A Study on Environmental – Friendly Solar-Powered- Electric Vehicle

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***Abstract**:* This paper presents a study on environmental-friendly solar powered electric vehicle. Solar energy is one of the important sources of renewable energy which can be feasible alternative to fossil fuels. On a bright sunny day the sun rays give off approximately 800-1,000 watts of energy per square meter of the earth surface. If energy from the sun is clean and free, why aren't we using it to power our vehicles? Is a solar powered vehicle a good solution? Solar power is the term for using the sun's energy to power a device or an electrical system. Solar panels are made up of a grid of solar cells. These cells collect the sun's energy and convert it into electrical energy. Now the Solar vehicles harness energy from thesunbyconvertingitintoelectricity.Thiselectricityfuelsthebatterythatrunsthevehicles motor. Instead of using a battery, some solar vehicles direct the power straight to an electric motor .Nowadays the solar vehicles can be categorized as a 'green vehicle' which is powered by renewable energy with zero carbon emission.

KEYWORDS: Solar energy, solar powered electric vehicle, grid, solar cells, Green vehicle

1. INTRODUCTION

In the present world, the demand for energy is increasing day by day. Sooner or later it will be much higher than the present condition. So the world is now heading toward renewable energy leaving behind fossil fuels energy for their harmful effects on environment. As solar energy is renewable and less harmful to the environment, it is gradually taking the place of fuels. To make the optimum use of solar power we took the initiative to work on our project. Our solar power hybrid car uses solar panel and batteries instead of using fossil fuels. So it can be considered as a fully eco-friendly vehicle which is the crying need of present situation of the world. By considering these things we have made our solar vehicle which is more effective and efficient for regular transportation uses. Hopefully solar powered Electric car will be able to replace the fuel vehicles and will play a major role in creating a safe and clean environment.

An electric vehicle (EV) is one that uses an electric propulsion system rather than an internal combustion engine (ICE). The vehicle's entire power comes from an electric motor, which also serves as the vehicle's primary drive source. The key benefit is the great efficiency of power conversion via the electric motor propulsion system. There has been a lot of research and development activity reported recently, both in academia and in industry. With the commercialization of electric vehicles, several governments have offered customers with incentives such as lower taxes or tax refunds, free parking, and low-cost/free charging stations. A hybrid electric vehicle (HEV), on the other hand, is a viable option. In recent years, it has received a lot of attention.Major car manufacturers across the globe have at least one model that uses hybrid technology or is completely converted to electric.

2. SOLAR VEHICLES

History of Solar Vehicles

In the late 1970's photovoltaic devices and electric vehicles were combined for the first time. Facing the pressure of the oil crisis, engineers and environmentalists started looking for an alternative source of energy and finally found solar the best alternative. In order to create more coverage and examine interest in solar powered transportation ,Hans Tholstrup organized a 1,865 mi (3,000 km) race across the Australian outback in 1987 ,better known as the World Solar Challenge (WSC), in which competitors were invited from industry research groups and top universities around the globe. General Motors (GM) with their Sun racer vehicle won the event by a large margin, achieving speeds over 40mh. In repine to their success, GM came up with the US Department of Energy(DOE) to hold the GM Sun ray in 1990 .Approximately the same length as the WSC, Sun racer is considered to be a more difficult race due to more varied terrain and climates as well as more challenging road surfaces and traffic blocking. Considerable improvements and attentive technologies of electric vehicles has been developed that can be applied to a broader range of automobiles to provide more efficient, effective and reasonable alternatives over combustion engine vehicle

Why Need Solar Powered Vehicles

The air pollution that warming the earth as a result pollutants from the automobiles which is about 23% of the total air pollution. One of the great problems fed in urban areas throughout the world is the increase in vehicles due to an imbalance between the public transport and the increase in population which finally results in a huge amount of air pollution Electric vehicle (EVSE) are experiencing rapid growth because of five key global trends. Over the last two decades, many experiments have been done to control emission from IC engine. So in this respect, this solar powered vehicle may be one of the solutions because of pollutant free property

WORKING

A solar car gets the energy it needs to move from sun light. If you look at the solar car below you can see that much of its surface looks black. This helps it to absorb the sun light black objects absorb most of the light that falls upon them .Usually, black objects just get hot in the sun. But in a solar But even the best of today's solar cells can convert only 20% to 24% of the sun's power into electricity. Therefore, under full sunlight, the motor put south about 2 hp. With the help of the battery, the output-for short times can be increased to 8 hp.

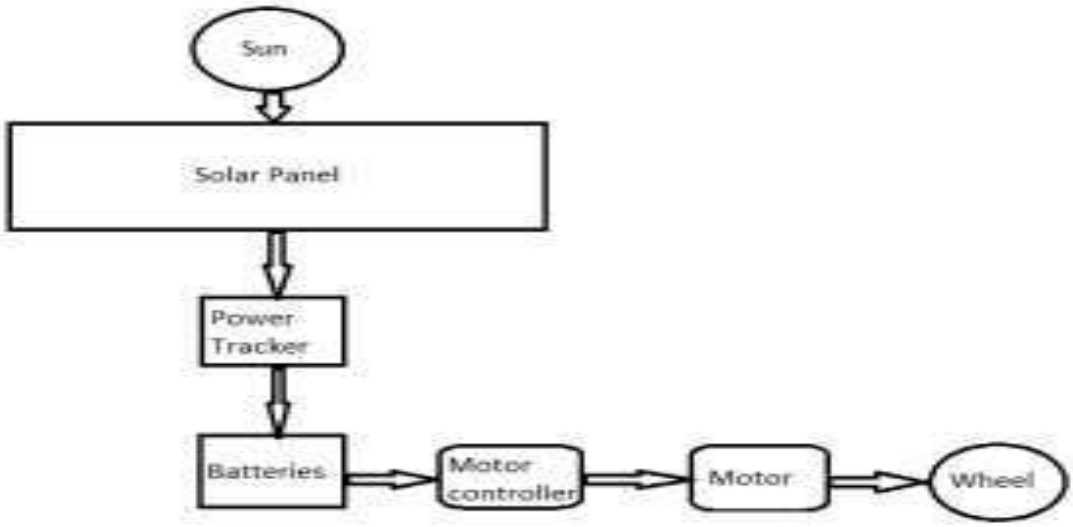

Fig . Working Principle of solar powered Vehicle

COMPONENTS USED

A. Solar Panel

A standard solar panel consists of a layer of silicon cells, a metal frame, a glass casing and various wiring to allow current to flow from the silicon cells. Silicon is a non-metal with conductive properties that allow it to absorb and convert sunlight into electricity. When light interacts with a silicon cell, it causes electrons to be set into motion, which initiates a flow of electric current. This is known as the "photovoltaic effect and it describes the general functionality of solar panel technology.

B. Power Tracked

Power trackers convert the solar panel voltage to the system voltage .In this step the power tracker in the car receive the energy from the solar array, and change the energy that it receive to energy that the car can be use. After it converts energy, it sends the remaining energy to the battery.

C. Batteries

Lead–acid battery having a very low energy-to weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, make it attractive for use in motor vehicles to provide the high current required by automobile starter motors

D. DC Motor

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line. DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

3. CALCULATION

A. Amount of Energy that can Battery Store

Battery capacity is measured in Amp Hours (e.g., 20 AH).You need to convert this to Watt Hours by multiplying the AH figure by the battery voltage (e.g., 24 V)

For a 20 AH, 24 V batteries the Watt Hours figure is

20 x 24 = 480 WH

This means the battery could supply 480 W for 1 hour or
240 W for 2 hours, i.e., the more energy you take, and the
Faster the battery discharges

B. Solar Panel Generate Over a Period of Time

The power generation rating of a Solar panel is also give in Watts (e.g., STP010, 10 W). To calculate the energy it can supply to the battery, multiply Watts by the hours exposed to sunshine, then multiply the result by 0.85 (this factor allows for natural system losses)..

For the Solar 10 W panel in 6 hours* of sunshine

10x6x0.85 = 51 WH. This is the amount of energy the Solar
Panel can supply to the battery.

C. The torque required for different speed

Torque is also an important factor for designing the tricycle because torque is required to move the vehicle from a stop. The required formula for calculating the developed torque in the tricycle is T= F × r
It is mainly important for acceleration, not for maintained speed. In order to get up speed and overcome the wind resistance and friction torque is initially required. So torque required to move the vehicle from a stop and helps it get up steep hills.

D .Calculating the solar panels needed

Identify what are the power of the equipment that you want to run on solar ennead the hours to run it every day. Take an example a 14" DC fan 20 W to run 12hours at night and a 16 W light to run 5 hours at night
The formula of the power of the solar panels needed is power of equipment running hoursX1.5(lost factor)/4hours of sunshine. Lost factor include the humidity and high temperature eintheequatorzone battery charginganddischarging lost and inverter conversion lost.

E Calculating the Batteries Needed

To package the battery needed, you have to decide how many days you want to have backup power. Taking the example 14" stand fan 20 W to run 12 hours at night and a16 W light to run 5 hours at night.
Total power a day is 320W = 12 V 26.7 A
Daily usage of the battery = Total power usage/12 V = 320

W/12 V = 26.7 A.

F. Solar Energy Calculation

One single solar panel from type standard 150 Watt/12volts can deliver a power of 150 Watt per hour considering full sunshine. Knowing that the sun shine varies during the day, the effective sun power of one day is equal from 6 to 8 hours of a maximum measured at midday. Since this maximum at mid days not the same every day, it should be taken in consideration, that more or less heavy cloud reduces the possible power. The electrical power is
Stored into batteries, similar to the one used in cars

Example: One solar panel of 150 W/12V produces between
150 W x 6 h = 900 Wh and 150 W x 8 h = 1200 Wh.

4. ADVANTAGES

1) Unlike regular vehicles, solar powered Vehicles are able to utilize their full power at any speed.
2) Solar powered Vehicles do not require any expense for running.
3) Solar Vehicles are quite.
4) Solar Vehicles require very low maintenance.

5. DISADVANTAGES

1) Solar Vehicles don't have speed or power that regular vehicles have.
2) Solar powered Vehicles can operate only for limited distance.
3) If there is no sunlight.
4) If it is dark out for many days, the car battery will not charge and this can be a problem. This is the main reason why people don't rely on solar vehicles.
5) Good & efficient solar powered Vehicles are expensive.
6) Parts used in solar Vehicle are not produced in large quantity so they are expensive

6. CONCLUSION

The objective of this study is to design and construct of cheaper solar powered vehicle. After performance study, it is obtained that storage system can run the solar vehicle about 12 km. The maximum speed of the solar vehicle has been found at 20 km/h. So, the solar powered vehicle is designed and constructed in this study can be used as a green vehicle in developing countries due to its less expensive and zero pollution effect nature

7. REFERENCES

1. Zahari Taha, Rossi Pascrell, Jamal Sah and Nasr din Bin Ad Racism (2008). A Review on Energy Management System of a Solar Car, The 9th Asia Pacific Industrial Engineering & Management SystemsConference,3-5 December 2008, Nusa Duo, Bali, paper93, pp. 2527-2530

2. Callahan, Parker, Sherwin, and Aiello's study.

3. A high-efficiency triple cycle for solar power generation (2002). Krebs A.

4. Hazel O'Leary(2002) greets contestants of the Solar Car Challenge Competition in 1995.

5. Arable Benita, R., Jejuna, K. "Design of Charging Unitfor Electric Vehicles Using Solar Power." In: 2013International Conference on Information Communication and Embedded Systems (ICICES),Chennai, 2013, pp. 919-924.

5. Praveen Kumar Sharma, Ms. Anjana Tiwari "Research A STUDY ON ELECTRIC VEHICLES CHARGING SYSTEM UTILIZING WITH SOLAR ENERGY" Journal of International Journal for Multidisciplinary Research , Volume 5, Issue 5, September-October 2023

6. M. Caspar, T. Eiler, and S. Hohmann, "Comparison of active battery balancing systems," *Proc. IEEE Vehicle Power Propuls. Conf. (VPPC)*, pp. 1-8, Oct. 2014, doi: 10.1109/VPPC.2014.7007027

7. Praveen Kumar Sharma , Ms.Anjana Tiwari "ELECTRICAL VEHICLE : A NOVEL APPROACH TO DEVELOPING A SOLAR-POWERED ELECTRICVEHICLES CHARGING SYSTEM UTILIZING VEHICLE -TO - GRID-ENABLED SMART TECHNOLOGY" International Journal of Research and Analytical Reviews – IJRAR. Volume 10 | Issue 3 | September 2023.

8. Praveen Kumar Sharma, Ms Anjana Tiwari " Designing and analysis of solar-powered electric vehicles " TIJER - INTERNATIONAL RESEARCH JOURNAL, October 2023, Volume 10, Issue 10