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Micro Solar Inverter Applications Using PV Cells

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Abstract

Solar inverter systems at present use centralized inverters; many solar panels feeding DC currents into a single large inverter. Trend is making inverters small enough so that each can be fixed to a single panel. This means simplified installation and management, better reliability. In this paper a lab model micro solar inverter has been designed and developed that converts DC power to AC power. The micro inverter is fixed backside of the solar module and the Alternating Current (AC) is drawn for use in any place and for any application.

Key words: photovoltaic cell, micro inverter, astable multivibrator, V-I curve.

Introduction

Recently there is game changing technology for photovoltaic (PV) power tapping concept. It is a basic modification in the inverter that changes the DC power produced by the solar panel to an AC power. Then the produced power can be used in connecting with a grid. The micro solar inverter is a one which we are going to fix at each solar panel backside and then in turn it can be attached to many solar modules which produces a large AC power this will be very useful for a small to large places. Those can accommodate and operate many household appliances.

Basically a photo voltaic solar panel is made up on a group of individual solar panels that can be fixed on the top of the buildings. All these solar panels are fixed on the roof top and can be connected with a same angle and size. Then in turn it can be feed to a grid to produce a larger power. Fig.1 illustrates the concept. The power from the circuit can be given to the buildings & business places.

The micro- solar can give new ideas to create power from small solar panels that vanishes the olden methods of power generation from solar panels. Because all solar panels have its own inverter fixed to its back side so it can produce power on its own and it can act as an individual power plant inverter. Hence it can be functions by himself and the more no of panels connected in an array that can able to produces

more power. This method of power production by a solar inverter will serve as a best solution for the remote areas. Fig 2 delivers the new concept.

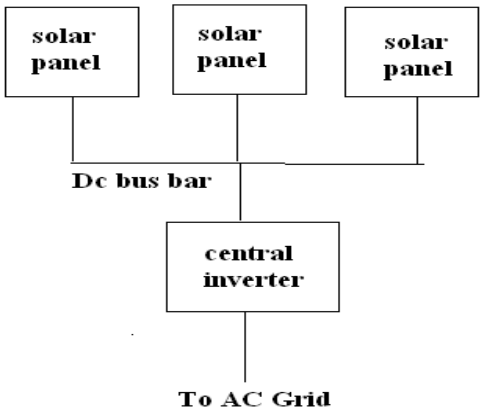

Figure 1: String (Centralized) Inverter Concept

In this paper, a new method has been proposed in the development of a micro solar inverter has been attempted. The design consists of a 50Hz square wave oscillator cascaded to a square wave to sine wave oscillator. The square wave is then given back to transformer to amplify the power through power amplifier and the output of the transformer gives 230V at 50Hz.

The main advantages of individual solar panel based inverters are:

- small in size and power
- directly mounted on the back side of the panels, hence reduced wiring harness
- all inverters produce 230vAC 50Hz and grouped them in parallel
- loss due to wiring harness from the panel to the summing point is reduced
- more reliability failure of a single panel will not affect the overall system
- Scalability

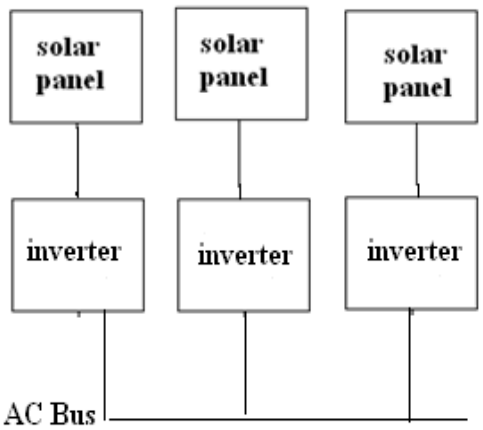

Figure 2: Micro Solar Inverter Concept

Design of Micro Solar Inverter

The schematic of micro solar inverter panel is shown in the Fig.3. The micro solar inverter consists of an Astable Oscillator that is been tuned for 50Hz. In turn it converts the signal to a pure sine wave using a converter. The available signal is then further boosted and connected to the input of the transformer. The output of the transformer the produces a 230V AC, 50Hz.

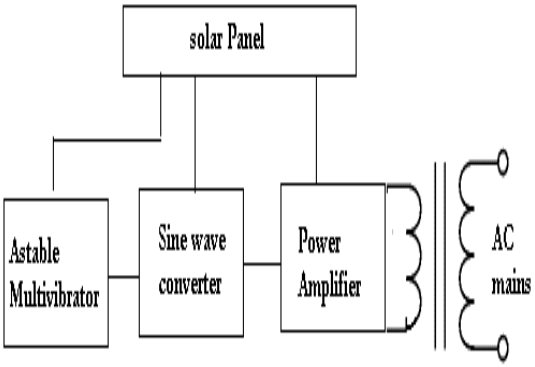

Figure 3: The Architecture of a Micro Solar Inverter

The experimental design for a thirty six solar panel module in the size of 635x550x38mm with power output rating of 37wp, 17.1 V_{mpp}. Was designed. The voltage & current characteristics of the solar panel module was shown in the Fig.4. The characteristics are taken for dark, moderate solar irradiance and high intensity solar irradiance

The astable multi vibrator produces a square wave of 50Hz. This is built around an Operational amplifier. The square wave is further modulated to produce a pure sine wave since this is required to feed the primary of a transformer. This voltage is power amplified and the output is fed to a transformer whose secondary produces an AC voltage up to 15W. The power for the load is drawn from the solar panel that supplies DC bias voltages to all the circuits. The micro inverter has been installed at the back of the solar panel and is compact in size. The complete configuration is shown in Fig.5.

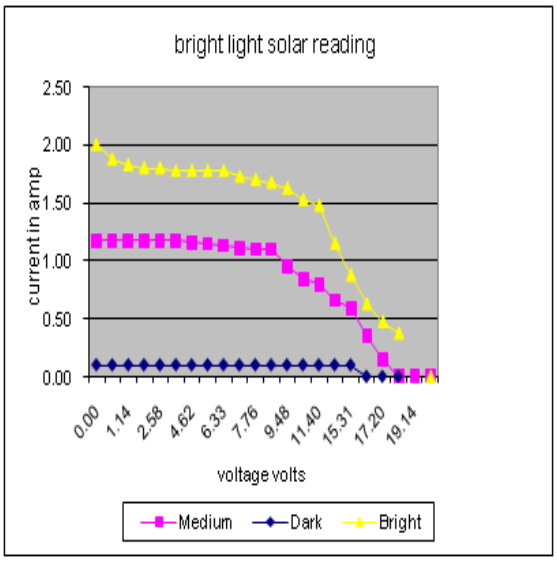

Figure 4: V-I characteristics of a solar panel

Figure 5: Final Assembled Micro Solar Inverter

Conclusion

In this paper, a design of a micro solar inverter has been attempted and a laboratory model for a 37wp solar panel has been successfully designed and developed giving a maximum of 15W output at 230v at 50Hz. This concept of design and development of solar micro inverter is new even in advanced countries and to our knowledge this has not been done in India though micro solar inverters of various power ratings are commercially available from China.

The laboratory model has proved the concept of direct AC from DC for each panel and the scalability. However many modifications in the design is required such as maximum power point tracking (MPPT) [4] [5] maximum irradiance, temperature sensing etc.

It is our Endeavour to design and develop solar micro inverters of different power ratings with a maximum supremacy position tracking of solar power for direct use in

residential and business areas was successfully designed with the maximum level of output.

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