International Journal of Advanced Research Methodology in Engineering & Technology,
Volume 1, Issue1, December 2016

DUAL AXIS SOLAR TRACKER USING ORGANIC SOLAR PANELS

V.Indhumathi[1], S.Jananisri[2] and K.Atcharavathy[3]
1 B.E (EEE-III Yr) kumaraguru college of technology- Coimbatore and vindhumathiss@gmail.com
2B.E(EEE-III Yr)kumaraguru college of technology- Coimbatore and sri.sumathi7@gmail.com
3.B.E (EEE-III Yr) kumaraguru college of technology- Coimbatore and atcharavathy96@gmail.com

ABSTRACT

As the energy demand and the environmental problems increase, the natural energy sources have become very important as an alternative to the conventional energy sources. The renewable energy sector is fast gaining ground as a new growth area for numerous countries with the vast potential it presents environmentally and economically. Solar energy plays an important role as a primary source of energy, especially forRural area. The project is divided into two stages, one part is by using dual axis solar tracker and the another one is by using organic solar panels in order to reduce the cost of panels.our part in this idea is that by using these panels for tracking the solar radiation and produce more power. Because of the reduced cost it can be implemented in every homes and for agriculture purpose

Key words:
Dual axis tracker, organic solar panels, efficiency,,cost,arduino

1.INTRODUCTION

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. Renewable energy is derived from natural processes that are replenished constantly.

Renewable energies are inexhaustible and clean. The energy comes from natural resources such as sun, wind, tides, waves, and geothermal heat. Solar energy is quite simply the energy produced directly by the sun. Solar energy is radiant light and heat from the sun harnessed using a range of technologies such as photovoltaic, thermal electricity and etc. A solar cell (also called a photovoltaic cell) is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. The majority of modules use wafer based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. The structural member of a module can either be the top layer or the back layer. Electrical connections are made in series to achieve a desired output voltage and in parallel to provide a desired current capability. Several types of solar cells are available. Monocrystalline Solar Cells, Polycrystalline Solar Cells, Amorphous Silicon (a-Si) Solar Cells, Cadmium Telluride (CdTe) Solar Cells.

2.PROBLEM DESCRIPTION

In order to get more power from solar energy we go for solar tracking systems. Solar tracking system is a device for orienting a solar panel towards the sun. Concentrators especially in solar cell application require a high degree of accuracy to ensure that the concentrated sunlight is directed precisely to the power device. Precise tracking of sun is achieved through systems with single or dual axis tracking.

2.1 Single Axis Solar Tracker

Solar panels with single axis tracking system panels can turn around the centre axis. The sun travels to 360 degrees per day ,but from the perspective of any fixed location the visible portion is 180 degrees during an average half a day period(more in spring and summer; less, in fall and winter).Local horizon effects reduce this somewhat, making the effective motion about 150 degrees. A solar panel in fixed oriented between the dawn and sunset extremes will see a motion of 75 degrees to either side, and thus will loss 75% of energy in morning and in evening. So rotating the panels to the east and west can help recapture those losses.

2.2Dual Axis Solar Tracker

But the sun also moves through 46 degrees north and south during a year. The same set of panels set at the midpoint between the two local extremes will thus see the sun move 23 degrees on either side, causing losses of 8.3% .Generally speaking the losses due to seasonal angle changes is complicated by changes in the length of the day, increasing collection in the summer in northern or southern latitudes. This biases collection towards the summer, so if the panels are tilted closer to the average summer angles, the total yearly losses tilted at the spring/fall solstice angle(which is the same as the site's latitude).so in order to absorb sun radiations more effectively we go for dual axis tracking.

For the most part our common every day solar cells run at an efficiency of 18-20%, meaning they convert 18-20% of the every they receive into electricity. While this is far better than the 3-6% efficiency that most green plants end up with, it doesn't quite meet our power needs. In fact solar panels that track the sun create around 30% more energy per day than a fixed panel.

Fig 1.1.2.a Dual Axis Solar Tracker

3. OBJECTIVES

- ✓ To track the sun efficiently.
- ✓ To improve the output power of solar power system.

3.1 METHODOLOGY

MATERIALS REQUIRED

- ➢ Arduino IDE
- ➢ Arduino Uno + USB Cable
- ➢ 1 x V3003 Plastic servo motor
- ➢ 1 x 9g micro servo motor
- ➢ 4 x Light Detecting Resistors
- ➢ 4 x 10K Ohm Resistors
- ➢ Organic pv cells

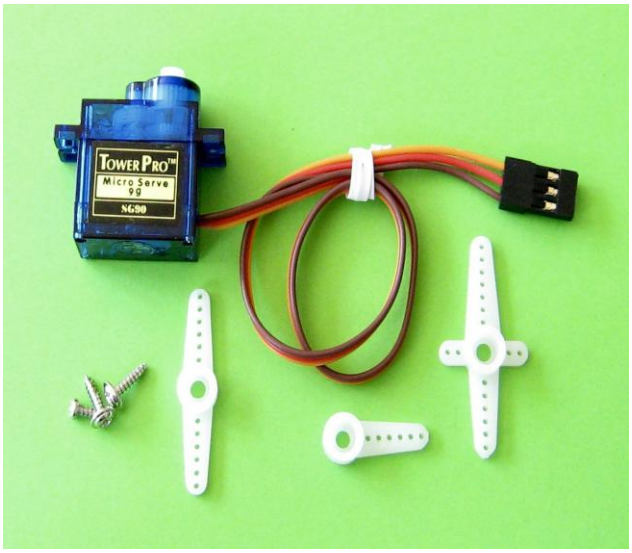


Fig 2.1.b 9gMicro servo motor

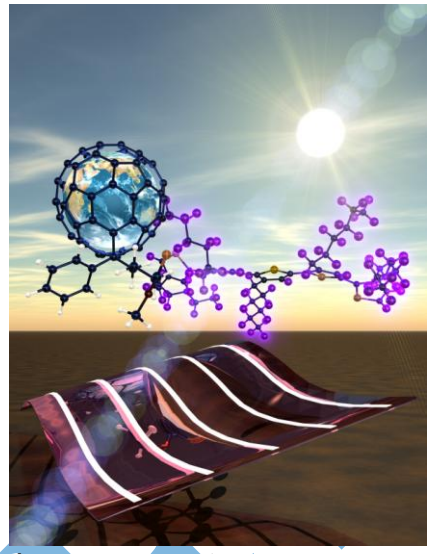


Fig 2.1.a Light Detecting Resistor

3.2 METHOD

The main impulsion is to design a high quality solar tracker. This paper is divided into two parts; hardware and software. It consists of three main constituent which are the inputs, controller and the output. A photo resistor or Light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000000 ohms, but when they are illuminated with light resistance drops dramatically. LDR's have low cost and simple structure. The principle of the solar tracking system is done by Light Dependent Resistor (LDR). Four LDR's are connected to Arduino analog pin AO to A4 that acts as the input for the system. The built-in Analog-to-Digital Converter will convert the analog value of LDR and convert it into digital. The inputs are from analog value of LDR, Arduino as the controller and the servo motor will be the output. LDR1 and LDR2, LDR3 and LDR4 are taken as pair .If one of the LDR in a pair gets more light intensity than the other, a difference will occur on node voltages sent to the respective Arduino channel to take necessary action. The Servo motor will move the solar panel to the position of the high intensity LDR that was in the programming.

A servo motor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. It has three terminals viz, supply, ground and signal. In our project in order to track dual axis we use two servo motors. One is used for horizontal rotation such that day around tracking .Another one is used for vertical rotation such that year around tracking or seasonal tracking.

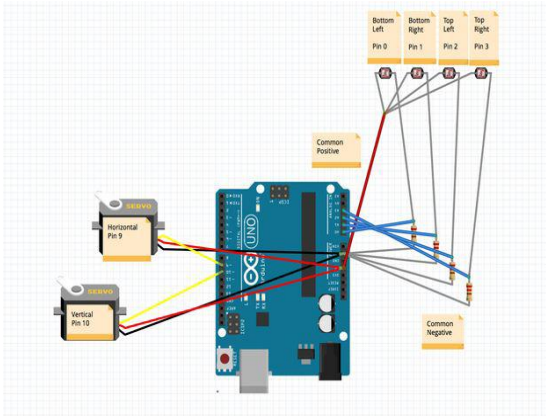


Fig 2.2.a Block Diagram

The signal pin of servo which is responsible for horizontal rotation is connected to digital pin9 and the signal pin of servo responsible for vertical rotation is connected to digital pin10 of Arduino. The supply and ground

pins of both servos are given to 5v and GND pin of Arduino respectively.

3.3 ALGORITHM

The algorithm of the program is given as steps in the following.

Step 1. Read all analog voltages from analog channels

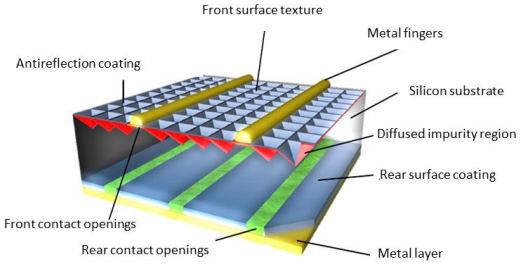
Step 2. If all voltages are equal then motor will be in stop position.

Step 3. If LDR1>LDR2 Then the top motor will rotate clockwise.

Step 4. If LDR1<LDR2 Then the top motor will rotate anticlockwise.

Step 5. If LDR3>LDR4 Then the down motor will rotate clockwise.

Step 6. If LDR3<LDR4 Then the down motor will rotate anticlockwise.



3.4 ORGANIC SOLAR PANELS

Organic cells is a type of photovoltaic that uses organic electronics.The molecules used in organic solar cells are solution-processable at high throughput and cheap resulting in low power production costs to fabricate a large volume.Combined with the flexibility of organic molecules organic solar cells are potentially cost-effective for photovoltaic application,Molecular engineering can change the band gap allowing for electronic tenability.The optical absorption co-efficient of organic molecules is high so a large amount of light can be absorbed with a small amount of materials,usually on the orger of hundreds of nanometers **Here our idea is that by using various chemical substances like zinc,perfluoro compounds to increase the efficiency..**

4 RESULT AND DISCUSSION

Data collected through the monitoring system will be analyzed to identify the features of the effective solar system. The sun position is one of the main factors that caused instability measurement output voltage. The solar panel will not be able to achieve a maximum illumination from the sun from its standard position. The comparison between static and moving panels shows that the solar panel with tracker produced higher output voltages as it gets optimum absorption.**By using organic panels,though efficiency will be low,our theme is to increase the efficiency by considering the chemical compounds used,so that we can increase the efficiency.we simulate our project using MATLAB.The results will be submitted during our presentation**

From the observation of output voltage,

S. No	Fixed Frame System	Dual Axis System
1.	0.32	0.65
2.	0.62	0.67
3.	0.42	0.64
4.	0.52	0.74

Fixed frame and Dual axis Solar System

5 CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION

Thus by tracking over both the axes such that day around and year around, solar panel could absorb most of the sunlight and solar power system produced more energy than fixed mound and single axis solar power systems.Also by using organic panels we can reduce the cost.

5.2 FUTURE SCOPE

Now-a-days the power for a country is mostly obtained from Non renewable energy sources, they will be exhausted in future. But Solar energy is available throughout a year and also has no effect on Environment, this dual axis tracking technique can be implemented in solar power plants so that maximum power can be produced and the power crises can be reduced.Since,the organic solar panels are very cheaper it can be implemented in all houses at low cost including villages and hence the power crisis can be minimized.

REFERENCES

[1] www.instructables.com
[2] www.browndoggagets.com
[3] www.wikipedia.com
[4] www.arduino.cc
[5] Zolkapli, M,AI-Junid S. A. , Othman Z,Manut, , Mohd Zulkifli M.” High- Efficiency Dual-Axis Solar Tracking Developement using Arduino”, 2013 International Conference on Technology, Informatics, Management, Engineering & Environment (TIME-E 2013) Bandung, Indonesia, June 23-26,2013
[6]^Pulfrey L.D(1978)Photovoltaic Power Generation New York.Van Nostrand Reinhold CO.