DESIGN AND FABRICATION OF PORTABLE DUAL AXIS SOLAR TRACKER

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Introduction:

The need for energy will rise in the future years, while the supply of traditional fossil fuels will diminish. From now on, obtaining energy from a renewable source is necessary to meet the world's energy demands. Solar energy is the most plentiful and always accessible of all the various renewable energy sources. A photovoltaic (PV) panel is used in solar technology to harness the sun's energy and transform it into electricity. Furthermore, PV technology is a rapidly developing advancement in science that needs little upkeep and leaves no carbon imprint. The performance of a PV panel depends on the solar radiation's incidence angle toward the PV panel in addition to the solar irradiance power, weather conditions, and ambient temperature.

The sun appears to travel through the sky from east to west during the day, so the angle between the sun and a stationary PV surface is always shifting. A stationary PV module's power density is, therefore, lower than the power density of incident sunlight. To extract the most electricity possible from the PV panel, numerous efforts have been made recently. An effective technological approach to raising the power output of the PV panel is a solar tracking system. It has been demonstrated via extensive study and experimentation that a tracking system may generate up to 40% more electricity than a fixed-tilted (non-tracking) PV panel by keeping constant direct exposure from the sun to the PV module. principally two types of solar

A single-axis tracker only moves the solar panels along one axis, which is often north and south. The solar panel may move on two axes that are aligned in both east-west and north-south directions with the help of a dual-axis tracker. This tracker will be able to follow the sun in all four directions, not just as it moves from east to west but also as it moves from north to south.

Objectives:

1. To design a solar tracker that constantly tracks the movement of the sun.
2. To design a cost-effective system that provides directional information to guide the photo voltaic panels to the best angle of exposure to sunlight for the collection of solar energy to maximize power generation.
3. To increase the efficiency as compared to a static station of the same installed capacity.
4. The tracker should be able to rotate the PV panel in two directions (or axes).
5. To make electricity access in remote areas.

Methodology:

Mechanical Design

Based on the availability of panel dimensions, the hexagonal frame for the setup is designed using a sun board. Then with the help of calculations and literature review, three MG996R servo motors are taken for two-axis rotation. As the MG996R motor has a torque value of 1.373 N-m (6V), and 1.471 N-m (7.2V). As it will be difficult to have intensity difference of light in resistor due to small area. So, the structure is made to create a shadow in certain LDRs with the position of the light source. Then another stand is made for the hexagonal box to give base support. The hexagonal box contains an electrical system.

Electrical Design

Under the electrical portion, the design includes the connection of LDRs, resistors, Arduino, and servo motors together. Besides this, an additional connection of battery(12v), charge controller, and load are also made. The circuit diagram is shown in the figure below. Here Arduino is powered through a battery. Then grounding (GND) and power is supplied to motors and LDRs by Arduino. After the completion of all the connection coding as per requirement is uploaded on board. So, the microprocessor will act as per the program.

Four LDRs are fixed in this setup to measure light intensity (Two for the Azimuth position sensor and another two for the Altitude position sensor). The built-in ADC (Analog to Digital Converter) and light comparison unit receive the analogue signal from the sensors. Along with the input command, this output is supplied to the Arduino board as an input. The output of the Arduino is provided to the motor driving circuit. The driving circuit, which controls both vertical and horizontal movement, is connected to three servo motors. The solar panel is turned by the motor in a direction that is perpendicular to the sun's rays. The LDR combination has a significant impact on this project.

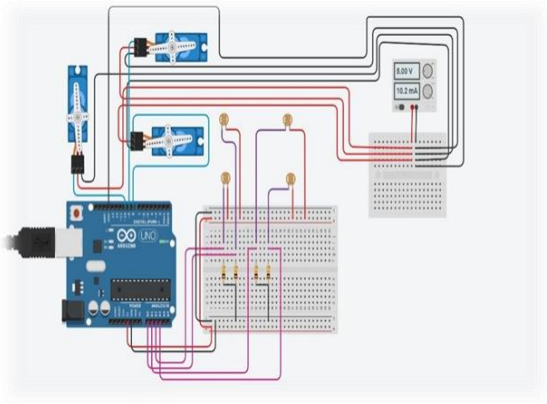

Fig: Circuit diagram

Fig: Setup of Portable Automatic Dual Axis Solar Tracker

Conclusion:

The dual-axis solar tracking solar panel powered by Arduino is built and successfully executed to boost the solar panel's efficiency, as shown in the graph. When compared to conventional solar panels, the dual-axis solar tracker is found to be more efficient. With the aid of the Arduino board, the planned solar tracker that automatically tracks the sun to capture the maximum solar radiation was successfully completed. The Arduino board's tracking solar power application has a minimal implementation cost and is straightforward. Finally, the experimental system shows that the suggested system tracks the sun more successfully than the current system does during various times of the day, and the solar panel's efficiency is

effectively increased. The product is transportable, allowing us to take it wherever remote. In comparison to a static station with the same installed capacity, these trackers will be able to produce 45–50% more power annually. Dual-axis trackers provide a shorter payback period than other types of trackers. Additionally, during their useful lives, profits will rise significantly.

Scope for future work:

1. This device can be implemented in an electrical power station to generate power, just by using a powerful solar panel we will be able to charge an E-vehicle, or E-battery (of 12v and 24v).
2. The device can be used by Indian army soldiers who are patrolling the area for 80-90 days and can cook food without fire (by using an electric stove) at the same time they can charge their electronic devices.
3. In the future this tilting mechanism with collector can be implemented on large solar plants and also can be operated automatically. At the same time, we will be able to provide electricity to the home appliances.
4. To improve the design as a more reliable and efficient dual-axis solar tracking system.
5. Making the device more compact by reducing its size.
6. Can be installed in remote villages.