

# PV Based High Voltage Bidirectional DC to DC Converter

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**Abstract-**This paper presents a basic style of PV integrated two-way DC-DC device to be used in low power applications. The arranged topology is predicated on a full-connection on the first and a flow encouraged push-pull on the optional part of a high recurrence separation electrical gadget. Accomplishing two-route stream of intensity exploitation comparative power components gives a direct, practical secluded topology with PV board support that is especially luring to be utilized in battery charge/release circuits in DC applications. The DC mains (given by the AC mains), once gave, powers the downstream load gadgets and in this manner the two-way converter that essentially works inside the buck mode to charge the battery to a standard estimation of 12V. On disappointment of the DC mains (got from the AC mains), the gadget activity is relating to that of a lift and accordingly the battery manages the transport voltage and in this way gives capacity to the downstream converters. Minimal flag and unflinching state breaks down are offered for this explicit application. The look of a lab precedent is encased. The gadget displays sensible transient reaction underneath load varieties and switchover from one method of activity to an alternate.

**Keywords-**PV panel; MOSFET Bridge; Battery; Filter.

## I. INTRODUCTION

Choppers are wide accustomed acquire a variable DC output voltage from a continuing DC voltage. It may be used for change of magnitude and step down operation. Implementation of two-way converters victimization resonant, soft switch and laborious switch PWM are reportable within the literature. But, these topologies might usually cause a rise in element ratings, circuit quality and physical wonder misfortunes in resounding mode executions, high yield current swell and loss of wistful switch at light-weight hundreds for delicate exchanged circuits, and absence of galvanic confinement in incorporated topologies. Anyway this paper introduces a two-way DC-DC gadget topology for battery charger/discharger. Inside the arranged topology, the Bi-Directional(Two-Way) control stream is accomplished by 2 topologies explicitly [\*fr1] extension and current sustained push-pull topology. The principal part of the gadget could be a [\*fr1] connect and is associated with the DC mains. The optional angle, associated with the battery, frames a current-encouraged push-pull. the upsides of a present nourished push-pull gadget are decreased switch misfortunes in push-pull arrange and along these lines the yield correction might be just streamlined. A reproduction investigation of the arranged gadget is regulated

exploitation matlab. The arranged gadget topology with input has been gave and reproduced exploitation tangle lab. The gadget shows high power (86.6% inside the forward mode and ninety.5% inside the reinforcement mode), low half tally on account of its Bi-Directional(Two-Way) highlight and galvanic disengagement. The outcomes are confirmed with equipment.

## II. LITERATURE SURVEY

An audit of segregated two-way D.C.- D.C. converters inside the writing is predicated on two-way converters that might be characterized into two noteworthy sorts: arduous exchanged and delicate exchanged. A few models from the writing are abridged beneath. The two-way D.C.- D.C. gadget together with vitality stockpiling has turned into a promising plausibility for a few power associated frameworks, and half and half vehicle, In sustainable power source applications, the various information two-way D.C.- D.C. gadget might be acclimated blend varying sorts of vitality sources. An electric cell essentially based framework for residential applications. The multi-input two-way D.C.- D.C. gadget is that the center that interconnects control sources and capacity parts and deals with the office stream. This two-way D.C.- D.C. gadget choices galvanic disengagement between the heap and consequently the electric cell, two-way control stream, ability to coordinate totally unique voltage levels, fast reaction to the transient load request, and so on. As of late, clean vitality assets like electrical wonder clusters and wind turbines are abused for creating inexhaustible power age frameworks. The two-way D.C.- D.C. gadget is generally acclimated exchange the sunlight based capacity to the electrical marvel vitality supply all through the radiant time, though to convey vitality to the heap once the D.C. transport voltage is low. Fluctuated topologies for feasible execution as two-way D.C.- D.C. converters are reportable in this way. Configuration exhibits a downsized vitality stockpiling framework for pinnacle stack shaving applications. The structure incorporates a bidirectional (Two-Way) inverter alongside a D.C.- D.C. converter fit for interfacing a battery save money with the air conditioner influence framework. The fundamental objectives of the venture incorporated the usage of two methods of activity: a battery release mode where current is being sustained into the lattice and a battery charging mode in which current is pulled from the matrix and put into the batteries. An auxiliary objective of the plan was to guarantee that the current being infused into lattice was at or close solidarity control factor. The aftereffects of the task were fruitful as current was infused into the matrix with close solidarity control factor by using a hysteresis

current control technique. The present waveform apparently was intermittent, which was no doubt caused by the inductance esteem used to channel the yield current. Trouble in structuring the yield channel was not out of the ordinary since hysteresis control has a natural variable exchanging recurrence. Notwithstanding this reality, the framework kept up the ideal RMS yield current and along these lines demonstrated the usefulness of the framework in release mode. The bidirectional (Two-Way) ability of the framework was additionally demonstrated by energizing the battery save money with no equipment changes. Testing results demonstrated that every one of the prerequisites were met as the framework demonstrated to work as a downsized vitality stockpiling framework.

III. METHODOLOGY

A. Bidirectional DC-DC converter

The converters can manage an outsized change of intensity from couple of watts to a few kilowatts. Galvanic segregation is required in specific applications demanding Personal wellbeing, clamor decrease any as right activity of security frameworks. Together certain frameworks might want voltage coordinating between the shifted stages for the correct vogue and in this way the development of arranged stages. For the most part Voltage coordinating and galvanic separation is accomplished by the gadget all through power hardware. This requires the prerequisite of the air conditioner connect for the vitality exchange. Along these lines the framework quality grows up with the fuse of this decisions. Fundamentally the greater part of the confined two-way DC - DC converters has the structure as appeared among the on prime of figure.

This framework needs two change DC to air conditioning converters agent at a high recurrence thusly on believer the

DC contribution to high recurrence air conditioning amounts. Galvanic disengagement between the accessibility and item side is given by the high-recurrence trans-previous. gadget together performs voltage coordinating between the suppliers and in this way the heap side since the voltage extent connection between them is unrealistically high. The gadget works with air conditioning amounts and along these lines a DC-air conditioning gadget is required at each the terminals. Since the framework is intended for the vitality move in each the bearings, DC to air conditioning converters used should have the capability of two-way control. These converters together like the non-disengaged two-way DC-DC converters work in two methods of activity i.e. in buck or lift.

Separated two-way DC-DC converters could likewise be approximately characterized into two classifications on the prospect of their design:

- A present nourished secluded two-way DC-DC gadget has relate inductance at its terminals that demonstrations sort of a current give sort of a standard lift gadget with partner inductance at the information terminals.
  - A voltage sustained separated two-way DC-DC gadget as appeared among the g.2.8 incorporates a gadget at its terminals that demonstrations sort of a voltage give sort of a normal buck gadget with a gadget at its info terminals.
- Since the separated two-way DC-DC zone unit having additionally propelled structure, territory unit further monster, costlier and heavier than the non-confined two-way DC-DC converters because of the nearness of the gadget, they are by and large use for the HEV application. Two-way DC-DC gadget is decided for the present vogue.

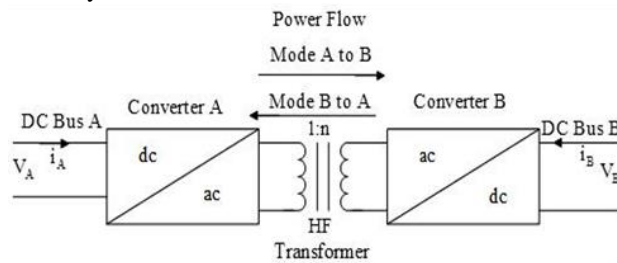


Fig.1: design of bidirectional DC-DC converter

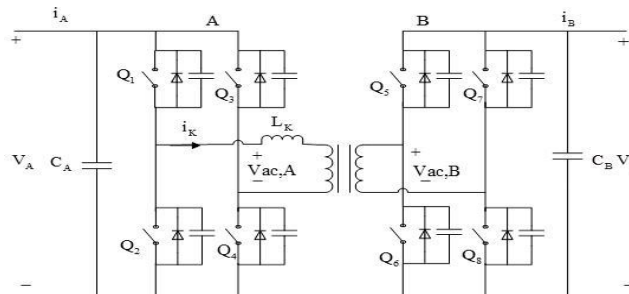


Fig.2: Dual Bridge Isolated Voltage Fed Bidirectional DC-DC Converter

### B. DCM operation of the Converter

Bidirectional DC-DC gadget are for the most part worked among the consistent characteristic wonder mode (CCM), and in this manner its vogue wants a considerably greater esteemed lter inductance. A significantly greater inductance could end up in an exceedingly ascend in physical size of the inductance, that won't intriguing. This colossal lter inductance will even obstruct the transient reaction of the gadget more as block any kind of mode changing. With the circuit working among the irregular normal marvel mode (DCM), the inductance esteem impressively decreases. Since the DCM activity encourages the reduction of the inductance esteem and in this manner making the reaction quicker, subsequently the gadget can intended to have a powerful thickness by working in DCM mode. Another essential preferred standpoint is that the zero-turn on

misfortune and accordingly low invert recuperation misfortune in diode all through DCM activity. In any case, since among the DCM task the chief switch is exchanged o at twofold the cost of the heap current, in this manner the misfortunes all through flip o can increment. Set up together along these lines, the inductance flow displays parasitic ringing all through turning o of the switch since the yield capacitance of the switch in relationship with the inductance endeavors to waver and accordingly causes control dissemination and electrical weights on the gadgets. This could be the key impediment related with the DCM task. The proficiency decreases as a result of this negative impacts of the DCM task. Thusly the delicate switch strategies more because of the medicinal measures for the parasitic ringing should be guaranteed among the gadget vogue.

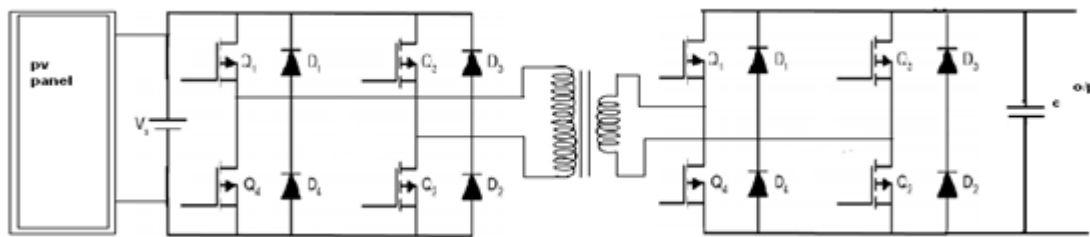


Fig.3: basic circuit design of bidirectional DC-DC converter

### C. Soft Switching Methods

On the off chance that the gadget circuit does not have any helper parts, the switches works underneath overwhelming switch task and this prompts the good measure of the power misfortune and high electrical worry among the switches all through initiate and switch o condition due to extremely enormous estimations of this and voltage at indistinguishable time crosswise over it. For the most part out and out the converters working underneath difficult switch conditions and eminently among the powerful converters, switch misfortunes puts the key restriction on the expansion of the switch recurrence that is wanted for the decrease in parts worth's and along these lines the size esteem and in this manner the smallness of the gadget. In this manner a trade off is made with {the worth the value. In this manner the power misfortune all through change is disposed of from the gadget. Delicate switch could likewise be accomplished by the expansion of the resounding parts (snubber gadget or inductor) as a substitute by the utilization of the parasitic segment of the gadget circuit. Delicate switch is cultivated among the DC-DC converters circuit by the expansion of the thunderous switches comprising of a controlled semiconductor switch (control MOSFET or partner IGBT), relate against parallel outside diode and a resounding gadget or a full inductance. Here the Soft switch could likewise be accomplished by the either zero voltage or zero current switch condition. The state of nostalgic switch can only be practiced among the gadget

the worth} of the switch recurrence among the a great deal of adequate change in this way on achieve the high proficiency among the gadget and at a practically equivalent to time as far as possible its esteem. The decrease among the estimation of the switch recurrence can build the extent of the uninvolved parts simply like the capacitors, inductors, transformers and so on and makes the DC-DC gadget heavier and hulky. Delicate switch procedures once utilized for the power converters, helps in expanding vitality change proficiency, moves up as far as possible for expanding switch recurrence and in this way the decrease among the measurements ,weight and along these lines the value of the aloof parts extra because of the decrease of the electrical and in this way warm weights on the switch gadgets and accordingly the EMI decrease all through switch.

circuit if the resounding a region of the switch can possibly reset itself (i.e. release itself) at the season of switch. In the event that the resounding gadget or the inductance over the switches can release themselves and in this way obtain zero voltage of zero current at the season of the switch, delicate switch is set up. hence by the expansion of the outer circuit components, the circuit could likewise be made to oversee beneath delicate switch condition.

IV. SIMULATION AND HARDWARE RESULTS

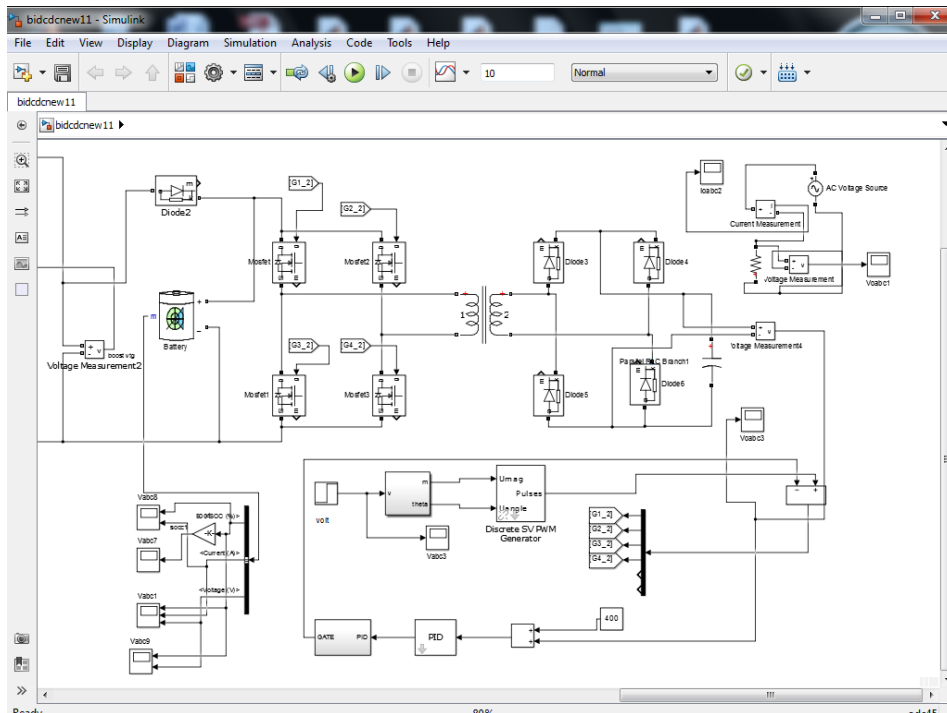


Fig.4: simulation for bidirectional DC to DC converter

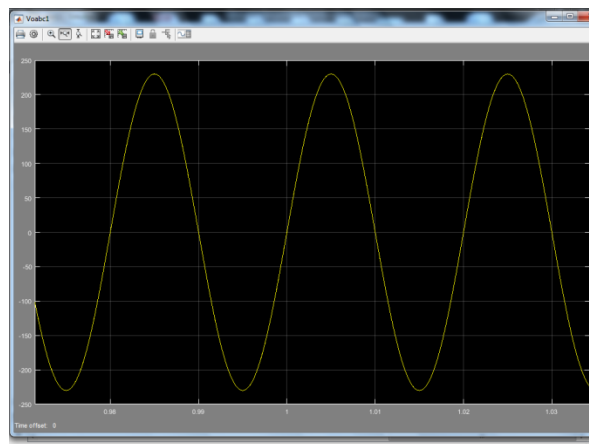


Fig.5: simulation inverter AC output waveform

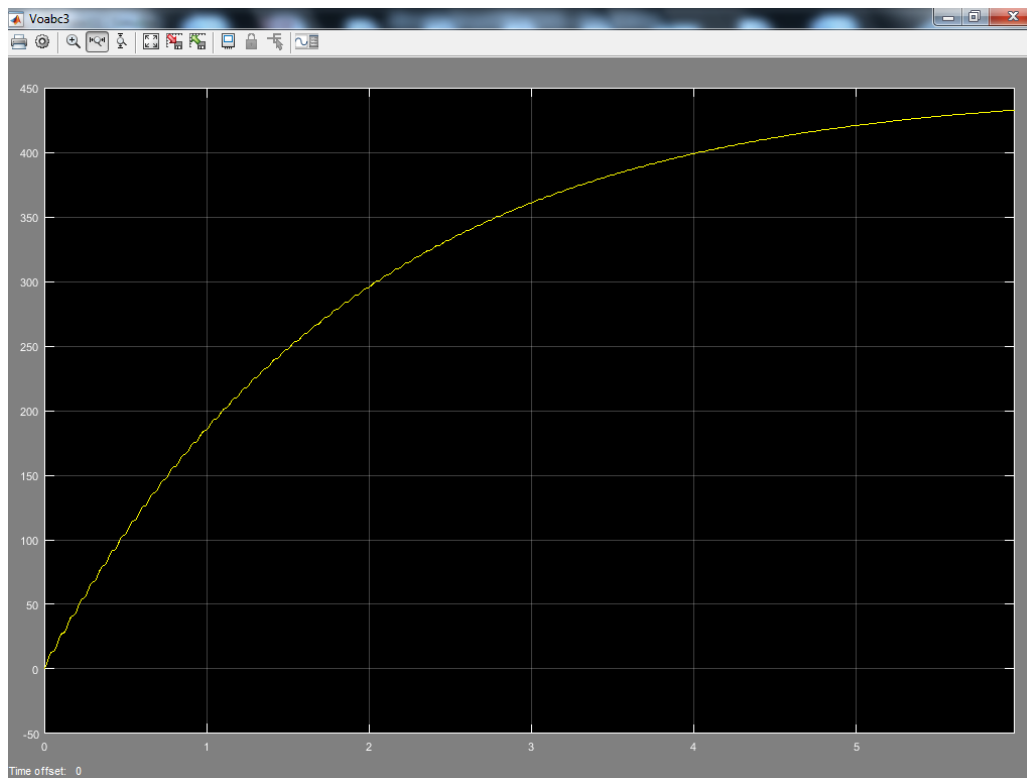


Fig.6: simulation inverter DC output waveform

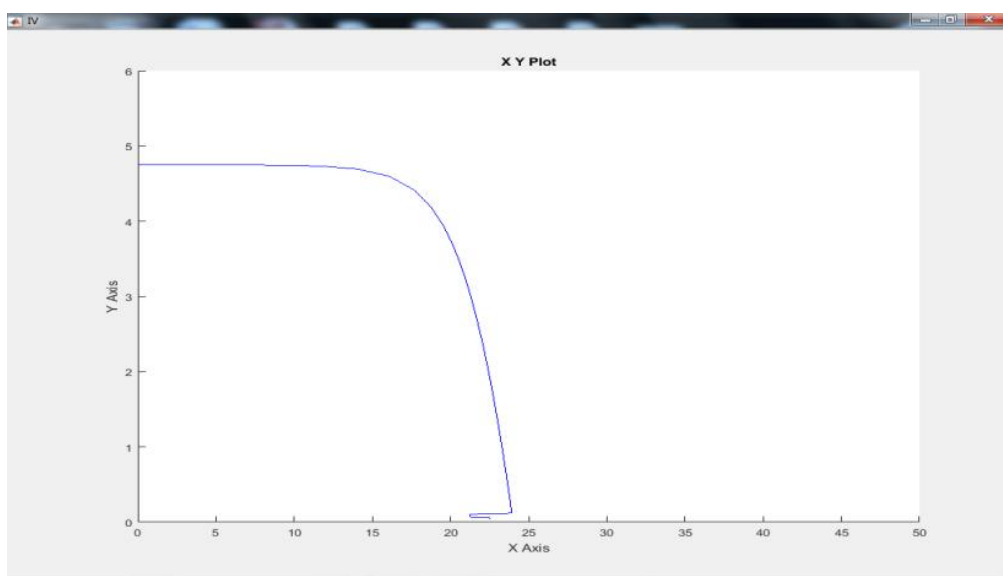


Fig .7: Current Voltage profile for PV panel

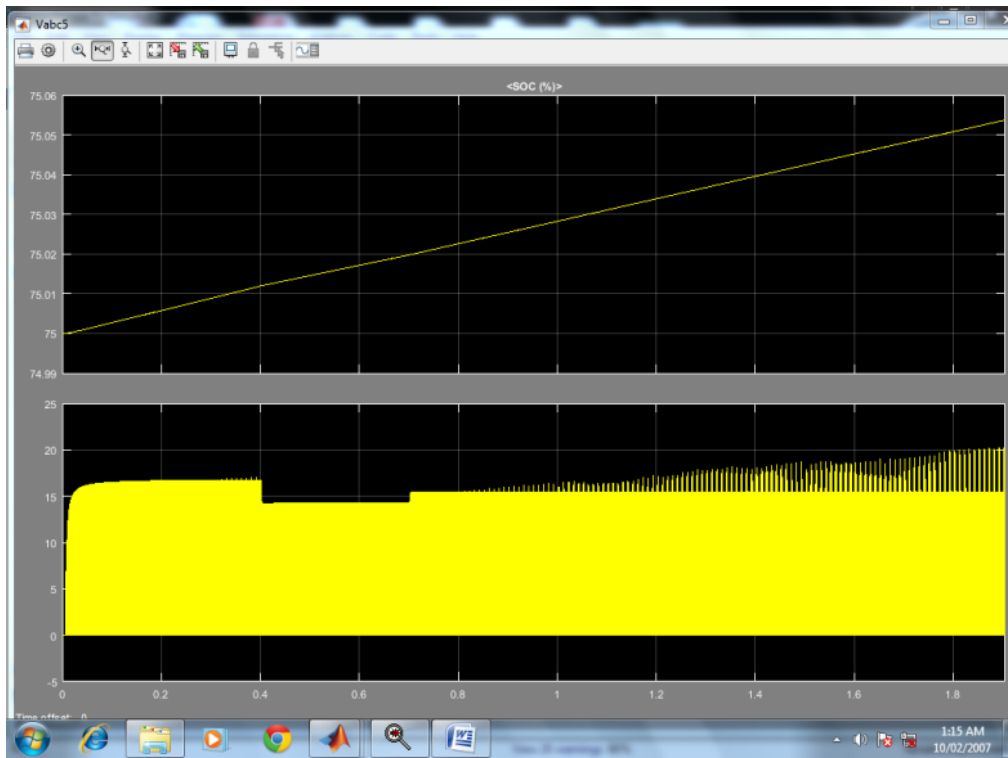


Fig .8: Voltage profile for PV panel

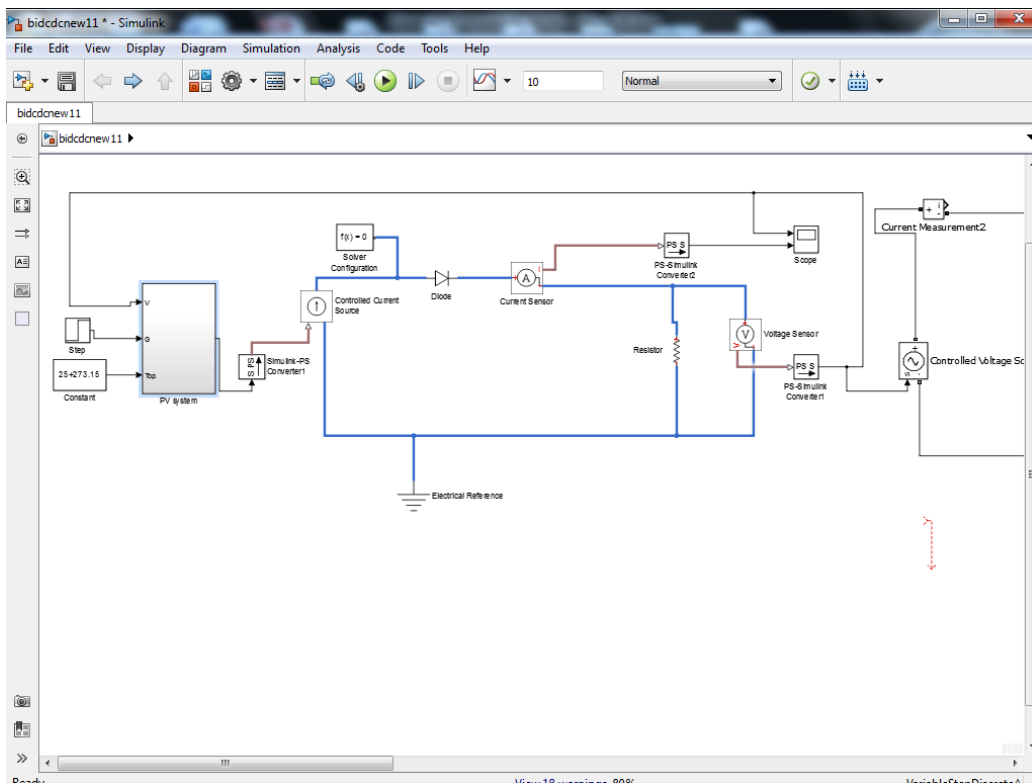
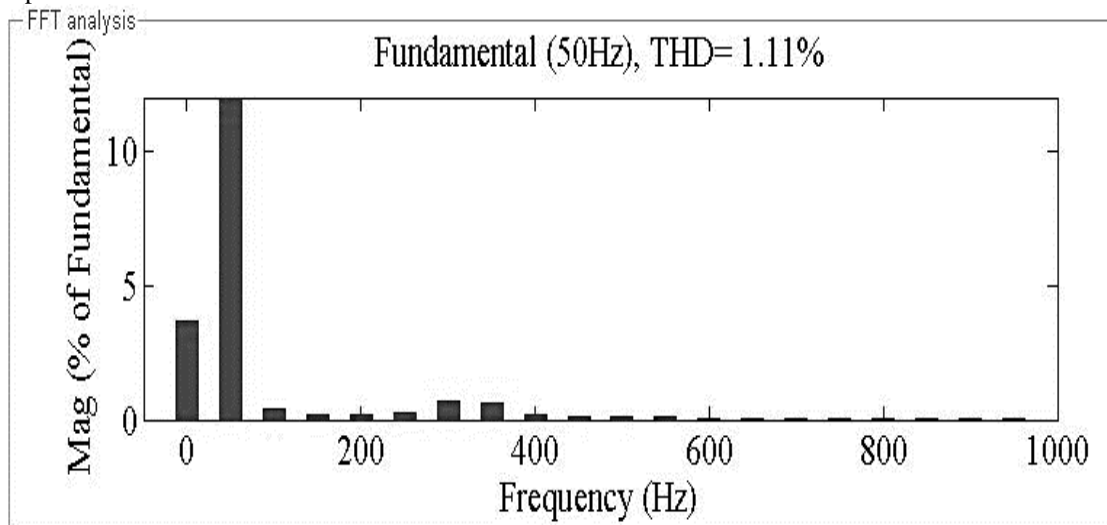


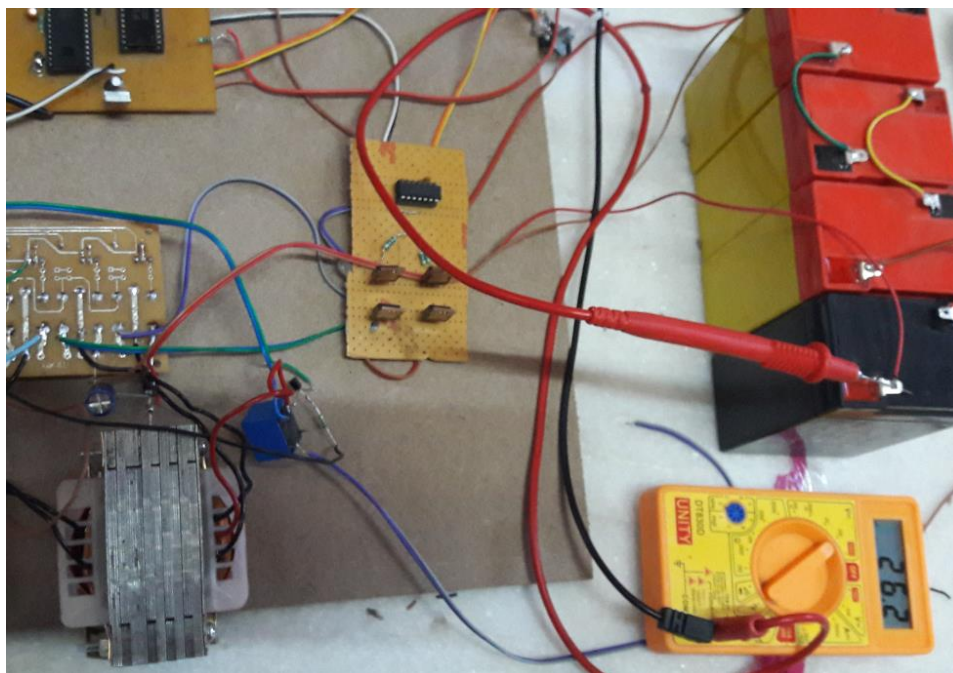
Fig .9: Voltage profile for PV panel

*Hardware results-*

- 1) Output DC voltage 400 DC 100w
- 2) Output ac 240v 50hz 100w
- 3) Voltage Thd 2% - 4%
- 4) Solar panel 12v 12w
- 5) Charging current: 1ampere
- 6) Input 24v DC 6.5ampere
- 7) Solar boost output 27v.



*Fig .10: Simulation thd*



*Fig .11: Hardware Input voltage*



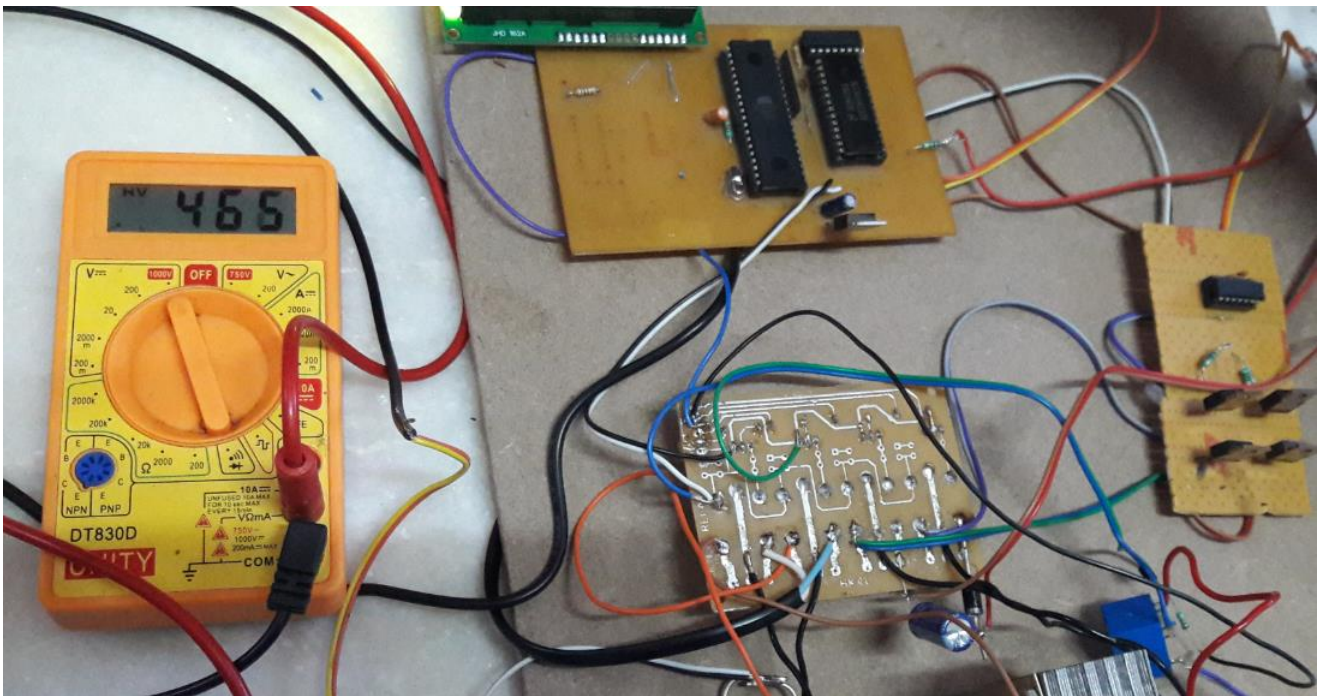


Fig .12: Hardware Output voltage

V. HARDWARE



Fig .13: Project Hardware Structure



## VI. CONCLUSION

A Bi-Directional(Two-Way) DC-DC converter in forward and reverse charging modes have been presented in this paper. Moreover, to boost the dynamic response of the device, a feedback system is additionally utilized and therefore the output voltage is regulated. Therefore, the planned device are an acceptable topology for PV applications.

## VII. REFERENCES

- [1]. H. G. Langer and H. -Ch. Skudelny (1989), "DC to DC converters with Bi-Directional(Two-Way) power flow and controllable voltage ratio," in Proc. IEE EPE Conf., pp. 1245–1250.
- [2]. Capel (1986), "A bidirectional high power cell using large signal feedback control with maximum current control for space applications," in Proc. IEEE Power Electron. Spec. Conf., pp. 684–695.
- [3]. K. Venkatesan (1989), "Current mode controlled bidirectional fly back converter," in Proc. IEEE Power Electron. Spec. Conf, pp. 835–842.
- [4]. Ray (1992), "Bidirectional DC–DC power conversion using quasiresonant topology," in Proc. IEEE Power Electron. Spec. Conf., pp. 617–624.
- [5]. Inoue, S. & Akagi, H. (2007). A Bidirectional DC-DC converter for an Energy storage system With Galvanic Isolation. IEEE Transactions on Power Electronics, Vol. 22, No. 6, (2007), pp. 2299-2306, ISSN 0885-8993.
- [6]. Krismer, F., Biela J. & Kolar, J.W. (2005). A comparative evaluation of isolated Bi-Directional(Two-Way) DC/DC converters with wide input and output voltage range, Proceedings of the Fourtieth IAS Annual Meeting, Vol.1, pp. 599-606.
- [7]. Yu, W., Qian, H. and Lai, J.S. (2010), "Design of High-Efficiency Bidirectional DC–DC Converter and High-Precision Efficiency Measurement", IEEE Transactions on Power Electronics, Vol. 25, No. 3., pp. 650-658.
- [8]. Tao, T., Duarte, J.L. & Hendrix, M.A.M. (2008). Three-Port Triple-Half-Bridge Bidirectional Converter With Zero-Voltage Switching. IEEE Transactions on Power Electronics, Vol. 23, No. 2, pp. 782-792.
- [9]. Sheng-Yuan Ou, Ho-Pu Hsiao and ChenHung Tien (2010), "Analysis and Design of a Prototype Single-Stage Half-Bridge Power Converter,"2010 5th IEEE Conference on Industrial Electronics and Applications, pp.1168-1173.