Design And Analysis of Rotating Solar Panel Support Structure

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Abstract—Need and want are two different things when it comes to science as well. Driving most sophisticated car in the world can certainly be anyone’s desire but on the other hand developing the electric cars is the necessity as the petroleum fuels on which the modern car runs are nonrenewable resources. Alternative source of energy is the need of tomorrow and its demand is increasing exponentially day by day.

Solar energy is incident on the earth’s surface throughout the day and among them approximately 70 percent of the energy is absorbed by the earth’s surface. The total amount of solar energy reaching the earth’s surface every hour is greater than the total amount of energy used by the earth’s population over an entire year. Thus, to be able to trap more solar radiations is the best way possible to meet the energy demand sustainably in the future.

In this project, the support structure moves the solar panel throughout the day to keep them facing the sun so that more energy can be generated. The main aim of this project is to review the literature of the rotating solar panel support structure, its design and analysis. A simple design (SolidWorks) is proposed which can achieve the maximum overall efficiency. A finite element analysis (SolidWorks simulations) is performed to review the deformation and performance under various load conditions.

Index Terms—Solar Panel, Solar Energy, Sensor

I. INTRODUCTION

Solar panels are built with many individual solar cells which are again built with the component like silicon, phosphorus, and boron. Phosphorus provides the negative charge and boron provides the positive charge. This method is clean energy generating method.

Solar panels absorb photons, resulting the generation of energy from photons striking in the surface of the solar panel. This happened by allowing the electrons to be pull out of their atomic orbits and push into the electric field by these cells. There are different types of solar cells, the most common cells used in modern day is Photovoltaic cells which is also made of the silicon acts as a semiconductor here.

An electrical current is a flow of the electrons. The flow of the electrons in PV cells takes place within the electrical field that the electron is forced by the absorption of light coming from sun directly to the panel in a certain direction.
II. TECHNOLOGY IN THE PAST

In the 19th century, it was found that the sunlight ray strikes the materials and that can generate the electric current with some conditions. So, from these times it is been used in many applications to produce electricity.

Figure 1. Silicon Solar cells

A. Major development between 1800s to 1999

Using the concept of solar cells, many scientist and inventor were able to design different system which can be used in our daily life. One of the major achievement can be said as the invention of solar heating system for water. Even one of the best communication satellite called Telstar was power by solar energy. Different types of watch which is run by solar energy for example wristwatch were come to use. Not only watches but this principle was used to invent solar calculators. In 1992, a 15.89% efficient thin-film cell was introduced.

III. TECHNOLOGY OF TODAY (2000 TO PRESENT)

Different size and types of the solar cells and panels are used in the roof of the house for producing the electrical energy. Even in the white house roof by different Presidents. Google start using the application of solar panel for their different projects. The Scientists at the U.S. Department of Energy made new records’ National Renewable Energy. They were able to design and constructed solar cell with a photovoltaic device and the efficiency was converted to 40.80%. This is great record in the history of solar panel. Different robots are design with the energy sources from solar energy. Vehicles are run with the solar panel energy.

IV. FUTURE OF THE TECHNOLOGY

These technology is based on the natural sources called sun, which is free energy and clean among other sources of energy. Other sources of energy need some extra amount of work for the extraction process, purification, and distribution also with great investment on research work. But using the sun ray direct to the solar panel save lot of extra work and do not create any types of pollution. It can be used to all kind of work from morning to night for transportation, communication, and so on. Which only need the investment for the installation and after that some time maintenance’s charge. Now a day, Different vehicles are run using solar energy. Some house is design in such a way that only solar energy is used to control all the housework.

V. PROJECT DESCRIPTION

This project deals with the maximum use of the solar energy which can be achieved by maintaining the direction of the sun rays strikes in the solar panel. This project consists of mainly 4 different components.

A. Solar panel

The solar panel used in the project is one of the standard solar panel easily available in the market. This is used to absorbs the
photons from the sun light and helps to generate the electric energy and store in the battery.

Figure 2. Solar Panel

B. Supporting rod

By name it is easy to understand the meaning of this component which help to support and connect the other component in the project. It can support all the solar panel and the control unit with rotating machine attached with the solar panel.

Figure 3. Supporting Rod

C. Control units

This component is the brain of the project which control all the other component by using the principle of different electric application and the mechanical mechanism. Mainly it controls the rotating mechanism of the System.

Figure 4. Control Units

D. Rotating part

The rotating part is controlled with the Arduino. The program is design in such a way that the rotation of the device is based on the time increasing basics. The parts of the rotating device are shown in the assemble drawing in below.
E. Light sensor

The sensor will help to sense the direction of the sun light and it will help to conduct the mechanism of the rotation of the solar panel. This chip is very important in this project because the maximum use of the solar energy can be possible only if we are able to rotate the solar panel according to the direction of the sun. It can be shown below:

VI. TECHNOLOGICAL MERITS

This Technology is portable, less weight, pollution free and easily manufactured in the company in mass amount. The investment cost is only the cost we need to invest. The energy is produce freely from the sun and this technology can be used in most the application which need electricity. The technology is more compatible for small devices that need battery as the extra source of energy.
VIII. TECHNOLOGICAL RESULTS

A. Stress analysis results by its weight

The stress analysis was observed by applying the self-load and the analysis can be explain by using stress simulation as shown in figure.

B. Stress analysis when load is greater than self load

Any metal start deformation after it exceed the maximum limit of force to the body. The deformation can be seen in the analysis above in the figure.

Figure 9. Stress Analysis

IX. FUTURE TECHNOLOGICAL IMPROVEMENT

This project deals with the maximum uses of the sunlight. This can be done by maintaining the direction of the sun ray direct to the panel and the control of panel can be done using the light sensors for solar tracker. This technology has best merits on the area where the electricity has not been supplied to it. More than 50% of the land is used so using the solar panel more energy can be created and generated for making its maximum use.

A. Long Term Target

- Can be use for any type of project, Small or big the use of solar panel is like same to all.
- The lifespan of the sun is great than any thing in the world as compare to other energy sources, so it will re revolutionary for long time.
- More profitable so, engineering is working more under solar energy sources.

B. Short Term Target

- Power saving technology.
- Electric bills minimize.
- Good for the people who live I rural areas where no electricity supply.

C. Feasibility on improvement

- Many research are going under the topic of solar panel.
- Scientist has predicted different materials for building the solar panel.
- Researcher are working day and night, trying harder to increase efficiency of the solar panel.
• This project can be use for many application and the output of this project will be better than other instancing project.
• This project help to optimize the max use of sun ray, so the efficiency is better then compare to other project and research.

X. CONCLUSION

The solar panel support structure has been designed to fulfill the needs low cost as well higher efficiency by tracking more solar rays incident on it. The key aspect of the design is that it can rotate as per the direction of sun rays and thus has higher solar rays tracking ability.

REFERENCES