Design And Development of Aerosolar Car

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***Abstract* - This paper reports the design and development of aerosolar car. A aerosolar car is a vehicle, which is powered by wind and sun's energy. This car is a light weight, low power vehicle designed. They have limited seating (two people), they have very little cargo capacity, and they can be driven during the days and Nights also by using dynamo motor attachment on the front of the vehicle. It does, however, offer an excellent opportunity to develop future technologies that can be applied to practical applications. The main components of an Aerosolar car are its solar arrays & alternators which collect the energy from the sun & wind respectively and convert it into electrical energy. The process of combining these mechanical and electrical components is not an easy task especially at the design stage because of the individual part specific characteristic and function. Since the development cost is one of the major constraints for this project, the sustainable design concept was implemented. Suitable parts which can be easily recycled and re-used, with desired functions that contribute to vehicle optimum performance are properly selected.**

Keywords: Wind energy; sun energy; Dynamo motors; Solar array; alternators; DC Motor

I. INTRODUCTION

Aerosolar car is powered by the sun and wind energy. The main components of an Aerosolar car are its solar arrays & alternators which collect the energy from the sun & wind respectively and convert it into electrical energy. The solar cell collects a portion of the sun's energy and stores it into the batteries of the car. Before that power trackers converts the energy collected from the solar array to the proper system voltage, so that the batteries and the motor can use it. The car makes use of high density Lead-acid batteries to account for a 4.8KWh pack, enough to travel over 45 miles without sun. After the energy is stored in the batteries, it is available for the use of motor & motor controller to drive the car. The motor controller adjusts the amount of energy that flows to the motor to correspond to the throttle. The motor uses that energy to drive the wheels through differential.

1.1. Working Principle of The System

This car runs with solar and wind power. The Schematic diagram is shown in the below figure. The Solar and wind power is connected to the battery with the help of a charge controller. The battery can store up to 48Volts this power is supplied to the motor when ever required. A motor controller is used to control the motor and it is placed between the battery and motor. The motor power is supplied to the drive wheels with the help of differential mechanism to the front wheels.

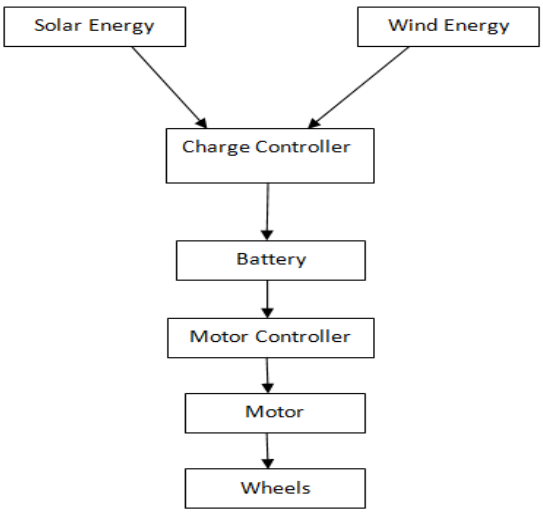

Fig:1 Schematic representation

II. EXPERIMENTAL DETAILS

2.1 selection and sizing of collector modules

Solar panels convert solar energy into electrical energy. Solar panels are arrays of photovoltaic cells (PV cells), specially designed modules that convert solar energy into electrical energy. This conversion is made

possible by the basic properties of matter. Solar Panels are a form of active solar power, a term that describes how solar panels make use of the sun's energy: solar panels harvest sunlight and actively convert it to electricity. Solar Cells, or photovoltaic cells, are arranged in a grid-like pattern on the surface of the solar panel. These solar voltaic cells collect sunlight during the daylight hours and convert it into electricity.

Converting solar energy to electrical energy

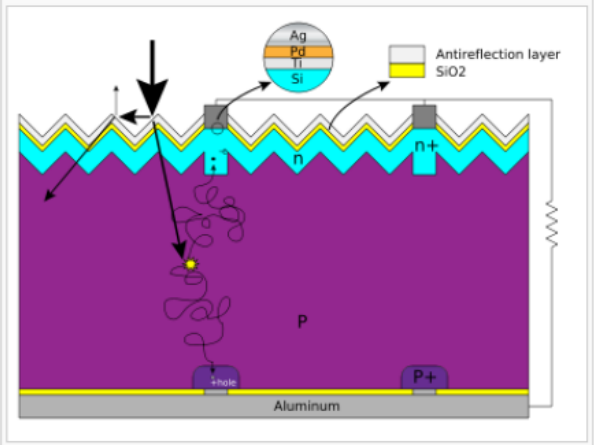

Fig:2 Converting Solar Energy to Electrical Energy.

The material of the semiconductor is most often silicon, but can be any of many different semiconductors. Some of the more common materials that are utilized in constructing solar cells are thin films, cadmium telluride, and gallium arsenide. These are only some of the materials being used in today's solar cells. Some of the materials listed are multi-junction concentrators, crystalline Si cells, thin film technologies, and emerging PV. This project is using the mono crystalline Si cells.

Fig:3. Solar panel

Specification of solar panel

Maximum power : 100 Watts

Voltage at Pmax : 20 Volts

Current at Pmax : 5 Amps

Size : 1055 * 650 * 35(mm)

Weight : 10kgs

2.2Selection and arrangement of alternators

Alternator:

An alternator is an electromechanical device that converts mechanical energy to electrical energy in the form of alternating current.

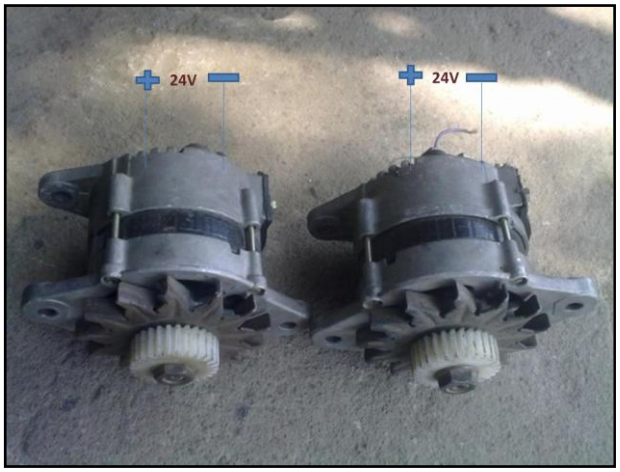

Fig:3. Alternators

Specification of alternators:

Voltage - 24Volts

Current -70Amps

Weight - 15kgs

Output - 1.6kw

Fig:4. Arrangement of alternators

The two alternators are welded at the front side of the car body and the bearings are arranged to support the shaft of the propeller.

2.3 Selection of batteries

The batteries store energy from the solar array and make them available for the motor's use. Most high school teams use lead-acid batteries because they are inexpensive, but some teams use lithium-ion or nickel-cadmium. We have selected lead-acid batteries because they are readily available and inexpensive. The number of batteries to choose depends on the motor (system) voltage. The system voltage is 48Volts so it requires 48Volts storage batteries and 100Ah rating.

Fig:5.battery

AEROSOLAR CAR

Experimental results and discussion

1. Charging Voltage Vs Battery temperature

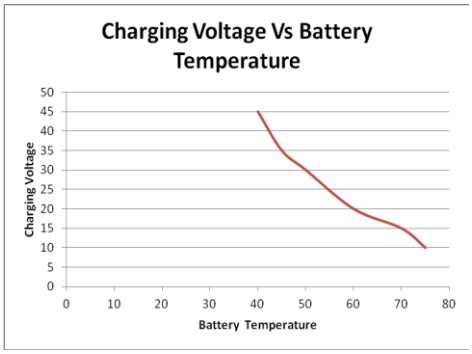

Fig: 2. Charging Voltage Vs Battery temperature

From the experimental results we have plotted the graph between the temperatures and charging voltage, it is evident from the graph that there is inverse relationship between them. As the battery temperature increases the charging voltage decreases

2. Speed Vs Voltage

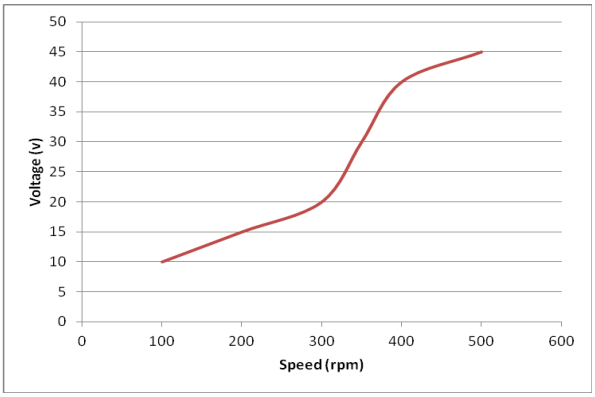

Fig:3. Speed Vs Voltage

As the Battery voltage supplied to the motor increases the wheel rpm increases. The graph given in fig.3 shows that the speed is directly proportional to the supply voltage.

3. Speed Vs Power

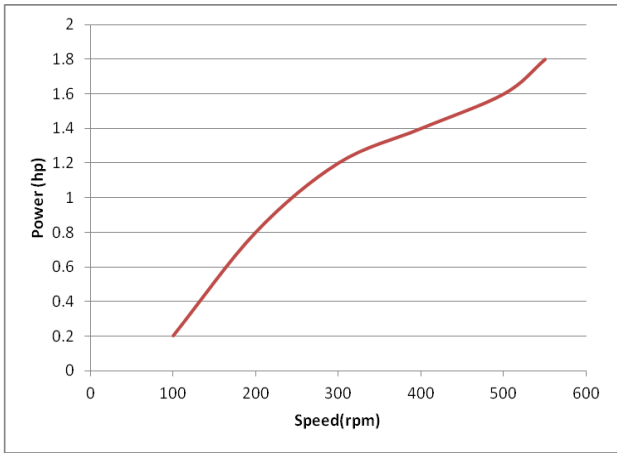

Fig:3.Speed Vs Power

As the power supplied to the motor increases the speed (rpm) of the vehicle increases.

4. Speed(rpm) Vs Acceleration

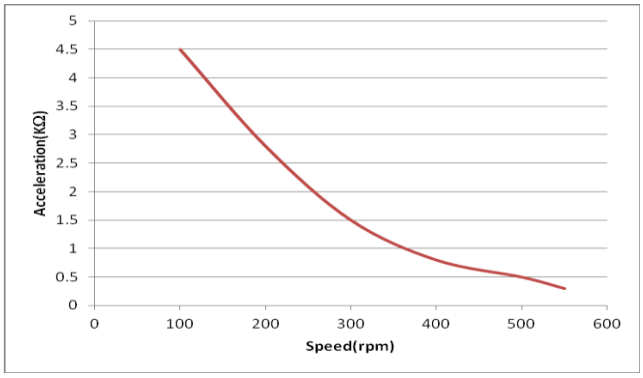

Fig:4. : Speed Vs Acceleration

Accelerator is used to regulate the speed of the vehicle. Accelerator pedal works on the principle of Potentiometer. When the pedal is released the resistance will be high and no voltage is supplied to the Motor and when the Pedal is pressed the resistance is decreased and the voltage increases and is supplied to the motor.

III. CONCLUSIONS

1. Aerosolar car designed in this paper makes use of both solar energy and wind energy. If only the solar energy is to be used, then it was found that it requires a larger solar insulation area and the vehicle cannot be compact. Hence it was proposed that, if both solar and wind energy are used simultaneously, the required power to drive the vehicle can be obtained.
2. At the start of the vehicle, solar energy can be utilized and after attaining certain speed, the wind energy can be utilized for further motion of the vehicle.
3. The Aerosolar car consumes the power of 48Volts and 35 Amps. The car can run at a speed of 45-50km/hr.
4. This car is totally diverse compared to other universal cars working on fossil fuels.
5. This newly developed Aerosolar car overcomes the problem of excessive running cost due to expensive fuel price like petrol and diesel.
6. The cost of the Aerosolar car is very cost-effective compared to other cars and maintenance cost is very less.

Solar power technology is improving consistently over time, as people begin to understand all of the benefits offered by this incredible technology. As our oil reserves decline, it is important for us to turn to alternative sources for energy.

IV. REFERENCE

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