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Design and Optimization of Smart Solar Panels

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***Abstract*: Now-a-days, Energy market change drastically. Technology which is the future of solar market. It is based on Tracking of route of sun and prevention of damage of solar panels. A device which opens and closes by detecting sun rays and Tracking the direction and motion of sun, it is not only a clean and green source of energy but also it produces 40 % more energy than regular solar panels. This device is fully automated which helps in its own protection from strong winds or rainfall. Hence it is also known as smart Panels. Smart Solar panels basically design to optimize the energy of sun not only at afternoon but also in morning and evening too by using it unique Solar Tracking Technique.**

***Keywords*: optimization, solar panels.**

1. Introduction

The Smart Solar Panels solar flower is an all-in-one ground-mounted as well as portable solar system with a technology of follow the path of Sun. it doesn't same as solar panels which you might be used it is the modified version of that panel. Which modifies to get more energy output. In this paper we see comparison of normal solar panel to Smart solar panels.

Smart Panels name comes from its design – the three solar panels are arranged such way that they can able to flip on each other to protect itself from external dangers. And to get more output on individual "panels" that open at the morning of each day like sunflower. And as the sun goes down, the Smart Solar panels fold up on each other, because at night time there is no sun so no point to keep it open hence here we called it as Smart Solar Panels. Because it can move or adjust itself according condition or requirement.

In addition, the Smart solar panel system has a dual-axis tracker that makes it possible for its panels to follow the sun across the sky throughout the day. And because of this tracking capability, the Smart solar panel can produce far more electricity than a similar-sized normal rooftop solar panel system – It can generate up to 40 percent more electricity, according to study.

2. Problem Statement and Objective

A. *Problem Statement*

Non-Renewable energy sources like Coal, Natural gas, oil, or nuclear are limited but still use in the majority of the energy market. But unconventional energy sources like tidal energy, fuel cells, solar energy, biogas energy, wind energy, geothermal energy, etc. are clean, green, free and easily available in nature and hence are best option over conventional energy sources.

But the energy generation cost from this Renewable sources are very high so more. The installation cost of such energies also high but this cost is only one-time investment after that there is only little amount required for maintenance. People are still using old methods to generate energy but we have to understand that this sources are presented in limited percentage. The pollution created because of this non-renewable energy sources are also high which cause in many health & environmental problems.

B. *Objective*

1. Besides generating solar energy, another objective of installing smart solar flower is to create public awareness and increase the adoption of renewable energy.
2. Photovoltaic systems like smart solar flowers are not typical primary sources of energy for a property, which is fulfilled by traditional rooftop solar panels. Solar flowers work as complementary to rooftop solar systems or various other green building techniques, and symbolizing the environmental benefits of renewable energy.
3. Main motto behind optimization of smart solar flower is reducing the cost and making it portable and changing the complex structure to simple one.

3. Software's to be Used

A. *Computer Aided Design (CAD)*

Computer-aided design (CAD) is the use of computers to do the creation, modification, analysis, or optimization of a design. CAD software is used to make design by easy and accurately, it helps designer increase his productivity. It helps to improve the quality & accuracy of design, it can result in better communications through documentation, and to create a historical database for company & manufacturing. CAD software helps engineers, designers and architects to design, check and manage engineering projects in a graphical user interface (GUI) on a computer.

CAD SOFTWARES: AutoCAD, CATIA, Fusion360, PTC Creo, SolidWorks, etc.

B. *Computer Aided Engineering (CAE)*

Computer-aided engineering (CAE) is the use of computer software to do engineering products analysis on different

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parameters. Computer aided engineering mainly uses CAD software, which are called CAE tools. CAE tools are being used, to analyze the strength of material, movement of assemblies, Strength & stress analysis. This all analysis done by simulation, validation, and optimization of products and manufacturing tools in CAE software's.

CAE SOFTWARES: ANSYS, Fusion360, Solid Edge, Abaqus, etc.

4. Working Principle

Since the smart solar panels knows its place and time of the day, it calculates and follows the sun's path & direction. It utilizing its full capacity by using dual axis tracking technology. Therefore, as the sun rises, the smart solar panels automatically open itself and the solar panels follow the sun at a 180-degree angle, even when the sun is covert behind clouds. This results in up to 40% more energy generation as compared to an ordinary rooftop system.

The hourly power output benefit of the smart solar panel in comparison to a conventional rooftop system. Because of the sun tracking feature, the smart solar panel has a considerably longer peak power phase. It starts producing power earlier in the day and consistently maintains more power output until the last sunbeam of sun. The maximum benefit of solar energy begins at afternoon, when electricity costs the most. Since a conventional solar system has fixed alignment to the sun, it peaks at afternoon and then production rapidly falls because of static alignment, whereas, the smart sun flower will continue high energy production much longer.

5. Parts of Optimized Smart Solar Panel

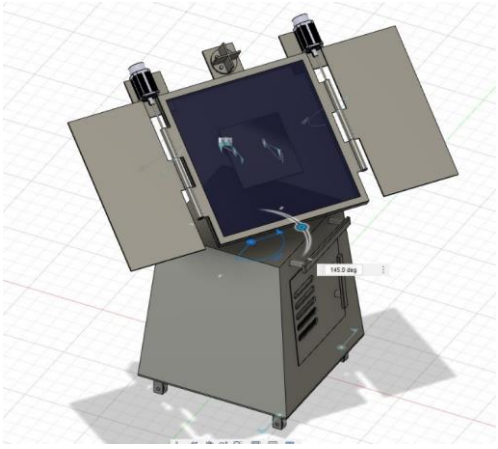

Fig. 1. Smart solar panel

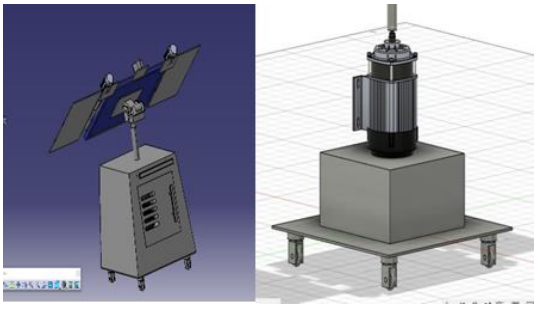

Fig. 2. Base

- It is mainly made of mild steel.
- This part supports the whole system.

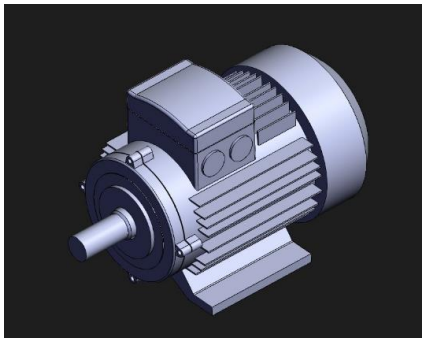

Fig. 3. Induction motor

- It helps the shaft to rotate whose one end is connected to motor and another end connected to Panel body.

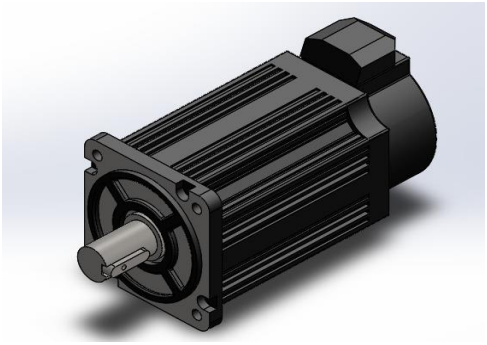

Fig. 4. Servo motors

- Three servo motors are use here.
- One for opening and the other for closing the panels at the time of bad weather.
- And the third motor is used for 180 degrees' sun tracking.

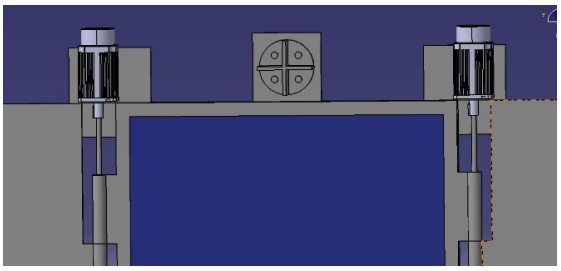

Fig. 5. Sensors

- Sensors are used for sensing the direction of sun
- Meteorological sensors are used to understand and measure climate and weather.

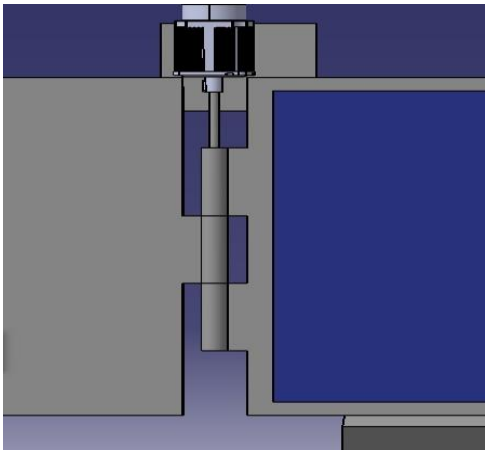

Fig. 6. Hinges

- Two hinges are used here
- Both are used for opening and closing of solar panels

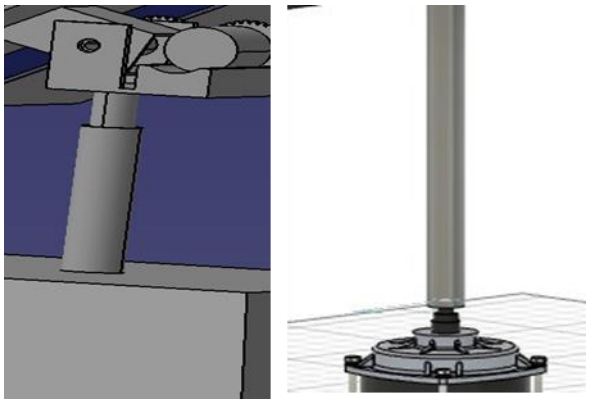

Fig. 7. Connecting shaft

- It is used to rotate the solar panels
- It is connected to induction motor

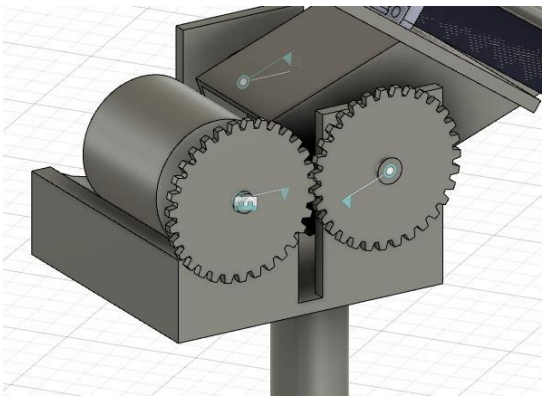

Fig. 8. Gears

- Gears help us in rotating the solar panels in 180 degrees' direction.

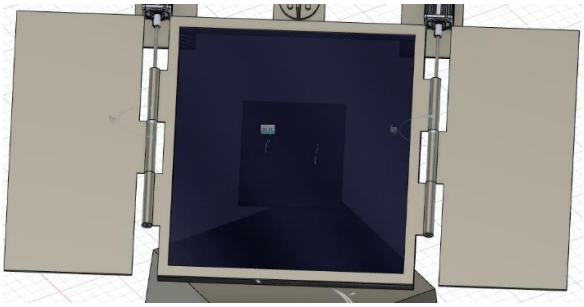

Fig. 9. Solar panels

- Solar Smart panels use sunlight as a source of energy and generate direct current electricity.
- This solar panels follows the suns path using another mechanism to generate more energy.
- Side 2 panels are flip on middle panel at night to and in dangerous situation.
- This panels are made from Crystalline Silicon material.

6. Conclusion

Smart-Tracking: The solar panels move horizontally and vertically along the suns' position, even when it's cloudy. This guarantees optimum adjustment with the sun during the entire course of the day, resulting in (up to 40%) more efficiency.

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