

NOVEL DESIGN OF SOLAR PANEL SYSTEM

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Abstract - Solar energy has a big potential as one of the renewable energy resources in the world. However, the conventional fixed photovoltaic (PV) system provides less efficient and less innovative system. This type of system faces problems of dust, heat, wind, difficult installation and also very less efficient in terms of electric power. To overcome these problems there should be a system which solves these problems automatically. In this research paper, a Novel Design of Solar Panel System is proposed which will solve these problems by self-cleaning, natural cooling, wind protection, solar tracking, easy installation. In these proposed methodology, self-cleaning features, natural cooling elevated design, wind protection system and dual-axis solar tracking system will be added to increase its overall efficiency by 40%. The proposed work is validated with the help of experimental prototype.

Keywords - Solar energy, photovoltaic, solar tracking.

I - INTRODUCTION

Solar panels are a great way to offset energy costs, reduce the environmental impact of your home and provide a host of other benefits, such as supporting local businesses and contributing to energy independence. Solar energy works by capturing the sun's energy and turning it into electricity for your home or business. Our project is a versatile alternative to rooftop, land and water surface installed PV systems. The system consists of 6 solar panels that with the help of a frustum structure would be placed at the upper half of the structure. The structure is

designed in such a way that the solar panels with the help of solar tracking system is automatically able to adjust itself in the direction of the sun. This is actually done with the help of servo motor. Also, the system is equipped with N20 gear motor to open and close the solar panels which will be over one another just like the Shan Chinese Fan. The attractive sculptural design is designed such a way that the brushes attached at the backside of each solar panel would be able to clean the below placed solar panel itself without any

external support. The system's exceptional elevated design allows the solar panels to cool naturally; air moves above as well as below of every panel to provide natural cooling. This contributes to a rise in each panel's overall productivity by around 10 percent. Novel Design of Solar Panel System is advantageous in the sense that it will contain all of the hardware and other components within itself so that it can be easily installed and disassembled. The system being so easy to install and uninstall can easily be relocated to newer locations and just like the typical PV systems haven't got much hectic task of wiring each panel and then connecting all of that to the inverter followed by connecting it to the system and finally to the grid. The device is designed also to save space and make it appear appealing to the viewers. Just like the ground mounted PV systems that are installed in hectares of solar farms or the roof-mounted solar panels that are installed on the roofs of the houses, this system is completely opposite to that. Novel Design of Solar Panel System is completely balanced on a frustum structure that takes very little space for installation. All these features together make this system most efficient. Novel Design of Solar Panel System is a good alternative to the existing PV models and will prove to be a significant step in advancement towards harnessing abundant energy from the sun.

II - PROPOSED METHODOLOGY

The proposed methodology involves 6 pieces of solar panels and each has 6V 60mAh power output, wired with one pair of panels in series and 3 pairs in parallel, then the voltage output $6+6=12v$, So basically when the panel are fully opened the voltage output is 12V and when the

panel goes on in home position the voltage output will be 1-3 volts. The 12.6V Li-ion rechargeable battery pack for this project, this batteries are getting charged when the sunlight is available. Resistors, Voltage Regulator, Arduino nano, L293D Driver and male & female header are place on printed circuit board Arduino is used as the brain of the model. It programmed to control the way motors, limit switches, LDR. At the tip of the system 5 LDR is fixed which help to detect sun rays to control limit of rotation of servomotor two limit switch are used N20 gear motor attach to 3D part along with panel, so N20 gear motor will help to opening and closing of panel in system. Once the system get open means all panel will arrange to there respective position maintaining solar panels approx 90° with sun.

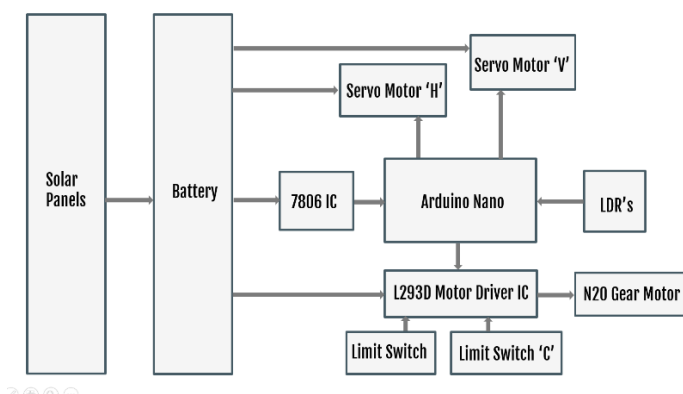
Table 1 – List of Components

Sr. No.	Components	Quantity
01.	Arduino Nano	01
02.	Solar Panels	06
03.	L293D Driver	01
04.	7805 IC	01
05.	Resistors	07
06.	LDR's	05
07.	Servo motors	02
08.	Jumper Wires	45

09.	Header Pins	06
10.	Wires	10
11.	LED Light	01
12.	Breadboard	01
13.	N20 gear motor	01
14.	Soldering Wire	01
15.	Battery	01
16.	3D parts	12
17.	Limit Switches	02
18.	Diode	01

middle position of the solar top, when the light is minimum, the micro controller Arduino read the LDR's resistance value and the the threshold value is stated in the coding section, when the light is available and the threshold level breaks, the Arduino rotate the N20 gear motor anticlockwise through the L293D Driver till the limit switch level high, when anticlockwise limit switch pressed the panel stop rotating and panel is fully opened position when the button is pressed, now the main work is going to progress, according the sun rotation other 4 LDRs sense the light and send data to the Arduino, and Arduino process the data then rotate the servo motors according the sun rotation, the rotation position of the servo is max 170 degrees, when the sun goes down the fifth LDR sense data again and this time the process is reverse condition, the LDR data goes down blow the threshold level and Arduino Rotate the N20 gear motor clockwise till the limit switch press and run the servo in home position, when light is available in next day the same process goes on again.

Fig 1- Block Diagram



III – DESIGN

As all the arrangements are done according to block diagram then fifth LDR is placed on the

Fig 2- Plot of output power versus time

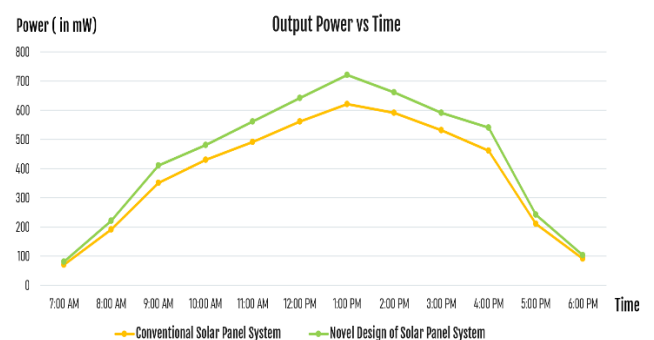


Fig 3 – Bar Chart of Average Power Output

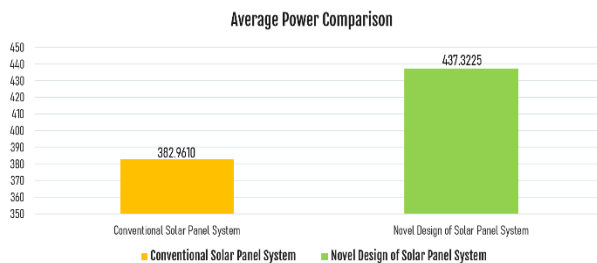
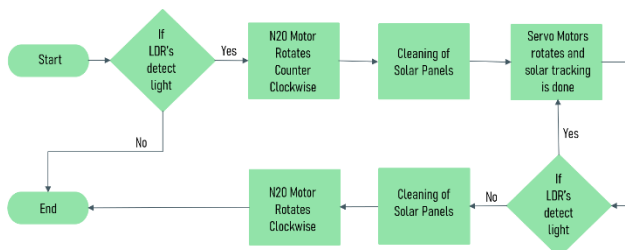


Fig 4 – Flowchart of the system



Experimental Output

Unlike fixed or stationary solar panels, our project tracks the sun from morning to evening , ensuring that its solar panels are always at the optimal 90-degree angle to the sun , producing 40% more energy than fixed solar panels. The unique design of our project allows for natural cooling of its solar panels resulting in as much an additional 10% increase in productivity. Also our project automatically cleans its panels every morning and every evening, which allows it to avoid losses in production that typically occur with stationary solar panels and improves productivity by another 1-2%.

Fig 3 – Pictorial Representation of Experimental Prototype



Fig 3 – show the pictorial representation of an experimental prototype of an original system. All the electronics circuits, battery are present inside the frustum structure.

IV – CONCLUSION

As discussed in the paper, the conventional solar systems are more of dependent on grid power to supply the additional energy that is required to meet the demand. But with Novel Design of Solar Panel System, the reliance on grid power and the use of grid power in case of power outage will be almost eliminated. It is a system with which 95% self-utilization can be achieved meaning the user will not have to worry about the solar power outage and will

not have to consume power from the grid. The smart and elegant design of the solar system along with generating required energy also adds beauty to the place where it is to be installed.

Following are some other conclusions that can be drawn from the working of the Novel Design of Solar Panel System.

- The panels are fitted on servo motor that helps the panels in getting inclined towards the direction of the sun and allows it to easily track the sunlight during daytime from east to west. This feature allows the solar system to enhance the efficiency of the panels by improving the rate of number of photons striking the solar panel during a whole day.
- The system being frustum structured, its exceptional elevated design allows the air to cool the solar panels naturally. As, only a small amount of solar radiation falling on the surface of PV cell turns into electricity and the remainder of the radiation gets absorbed by the PV cell which in turn heats up the solar panel and elevates the surface temperature. So, cooling too is important when it comes to improving the efficiency of solar panels.
- The dust also plays a vital role in reducing the efficiency of the panels. So, time-to-time cleaning of panels is also important. The Novel Design of Solar Panel System has a rubber wiper attached at the back of each solar panel which cleans the solar panels during rotation.
- N20 gear motor is made available to the system, which ensures regular opening and closing of panels. At the time of dawn, the

panels would by itself open sensing the presence of sunlight. And would by itself close at the time of dusk. This feature not only helps in cleaning but also protects the panels from the strong winds or harsh weather conditions. The Novel Design of Solar Panels would by itself close in such conditions ensuring protection against such situations.

- The system is also made in such a manner that it can very easily be self-contained. This means that all the software and hardware are installed with the system itself so, the entire system as a whole can easily be installed and removed and shifted to some other place which reduces wastage of time.
- The Novel Design of Solar Panels is completely balanced on a frustum structure that takes very little space for installation and thus, saves sufficient amount of space. The proposed system would help in improving the efficiency of solar panels and also in the protection of the system and since everything is automatic. The conditions that reduce the efficiency of the system is also eliminated with the proposed design and also serves as a smart and automatic model which gives sense of viewing a scenic flower sculpture.

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