THE USE OF SOLAR ENERGY AS ASSISTANCE TRACTIVE FORCE FOR CHEVROLET CAMARO

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ABSTRACT

The Chevrolet Camaro is one of the cars that consumes a lot of fuel. Nowadays, many researchers tries to use clean and renewable energy for protecting the environment. Among these energies, solar energy is one of the most important renewable energies. With this energy, fuel consumption of Chevrolet Camaro is reduced. In this way, less damage happens to the environment, and fuel consumption cost is also reduced. In this research, an electric motor is used between the gasoline engine and gearbox, so that it can reduce some of the generated power in gasoline engine, and the reduced power in gasoline that is supplied by a photovoltaic panel, is compensated by the electric motor. Thus less fuel is used for propulsion. According to the investigations, received power from installed panels is estimated about 3.75 kWh per day, that as reinforcement can be effective for reducing the fuel needed to drive the car.

KEYWORDS

Solar energy, Chevrolet Camaro, Electric motor, Environment, Fuel consumption, Photovoltaic

1. INTRODUCTION

Today, transportation is a major contributor to air pollution and global warming. Vehicles cause the release of toxic gases and pollutants such as sulfur dioxide, carbon dioxide, and nitrogen oxides. This made governments to use clean and permanent energy instead of fossil fuels. Today, the use of solar energy for various uses has begun in developing countries [1-4].

Hammad and Khatib [5], have researched about solar-powered cars. The researchers have considered all parameters related to energy and basics of power in these cars. They studied weather conditions, vehicle weight, friction and slope of road as variable parameters to calculate the speed of the car. They state that solar car design is not easy and the design does not finish with calculation of some parameters and even making prototype. This study is along with a continuous work and changes of research projects.

An overview of photovoltaic technology used in automobile manufacturing is done by Giannouli and Yianoulis [6]. According to the amount of required energy, they studied the conditions for building a solar car prototype.

Nikolay et al [7], have researched the optimum cooling and increase of efficiency of solar panel cars. The researchers conducted their study on a moving solar car. They stated that in photovoltaic systems, the flow conditions affect solar cells temperature. Given the complexity of solar car roof, it is different for solar cells in different areas. In most cases, the heat transfer within the photovoltaic modules is more efficient than removal of heat from the surface. The researchers stated that one of the major issues of solar-powered cars design is drag reduction. Optimized form of solar-powered cars not only reduces aerodynamic drag, but also enhances heat dissipation and produced power of photovoltaic (PV) panels.

Bin et al. [8], have studied technical and economical issues of increasing charging stations in China. They state that in China the production of power is the biggest cause of environmental pollution and transportation is an important factor in the production of these kinds of pollution. In their research, they tried to have a better use of renewable energies and reduction of environmental pollution with the aim of increasing charging stations for electric cars. They say charging stations for photovoltaic vehicles for 4500 kW power generating cost about three millions and six hundred thousand dollars. By using solar-powered cars 99.8 percent of carbon dioxide, 99.7 percent of sulfur dioxide, and 100% of sulfur oxide will be reduced. Finally the researchers said with 6 percent increase of interest rate, with a focus on reducing environmental pollution, the economic viability of the project is acceptable. Since 2011 design of solar cars for urban roads and stronger daily use has been progressed [9].

In this article we discuss about Chevrolet Camaro. Its energy is provided by solar energy panels installed on the car. Its fuel consumption is high, but because of its beauty it has a lot of fans. To reduce fuel consumption, we can use the sun's energy especially in summer [4]. Solar Powered Chevrolet Camaro is charged by solar energy, and its components of the system include solar panels, solar charge controller, battery, and electric motor. Solar panels on the body of the car absorb the sun's energy. In the next step, according to the calculated area for the placement of the panels, the power is obtained, and the power is stored in the battery and reaches to electric motor. Hence, the main reasons for using solar energy to provide automotive energy are conserve fossil fuels and reduce environmental pollution.

2. USING SOLAR ENERGY IN CHEVROLET CAMARO

Nowadays, due to global warming, deforestation and environmental pollution, researches on solar car have been increased. In the future, the main problem will be destruction of the ozone layer caused by the release of toxic gases from vehicles. Therefore the development of solar-powered cars should be more, because this the cleanest and easiest way for energy output [9].

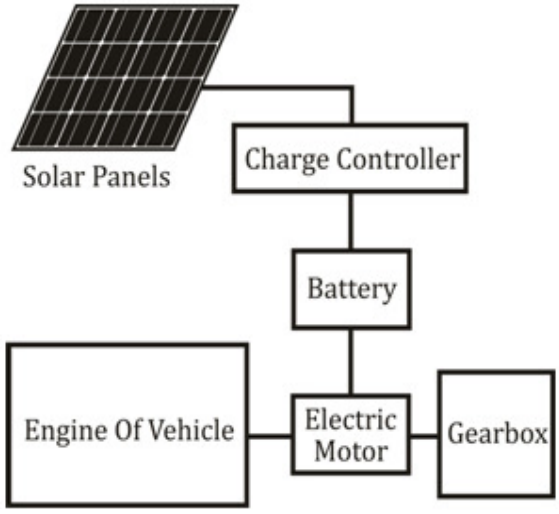

Figure 1. Overview of solar electric system for the car

The use of photovoltaic panels on the roof and hood of cars has been proposed by Sasaki et al. [10]. They used a 1.6 kW motor to supply the energy of the car, while the main power generator was petrol generator. In solar-powered Chevrolet Camaro a charge controller is used between the panel and battery whose duty is to protect the battery. Figure 1 shows the solar electric system for the car, as it can be seen, the output of the electric generator is directly connected to the gearbox. Considering that the electric generator is located between the gasoline engine and the gearbox, when the gasoline engine is in operation, electricity can be stored in the battery by rotating the electric generator shaft. In this case, the electric energy storage system will be charged both by solar energy and gasoline engine. When the electric motor is running, the gasoline engine is disabled and the electric motor directly drives the gearbox input shaft, thereby the car is moving. The operation of the electric motor is interrupted by a key in the driver's control. The amount of battery charge is shown on the display. Therefore, the driver, depending on the amount of charge in the battery, connects the electric generator. However, if the battery charge is less than specified value, the system will be automatically disable the electric motor and operate the gasoline engine. Next, we discuss the design of Chevrolet for placement of photovoltaic panels. Figure 2 shows embedded panels on the different parts of the car.

According to Figure 2 it can be seen that the panel is installed in the hood, the back and roof of the car.

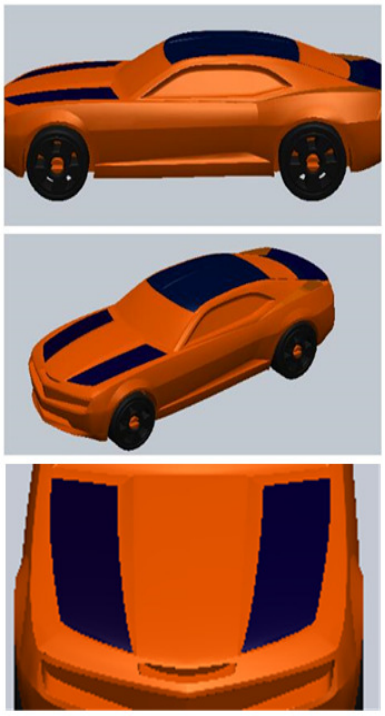

Figure 2. Considered of PV Cell in Chevrolet Camaro

At this stage, the measurement of panels, according to the actual dimensions in the researches, has been done. Figure 3 shows the overall level panel needed for the car.

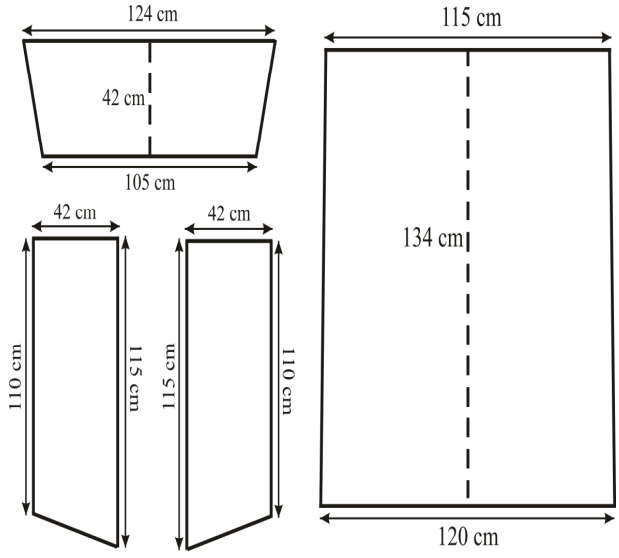

Figure 3. Sizing of PV Panel in actual dimensions

3. MEASUREMENT OF PANELS AND EXTRACTED POWER

Table 1 shows the area of different parts of solar powered Chevrolet Camaro based on the square meters. According to Table 1, usable area for the installation of photovoltaic panels is obtained from the total areas of the hood, back and roof of the car that equals to 3.1 square meters.

Tabel 1.Usable area for installation of photovoltaic panels in Chevrolet Camaro

Parts of the vehicle	Area(m^2)
Front Hood	0.95
Trunk lid	0.5
Roof	1.58
Total	3.1

At this stage, given the area obtained for the placement of photovoltaic panels, extracted power from the panels is obtained from the equation (1) [11]:

$$P = A_s \times I \times \mu \quad \textbf{(1)}$$

In the equation, A_s is the total area of solar panels in square meters, I is the peak hours of sunshining and μ is Efficiency of the Panel. In calculating the required power, the material of panel is silicon and its coefficient is considered 20.4 percent [12]. Peak of sunshining hours in Rasht, according to the amount obtained by NiaJalili et al. [4], is considered 5.92. Therefore the amount of power acquired from photovoltaic panels is 3.75 kWh per day. It can be used as reinforcement for Chevrolet Camaro driving force and thereby it reduces fuel consumption and environmental pollution.

4. CONCLUSION

Chevrolet Camaro is a powerful car with high fuel consumption. In this study, to reduce fuel consumption and reduce environmental pollution, solar energy is used as reinforcement in vehicle propulsion. By embedding components such as solar panels on the sides and roof of the car, charge controller, battery and electric motor, which is placed between gasoline engine and gearbox, the car is equipped with solar energy. Solar panels absorb solar energy and convert it into electricity. Charge controller is between the solar panels and solar battery and has the duty of protecting the battery. The battery stores solar energy and transfers it to the electric motor. By installing solar panels and other equipment on the Chevrolet Camaro, due to availability of solar energy, part of the vehicle's energy is being provided. According to calculations, the power of the panels is estimated 3.75 kWh per day. With a correct strategy we can use this power in order to reduce fuel consumption and environmental pollution.

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