Innovative Systems Design and Engineering
ISSN 2222-1727 (Paper) ISSN 2222-2871 (Online)
Vol.7, No.5, 2016

Voltage Based P&O Algorithm for Maximum Power Point Tracking using Labview

B.Amar nath Naidu S.Anil Kumar G.Srinivasa Reddy
Department of Electrical and Electronics Engineering, G.Pulla Reddy Engineering College,
Kurnool, Andhra Pradesh Kurnool-518007

Abstract
In the present scenario renewable energy sources play a crucial role in the place of conventional fossil fuel energy resource. Several MPPT techniques are used to track maximum power from PV array. In this paper voltage based Perturb and Observe (P&O) methods is used which is implemented by using LABVIEW.
Keywords: Maximum Power Point Tracking ,Perturb and Observe.

1.INTRODUCTION

Photo voltaic energy is available abundantly .As the maximum power depends up on various factors such as solar insolation, temperature, voltage (Voc) and current (Isc) etc. So, with the change in atmospheric condition, the power increases or decreases as its relation varies with that factor accordingly. So, it is essential to track maximum power point to draw more efficiency from PV panel. For this purpose, there are many MPPT algorithms are available. Such as perturb and observe (P&O), incremental conductance, constant voltage, constant current and parasitic capacitance algorithm etc. In this paper , Perturb and Observation (P&O) algorithm is used, which is based on the "hill- climbing" principle, which consists of moving the operation point of the PV array in the direction in which the power increases.

2.ELECTRICAL MODELS FOR PV ARRARY

A photovoltaic array can be represented by different models some of which are more simplified equivalents. . The current produced by the solar cells are represented by the current source, and an ideal diode represents the intrinsic p-n junction of the solar cell.The equivalent circuit diagram of the PV apnel is shown in figure 1

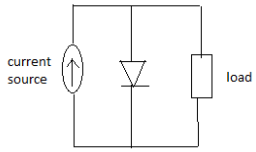

Figure:1 **1PV Cell block**

The load current is $I=I_{ph}-I_d$ where I_{ph} is generated by the current source, I_d is given by the Shockley equation to be $I_d = Is (\exp (qV / mkT) – 1)$ .And the I-V relation is given by

$$I=I_{ph} - Is (\exp (qV / mkT) – 1) \quad (1)$$

3. PROPOSED MPPT TECHNIQUE

A typical solar panel converts only 40 percent of the incident solar irradiation into electrical energy. Maximum power point tracking technique is used to improve the efficiency of the solar panel .According to Maximum Power Transfer theorem, the out power of a circuit is maximum when the Thevenin impedance of the circuit (source impedance) matches with the load impedance. Hence problem of tracking the maximum power point reduces to an impedance matching problem.

On the source side we are using a boost convertor connected to a solar panel in order to enhance the output voltage so that it can be used for different applications like motor load. By changing the duty cycle of the boost converter appropriately we can match the source impedance with that of the load impedance.

3.1 Perturb & Observe

Perturb & Observe (P&O) is the simplest method. In this we use only one sensor, that is the voltage sensor, to sense the PV array voltage and so the cost of implementation is less and hence easy to implement. The time complexity of this algorithm is very less but on reaching very close to the MPP it doesn't stop at the MPP and keeps on perturbing on both the directions. When this happens the algorithm has reached very close to the MPP and an appropriate error limit can be used or can use a wait function which ends up increasing the time complexity of the algorithm. The Perturb & Observe algorithm states that when the operating voltage of the PV panel is perturbed by a small increment, if the resulting change in power P is positive, then we are going in the direction of MPP and

we keep on perturbing in the same direction. If P is negative, we are going away from the direction of MPP and the sign of perturbation supplied has to be changed.

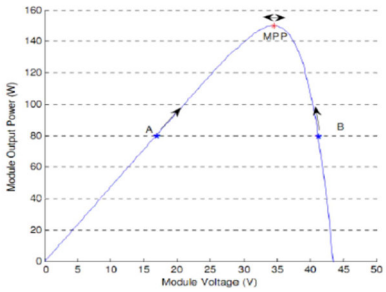

Figure:2 Solar panel characteristics showing MPP and operating points A and B

Figure 2 shows the plot of module output power versus module voltage for a solar panel at a given irradiation. The point marked as MPP is the Maximum Power Point, the theoretical maximum output obtainable from the PV panel. Consider A and B as two operating points. As shown in the figure above, the point A is on the left hand side of the MPP. Therefore, we can move towards the MPP by providing a positive perturbation to the voltage. On the other hand, point B is on the right hand side of the MPP. When we give a positive perturbation, the value of P becomes negative, thus it is imperative to change the direction of perturbation to achieve MPP. The voltage based P&O algorithm flow chart is shown in figure 3

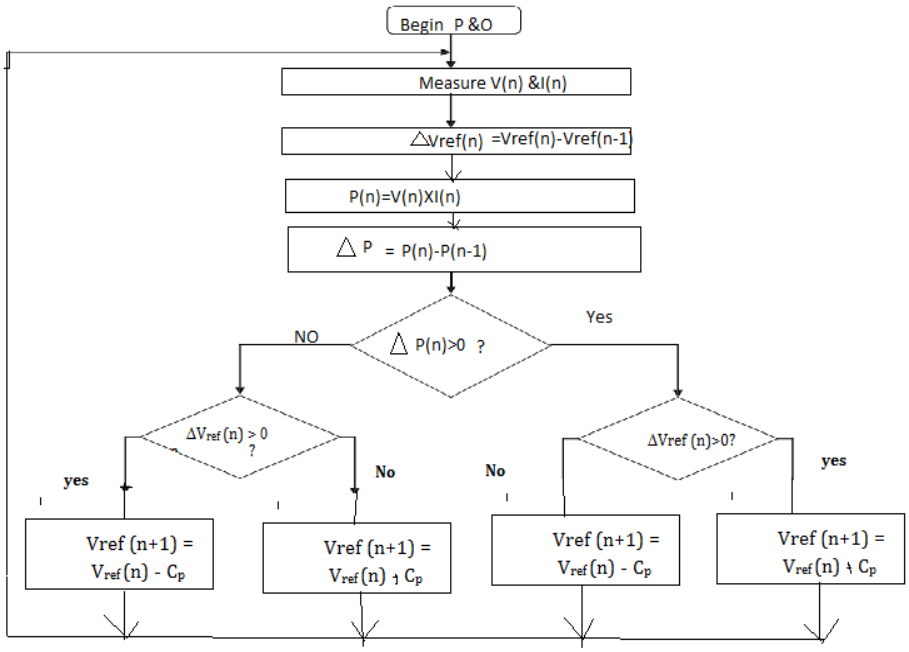

Figure 3: Perturb and Observe algorithm flow chart.

4.SIMULATION AND RESULTS

The voltage based P&O method is implemented by using LABVIEW software .A PV cell is designed based on the ideal equation .The designed specification of the solar panel are shown in the table 4.1

Iph	2.5A
Io	1E-10
N	0.55
K	1.38065E-23
T in Kelvin	500 K
Q	1.609E-19

Table 1: Designed specification of the solar panel *4.SIMULATION AND RESULTS*

The front panel and block diagaram of the PV cell are shown in figure 5

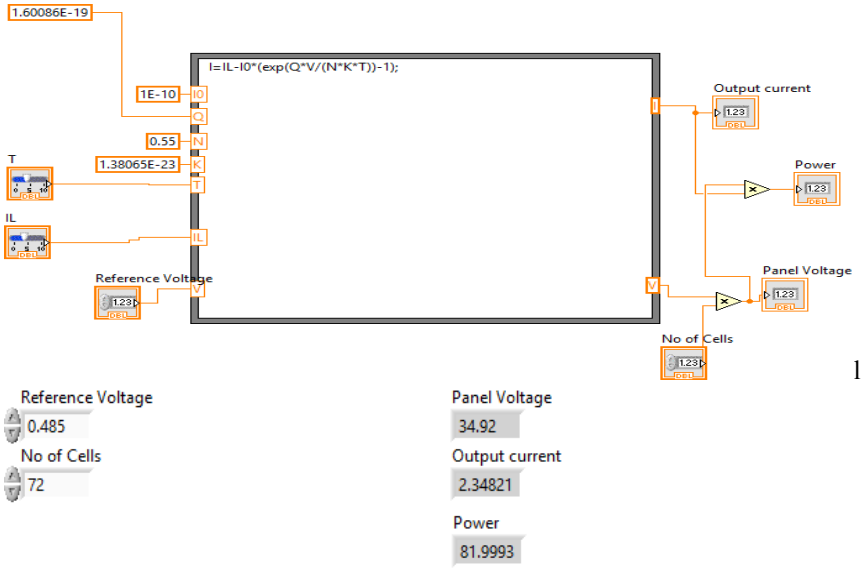

Figure 5. Front panel of PV Cell and block diagram

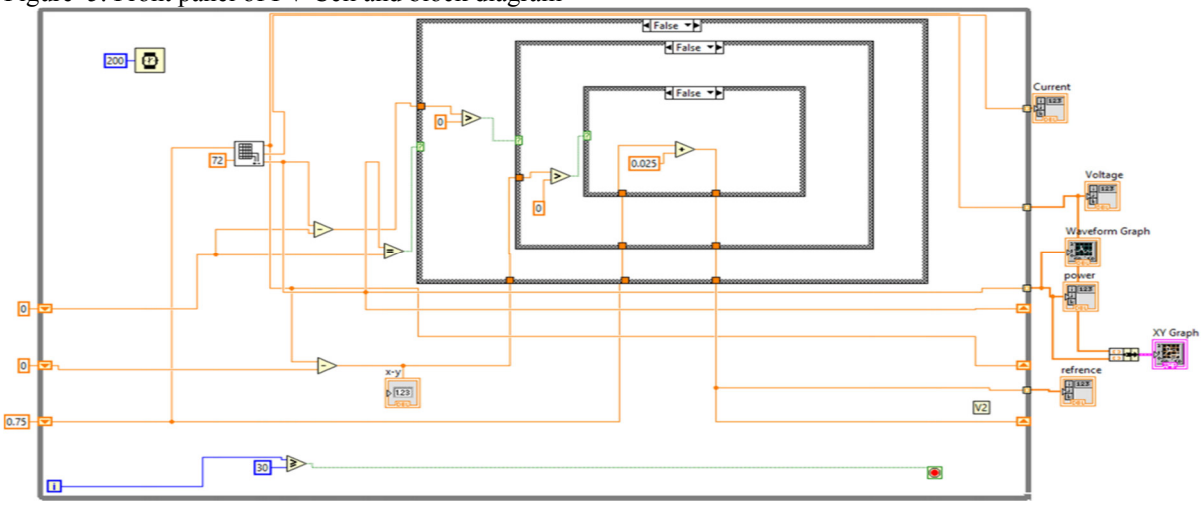

Figure:6 Block diagram of the PV cell with P&O algorithm

The front panel and Block diagram of solar panel was shown in figure 5.The block diagram is model using LABVIEW taking ideal condition equation of the PV array.Figur 6 shows the block diagram of the P&O MPPT method with PV cell as sub block in it. The front panel shows out put plotPower Vs ts time and power Vs Voltage.

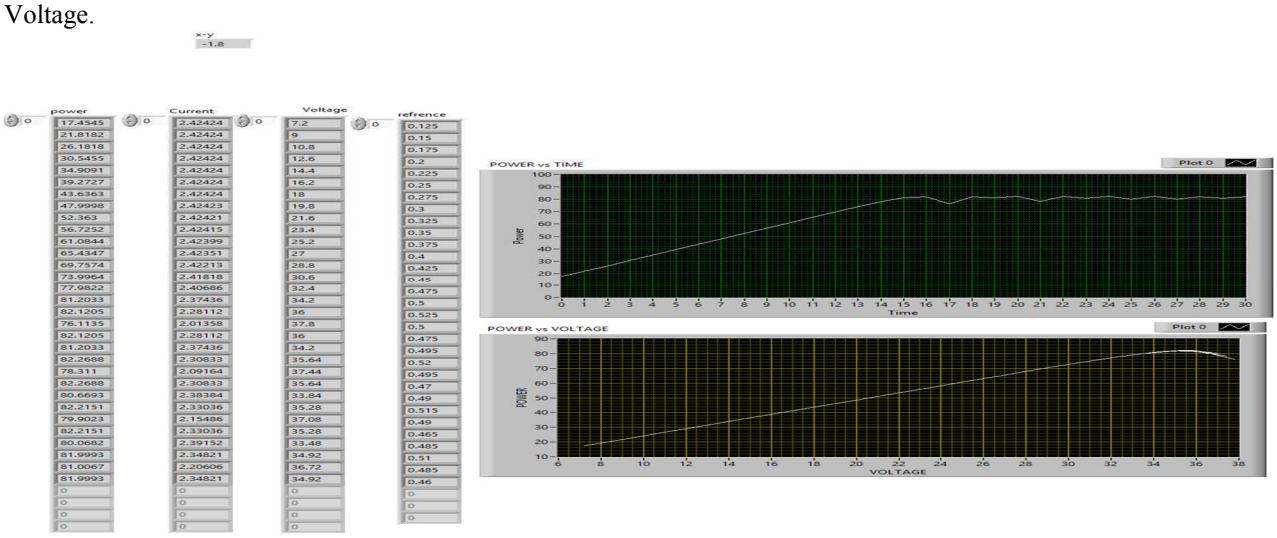

Figure:7 Front panel of the PV cell with P&O algorithm

Time - Plot 0	Power - Plot 0	VOLTAGE - Plot 0	POWER - Plot 0
0	17.4545	7.2	17.4545
1	21.8182	9	21.8182
2	26.1818	10.8	26.1818
3	30.5455	12.6	30.5455
4	34.9091	14.4	34.9091
5	39.2727	16.2	39.2727
6	43.6363	18	43.6363
7	47.9998	19.8	47.9998
8	52.363	21.6	52.363
9	56.7252	23.4	56.7252
10	61.0844	25.2	61.0844
11	65.4347	27	65.4347
12	69.7574	28.8	69.7574
13	73.9964	30.6	73.9964
14	77.9822	32.4	77.9822
15	81.2033	34.2	81.2033
16	82.1205	36	82.1205
17	76.1135	37.8	76.1135
18	82.1205	36	82.1205
19	81.2033	34.2	81.2033
20	82.2688	35.64	82.2688
21	78.311	37.44	78.311
22	82.2688	35.64	82.2688
23	80.6693	33.84	80.6693
24	82.2151	35.28	82.2151
25	79.9023	37.08	79.9023
26	82.2151	35.28	82.2151
27	80.0682	33.48	80.0682
28	81.9993	34.92	81.9993
29	81.0067	36.72	81.0067
30	81.9993	34.92	81.9993

Table 2:Power Vs Volatge variations

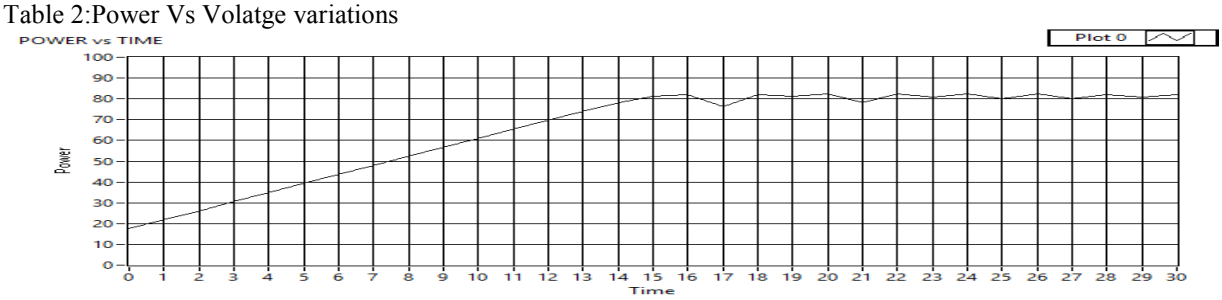

Figure 8:Power Vs Time

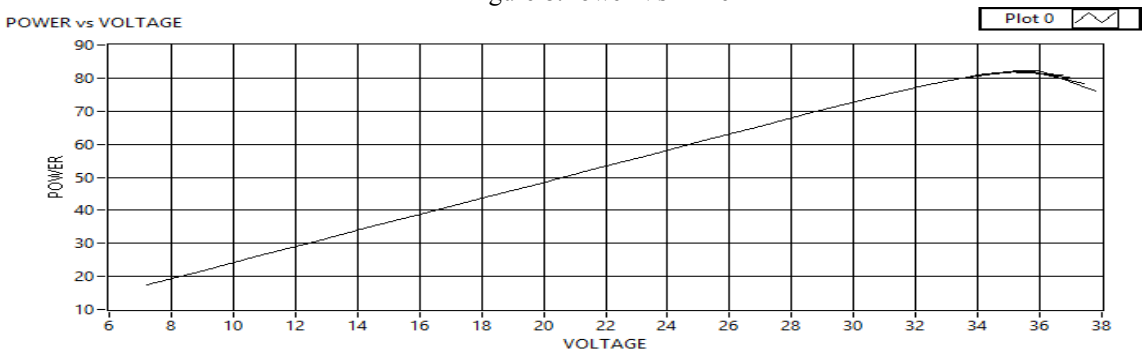

Figure 9:Power Vs Voltage

CONCLUSION

The standard P&O algorithm has been implemented so as to improve the maximum power point tracking in PV systems. Here reference voltage based p&o technique is implemented. The proposed system offers powerful abilities which are: good tracking efficiency, high response, simple user interface, sophisticated control, high processing and good control for the extracted power. The simulation results are presented in waveforms and tables.

FUTURE SCOPE

An enhanced P&O algorithm along with hardware can be implemented by using LABVIEW

REFERENCES

1.Villalva, M.G.; Gazoli, J.R.; Filho, E.R., "Comprehensive Approach to Modelling and Simulation of Photovoltaic Arrays," Power Electronics, IEEE Transactions on, vol.24, no.5, pp.1198, 1208, May 2009.
2.Femia, N.; Petrone, G.; Spagnuolo, G.; Vitelli, M., "Optimization of perturb and observe maximum power point tracking method," Power Electronics, IEEE Transactions on, vol.20, no.4, pp.963, 973, July 2005.

B.Amarnath Naidu was born in India in 1986. He received his B.Tech in Electrical & Electronics Engineering from Jawaharlal Nehru Technological University, Hyderabad in 2007. He is completed his Master of Technology in power Electronics from the Sri Krishna Devaraya University, Anantapur.He is currently working as an Assistant Professor in Electrical and Electronics Engineering Department at G.Pulla Reddy Engineering College, Kurnool. His Research interests include Renewable energy sources ,electric power distribution systems, HVDC, FACTS and Power Electronics.

S.Anil Kumar was born in India in 1986. He received his B.Tech in Electrical & Electronics Engineering from Jawaharlal Nehru Technological University, Hyderabad in 2007. He is completed his Master of Technology in Electrical power systems from the Jawaharlal Nehru Technological University, Anantapur. He is currently working as an Assistant Professor in Electrical and Electronics Engineering Department at G.Pulla Reddy Engineering College, Kurnool. His Research interests include electric power distribution systems, HVDC.FACTS and Power system operation and control.

G.Sreenivasa Reddy was born in India in 1980. He received his B.Tech in Electrical & Electronics Engineering from Jawaharlal Nehru Technological University, Hyderabad in 2006. He is completed his Master of Technology in High Voltage Engineering from the Jawaharlal Nehru Technological University, Kakinada. He is currently he pursuing his Ph.d and working as an Assistant Professor in Electrical and Electronics Engineering Department at G.Pulla Reddy Engineering College, Kurnool. His Research interests include electric power distribution systems, Renewable energy and Power system operation and control.