-magnet generator (DDPMG), the permanent-magnet generator with single stage gearbox (PMG1G), and the doubly-fed induction generator with single-stage gearbox (DFIGURE1G). The comparison is based on cost and annual energy yield for a given wind climate. The DFIGURE3G is a cheap solution using standard components.

III. BLOCK DIAGRAM



IV. HARDWARE DESCRIPTION

POWER SUPPLY:

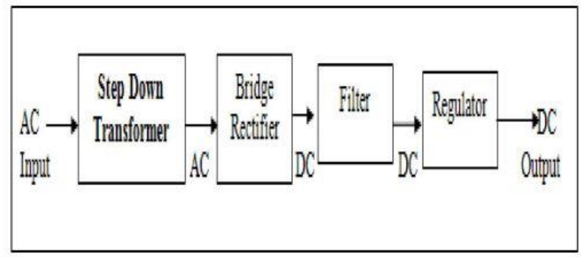
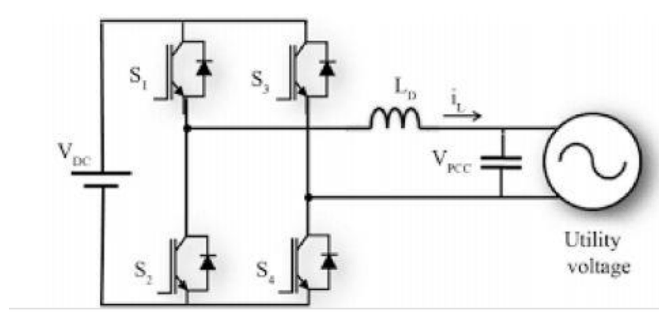


Fig: power supply

Power Supply is the device that transfers electric power from a source to a load using electronic circuits. Power supplies are used in many industrial and aerospace applications and also in consumer products. Some of the requirements of power supplies are small size, lightweight, low cost, and high power conversion efficiency. In addition to these, some power supplies require the following: electrical isolation between the source and load, low harmonic distortion for the input and output waveforms, and high power factor (PF) if the source is ac voltage. Some special power supplies require controlled direction of power flow. Typical application of power supplies is to convert utility's AC input power to a regulated voltage(s) required for electronic equipment. Depending on the mode of operation of power semiconductors power supply can be linear or switching

V.VOLTAGE SOURCE INVERTER

Inversion is the change of dc power to ac power at a desired output voltage or current and frequency. A static semiconductor inverter circuit does this electrical energy inverting transformation. The terms voltage-fed and current-fed are used in relation with the output from inverter circuits. Conventionally, inverters are classified into two broad categories – voltage source inverter (VSI) and current source inverter (CSI).



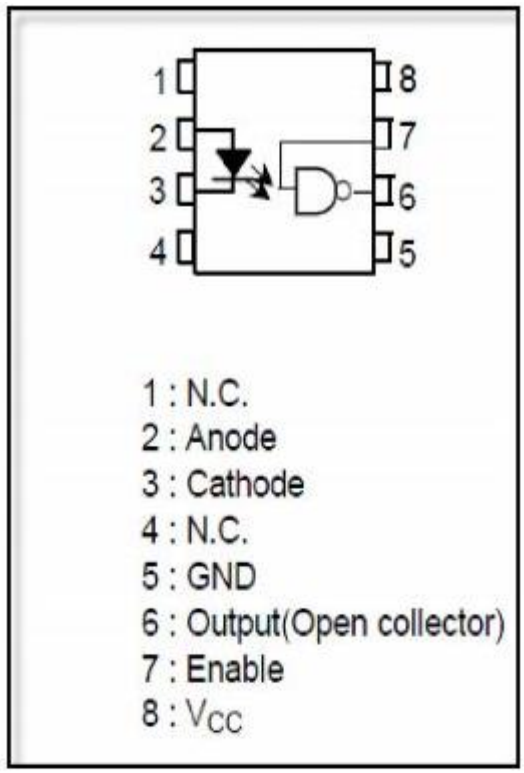
A VSI is one in which the dc input voltage would have to keep constant and independent of the load current drawn. The inverter dictates the load voltage while the drawn current shape is specified by the load.

These topologies are widely used because they behave as voltage sources naturally as required in many industrial applications, such as adjustable speed drives (ASDs), which are the most famous application of inverters. Similarly, these structures can be used as CSIs, where the independently controlled ac output is a current waveform. These structures are widely used in medium-voltage applications, where good-quality voltage waveforms are required. Static power converters, mainly inverters, are constructed from power switches and the ac 45 output waveforms are therefore constructed of discrete values. This leads to the formation of waveforms that features fast transition rather than smooth ones. Depicts the traditional or conventional three-phase voltage-source converter (that can be abbreviated as VSC) structure. A dc voltage source which is supported by a large capacitor feeds the main converter circuit, a three-phase bridge. This dc voltage source can be a battery, fuel-cell stack, diode rectifier, or capacitor. Six switches which are represented by IGBTs with an anti-parallel diode are used in the main circuit; to provide bidirectional current flow and unidirectional voltage blocking capability. The VSC is commonly used. However it has following limitations:

- The ac output voltage is limited below and cannot cross the dc-rail voltage. Therefore, the VSC is a buck inverter for dc-to-ac power conversion and the VSC is a boost rectifier for ac to dc power conversion.
- For applications where over drive is required and the available dc voltage is not sufficient then an additional dc-dc boost converter is required to get the desired ac output. These additional converter stages raise the system cost and lower down the efficiency%. The upper and lower devices of each phase leg cannot be gated on simultaneously otherwise, a shoot-through would occur which would destroy the devices. The shoot-through problem by electromagnetic interference (EMI) noise's miss-gating-on is one of the main problems in terms of reliability of the converter
- An output LC filter is required to provide a sinusoidal voltage compared with the CSI, which causes additional power loss. A CSI is one in which 46 the source and therefore the load current is predetermined and the load impedance decides the output voltage. The supply current cannot change rapidly. This current is controlled by series inductance which control sudden changes in current. The magnitude of load current is controlled by varying the input dc voltage to the large inductance, hence inverter response to changing load is slow. Being a current source, the inverter may survive a short circuit thereby offering fault ride-through properties.

VI. OPTO COUPLER

The function of Opto Coupler is isolate to the control circuit from power circuit. Pulse width modulation signal (PWM 1 to PWM 12) comes from DSPIC Processor. This signal is not directly fed through a power circuit. Suppose Control Circuit (DSPIC) is connected to power circuit without isolation circuit, the control circuit may get affected. So we need to isolation circuit interface between power circuit and control circuit.

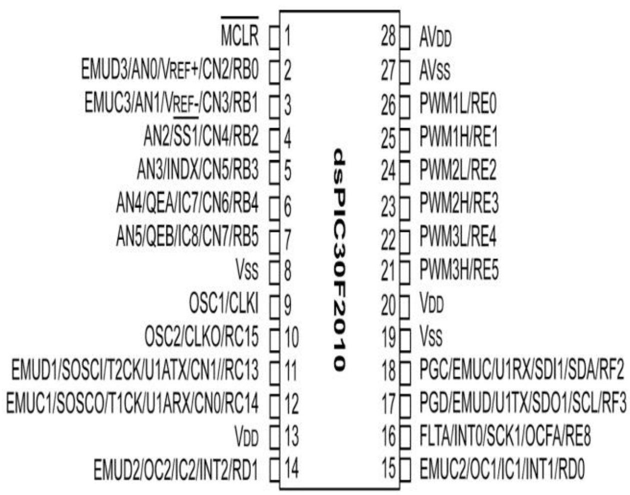


VII.DSPIC CONTROLLER

Microchip Technology's Motor Control & Power Conversion family of dsPIC Digital Signal Controllers provides an easy-to-use solution for applications 70 requiring motor control. Microchip Technology introduced 20 16-bit Flash micro controllers that provide the industry's highest performance. The dsPIC family of Digital Signal Controllers features a fully- implemented digital signal processor (DSP) engine, 30 MIPS non-pipelined performance, C compiler friendly design, and a familiar Microcontroller architecture and design environment. The 20 new dsPIC30F2010 devices form three product families targeting motor control and power conversion, sensor, and general-purpose applications. The dsPIC core is a 16-bit (data) non-pipelined modified Harvard machine that combines the control advantages of a high-performance 16-bit Microcontroller with the high computation speed of a fully implemented DSP to produce a tightly coupled, single-chip single-instruction stream solution for embedded systems designs.The initial 20-dsPIC30F2010devices feature 12 Kbytes to 144 Kbytes of on-chip secure Flash program memory space and up to eight Kbytes of data space Operating voltage appeals to many Microcontroller applications that remain at 5 volts, while many DSPs are restricted to 3.3-supply V maximum. Devices are planned in 40-pin package.

CONFIGURATION:

The architecture of dspic30f2010 is shown in fig,



VIII.CONCLUSION

A new reliable hybrid DG system based on PV and wind driven PMSG as sources, with only a LUO converter followed by an inverter stage, has been successfully implemented. The mathematical model developed for the proposed DG scheme has been used to study the system performance in MATLAB. In addition, it has been established through simulation that the two controllers, digital MPPT fuzzy logic controller and PI controller which are designed specifically for the proposed system have exactly tracked the maximum powers from both the sources. Maintenance free operation, reliability and low cost are the features required for the DG employed in secondary distribution system. . The steady state waveforms captured at grid-side show that power generated by the DG system is fed to the grid at unity power factor. The voltage THD and the current THD of the generator meet the required power quality norms recommended by IEEE. The proposed scheme easily finds application for erection at domestic consumer sites in a smart grid scenario.

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