A SOLAR CAB BY WORKING SOLAR ENERGY

Samet Bakırcı[1], Usame Demir[1], M. C. Soyhan[2] and H. S. Soyhan[1]
Faculty of Mechanical Engineering – Sakarya University Turkey [1]
Team-SAN Co., Technological Development Area, Teknokent, Sakarya, Turkey[2]

Abstract: *The aim of the paper is firstly to prevent to environmental pollution by using Solar energy. Our solar cab supplies a green, economical and practical transportation. In our design, the cab is designed for three people: a driver and two passengers. It is also suitable for low slope angles and preferred limited speed by drivers during the traffic.*

Keywords: SOLAR, CAB

1. Introduction

Electric vehicles have been developed to decrease the air pollution caused by consumption of the fossil fuels and fuel costs. However, they have some problems such as having short travel distance, insufficient number of charging stations, a high cost, and so on. Because of these problems, EVs have not yet widely spread to the markets. A more practical way of using electric engines in automotive industry is designing hybrid cars equipped with an electric motor, a gasoline engine and solar cells [1].

Traffic jam and environmental pollution is one of the biggest problems of the developed cities with their increasing population since most of the vehicles are still running with internal combustion engines having a giant development for last three decades. However, the facts of causing huge amount of environmental pollution and finishing the fossil fuel reserves in near future, researchers have to find an alternative source other than fossil fuels.

Nowadays, one of the applicable alternatives is cars running with solar energy and having almost same principles with electrical cars. Since solar cars can constantly charge their batteries, they have an important advantage of having the solar panels. They also provide us to charge our batteries during stops on traffic, constantly going on the way or parking.

2. SOLAR POWERED VEHICLES

An electric motor must be used in a car to be able to use solar energy. In theory, the power rating of the motor used in the largest must be lower than the level used in the production of solar cells and power must be equal. These conditions will be eligible to use the system in a car [2,3].

Solar energy on the automotive industry has emerged to be the start of in recent years. Solar powered cars generally referred to as solar car.

In 1983, the first time the idea of solar cars have come up with the work of researchers who are Hans Tholstrup and Larry PERKINS. Their solar cars was reached from Perth to Sydney in 20 days. Since this achievement, development of solar cars progressed very slowly up to the present. The main reason is very low energy conversion efficiency of the solar cells. The average yield is about 20% of solar cells used today. For example, for 100 Watt energy from the battery only equals to the 20Watt of electrical energy. The solar cars are still under development and subject to many researches today. [4,5]

2. Designing our solar-powered car :

Designing a solar-powered car requires the following stages:

- Identifying the boundaries for the vehicle
- Determining sitting position and sitting posture of car driver
- Selecting wheels' position
- Defining position of engine and position of drivetrain
- Designing of car shell
- Connecting solar cells to electrical system
- Creating structure of car shell
- Designing mechanical parts
- Designing electrical installation of car
- Compliance control of all systems
- Mounting all systems to each other
- Advancing with a form of sequence.

2.1 Identifying the boundaries for our solar car:

Boundaries of vehicle dimensions need to be designed to have enough space for panels and also to be fit for daily city life. Our car's dimensions are 1800mm width and 4500mm length.

By increasing height of car the center of gravity will be higher since there will be more balance disorder with effect of centrifugal forces on curved roads. Thus vehicles have to be designed closer the ground most. The lowest height for the car is calculated and chosen to provide necessary safety limits with applying standard sitting position of a person in vehicle.

2.2 Sitting position and posture of car driver:

Critters of car driver had been chosen appropriate to International Road Laws of Australia for giving plate to car powered by solar energy and in accordance with resources. According to this law the driver can have max 27 degree distance from vertical. Lowest limb must be feets of driver while driver using car. Driver must have enough space to move his had freely.

It is also very important to define the position of all people in the car to distribute the loads equally. Unequally distributed loads causes unstable movement while vehicle is moving. One other point is that complications for driver who must control environment good. Driver must be provided with a good sight from the left to the right. And also driver must able to see all boundaries of foreland and sides of vehicle while driving and able to control them well.

2.3. Determining position of wheels:

Wheels transfers all loads of vehicle to ground and all reactions to vehicle. Wheels also create a balance area which covers center of gravity too. Balance areas are consisting of connecting the points where wheels touch the ground. Bigger balance area means hard to overturn the car. Border of balance must have an equal distance to the center of gravity. In this way possible risks, which may occur by critical effect from any directions, can be reduced.

3. Model and Design

The aim of the paper is firstly to prevent to environmental pollution by using solar energy in cabs. Our solar cab supplies an economical and practical transportation. In our design, the cab is designed for three people: a driver and two passengers. It is also suitable for low slope angles, preferred limited speed by drivers and consistently stoppage during the traffic period.

Nowadays, one of the most important problems of solar cars is low efficiencies (22%). Thus solar cars are designed in lowest possible weighs giving very good aerodynamics in design since the major resistances for moving the cars are rolling and aerodynamics resistances. To overcome these resistances, we use tires which are exclusively designed for solar vehicles. The cab is also designed to minimize to air resistance. We built the cab and chassis from carbon fiber shell so that it is two times lighter than current cars in terms of weight.

Our solar car (see Fig. 1) can move by using energies stored in the batteries before the travel. If the cab doesn't absorb any daylight, in order to move to the cab, it will use Li-po batteries whose weight are between 70 and 100kg. In order to increase to the efficiency, we will use hub motors to provide maximum mechanical and electrical efficiencies. Beside this, the cab will be more efficient with the preventions like usage of super capacitors for instantaneous stoppages and actions.

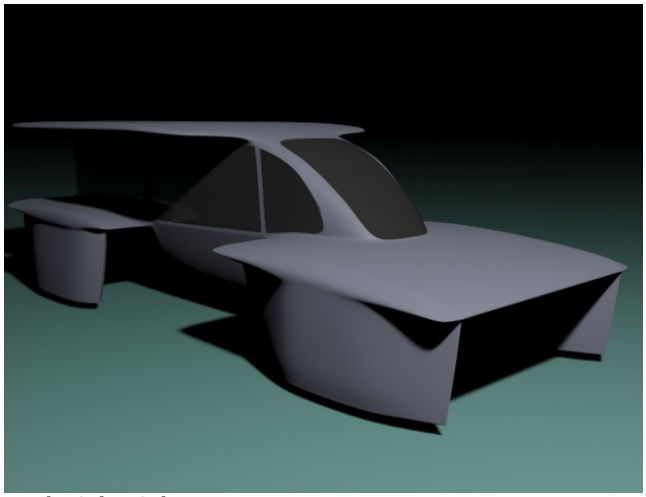

Fig. 1 *The Solar Cab*

4. Results

Solar powered vehicle was examined in terms of electrical aerodynamic and structure component. Design work is concerned with the general case, the vehicle should be inspected and checked again.

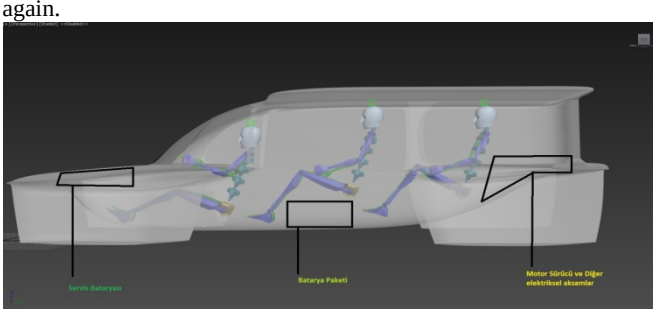

Fig. 2 *General view of solar car*

Gray area represents the solar cells placed in the upper surface in the solar car having 90° to the sunlight to get a maximum efficiency in converting solar energy to electricity. In total, we have 6 m² area covered by solar panels. There are two HUB engines in back rears in our solar cab.

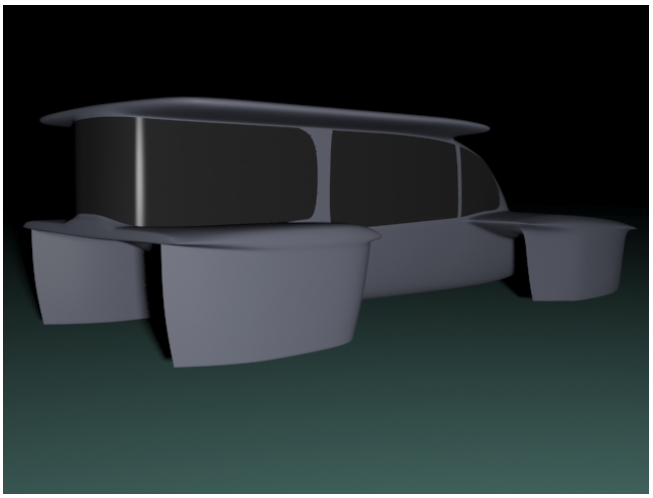

Fig. 3 *Isometric view of the vehicle*

MPPT cards are usually small in size. An easy access point in the vehicle needs to be chosen for this card. The important point is that the MPPT cards can be made more accessible to interventions during maintenance. For this reason, during the opening of the upper crust needs to be easy accessed to nearby places is advisable to make the front of the vehicle left or right.

Our solar car is suitable for using on the highway. The solar car is provided to have a great extend for fuel economy and clean energy criteria. There is a very small amount of heat and noise during driving our solar car. Heat and sound produced in our solar-powered car is negligible relative to the internal combustion engine vehicles. Since the energy required for the vehicle is fully provided from solar energy, there is no dependence on any petroleum product.

Energy from the solar cells may be inadequate when it comes to the cloudy and rainy weather, for high speed values and stop-and-go cases. In the case of low-energy solar cell, this case is compensated by suitable capacity battery pack which is located within the car.

Another big loss of efficiency of a car is faced because of wind resistance. Surface geometry of the exterior of the car is designed carefully directing the wind to have lowest wind resistance. Vehicle wind drag coefficient (Cd) was measured as 0.2. Wind resistance was measured as only 70N when the solar car is driven with 70 km/h speed. The solar car is designed with special low rolling resistance tires. In addition, the mechanical losses were avoided as much as possible by using ceramic coated bearings.

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