International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 12 (2018) pp.10406-10411

Efficient MPPT of PV Cell & Wind for Internet of Things

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Abstract:

There are many useful advantages of using renewable sources which can be used for the internet of things, the high power indoor applications and the low power systems which are used in the WSN. The most realistic examples of generating force from the waste are of: Wind Turbines and Photovoltaic Cells. The Photovoltaic power framework uses the MPPT (maximum power point) which is used for collecting the most important possible sunlight in the form of energy. The exchanging mode converters provide the energy to the most of the gadgets. Because of which there is increase in the cost, loss, volume and weight. This project will work on finding sunlight based dynamic supply source which can be directly used by the gadgets without any storing element and converter thus increasing the productivity for the high power indoor applications, web of things and the low power applications (WSN). The losses are less by neglecting the storing element and converter up to 20%. Indirectly efficiency of the system increases. Also we will get efficiency during day as well as night as we are manually changing the switch according to avaibility of source.

Keywords: PIC Micro-controller, Wireless System, Renewable Energy resources (solar and wind), maximum power point tracking (MPPT), Energy harvesting system.

INTRODUCTION

There has been tremendous development in the applications which work on the energy based frameworks. Battery based applications have drawbacks when it comes to time and affect their own performances. Collecting the energy is a vital step which needs for the wellbeing of different sources. The examples of such application are thermal, motor, radio recurrence and optical source. These energies boost the power of these sensors which can be used as an alternative to the batteries. Based on the current, voltage, ability and the force thickness, the Photovoltaic Cell (PV) is the most unique form of valuable source. As compared to PV, the batteries have less impedance. The PV frameworks consists of the MPPT which is essential for the large as well as the small scale sun based systems. These are in the form of sub mili watt sensor hubs or the mili watt sensor hubs. The two essential components for understanding the nature of the MPPT are:

1. The usefulness of the MPPT (Most Extreme Power Point)
2. The efficiency of the DC to DC change circuit

In the MPPT method, the voltage generated by sources is checked every time for measurement of energy. It is also known as the slant climbing system. This is based on the twisting movement of force against the voltage. Due to its simplicity and high level of efficiency, this method is being used commonly. [1]

In incremental conductance method, as the name indicates, the microcontroller measures the incremental changes in voltage and current of PV cells. In perturb and observe method increasing conductance is calculated based on changes in fluctuating voltage. [2]

For displaying the incremental conductance strategy uses the drive point by connecting the incremental conductance. When both of these are similar then the generated voltage becomes the MPP voltage. This voltage is maintained by the controller. A compass wave from is utilized for checking the time for settlement of IV characteristics of PV cell in current used breath system. Further some reaches used the term constant voltage for explaining the incremental changes. Some of the scientists have used the word wild voltage for the same. The last technique is known as the 'open voltage'. In which if the yield voltage is kept steady then there is no impact to the MPP. Which means that it isn't a MPP tracking system. In the 'consistent voltage' technique which is also known as the open voltage system, zero current is calculated at the open circuit voltage when the power send to the stack is quickly deferred. After which the controller keeps on working on the voltage controller. This is the regular method of the MPP based on the working conditions. The reason why the PV Cluster works is because the MPP deals with the show voltage and plans it according to the reference voltage. The main reason for the 'consistent voltage' proportion methodology to work is that of the MPP voltage for a constant yield voltage. [2]

Because of its low control utilization the FVOC (Fractional Open Circuit voltage) approach is favored. It shows the clear relation of the voltage at MPP (most extreme power) and the photovoltaic board open circuit voltage. Various equipment's are required for the high power system which might be under 50W force. So these systems need to correct their MPPT. For the systems which run on low voltages a high capable change circuit is required. Therefore, a DC to DC convertor is essential in a photovoltaic cell. As the voltage varies therefore the DC to DC converters with high effectiveness are required.

RELATED WORK

As explained by Yin Li and Ronghua Shi, a solar based illumination system using MPP is demonstrated. Instead of programming, a device is used for charging of the batteries. Due to this the strength of framework is increased. The major focus is given on the point where vitality of radiations is more. During daylight, cloudy climate, amid cloudy environment and during evening, the strength & effect of these radiations may be lower.The framework adjusts accordingly to benefit from the illumination and it guarantees that the battery support has a long life span by selecting proper charging arrangements. Generating and collecting energy is a good alternative for the battery power. But still these kind of methods depend on the capacity of the gadgets. [1]

The researchers have also worked on point of maximum energy. Furthermore, genuine models were used which requires impedance matching. A procedure using voltage & recurrence control is also implemented. [3], [4].A micro Grid is supported by sun situated PV generators with the most extraordinary drive point taking after (MPPT) control and battery.

A method based on number and position of adjacent MPPs which depends on charging of cells and temperature conditions which is very basic need of PV module. [5]

In another technique called HCPSO (Hybrid Combinatorial Particle Swarm Optimization) estimation, operational necessities of the goal PV application using elective dc to dc control converter is explained. [6]

The controlled strategy for the re-enactment of photovoltaic modules with Matlab/Simulink is shown. To demonstrate I-V and P-V characteristics of a regular 36 W sun arranged module, One-diode indistinguishable circuit is used. The framework serves as a manual for induce more people into photovoltaic research and get a closer cognizance of I-V and P-V characteristics of PV module.

In Simulink square libraries, a model is created with images. In this system, the most outrageous compel point taking after of sun radiations and capacitor arrangement is implemented to improve the performance. [7]

In next method, high reasonability, low multifaceted design, and the basic likelihood is considered to legitimize this result is explained. The open circuit voltage is identified to identify temperature assortments. The strategy has been completed in an insignificant exertion 8-bit microcontroller and attempted in a battery charger application with attractive outcomes. [8]

PROPOSED SYSTEM

The proposed outline shields the additional end point that can prove to be beneficial for users.

1) Using two renewable energy source manually generation of power
2) Through the day & at evening the increased vitality productivity of the framework.
3) To provide for the heap of gadgets there is a need of eliminating the need of capacity and converter components.

Two novel vitality collecting frameworks are used for the proposed framework square chart that is the photograph voltaic and the wind turbines which are developed as basics of vitality specialists. To increase the efficiency of framework, the basic point is complete closed & increase efficiency during day. It is important to maintain a record of a battery or of any capacity gadget which is not utilized for the vitality given during day and night. A wind turbine is an adequate source as during the evening the vitality required for the major part of it is family unit this is not more part of that is exterminated.

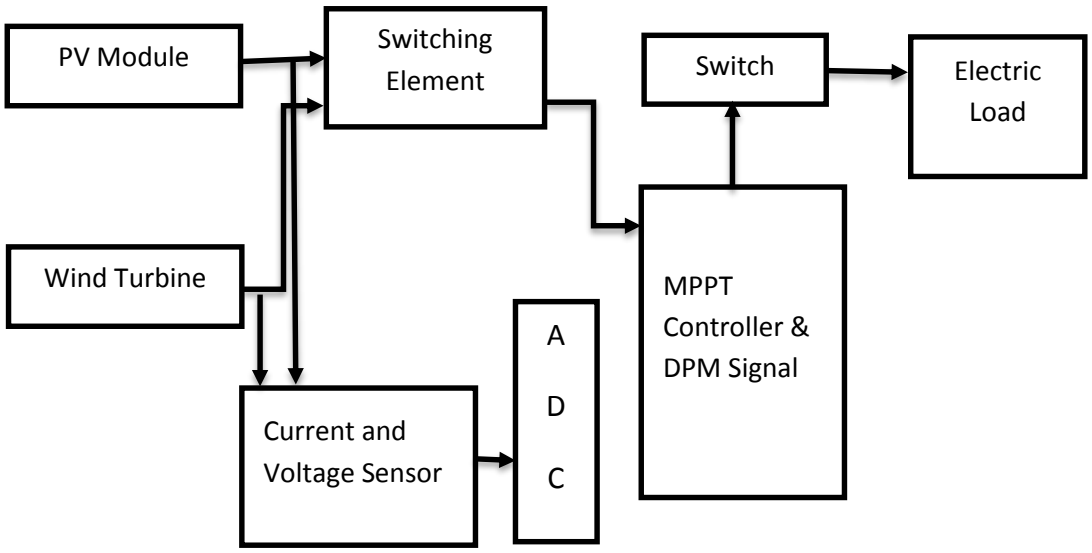

Figure 1. System Architecture

Solar Panel:

In project the solar is important renewable energy source because sun is wide range source. From sun we generate more power. From this panel we can get 12-24 Voltage having maximum capacity of current 1-2 Amp. Electrical vitality is obtained by changing the occurrence light.

Wind Turbine

Another important source is that of Wind turbine. The central inspiration to add this source is to boost the affectivity of the framework during the night hours when the daylight is entirely zero, so at that time the wind turbine will stream vitality to the heap.

ADC

While creating the MMPT on the PIC microcontroller and the PIC microcontroller won't realize simple valuations of current and voltages so that the first MPPT (PIC microcontroller) we are operating PIC microcontroller to represent MPPT Algorithm. To track the maximum power transfer from source to stack is the first primacy of MPPT. This will happen when the source impedance, the load or the formed power is in tune.

To decide the work stack, control flag has to be generate by comparing measure voltage & current in MPPT.

DPM Signal:

Using pulse width modulation we can change the duty cycle of switch which we are using for conduction. For efficient energy we have to reduce losses 20% by devoid of converter and respoaitary element with the help of this signal we can attain the difference among load and source.

Voltage and Current Sensors:

First the current of the sun based board, the wind turbine and the yield voltage should be measured to execute the MPPT calculation so as to track the time when the maximum power is generated. These sensors will identify the variations in voltage and current formed by the board and the turbine which are subject to variation in the wind speed, temperature and illumination.

RESULTS

With the resultant values of voltage, the wind turbine, power and current of both the photovoltaic models the maximum power point tracking results are shown.

Graphical representation of solar parameter:

The graphical representation of all parameter is shown.

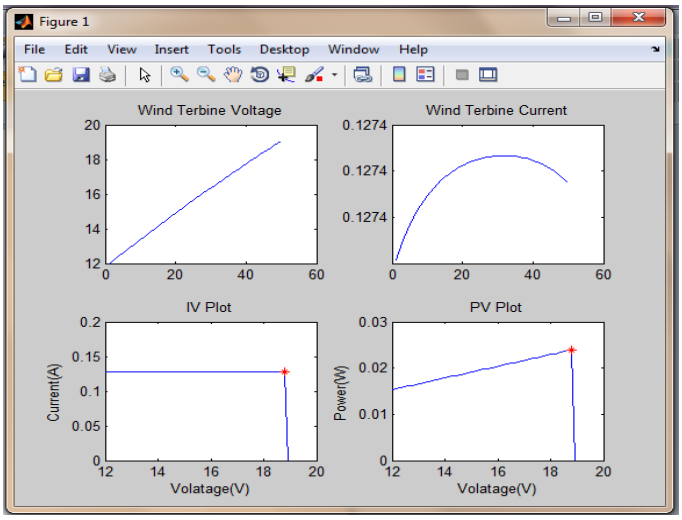

Figure 2. Solar Panel characteristics after simulation.

The IPV, VPV Analysis and Its Matching Power of photovoltaic model In the following table 1 are the values obtained during the simulation of the PV module for finding the maximum power point. These qualities are changed into the advanced by ADC. Table 1 shows the Corresponding Photovoltaic current, the power generated and the voltage.

Table 1: Results of Proposed system

Sr. no.	Ipv	Vpv	Power	Sr. no.	Ipv	Vpv	Power
1	0	0	0	26	0.78489	10.2857	8.07317
2	0.91224	0	0	27	0.76781	10.7143	8.22655
3	0.91126	0.42857	0.39054	28	0.74857	11.1429	8.34122
4	0.91015	0.85714	0.78013	29	0.7269	11.5714	8.41125
5	0.90891	1.28571	1.1686	30	0.70249	12	8.42982
6	0.90751	1.71429	1.55573	31	0.67499	12.4286	8.38912
7	0.90593	2.14286	1.94128	32	0.64401	12.8571	8.28014
8	0.90145	2.57143	2.32496	33	0.60912	13.2857	8.09588
9	0.90215	3	2.70644	34	0.56982	13.7143	7.81463

Sr. no.	Ipv	Vpv	Power	Sr. no.	Ipv	Vpv	Power
10	0.89989	3.42286	3.08533	35	0.52555	14.1429	7.43271
11	0.89735	3.85714	3.46119	36	0.47568	14.5714	6.39129
12	0.89448	4.28571	3.83349	37	0.4195	15	6.29256
13	0.89126	4.71429	4.20363	38	0.35623	15.4286	5.49611
14	0.88762	5.14286	4.56491	39	0.28496	15.8571	4.51858
15	0.88353	5.57143	4.92251	40	0.20467	16.2857	3.33321
16	0.87892	6	5.2735	41	0.11424	16.7143	1.90938
17	0.87372	6.42857	5.61679	42	0.01237	17.1429	0.21204
18	0.86787	6.85714	5.95113	43	-0.1024	17.5714	-1.7989
19	0.86128	7.28571	6.27506	44	-0.2316	18	-4.1693
20	0.85386	7.71429	6.58691	45	-0.3772	18.4286	-6.9517
21	0.8455	8.14286	6.88476	46	-0.5412	18.8571	-10.206
22	0.83608	8.57143	7.16638	47	-0.726	19.2857	-14.001
				48	-0.934	19.7143	-18.414
23	0.82547	9	7.42922	49	-1.1684	20.1429	-23.536
24	0.81352	9.42857	7.67031	50	-1.4325	20.5714	-29.468
25	0.80006	9.85714	7.88626	51	-1.7299	21	-36.327

Graphical representation of Wind parameter:

The graphical representation of all parameter is shown.

In figure the relation between power and voltage, voltage & current are plot.

The IWT VWT Analysis and the Corresponding Power of wind turbine model

These are the values of wind turbine simulation

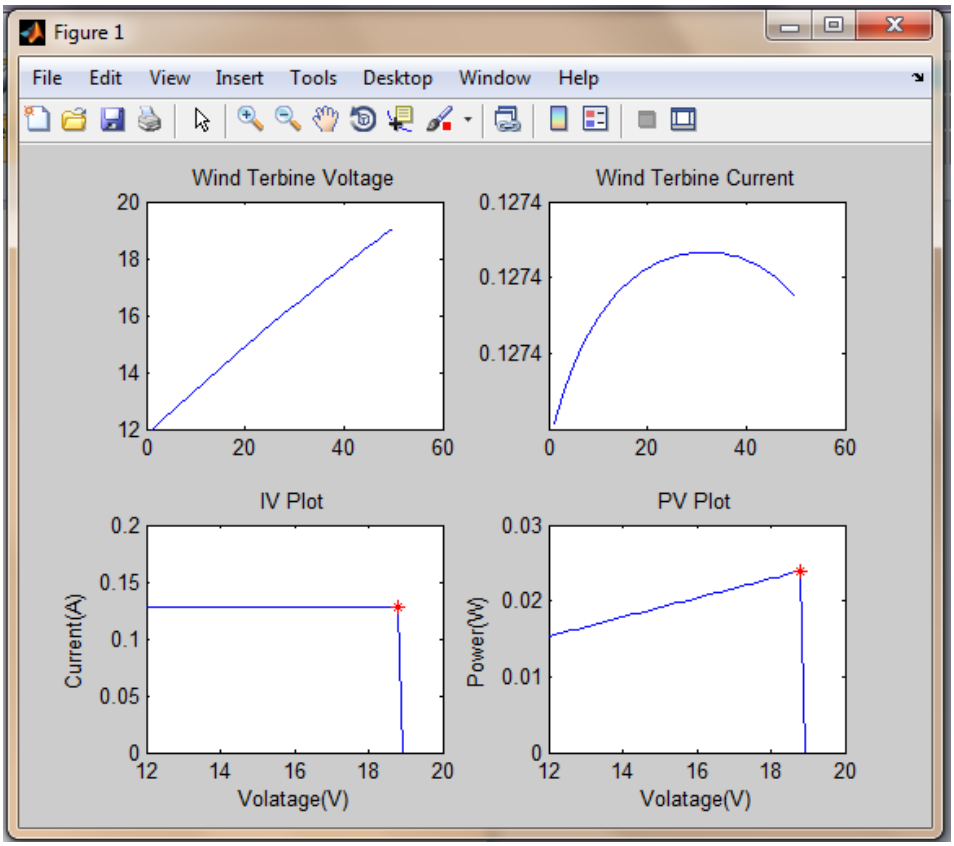

Figure 3. Wind Turbine Characteristics after Simulation

Table 2: The values of power through, current and voltage generated through the Wind Turbine.

Sr. no.	Ipv	Vwt	Power	Sr. no.	Ipv	Vwt	Power
1	0	0	0	23	0.12744	15.1924	1.93614
2	0.12744	12	1.52929	24	0.12744	15.3405	1.955
3	0.12744	12.1539	1.5489	25	0.12744	15.488	1.9738
4	0.12744	12.3077	1.5685	26	0.12744	15.635	1.99253
5	0.12744	12.4615	1.5881	27	0.12744	15.7813	2.01118
6	0.12744	12.6152	1.60769	28	0.12744	15.927	2.02975
7	0.12744	12.7688	1.62727	29	0.12744	16.0721	2.04824
8	0.12744	12.9223	1.64683	30	0.12744	16.2165	2.06664
9	0.12744	13.0757	1.66637	31	0.12744	16.3602	2.08496
10	0.12744	13.2288	1.68589	32	0.12744	16.5032	2.10318
11	0.12744	13.3818	1.70539	33	0.12744	16.6455	2.12131
12	0.12744	13.5345	1.72485	34	0.12744	16.787	2.13934
13	0.12744	13.687	1.74428	35	0.12744	16.9277	2.51727
14	0.12744	13.8392	1.76368	36	0.12744	17.0676	2.1751
15	0.12744	13.9911	1.78304	37	0.12744	17.2066	2.19283
16	0.12744	14.1427	1.80235	38	0.12744	17.3448	2.21043
17	0.12744	14.2939	1.82163	39	0.12744	17.4821	2.22794
18	0.12744	14.4448	1.84085	40	0.12744	17.6386	2.24532
19	0.12744	14.5952	1.86002	41	0.12744	17.7541	2.26259
20	0.12744	14.7452	1.87914	42	0.12744	17.8886	2.27974
21	0.12744	14.8948	1.8982	43	0.12744	18.0222	2.29676
22	0.12744	15.0439	1.9172	44	0.12744	18.1548	2.31366
				45	0.12744	18.2864	2.33043

CONCLUSION

In purpose system using two renewable energy sources solar and wind generated electrical energy is supply to the load through the MPPT. By neglecting the converter and storing element efficiency will increase by 20-30 %. Inside the MPPT pic controller is used for pulse width modulation to increase or decrees the duty cycle of switch. By changing the Pic controller delay we can set the reading time. MPPT every time take the reading and matches with the load. In this the VI and PV characteristics of PV panel and wind with MPPT is shown with the help of simulation and mat lab.

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