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Study and Design Aspects of Light Weight Inverter for Renewable Energy Resources.

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Abstract: *Due to growing trend of energy generation from renewable resources, there is a great demand for highly efficient & cost effective inverters in the market. This paper focuses on advancement and development of light weight power converter technology inverter powered by PV cells and that could supply stand-alone single phase AC loads. Now-a-days, the conventional inverters with heavy transformers are being replaced by power converter technology inverter. Various inverter topologies are presented and compared. Finally one topology is selected and suggested to be suitable for single phase standalone AC loads. The proposed inverter employs push-pull topology to amplify the current and Arduino NANO is used to accomplish the task of MPPT*

Keywords: *Power converter, Inverter, MPPT*

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I. Introduction

These days, the development and advancement of unused energy sources are being continuously upgraded which in turn makes non-conventional energy sources more important contributor to the total energy consumed in the world. Traditional way of power generation from conventional energy sources are considered to be unsustainable in long term national strategies. This has been one of the most driving forces for an expanding commissioning of non-conventional energies like wind power, solar photovoltaic(PV) power, hydropower, etc. into the public grids. Among the major non-conventional energy resources, solar energy power supplied to the utility grid is gaining more and more important, while the world's power demand is increasing[1].

Not many Solar system has yet been installed due to high initial cost. Most of the Solar system are designed with transformer for safety purpose. High frequency transformer is used on DC side, while low frequency bulky transformer are used on output side of the inverter[2]. This increases the weight and cost of the inverter. To overcome these problems, power converter technology inverter is introduced. In this paper we will make a prototype of a power converter technology inverter powered by solar panels and that could supply stand-alone loads

II. Types Of Inverters

Solar inverters may be classified into three broad types.
1. Stand Alone Inverters
2. Grid Tie Inverters
3. Battery Backup Inverters

a. Stand Alone Inverters

Stand-alone inverters, used in isolated systems where the inverter draws its DC energy from batteries charged by photovoltaic arrays. Many stand-alone inverters also incorporate integral battery chargers to replenish the battery from an AC source, when available. Normally these do not interface in any way with the utility grid, and as such, are not required to have anti-islanding protection.

b. Grid Tie Inverters

Grid-tie inverters, which match phase with a utility-supplied sine wave. Grid-tie inverters are designed to shut down automatically upon loss of utility supply, for safety reasons. They do not provide backup power during utility outages.

c. Battery Backup Inverters

Battery backup inverters, are special inverters which are designed to draw energy from a battery, manage the battery charge via an onboard charger, and export excess energy to the utility grid. These inverters are capable of supplying AC energy to selected loads during a utility outage, and are required to have anti-islanding protection.

III. Hardware Model

This paper is all about designing an inverter from scratch, with this inverter, you can power up various electronic appliances like TV, Fan etc. The aim of the inverter circuit is to convert 12V DC to 220V AC, now to achieve this, we have to first convert 12V DC to 12V AC followed by 12V AC to 220V AC.
In short, we can classify the designing of inverter circuit into following stages.

1. Driver Stage
2. Power Stage

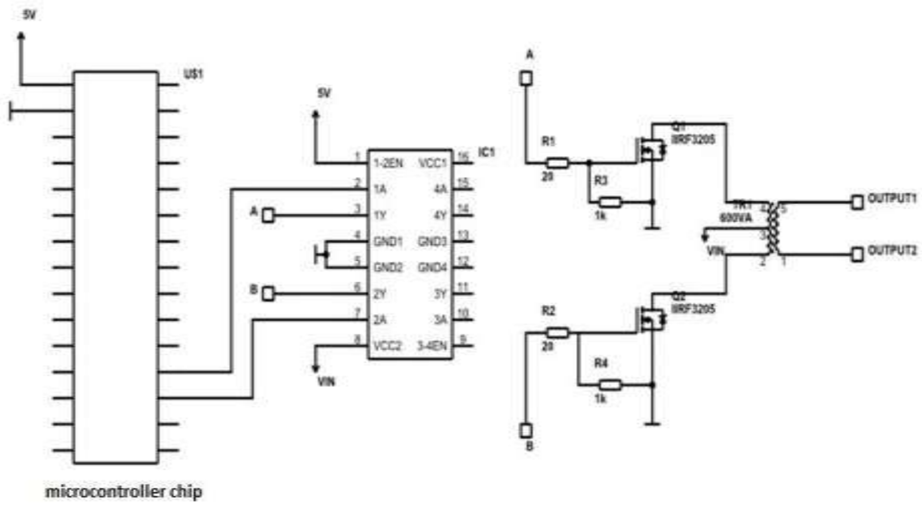

Fig. 1 Circuit Diagram of Inverter

3.1 Driver Stage:

The tasks that are performed in driver stage are generation of modified sine wave, monitoring the battery voltage, handling the other housekeeping tasks such as short circuit protection, etc. Here Arduino NANO is used to accomplish all these tasks. Arduino is generating a modified sine waveform of 5V which is amplified to a level of 12V using L293D Ic. Battery voltage is monitored every 20ms using timer interrupt.

3.2 Power Stage:

The current amplification task is performed by the power stage. In this stage two N-MOSFETs are configured in push-pull topology to amplify the current. MOSFET Chosen are IRF3205.

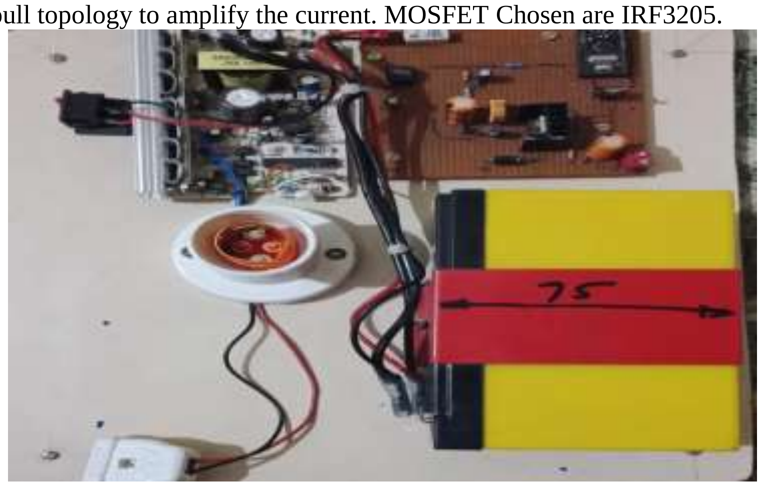

Fig. 2 Hardware Model of Inverter

3.3 Maximum Power Point Tracking

There are many charge controllers available in market, but ordinary cheap charge controllers are not efficient to use with maximum power from solar panels and the ones which are efficient are very costly. So a charge controller was designed which is efficient and smart enough to understand the battery needs and solar conditions. It takes appropriate actions to draw maximum available power from solar and put it inside the battery very efficiently.

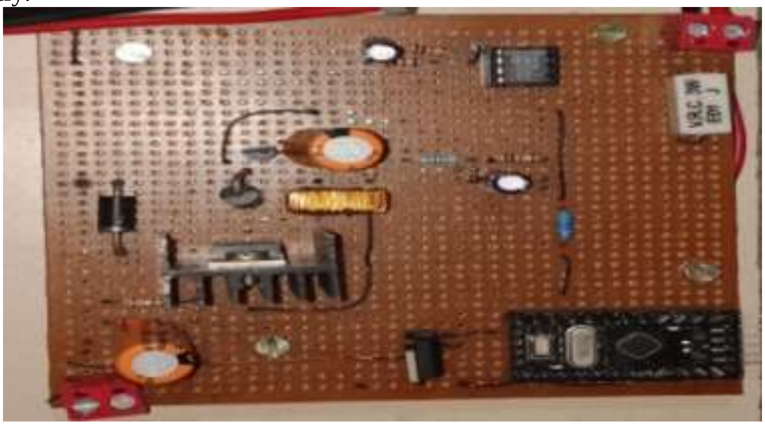

Fig. 3 MPPT Circuit

IV. Calculations

The Total load is = 50 watt
The inverter is designed for 12 volt
Voltage = 12 volt
Power = voltage * current
50 = 12*current
Current = 50/12=4.16 ampere
Battery = total load * no of hours/voltage
= 40*5/12
= 16.66 28
= 16 Ah or 17 Ah
But efficiency of inverter 85% & DOD = 80%
A-hr= (16A-hr/ (0.85*0.8)) =23A-hr battery
Solar panel
Charging current = 1/10th of its total Ah
= 1/10 * 23
= 2.3 Ah
Solar panel needs 2.3 amps current to feed our battery bank
= 2.3 + 4.16
= 6.46 amps
Solar panel should make 6.46 amps

Here 2. 3amps need to feed battery and 4.16 to run electrical load through solar
Power =12 * 5 = 60 watt
50 watt panel give output of approx. 35 watt so 100 watt panel will be required.

V. Conclusion

The project described is valuable for the promising potentials it holds within, ranging from the long run economic benefits to the important environmental advantages. This work will mark one of the few attempts and contributions in the Arab world, in the field of renewable energy; where such projects could be implemented extensively. With the increasing improvements in solar cell technologies and power electronics. The solar inverter made by us is just a prototype for making future projects which incorporate advanced technologies like micro controlled solar tracking, charge control, etc. this is to show that solar inverters are very cheap and easy to install so that the energy demands are shifted on using renewable sources of energy.

References

[1]. Carmaline Anthony, S.Gotekar, and S.P. Muley, Single Phase Transformer less Grid Connected PV Inverter: A Review, International Journal on Recent and Innovation Trends in Computing and Communication, Volume:4, Issue 5.

[2]. L. Ashok Kumar and N. Sujith Kumar, Design and Analysis of Highly Efficient and Reliable Single-Phase Transformerless Inverter for PV System. World Academy of Science, Engineering and Technology International Journal of Energy and Power Engineering, Vol:8,No:9,2014

[3]. Mr. Deshmukh P.R. and Mr. Kolkure V.S., Self-Electricity Generation and Energy Saving By Solar Using Programmable System on Chip (PSOC), International Journal of Engineering and Science (IJES) Volume 4, Issue 2, 2014

[4]. Salvador Alepuz, Sergio Busquets-Monge, JosepBordonau, Javier Gago, David González, and JosepBalcells, Interfacing Renewable Energy Sources to the Utility Grid Using a Three-Level Inverter, IEEE Transactions On Industrial Electronics, Vol. 53, No. 5, October 2006

[5]. E.Koutroulis and K.kalaitzakis, Novel Battery Charging Regulation System For Photovoltaic Applications, IEE Proc-Electr.Power Appl., Vol 151,No 2, March 2004,pp.191-197

[6]. M. Vasugi and Prof. R.Jayaraman, Solar Charged Stand Alone Inverter, Int. Journal of Engineering Research and Application, Vol. 4, Issue 7, July 2014

[7]. Kumaresh.V, Mridul Malhotra, Ramakrishna N and SaravanaPrabu, Literature Review of Solar MPPT Systems, Advance in Electronic and Electric Engineering, Vol.4, 2014

[8]. Jun Pan, Chenghua Wang and Feng Hong, Research of Photovoltaic Charging System with Maximum Power Point Tracking, The Ninth International Conference on Electronic Measurement & Instruments ICEMI, 2009.

[9]. EftichiosKoutroulis, Kostas Kalaitzakis, et al., Development of a Microcontroller-Based, Photovoltaic Maximum Power Point Tracking Control System, IEEE Transactions on Power Electronics, Vol. 16, No. 1, Jan. 2001.

[10]. Gaurav Arora, Neha Agarwal, Prajjwal Singh and Debojyoti Singh, Solar Power Inverter, International Advance Research Journal in Science, Engineering and technology, Volume:2, 2015

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