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Single Phase Cascaded Half Bridge Inverter Based on Photovoltaic Applications

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***Abstract*-In this paper a single phase half bridge inverter is propsed.This paper presents a minimum number of power electronic evicet.Thus obtaining fully dedicated digital circuits.In this system there is a two cells (H-BRIDGE). Each cell having a one switching circuit.The experimental results show good performance used to reducing the switching circuit.The efficiency level is high.The simulation for the proposed system will be obtained from MATLAB simulation**

Keyword: single-phase, photovoltaic cell, fpga, half bridge inverter

I.INTRODUCTION

Basically Inverter is a device that converts DC power to AC power at desired output voltage and frequency. Demer its of inverter are less efficiency, high cost, and high switching losses. To overcome these demerits, we are going to multilevel inverter. The term Multilevel began with the threelevel converter. The concept of multilevel converters has been introduced since 1975. The cascade multilevel inverter was first proposed in 1975. In recent years multi level inverters are used high power and high voltage applications .Multilevel inverter output voltage produce a staircase output waveform, this waveform look like a sinusoidal waveform. The multilevel inverter output voltage having less number of harmonics compare to the conventional bipolar inverter output voltage. If the multilevel inverter output increase to N level, the harmonics reduced to the output voltage value to zero. The multi level inverters are mainly classified as Diode clamped, Flying capacitor inverter and cascaded multi level inverter. The cascaded multilevel control method is very easy when compare to other multilevel inverter because it doesn'trequire any clamping diode and flying capacitor.There are two PWM methods mainly used in multilevel inverter control strategy. One is fundamental switching frequency and another one is high switching frequency. For high switching frequency classified as space vector PWM. Among these PWM methods SPWM is the most used for the multilevel inverter, because it has very simple and easy to implemented. In this paper present SPWM method with the different carrier based disposition PDPWM, PODPWM and APODPWM has been analyzed Micro inverter- This inverter architectures, each solar panel has its own inverter that performs power conversion for each module. Micro-inverter architectures are more expensive than the other two, but offer the highest power optimization and design flexibility and also avoid a single point of failure. The main focus of this thesis is on micro-inverters, particularly micro-inverters that are based on the flyback converter topology. The same sunny days that dry out plants, make animals thirsty, and heat up buildings and cars are also good days for generating electricity with photovoltaics. This electricity can be used to power water pumps for irrigation and drinking wells, and ventilation fans for air cooling. For this reason, the most simple PV systems use the dc electricity as soon as it is generated to run water pumps or fans.These basic PV systems have several advantages for the special jobs they do. The energy is produced where and when it is needed, so complex wiring, storage, and control systems are unnecessary. Small systems, under 500 watts (W), weigh less than 68 kilograms (150 pounds), making them easy to transport and install. Most installations take only a few hours. And, although pumps and fans require regular maintenance, the PV modules require only an occasional inspection and cleaning. Where utility power is available, a grid-connected PV system can supply some of the energy needed and use the utility in place of batteries.Some homeowners, considered pioneers in the energy field, are using PV systems connected to the utility grid. They are doing so because they like that the system reduces the amount of electricity they purchase from the utility each month. They also like the fact that PV consumes no fuel and generates no pollution.The owner of a grid-connected PV system cannot only buy, but can also sell, electricity each month. This is because electricity generated by the PV system can be used on site or fed through a meter into the utility grid. When a home or business requires more electricity than the PV array is generating (for example, in the evening), the need is automatically met by power from the utility grid. When the home or business requires less electricity than the PV array is generating, the excess is fed (or sold) back to the utility. Used this way, the utility backs up the PV like batteries do in stand-alone systems. At the end of the month, a credit for electricity sold gets deducted from charges for electrical work

II.RELATEDWORK

Single phase grid-connected PV inverters present similarities with the application and control, power decoupling strategies as well as topologies from have been adapted to PV inverters. A buck converter connected between the solar panel and the grid using anunfolder stage, thus working as a current source, as in the boost converter applications, if the buck converter is operated in the boundary between continuous and discontinuous conduction modethe injected current to the grid is proportional to the grid voltage. By analyzing the average current value ina switching cycle, it can be concluded that this is possible if the off-time is kept constant.Two possible implementations are proposed for the singlestage forward microinverter, as shown in Fig. 3: a) with unfolding stage and b) with secondary side switches. In both cases, the primary transistors are high-frequency switched to operate the microinverter in the boundary mode. Implementation b) integrates the unfolding stage in the microinverter power stage, i.e., the secondary side bidirectional switches are line frequency switched according to the grid voltage polarity. Thus, two subcircuits are generated as depicted in Fig. 4. Therefore, the two primary windings are used either for energy transfer or transformer reset during the corresponding grid half-cycle and the primary to tertiary turns ratio is forced to be the same. Furthermore, both primary windings are designed for the same current stress; hence, a bigger core is needed.The parallelization in the primary side reduces the current stress in both switches and primary windings of the transformer. The current sharing is guaranteed because of the secondary series connection, although affected by the coupling of the individual transformers. The current stress is also decreased in the secondary side diodes due to the common cathode configuration and the synchronized driving of the primary switches.

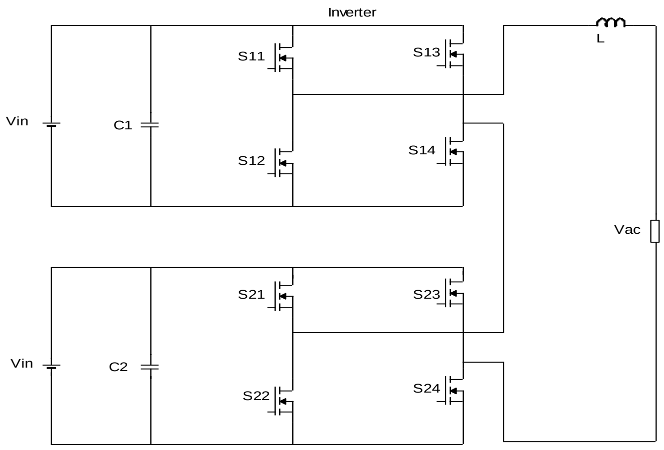

Fig.1 Block diagram of proposed inverter

As a result, SMD devices can be used, a low-profile implementation is feasible and the thermal management is improved, although more devices are needed. The secondary series connection allows achieving the grid voltage using transformers of lower turns ratio. Therefore, the primary to secondary coupling at each transformer can be significantly improved, i.e., primary side current sharing is improved and parameters such as leakage inductance can be reduced, thus improving the off transition of the primary transistors. It should be pointed out that this multilevel topology requires as many isolated power sources as H-bridge power stages, which is considered a problem when it is used in classical power electronics applications (e.g. high power motor drives).

However, photovoltaic modules meet this requirement, which in turn has made the CHB topology an interesting choice for the photovoltaic power inverter design process. One of the most interesting feature in this topology is the ability to boost the inverter AC side voltage enough to inject current into the grid without using neither a transformer nor an additional boost converter, due to the fact that as much modules as desired can be stacked in series, thus increasing the number of output voltage levels In fact, this characteristic has motivated the study of different maximum power point tracking strategies which enables the independent control of each group of photovoltaic modules, while controlling the current injected into the electric grid. It is worth pointing out that some works have exploited this modular structure to work even with damaged power cells, thus increasing the reliability of the system. Finally, it should be noted that the number of semiconductors needed would affect the cost and the reliability, and that the leakage current can be high, depending on the number of cells connected in series

III.PROPOSED WORK

The cascaeded half bridge inverter is to improve the system performance and the stability of the photovoltaic inverter. The rate of total harmonic distortion (THD) will also get reduced by this implementation method. The increasing number of switches will increase the firing circuit for the unit that will be reduced by this concept.

The block diagram of the system will explain the implementation of the proposed system. The PV panel (or) DC source used here will protect by the rectifier used here. The filter used here was LC filter and it will filter the unwanted DC component coming from the source.

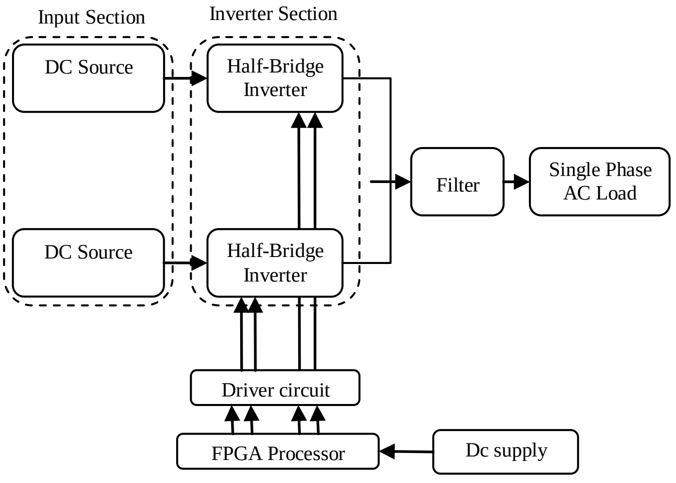

Fig.2 Block diagram of proposed inverter

The inverter switch is nothing but a switch which will connect with a filter. The filter is then connected with a load. Then the micro inverter will convert the DC in to AC. The output of the inverter will filter out then it is given to the ac load. The controller used here is driver circuit then the firing circuit will give the firing pulse to the MOSFET connected with the circuit.

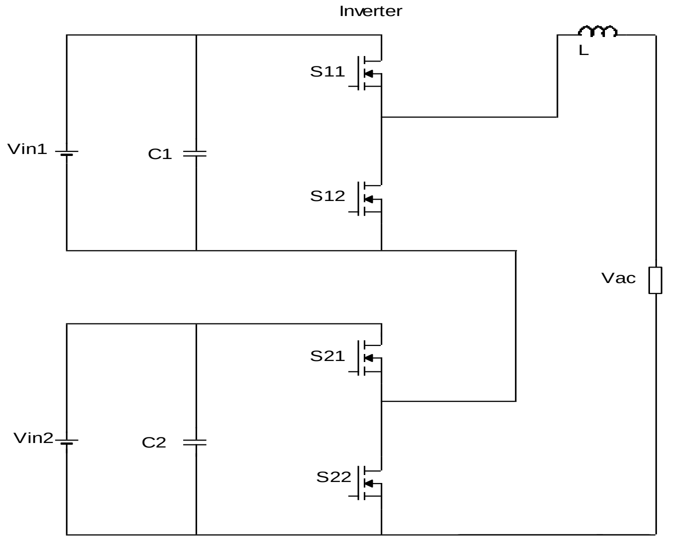

Fig.3 Circuit diagram of proposed inverter

The cascaded half bridge inverter is used in both AC/DC and DC/DC conversion with the galvanic isolation between the input and any of the outputs.

The inverter is a cascaded hbridge inverer, so that the voltage ratios are multiplied with an additional advantage of isolation.

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The term H-Bridge is derived from the typical graphical representation of such a circuit. An H bridge is built with four switches. When the switches S11 and S22 are closed and S12 and S21 are open a positive voltage will be applied across the load. By opening S11 and S22 switches and closing S12 and S22 switches, this voltage is reversed, allowing reverse operation of the load.

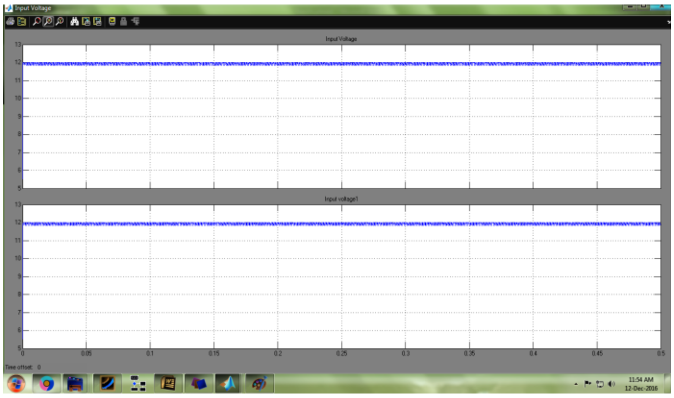

Fig.4 Input pulse waveform

The input pulse and the gate pulse of the proposed halfbrige inverter is shown in the fig. 4 and fig. 5 respectively. The constant 12V was given as an input for the switch and the overall system. Similarly the gate pulse for the MOSFET switches is also given to the circuit.

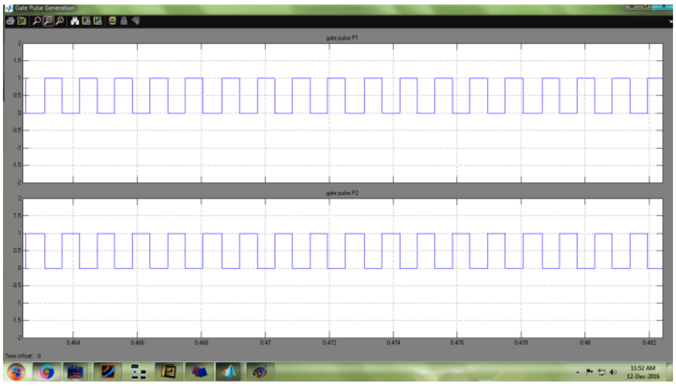

Fig.5 Gate pulse waveform

IV.SIMULATION RESULTS

The output waveform of the proposed system will be shown in the fig. 6. The given 12V input will get raised in to 120V with the help of step-up transformer. That is the transformer used here is 1:10 ratio transformer. The output wave form will explain the transition of the proposed system. That is the output of the proposed system will give raise to the fluctuation less system design using flyback concept. Compare to the existing system the proposed system will have low THD level.

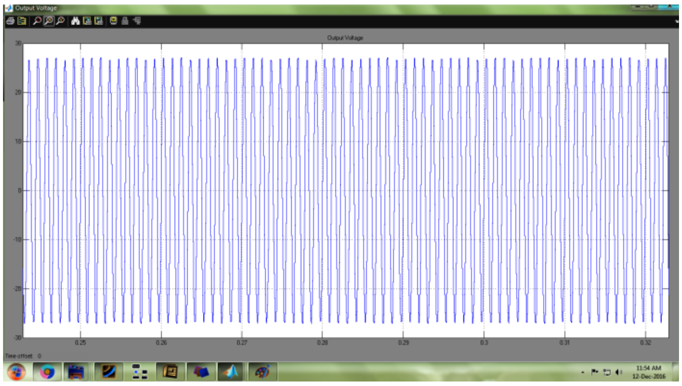

Fig.6 Output pulse waveform

The figure 5 will explain the comparison of THD level between existing system and proposed system. In the existing system the number of MOSFET will be high that is in the adaptive snubber there is four MOSFET with capacitors are used as a filter. The adaptive snubber is nothing but a filter with a combination of capacitor and MOSFET. This will improve the number of firing circuit. And that will increase the amount of THD rate in the existing system compare to the proposed system. In the proposed system the disadvantage in the existing systems topology will get changed with the help of flyback topology. Here the number of MOSFET will be getting reduced in the proposed system with improved topology. The THD rate of the existing system will be between 0.8 to 0.9 percentages . But in the proposed system the THD rate will get reduced and the percentage of THD will be between 0 to 5 percentages . This will be obtained in the proposed flyback micro inverter topology.

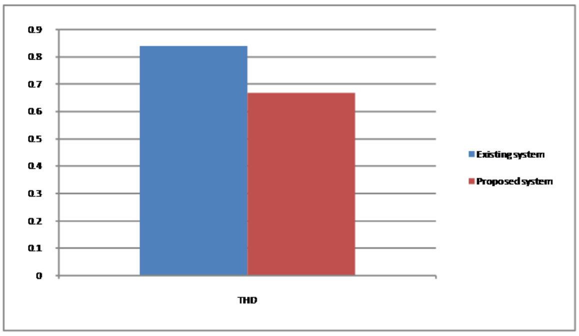

Fig.7 THD level comparison between existing and proposed system

V.CONCLUSION AND FUTURE WORK

This chapter exposes the detailed results and comparative analysis between existing and proposed topology. The disadvantages in the existing system will be overcome in the proposed system with change in circuit topology and advanced improved system technique. The modulation technique implemented in the flyback topology and validated results will prove the proposed technique will be best compare to the existing topology.The new, innovative and control modulation techniques may be used to solve the problem in this field instead of the proposed modulation technique.The simulation process may be performed in any other software platforms instead of the proposed MATLAB environment.The new, innovative topology may be performed by any other leading and recent modulation techniques.

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