Ilkogretim Online - Elementary Education Online, 2019; Vol 18 (Issue 4): pp. 2481-2488
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2019.641243

Simulation And Hardware Implementetation Of Grid Connected Solar Charge Controller With Mppt

Prof. Kaushalchandra N. Barot (Electrical Engineering Department, Gokul Global University, Sidhpur India, kaushalpower@gmail.com)

Prof. Sanjay R. Patel (Electrical Engineering Department, GTU, Ahmedabad, India, sanjaypatel265@gmail.com)

Abstract— A renewable energy source plays an important role in electricity generation. Various renewable energy sources like wind, solar, geothermal, ocean thermal, and biomass can be used for generation of electricity and for meeting our daily energy needs. Energy from the sun is the best option for electricity generation as it is available everywhere and is free to harness. Onan average the sunshine hour in India is about 6hrs annually also the sun shine shines in India for about 9 months in a year. Electricity from the sun can be generated through the solar photovoltaic modules (SPV). The SPV comes in various power output to meet the load requirement [1]. Maximization of power from a solar photo voltaic module (SPV) is of special interest as the efficiency of the SPV module is very low. A peak power tracker and DC-DC Boost Converter is used for Extracting the maximum power from the SPV module. And simulation in PSIM software and hardware result is compare and solar panel maximum efficiencies is increase nearby 85% using dither routine algorithm method use.

Keywords— PV module, Battery, Grid, Maximum Power Point Tracking(MPPT) module, Inverter, PSIM, Boost converter.

I. INTRODUCTION

Renewable energy sources play an important role in electricity generation. Various renewable energy sources like wind, solar, geothermal, ocean thermal, and biomass can be used for generation of electricity and for meeting our daily energy needs. Energy from the sun is the best option for electricity generation as it is available everywhere and is free toharness. On an average the sunshine hour in India is about 6hrs annually also the sun shine shines in India for about 9 months in a year. A worldwide concern for future access to affordable, sustainable energy is driving the development of more efficient solar power generation [2]. In any photovoltaic (PV) based system, the master controller is a critical component responsible for the control of electricity flow between themodule, battery, loads, grid. The proposed for maximum powerpoint tracking, boost converter, battery charging, and load control. The main elements of maximum power point tracking system for dc-dc boost converter, battery charging circuit, PIC controller which selects energy sources to continue supply the load. Using the simulation software PSIM proposed boost converter topology with predictive control has been chosen.

The final simulation of dc-dc boost converter has been done, which was made in PSIM. It is shown that the output voltage (30 Vdc) to supply the load and, to charge the battery ifsolar output power is greater than the load power. The proposed control algorithm including the whole system controlis implemented on a low cost, microcontroller PIC16F690.solarsystem efficiency increase near 90%.

II. SIMULATION OF DC-DC BOOST CONVERTER IN PSIM

The boost converter, also known as the step-up converter, isanother switching converter that has the same components as the buck converter, but this converter produces an output voltage greater than the source. The ideal boost converter has the five basic components, namely a power semiconductor switch, a diode, an inductor, a capacitor and a PWM controller. The placement of the inductor, the switch and diodein the boost converter is different from that of the buck converter, which is shown in the Fig.1.

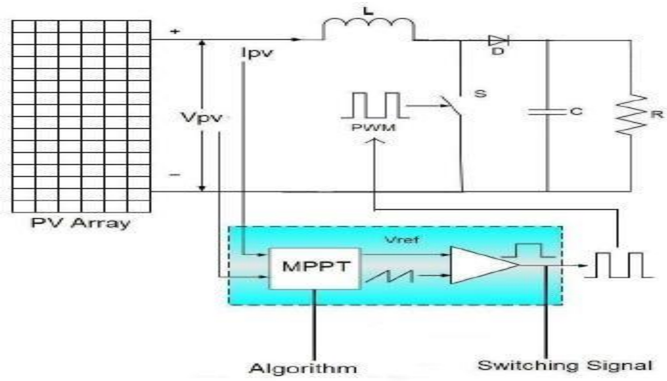


Fig.1 Basic of DC-DC Boost Converter Circuit Diagram [4]

A. Simulation of Open Loop Dc-Dc Boost Converter & Result

The simulation of DC-DC Boost converter is shown in the Fig.2

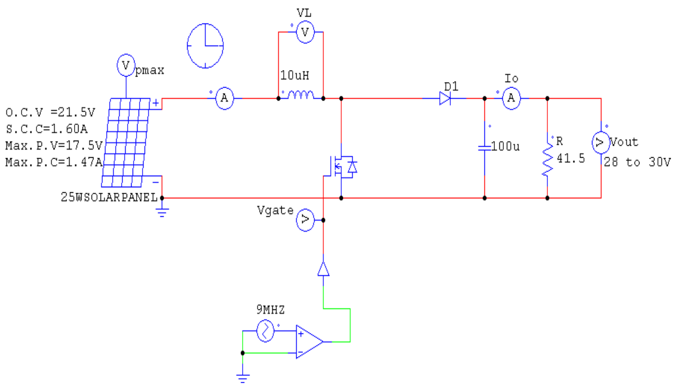
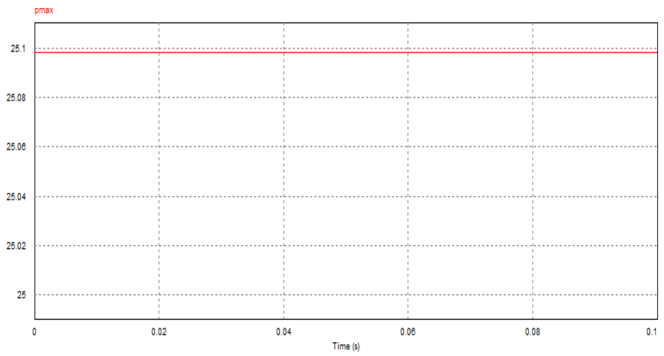
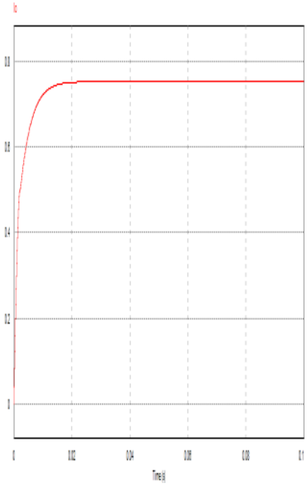


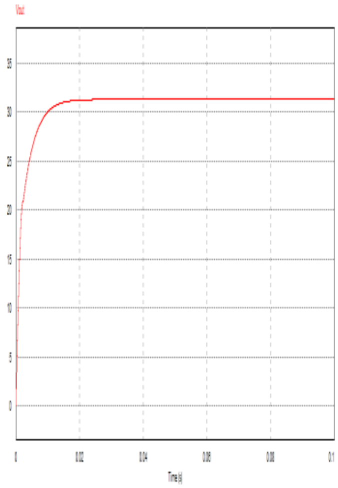
Fig.2 Simulation of PV with Open Loop DC-DC Boost Converter

Fig.3 (a),(b) and (c) shows that the output waveform of open loop DC-DC Boost converter of solar panel output power25W, output current 0.75A and output voltage of 30V respectively.



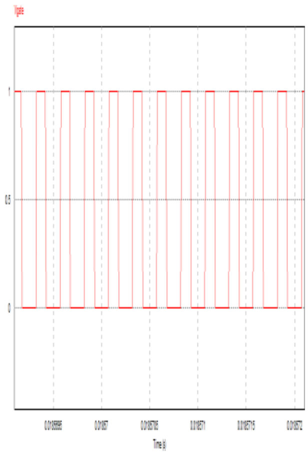
a. Result of Open Loop DC-DC Boost Converter of Solar Panel Power 25W

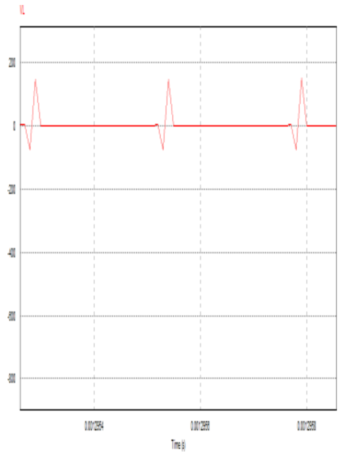




(b) (C)

Fig.3. (b)Result of Open Loop DC-DC Boost Converter for Output Current 0.75A, (C)Result of Open Loop DC-DC Boost Converter output voltage 30V





(a) (b)

Fig.4 (a) Switching Wave of MOSFET Using Open Loop DC-DC Boost Converter, (b) Voltage across Inductor Wave of Open Loop DC-DC Boost Converter

Fig.4 (a) and (b) shows that the switching wave of MOSFET Using Open Loop DC-DC Boost Converter and Voltage across Inductor Wave of Open Loop DC-DC Boost Converterrespectively [6].

III. HARDWARE CIRCUIT DIAGRAM OF BOOST CONVERTER

A circuit diagram is required to implementation ofhardware model, which is shown in the Fig.5 [5].

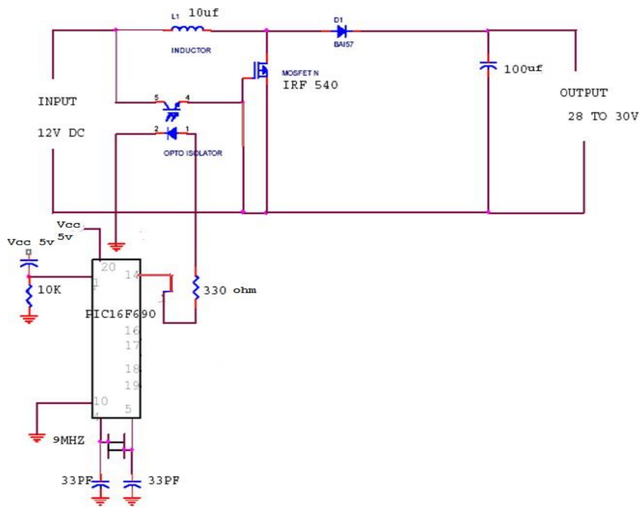


Fig.5 Circuit Diagram of Open Loop DC-DC Boost Converter Based on the hardware circuit diagram the model could beprepared, which is shown in the Fig.6.

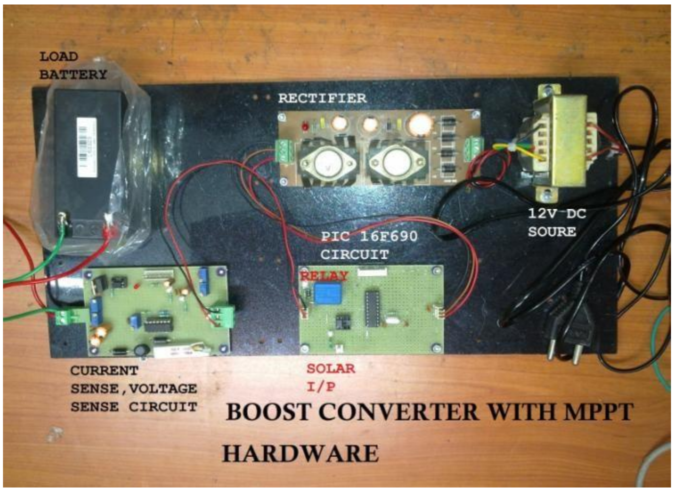


Fig.6 Snapshot of Open Loop DC-DC Boost Converter

Fig.7 shows that the hardware result of boost converter withMPPT.

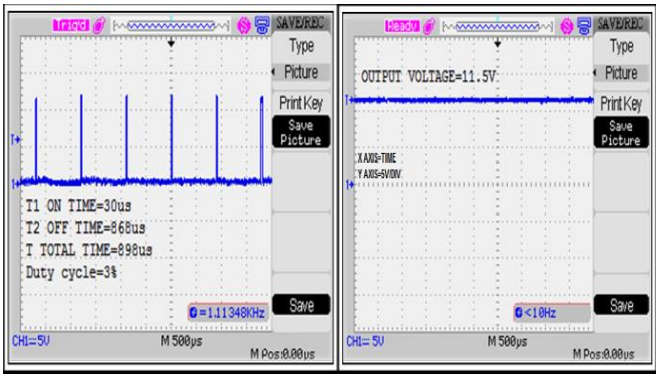
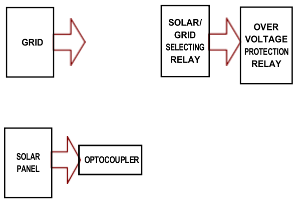


Fig.7 3% Input duty Cycle and o/p voltage 11.5V waveform



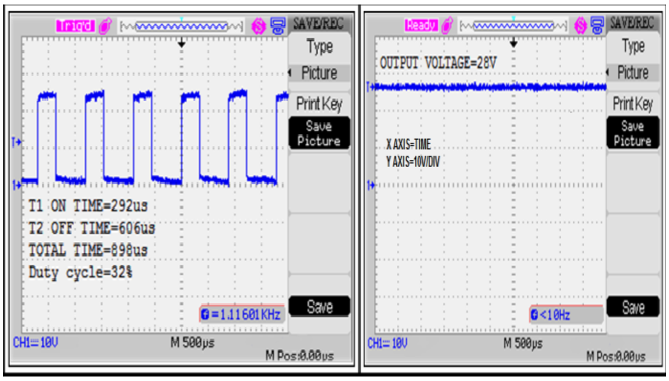


Fig.8 32% Input duty cycle and O/P voltage 28V waveform

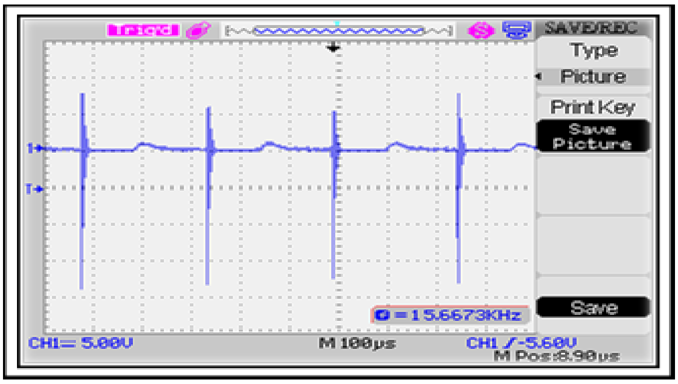


Fig.9 Voltage across Inductor Wave of DC-DC Boost Converter Hardware Result

Table No.1 shows that the testing result of hardware with solarpanel. Which is graphically represented in the Fig.12 and Fig.13 identically.

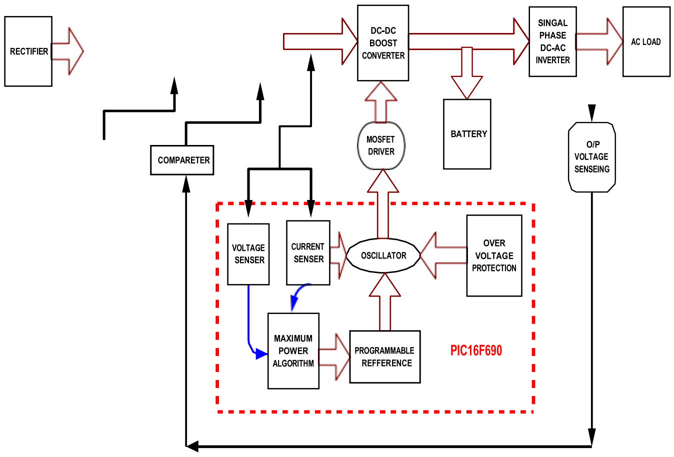


Fig.10 Hardware Block Diagram of MPPT

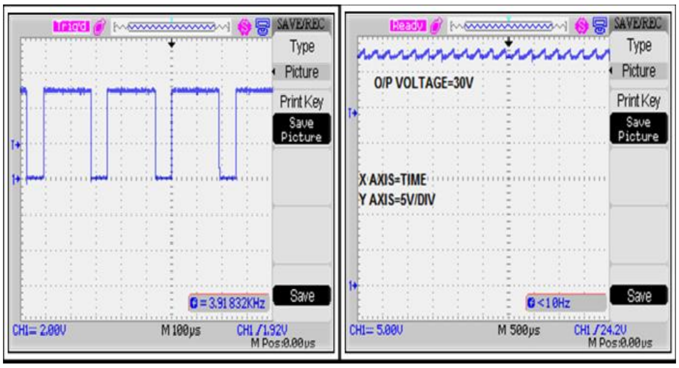
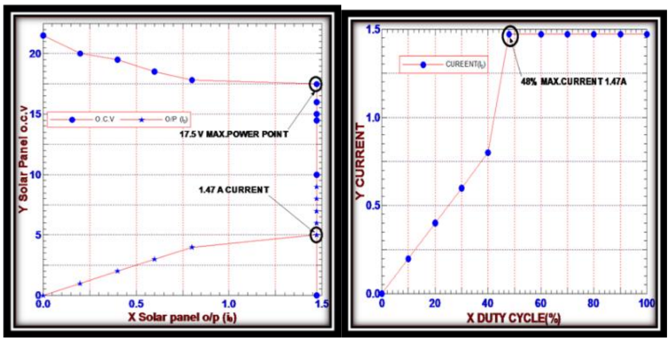


Fig.11 48% O/P Voltage Duty Cycle and O/P Voltage 30 V Waveform

TABLE NO.1

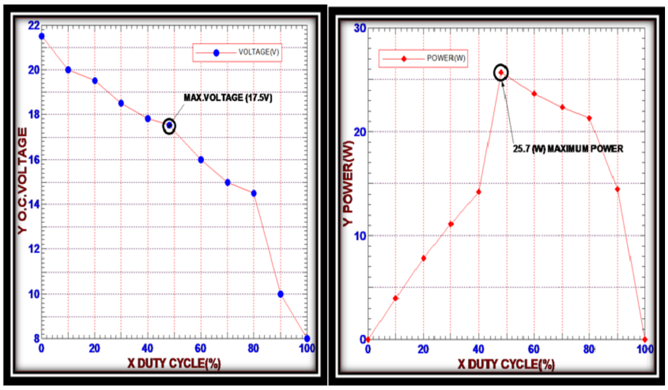
NOOF READING	SOLARPANEL O/P (I0)	SOLAR PANEL O.C.V(V)	MAXIMUMPOWER(W)	DUTY CYCLE(%)
1	0	21.5	0*21.5=0	0
2	0.2	20	0.2*20=4	10
3	0.4	19.5	0.4*19.5=7.8	20
4	0.6	18.5	0.6*18.5=11.1	30
5	0.8	17.8	0.8*17.8=14.24	40
6	1.47	17.5	1.47*17.5=25.7	48
7	1.47	16	1.47*16=23.52	60
8	1.47	15	1.47*15=22.05	70
9	1.47	14.5	1.47*14.5=21.3	80
10	1.47	10	1.47*10=14.7	90
11	1.47	0	1.47*0=0	100

The software to control the Maximum Power Point Converter can be broken into two algorithms: Current Reduction and the dither routine, which are controlled via the Interrupt Service Routine (ISR). Both algorithms manipulate the current of the solar panel via the Programmable Voltage reference generated by the PIC16F690"s 10-bit PWM [7].



(a) (b)

Fig.12 (a) V-I Characteristics Solar System, (b) Duty Cycle Vs Current



(a) (b)

Fig.13 (a) Duty Cycle Vs O.C.Voltage, (b) Duty Cycle Vs Power Fig.13 shows that the final implementetation of hardware withresults.

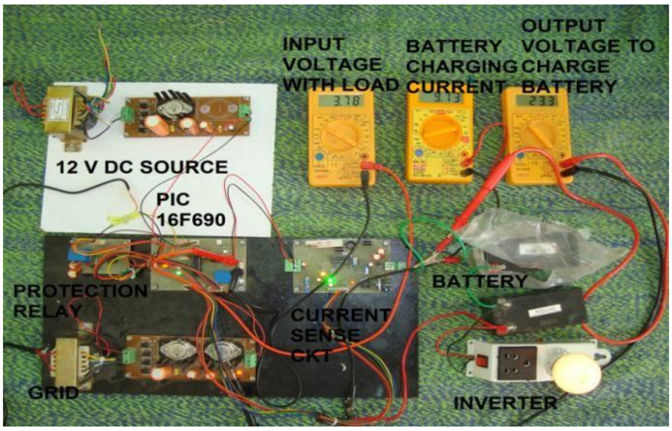


Fig.13 Snapshot of Final MPPT System Hardware

IV. CONCLUSION

Above hardware in Dither Routine technique and PIC Controller (16F690) can be used to implement

Maximum power tracking logic and as a result we can tack maximum power at output (load) from solar panel. Increase solar system efficiency is near the 90%. Shortcomings and execution efficiency for three power-feedback type MPPT methods, including perturbation & observation, incrementalconductance and Dither Routine. The PV Simulation in PSIM software use [8].

The model of PV modules used in PV simulation system is established according to the electrical specifications of the PV module after accomplishing the model of PV modules, the models of DC-DC boost converter and MPPT systems are combined with it to complete the PV simulation system with the MPPT function. The accuracy and execution efficiency foreach MPPT algorithm can then be simulated under different weather conditions after in system to use battery is charge with connected inverter to dc o/p converted into ac power. In this solar system to use and maximum efficiency increase to near 90%.Dither Routine algorithm is other algorithm to compare accurate result and high efficiency.

ACKNOWLEDGMENT

We would like to thank Topsun Energy Ltd., Gandhinagar, forgiving us an opportunity to perform the project under its premises and give me the industrial exposure with great level of research platform. We would also thankful to our colleaguesand friends for their kind help.

REFERENCES

[1] Mukund.R.Patel "wind and solar power system design, analysis and operation"" 2ndedition Taylor & Francis Group 2006, New York.

[2] "Comparison of Solar Panel Types"" http://www.eco- camper.com/faq/solar panel/54-comparison-of-solar-panel types.html

[3] http://www.golandcentury.com Room 220, Material Building, Houhai Street, Nanshan District, Shenzhen, China

[4] Yen-Jung Mark Tung, Dr. Aiguo Patrick Hu, Dr. Nirmal- Kumar Nair, Dept. of Electrical and Computer Engineering, University of Auckland "Evaluation of Micro Controller Based Maximum Power Point Tracking Methods Using dSPACE Platform" Australian University Power Engineering Conference 2006

[5] John Charais "Maximum Power Solar Converter AN1211"Microchip Technology Inc, 2010.

[6] Chihchiang Hua and Chihming Shen, "Control of DC/DC Converters for Solar Energysystem with Maximum Power Tracking".

[7] D. P. Hohm, M. E. Ropp,"Comparative Study of Maximum Power Point Tracking Algorithms Using an Experimental, Programmable, Maximum Power Point Tracking test Bed", IEEE, 2000.pp.1699-1702.

[8] C.R. Sullivan and M.J. Powers, "A High-Efficiency Maximum Power Point Tracking for Photovoltaic Arrays in a Solar-Power Race Vehicle", IEEE PESC„93, 1993, pp.574-580.

[9] Xuejun Liu and A.C.Lopes,"An Improved Perturbation and Observe Maximum Power Point Tracking Algorithm for PV Arrays" IEEE PESC '2004, pp.2005-2010.