International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 06 | June 2019 www.irjet.net p-ISSN: 2395-0072

Tracking of Wall Mounted Solar Panels with Real Time Monitoring

Abishek B R[1], Adithya.S[2], D.J.V.S. Chandran[3], Sre Vignesh.S[4]

[1]*Student, Dept. of EEE, SRM Institute of Science and Technology, Chennai, India*
[2]*Student, Dept. of EEE, SRM Institute of Science and Technology, Chennai, India*
[3] *Student, Dept. of EEE, SRM Institute of Science and Technology, Chennai, India*
[4] *Student, Dept. of EEE, SRM Institute of Science and Technology, Chennai, India*

Abstract - *Solar Energy, one of the world's most abundant and most used renewable sources has a plethora of applications in the many fields of study including wireless power transfer, automated vehicle systems, net metering and many more. In an hour, the amount of solar energy that strikes the surface of the earth Is approximately equal to 410-430 quintillion joules, which is more than the amount of energy consumed by all the humans which is about 400 to 410 quintillion joules. With the recent developments in technology, the percentages of the energy produced through solar panels are slowly increasing with an expected 20 percent yield by 2050. One of the recent developments, by which the efficiency of solar energy production increased, is by the use of a tracking system that tilts the panel towards the sun at all times so as to produce optimal power with less increment in cost. These solar panel tracking systems are used in numerous areas in many countries and in order to keep in check of the power output, efficiency, angle of rotation and many other parameters, the real time monitoring of the generating capacity of the solar panels, using measuring devices to get real time data at any moment at the user's demand. This Project focuses on a Wall mounted solar panel system equipped with a tracking system, that can help in increasing the generating capacity of the solar panel system along with which a Portable digital power meter is used to measure voltage, current and power at real time of the solar panel system, so as to store and provide real time data of the solar panel system's production.*

***Key Words*: Solar Panels, Tracking system, Real Time Monitoring, Solar energy, Wall Mounted panels, Efficiency, CAD, Design, Power Generation.**

1. INTRODUCTION

Solar Energy, one of the most abundant supply of renewable energy, is the energy radiated by the sun that is harnessed by the continuous evolving technologies such as solar heating, solar panels and many more technologies.

Solar panels, which is one of the most efficient methods of harnessing solar energy by absorbing the radiation of the sun and converting the radiation into electrical energy. The Solar panel's ability to convert the sun's energy to electrical energy, is due to the presence of the silicon cells, in solar cells. The solar panels consists of a large number of individual solar cells, which when exposed to sunlight produces some amount of usable electrical energy. Therefore, by increasing the number of individual solar cells in the solar panels the efficiency is increased.

The Solar Tracker is a device that is used for navigating the solar panels towards the direct component of the sun. This device is used so as to minmize the angle of incidence of the sunlight from the sun towards the solar panels so as to increase the generating capacity of the solar panels.

In the case of a fully stationary panel system, the angle of incidence between the sunlight and the photovoltaic panel varies from 0 to 90 degrees, after which the sun goes out of visibility for the panel. By having a panel, installed in a stationary position, the effieciency in the generation of output power from the panel varies inconsistently, since the angle of incidence of the sunlight to the photovtaic panel keeps on varying every minute, therefore creating a inconsistency in the efficiency and also in the generating capacity of the photovoltaic panels that are installed in a stationery position. In order to eliminate this glaring dis-advantage, the concept of Solar tracking is introduced.

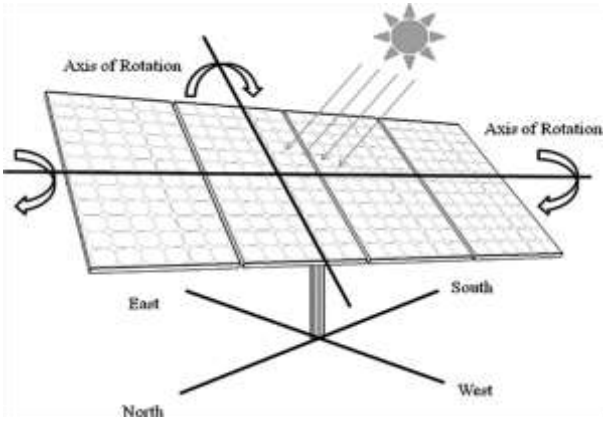

Figure 1 – Representation of a Solar Tracker

The Solar Tracking System is an essential implementation in the fields of application in Solar Energy, especially in areas of concentrator photovoltaics and concentrator solar applications in order to maximize the generating output of a solar panel system.

The Single axis solar tracking system is implemented in this project.

Wall Mounted type Solar Panels, is the type of mounting where the panels are installed along the vertical walls, therefore this type of mounting is used in areas where rooftop panels cannot be installed, especially in regions of low altitude. The Wall mounted panels unlike the rooftop panels are usually in a stationary form, usually tilted at an particular angle.

Figure 2 – Wall Mounted Solar Panel Representation

2. BENEFITS OF TRACKING SYSTEM IN WALL MOUNTED PANELS

Out of the two types of solar mountings, roof top panels are the type of mounting that is majorly used, since, the solar tracking can be implemented in this type of mounting. On the other hand, Wall Mounted type Solar Panels, is the type of mounting where the panels are installed along the vertical walls, such that this type of mounting is used in areas where rooftop panels cannot be installed, especially in regions of low altitude. The Wall mounted panels unlike the rooftop panels are usually in a stationary form, and by adding a solar tracking system would make it more efficient in its generating capacity, since the stationary panels mounted in the wall, would be able to orient itself towards the sun, therefore, producing more energy than before. These panels are widely used in areas like the North Pole or in regions of extreme low altitude such as Iceland and Chile.

This project focuses upon the application of the single axis solar tracking system in Wall mounted type of solar panels, so that it can be installed in locations of low altitude such as Chile and other countries.

3. REAL TIME MONITORING OF SOLAR PANELS

In this project, analysing the output production of the solar panels and storing the analysed data is of optimal requirement. Data such as current, voltage and instantaneous power are some of data's that are of top priority. These quantities provide a clean look on the operating capacity and the efficiency of the solar panels as well as the tracking system that is used.

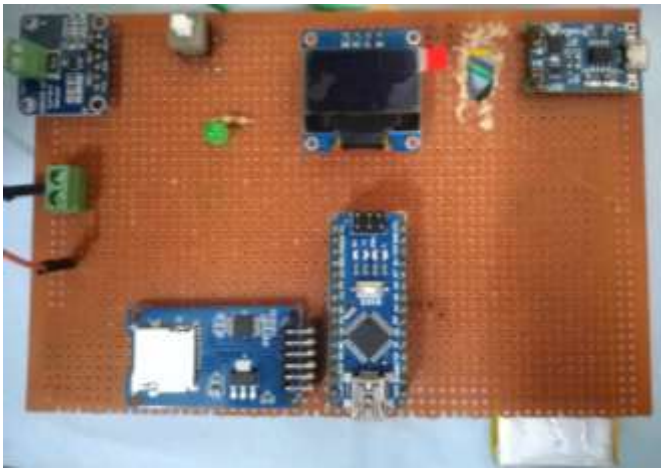

Figure 3 - Representation of Digital Portable Data Meter and Logger

In an usual operation, to measure the output voltage and current in any project, a multimeter is used to measure the said voltage and current, however, a multimeter cannot measure instantaneous power, also another disadvantage is that the multimeter cannot store the data measures and also must be connected to it at all times. Another main disadvantage, is that the use of multimeter requires the presence of a person to monitor it at all times and also it has a limited battery charge and cannot be charged via a cable.

In such a situation, this model comes in extreme handywork.

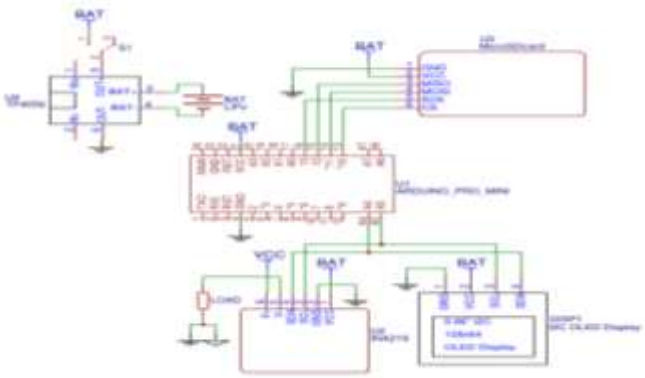

Figure 4 – Circuit Representation

The device consists of a –

- Sensing Unit - The Sensing unit consists of a current and voltage sensor that is capable of measuring current and voltages upto 3.2 A and 26 V.
- Processing Unit – The processing unit used in this project is a Arduino Nano due to its compact size and also cheap in price. The Voltage is measured by connecting the positive terminal to the analog terminal of the arduino and the ground terminal to the ground pin of the arduino.

- Display Unit – The display unit used is an OLED Display that is used for displaying all the measured and calculated quantities in real time.
- Storage Unit – The storage unit that is used is an SD Card, where all the measured data is stored and can be retrieved when deemed necessary.

This model is used in the proposed project as a measurement system so as to measure and store real time data at all times. This helps in determining the efficiency of the panels and also to determine when the panels are too given to maintenance.

4. HARDWARE DESIGN

The design of this project consists of a holding unit which holds the solar panel, where the holding unit is connected to a long rod shaft which in turn is connected to the shaft of the servo motor. The servo motor is placed in a slot that is constructed in the model, after which the shaft of the motor is connected to the rod shaft which is then connected to the holding unit. A prototype of this model is 3D printed so as to simulate its operation.

Figure 5 – Hardware Design

As seen, from the 3D CAD designs above, that the holding unit is present in the center of the module, here the holding unit is designed to hold 2 panels, and the holes present are for the leads of the panel to move out. The exterior design is present so as to provide structural stability. The Servo motors will be placed in the 2 boxes on top of the module, and to which long a rod shaft as seen I connected to the both the servo motor shaft and to that of the holding unit, such that the holding unit will move along with the rotation of the servo motor.

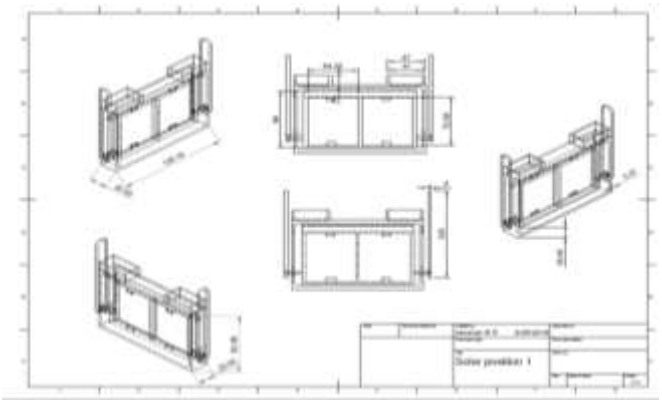

Figure 6 – Various Views of Design

5. SPECIAL CASE

In the North pole, the sun's the path is not vertical as in the equator, instead it follows an almost horizontal path as shown in the image below. In the north pole the suns the path is not vertical as in equator,instead it follows the almost horizontal path as shown. This path of sun is almost parallel to the vertical plane of earth surface(walls) so more solar incidence on panels placed on walls than on roof top. More over in north pole snow fall will cause a major maintenence hinderence to roof top solar panels this is not a problem to wall mount ones. It is the altitude of the sun , which is the angle between the horizon and the centre of suns disc. In poles it is between 16.5 to 63.5 throughout day. By incorporating a tracking system to wall mount based solar panels we can increase it's efficiency and also a mount on which it can be mounted.

Figure 7 – Movement of the Sun in the North Pole

6. TESTING

An Hardware simulation was conducted with the proposed model, where the model on day one was kept stationery from the time 9AM to 11:30AM, where all the panels remained stationery at 60 degrees orientation during this time of operation.

On day 2, the tracking module has been initiated, such that at the same time from 9AM to 11:30AM, the LDR's are used to detect the sun's orientation and sends the signal to the servo motor input, so that the servo motors rotate according to the given step signal. Such that the panels are getting oriented automatically and according to the Sun's orientation. The LDR's send a signal to the servo motors every half an hour according to the sun's orientation.

Reading of both models were taken at angles 0,30,60 and 75 degrees respectively.

Degree of Orientation	Non Tracking Model	Tracking Model	Efficiency over Nontracking Model
0	1.25 V	1.95 V	56 %
30	1.455 V	1.745 V	19 %
60	1.775 V	1.585 V	-10.7%
75	1.64 V	1.78 V	6.7%

Table -1: Data Obtained

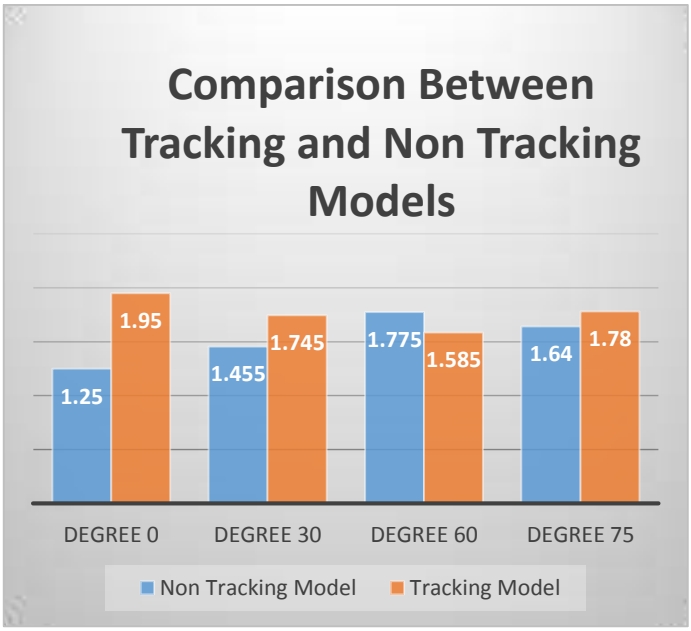

Figure 8 – Graphical Representation of Data Obtained

As seen, from both the figures above, we can see that the non tracking model having a fixed orientation of 60 degrees, as seen produced a max voltage of 1.775 volts at 60 degrees orientation, whereas, it has a lesser generating capacity at other orientation angles.

Whereas, in the case of the tracking module, which follows the sun's orientation as seen has a generating voltage at almost all orientation, which proves that it has a greater generating capacity compared to the non tracking system.

7. CONCLUSION

This Paper concludes that, the wall mounted based solar panel system although a inefficient system can be made into a efficient system with the help of tracking.

This Paper also concludes that the proposed design, is a cost effective and simple method of constructing a wall mounted solar panel system along with single axis tracking, is an efficient method of solar power generation.

Hence, concluding that the proposed design is a better alternative design for wall mounted panels for a better generating capacity.

8. ACKNOWLEDGEMENT

The Authors would like to express our gratitude to the many number of people who have helped us in bringing this project to fruition. The Authors would also like to thank SRM Institute of Science and Technology for providing their resources and support and to act as a hub for the Author'

9. REFERENCES

[1] Priyanka Rawat, Kamal Deep Singh, Hakima Chaouchi, Jean Marie Bonnin "Wireless sensor networks: A survey on recent developments and potential synergies"

[2] M. Reyasudin Basir Khan, Razali Jidin, Sharifah Azwa Shaaya,Dzesmillson Daryll "Wireless PV Module Performance Monitoring System"

[3] Abhishek Parikh, Farah Pathan, Bhavdipsinh Rathod, Sandeep Shah "Solar Panel Condition Monitoring System based on Wireless Sensor Network"

[4] Shih-Sung Lin, Chien-Wu Lan, Ping-Nan Chen, Min-Hsiung Hung ,Kuang-Hsiung Tan, Ya-Hui Wu, and Jo-Yen Nieh "Development of a Novel Power-Monitoring System Using Internet and Wireless Sensor Network Technologies"

[5] Vinodkumar P. MoreÅ* and Vikas V. KulkarniÅ "Design and Implementation of Microcontroller Based Automatic Solar Radiation Tracker"

[6] B.Suchitha Samuel, J.Mrudula

[7] "Design of Intelligent Solar Tracker Robot for Surveillance"

[8] Mr. Vishal Bhote, Prof. Jaikaran Singh "Implementation of dual axis solar tracker model by using microcontroller"

[9] Shruti Tiwari ; R N Patel "Real time monitoring of solar power plant and automatic load control"

[10] Ambuj Gupta ; Rishabh Jain ; Rakshita Joshi ; Ravi Saxena "Real time remote solar monitoring system"