SOLAR POWER GENERATION USING MPPT

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ABSTRACT

Using MPPT (Maximum power point tracking) technology. This paper has been worked on new method to increase the power output of solar panel by moving it in during a day and seasons with detecting degree of sunlight. And with one fixable mechanism with two degrees of freedom has been designed, developed and constructed for movement the solar panel by stepper motors. In this system we use external sensor for detecting the best location of panel under the sunlight's intensity the controller tilts panel to the best position. In this way a ARM microcontroller has been applied for controlling the stepper motor and finding the best position of panel under the sunlight's intensity. This system follows the sun like sunflower and with this way in all hours of day uses of maximum power of solar energy.

Keyword : - *MMPT, Stepper motor ,sunflower and ARM controller*

1.INTRODUCTION

Solar energy is rapidly gaining notoriety as an important means of expanding renewable energy resources. As such, it is vital that those in engineering fields understand the technologies associated with this area. Our project will include the design and construction of a microcontroller-based solar panel tracking system. Solar tracking allows more energy to be produced because the solar array is able to remain aligned to the sun. This system builds upon topics learned in this course. A working system will ultimately be demonstrated to validate the design. Problems and possible improvements will also be presented.

The world population is increasing day by day and the demand for energy is increasing accordingly. Oil and coal as the main source of energy nowadays, is expected to end up from the world during the recent century which explores a serious problem in providing the humanity with an affordable and reliable source of energy. The need of the hour is renewable energy resources with cheap running costs. Solar energy is considered as one of the main energy resources in warm countries.

In general, India has a relatively long sunny day for more than ten months and partly cloudy sky for most of the days of the rest two months. This makes our country, especially the desert sides in the west, which include Rajasthan, Gujarat, Madhya Pradesh etc. very rich is solar energy. Many projects have been done on using photovoltaic cells in collecting solar radiation and converting it into electrical energy but most of these projects did not take into account the difference of the sun angle of incidence by installing the panels in a fixed orientation which influences very highly the solar energy collected by the panel.

2. DESIGN

Fig -1shows the system interface. Arm controller is the main unit in controlling of the entire system. LDR's will collect the solar intensity in X and Y plane, the panel will be rotated by the data in the ULN driver.

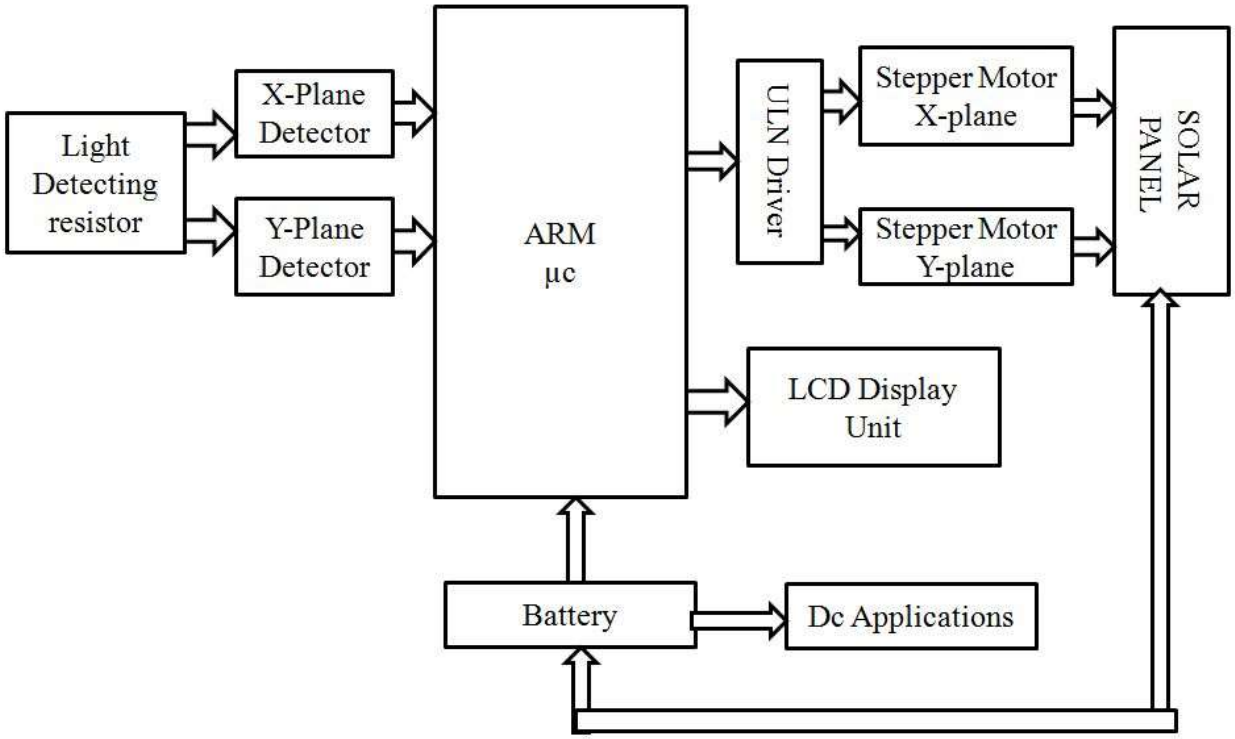

Fig -1: System interface

Three Light Detecting Resistors (LDR's) are placed in such a way that two of them are in X-plane and one is in the Y-plane. The LDR's in the X-plane are will function on daily basis and the one in Y-plane functions in monthly basis. Two stepper motors are responsible for the rotational movements of the solar panel in X and Y planes. This motor is controlled by the ULN driver. LCD display unit displays the particular LDR that is being made use of. The power supply to the ARM microcontroller is provided by an external battery.

Fig-2: Controller and display unit

Fig-2 shows the controller unit which controls the overall operations of the proposed system and the display unit displays the information of LDR which is being used.

3. OBSERVATION

The observation of solar panel was done in two cases with respect to sun, a)solar panel was kept in a fixed position b)solar panel was in rotation.

Table-1: Comparison of solar power generated with and without tracking

Tracking			
Time	voltage	current	Power
7am	10.62	0.103	1.09386
8am	10.71	0.111	1.188
9am	11.01	0.125	1.3762
10am	11.23	0.133	1.4935
11am	11.37	0.114	1.2961
12pm	11.25	0.15	1.6875
1pm	11.03	0.147	1.6214
2pm	10.92	0.144	1.5724
3pm	10.81	0.139	1.5025
4pm	10.51	0.136	1.4293
5pm	10.45	0.13	1.3585
6pm	10.01	0.125	1.2512
7pm	9.98	0.087	0.8682

a

Without Tracking			
Time	voltage(V)	current (A)	power
7am	8.56	0.0988	0.845728
8am	9.23	0.1043	0.962689
9am	10.72	0.1125	1.206
10am	10.87	0.1207	1.312009
11am	11.3	0.129	1.4577
12pm	11.24	0.14	1.5736
1pm	10.83	0.1317	1.426311
2pm	10.73	0.129	1.38417
3pm	10.71	0.126	1.34946
4pm	10.38	0.115	1.1937
5pm	9.25	0.107	0.98975
6pm	9.2	0.098	0.9016
7pm	8.21	0.085	0.69785

b

By implementing the proposed system with tracking, more power can be drawn out of the solar panel. But when tracking is not used, the maximum power output will be more only during the mid-day when the solar panel is placed horizontally in 180°. The Tab-1 above shows the same wherein we can observe that power output is the same in two methods i.e. by racking and without tracking during the mid-day(12pm).

But we can note the difference at other time slots that the output comparatively low when tracking is not used. This is because when tracking is used, the solar panel will always be perpendicular to the sun i.e. Particular LDR's will be working as per the light intensity from the sun. When tracking is not used, the amount of energy stored is low since the solar panels will be stationary

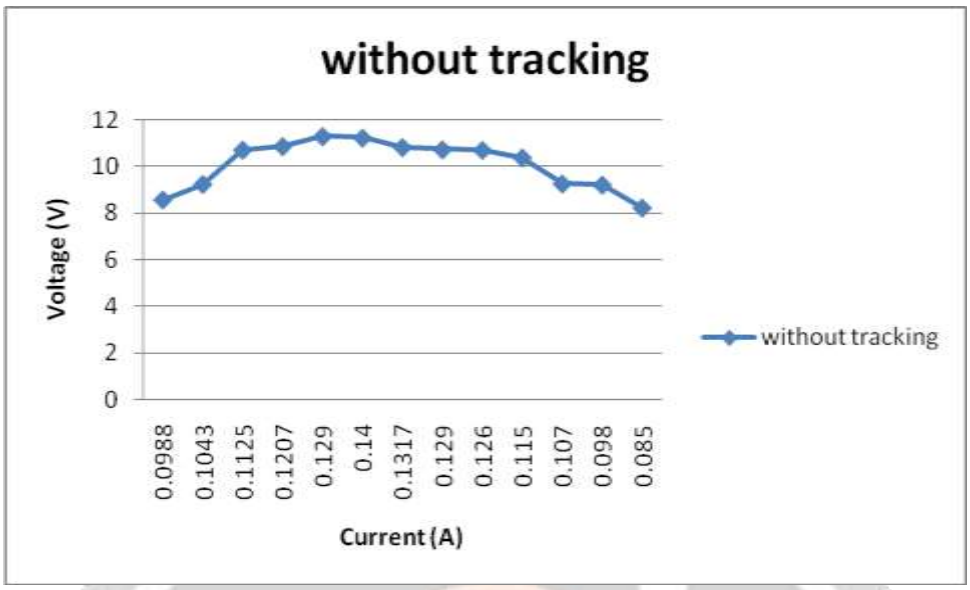

Chart-1: Plot of V/A without tracking

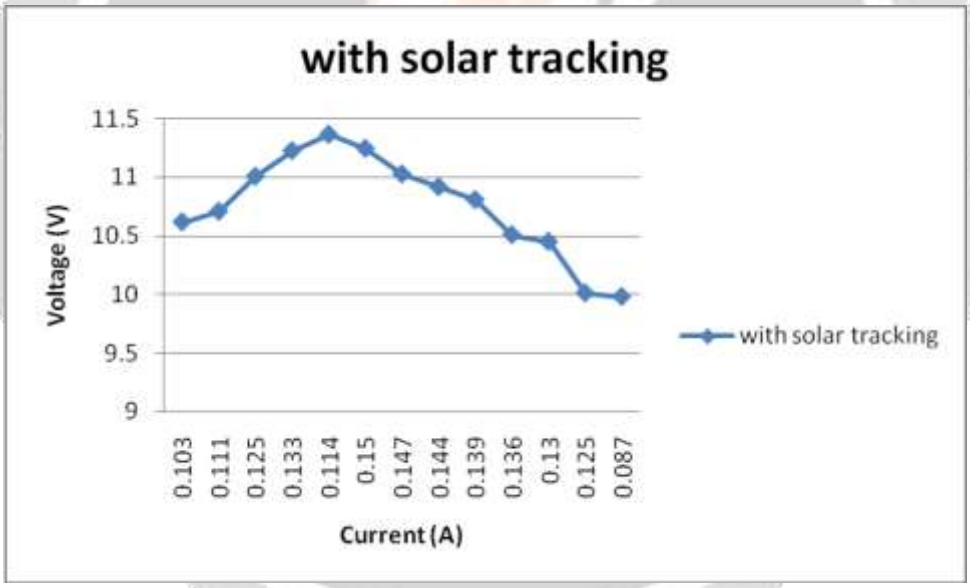

Chart-2: Plot of V/A with tracking

Chart-1 shows the plot of Tab-1a with solar power generation without tracking. The operating point is (8.21 V,0.085 A). Chart-2 shows the plot of Tab-1b with solar power generation with tracking. The operating point here is (10.51 V,0.136 A). From this stats, we can realize that the operating voltage increases by 2.3 V and 51 mA.

4. CONCLUSIONS

The ultimate aim of this paper is to maximize the power output from solar panel by controlling it in such a way that the light from sun is utilized to the best possible regardless of day and seasons. By implementing the proposed system, the efficiency of the system increases by around 40% compared to the systems which do not use tracking. The experimental results shown in the Tab-2 proves that the performance of the system is enhanced and this can be implemented for commercial purposes.

6. REFERENCES

[1]. "Two Axis Solar Tracker Design and Implementation". Salih FADIL, Ahmet Can CAPAR, Kerim CALAR.
[2]. "Performance Analysis of Dual-axis Solar Tracking System". N.Othman, M.I.A. Manan, Z. Othman, S.A.M. Al Junid. 2013 IEEE International Conference on Control System, Computing and Engineering, 29 Nov. - 1 Dec. 2013, Penang, Malaysia
[3]. "Development of Two Axis Solar Tracking Using Five Photodiodes". Munnik Haryanti, Abdul Halim, Arbai Yusuf. 2014 Electrical Power, Electronics, Communications, Controls, and Informatics Seminar (EECCIS)
[4]. "Design, Development and Performance Test of an Automatic Two-Axis Solar Tracker System". Prabodh Bajpai, Subhash Kumar.
[5]." Mechanism with Four Degrees of Freedom, Design and Construct with Controller for Increasing the Power Output of Solar Cell". Ali Moradkhani, Kaveh Ahmadi, Shadieh Ghalambor, Ehsan Habibizadeh, Mahdi Yahyaei. 2011 Third International Conference on Measuring Technology and Mechatronics Automation.