International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue: 05 | May 2024 www.irjet.net p-ISSN: 2395-0072

Solar Rooftop Charging for EV Buggy using dual axis solar tracker

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Abstract - One of the main problems in a developing nation like ours is the energy dilemma. The difference between energy production and consumption is enormous. One of the most potent forms of renewable energy that might significantly contribute to the resolution of this dilemma is solar energy. This study examines the effectiveness of an Arduino-based dual-axis solar tracking device. Due to its availability and environmental friendliness, solar energy is currently being used more and more. On a moving vehicle, a dual axis solar tracker fitted to the EV buggy's roof can track the sun's rays concurrently in both the horizontal and vertical axes. The gadget records daily tilt and seasonal fluctuations for best efficiency. The study focuses on the design and construction of an autonomous dual axis solar tracker utilizing Arduino code and microcontroller-based solar panel parameters. In addition to software programming for the solar tracker's microcontroller unit, the project's effort involved designing and implementing the hardware. Two servo motors in the system, which spin the solar panel in two axes, are moved by means of a microprocessor. Four photo sensors were placed close to the solar panel, and the microcontroller used these inputs to calculate how much rotation would occur. The project culminated in the design and implementation of a useful solar tracking system. It may repeatedly maintain the alignment of the solar panel with the sun or any other source of light.

1.INTRODUCTION

Energy is the primary driving force behind any nation's progress. Every day, a tremendous amount of energy is produced, transferred, and used in global civilization. The demand for energy is rising in tandem with the daily growth in world population. The primary energy sources today are oil and coal, yet it is true that these fossil fuels are finite and cause significant pollution. Even the price of gasoline has been rising year over year, and there are not very promising medium-term projections. Hydroelectricity, bioenergy, solar, wind, and geothermal energy, as well as tidal power and wave power, are new forms of energy that are gaining prominence .Solar photovoltaic (PV) [1]energy is one of the most widely used sources of energy among those categories. Due to research and development efforts to increase the efficiency and decrease the cost of solar cells, this technology is currently being used more often in homes. The International Energy Agency (IEA) reports that during the early 2000s, the average annual growth rate for global PV capacity has been 49%.This document is template. We ask that authors follow some simple guidelines. In essence, we ask you to make your paper look exactly like this document. The easiest way to do this is simply to download the template, and replace(copy-paste) the content with your own material. Number the reference items consecutively in square brackets (e.g. [1]). However the authors name can be used along with the reference number in the running text. The order of reference in the running text should match with the list of references at the end of the paper.

1.1 PROBLEM STATEMENT

To maximize the amount of energy generated, the primary objective is to maintain the solar PV panel perpendicular to the sun during the day. A dual-axis solar tracking system may be a useful tool for raising solar cell efficiency. Reducing pollution, which is a severe problem for both biotic and abiotic components of our home, can be accomplished by making solar energy the primary source of electricity generation. The finite natural resources, such as woodlands and fossil fuels, can be prevented from going extinct. In the intermediate future, individuals may find that a dual axis solar tracking system is a wise choice because of its increased efficiency and reduced negative effects**.**

1.2 CONSUMPTION OF SOLAR POWER IN INDIA

Energy is seen as a key driver of economic growth and a major contributor to wealth creation. Enhancing the standard of living also requires energy. The government is in charge of developing conventional energy sources to meet society's expanding energy needs at a reasonable cost. The necessity for new sustainable energy supply choices that use renewable energies has been highlighted by the depletion of fossil fuel resources and the environmental issues they have brought about. A lot of focus is also being placed on the development and marketing of new, unconventional, alternative, and renewable energy sources like solar, wind, and bioenergy. A news agency focused on alternative energy has long maintained that wise investments in renewable energy can bring in large sums of money. Solar energy is one of the most popular sectors.

India is located in the world's sunny belt. Solar energy has enormous potential for thermal uses and electricity generation. India is a very attractive location for the use of

solar energy because the majority of the country receives 300 days of sunshine annually. Depending on the location, the daily average solar energy incident across India varies from 4 to 7 kWh/m2, and the annual sunshine hours range from 2300 to 3200. India has enormous solar energy potential from a technical standpoint. With a 10% PV module conversion efficiency, the nation receives enough solar energy to provide more than 500,000 TWh of electricity annually.

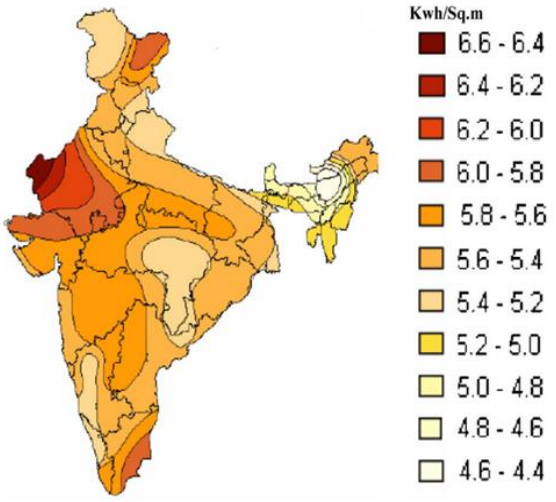

Fig-1: Solar Energy Potential in India

2. BLOCK DIAGRAM

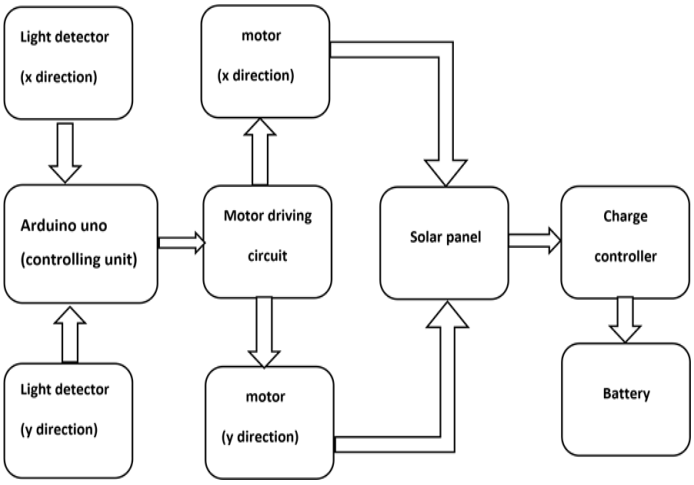

Fig-2-Block Diagram

2.1 PRINCIPLE OF OPERATION

Four LDRs are fitted in this system to sense light intensity: two for the altitude position sensing and two more for the azimuth position sensing. The built-in light comparison unit and ADC (Analog to Digital Converter) receive the analog signal from the sensors and this output fed as an input to the Arduino. Two DC motors are connected with the driving circuit, one for vertical and another one for horizontal movement. The motor rotates the solar panel in perpendicular in the direction of solar radiation and as a result the output power will be displayed in the LCD screen.

Here battery is used to store and give the DC supply to the inverter, which is taken from the solar panel. Output of the battery is given as an input to the Inverter it will convert the DC to AC .The LDR plays a vital role during the working period. The light's intensity determines the resistance of the LDR, which fluctuates accordingly. When light intensity is high, LDR resistance will be lower, resulting in a lower output voltage; conversely, when light intensity is low, LDR resistance will be higher, producing a higher output voltage. To extract the output voltage from the sensors, a potential divider circuit is utilized (LDRs).

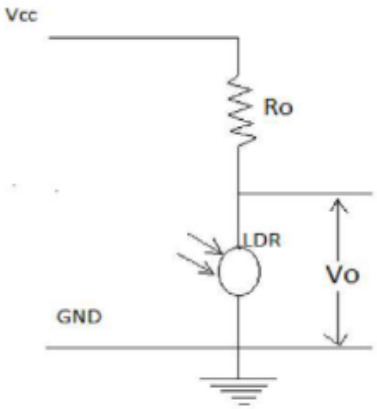

Fig-2.1:Circuit Diagram of LDR

The LDR generates a digital number at the output that typically ranges from 0 to 1023 after sensing the analog input at values between 0 and 5 volts. This will now use the Arduino software (IDE) to provide feedback to the microcontroller. This mechanism can be used to regulate the position of the servo motor; it is covered later in the hardware model. After determining the greatest intensity of light falling perpendicular to it, the tracker finally modifies its position. It remains there until it detects any additional changes. The point source of light affects the LDR's sensitivity. It barely makes a difference in the diffuse lighting situation.

3. METHODOLOGY

Materials used to make solar panels are mostly semiconductors. Si, which has an efficiency of up to 24.5%, is the main component of solar panels. Increasing the intensity of light falling on a solar panel is the only method to improve its effectiveness until highly efficient solar panels are produced. There are three methods to boost solar panel efficiency: using a tracking system, optimizing power output,

and boosting cell efficiency. Only the maximum power that stationary solar arrays can produce at any given moment will be provided via MPPT technology. But when the sun is not in line with the system, the technology is unable to produce more power. Due to the fact that the sun's position fluctuates throughout. Currently, there are two main types of solar trackers: the one axis and two axes.

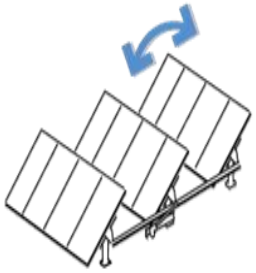

Fig-3(a)

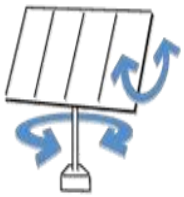

Fig-3(b)

Fig-3: (a) Schematic diagram of single-axis solar tracker
(b) Schematic diagram of double-axis solar tracker

4. DESIGN

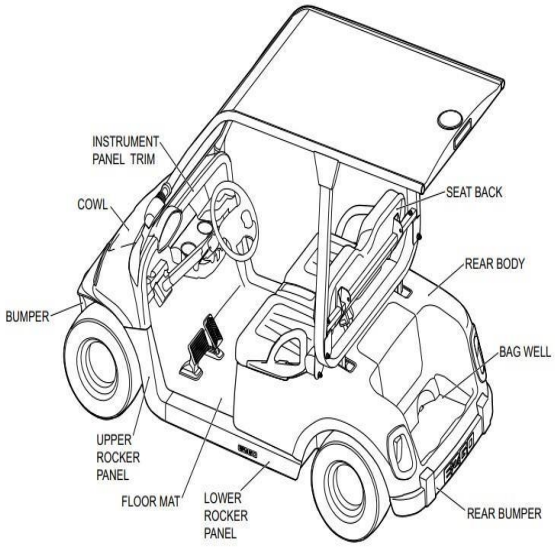

Fig -4: EV Buggy

4.1 WHAT IS AN EV BUGGY?

An electric-powered all-terrain vehicle is referred to as an electric off-road buggy, or EV buggy. These off-road vehicles combine off-road prowess with environmentally efficient operation, making them ideal for outdoor experiences. These are a few well-known electric off-road vehicles. It is light weight in nature usually it does not have a roof and it is mainly built for off-road requirements. These buggies ranges from 2-seaters to 14-seaters.

SPECIFICATIONS

- Overall Length 94.8 in (241 cm)
- Overall Width 47.3 in (120 cm)
- Power Source 48 Volt DC
- Motor Type 48-volt AC
- Horsepower (kW) 4.4 hp (3.3 kW) Continuous
- Batteries (qty/type) Four, 12-volt Deep-cycle
- Speed Controller 235-amp AC Controller
- Vehicle Load Capacity 800 lb (363 kg)
- Speed – Low 14.0 mph (22.5 kph)
- Speed – High 25.0 mph (40.2 kph)
- Rare wheel drive
- 105Ah Battery *(60-65 Miles w/ 4.5 h Charge Time)*

4.2 EXPERIMENTAL SET UP

Fig-4.2 Experimental Model

5. CONCLUSION

The method of tracking the sun's location using an LDR sensor and microcontroller has been provided in the study. In particular, it shows how to position a solar panel at the location of highest light intensity to maximize solar cell output using a functional software solution. Additionally, the tracker has the ability to establish the beginning position on its own, negating the need for additional photo resistors. The straightforward mechanism for system control is an appealing aspect of the developed solar tracker. Since solar energy is produced on a massive scale globally, even a 1% increase in efficiency over stationary planes will result in a significant increase in net power generation. Therefore, tracking is always appreciated, regardless of the degree to which it boosts efficiency. In summary, this

mechanism may be used in a variety of solar tracking applications, such as parabolic trough collectors, solar dishes, lenses, and other PV systems, to gather the maximum amount of solar radiation and direct it towards the solar panel mounted on the rooftop of an electric vehicle.

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BIOGRAPHIES

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