HYBRID VEHICLE DESIGN FOR DISABLED AND IT’S CONTROL

Rüştü Gündürkün
Department of Electric-Electronic Engineering
Dumlupınar University
Kutahya/TURKEY
rustu.gunkturkun@dpu.edu.tr

Sükrü Kitiş, Hasbi Apaydin
Simav Vocational School
Dumlupınar University
Kutahya/TURKEY
sukru.kitis@dpu.edu.tr, hasbi.apaydin@dpu.edu.tr

Abstract— In this study, the design and implementation of disabled car that works with solar energy which is one of the alternative energy sources. Two of 12 voltages, 65 ampere gel battery are used on the disabled vehicle. Two solar panels which can produce 22V under sun and in the sizes of 740x570x3,5 mm, in the power of 50W, procured the batteries charged by solar energy by connecting in series.

Disabled car has been worked both by electricity energy and solar energy. Disabled car working by solar energy will have been compensated its cost in a year, according to the calculations. (Table 4.1). The disabled person who will used the car working with solar energy will avoid being independent to electricity energy which has an increasing cost, and also won’t need any help to charge the batteries.

Current and voltage ratings of solar panels have been measured in non-existence of sun, in cloudy weather and in sunny weather with the help of ampere meter and voltmeter connecting the port of DC motors (Table 4.2). Taking the gears drawing current capacities into consideration, voltage rates of disable cars have been determined as testing them at straight and sloping road. These values are shown in table 4.4. Generally, it can be stated that cars have drawn less current at sloping road.

Keywords— Photovoltaic (PV); Solar Cell; Gel Battery; Disabled Car Introduction (Heading 1)

I. INTRODUCTION

Increasing energy demand in World and parallel to that consumption of existing energy sources forces World states to search for new energy sources. According to the estimations of World Energy Forum, in case of consuming reserves like petroleum, coal and natural gas which are fossil-originated energies, they will be extinct in the next century. [1]. Emission of poisonous gases with the consumption of fossil-originated fuels constitutes a serious problem environmentally. [2]. As these energy sources cause global warming, they also cause air pollution, acid rains, ozone layer depletion and forest destruction. [3]. the main reason of CO2 (carbon dioxide) emission occurs from human activities. While this human-sourced emission was 2.6 billion tons worldwide in 2002, it is estimated that this will reach to 4.2 billion tons in 2030. [4].

Usage of photovoltaic systems has increased significantly to increase the efficiency, decrease the costs and compensate the energy need in new generation photovoltaic systems over time. [5]. The tendency of existing energy producing sources to be consumed fast, the increasing prices of raw materials, its negative effect on humans and environment, some difficulties in its usage, have increased the researches on renewable energy sources in recent years. Firstly, photovoltaic energy is an energy type that is clean, has no harm to environment and the living and includes no waste. The harm of energy producing systems based on nuclear and fossil fuels like petroleum, neutral gas, coal etc. is extremely high. As well as they are eco-friendly, they can be installed to wherever wanted by need. This is not the situation for other energy producing systems. Especially photovoltaic systems install near latest users reduces transmission and distribution device need and increases the reliability of local electricity services [6].

Net solar energy coming to earth surface is now 10.000 times the nuclear and fossil energy that people use. Total amount of solar energy reaching to earth surface is almost 1.2 1017 watt. %0.003 of solar radiation reaching only the surface can compensate the total global electricity demand [7]. Photovoltaic batteries can be used properly where there is no electricity network, agriculture lands away from settlement and because they can be set in required size, it is a sufficient energy source for implementations like compensating energy need in rural areas, irrigation and signaling [8]. In the production of photo voltage batteries, silicon is the most used semiconductor material [9] when solar radiation reach to the semiconductor material, it is soaked by the material. It thins the electron bonds in the material and creates electric current by making them go to a different place. Integrated metal collectors collect these electric current on semiconductor [10]. The way to attain electricity energy from sun is to benefit from photovoltaic accident. Photovoltaic accident is a physical event defined as transforming of sun light to electric energy. Solar batteries are semiconductor materials which turns sun light coming to their surfaces to electric energy directly. Sun battery that works with this principle, depending on the light amount falling on itself, produces voltage in its poles. Produced voltage, shows a proportional change [11].

In this study, it is aimed to make the batteries used in disabled car be charged by using solar energy which is an alternative energy source and avoid to be dependent on electric energy. There are right voltage batteries on
electrical disabled cars. For this purpose, in our study, 2 solar energy panels in 740x570x3.5 mm size, at 50W power with 36 cell were tied to 12 volt 65 A 2 gel type battery via regulator. Especially in winter, when solar energy is not enough for electric energy, battery is charged by electric. Battery powered disabled vehicles are charged by electric energy. It is a problem for disabled people that charging time of the batteries used in these vehicles are long, the vehicle cannot be used during the charging, electric energy is expensive and disabled people cannot charge the car without help. With this study, these problems are no longer an issue.

II. THE STRUCTURE OF THE SOLAR PANELS

Crystalline Silicon Cells conventional cells are generally made from layers of silicon a few hundred micrometers in thickness. Silicon for bulk cells is refined and grown into lightly p-type doped crystalline ingots that are then sliced into extremely thin wafers[12].

Amorphous silicon (“a-Si”) the non-crystalline form of silicon - can be deposited onto a conductive substrate in a layer a few micrometers thick to create a thin film solar cell. The deposition process of applying a-Si allows it to be less than 1% of the thickness of a crystalline cell[13,14]. Amorphous silicon cells are often built using two or three junctions to increase the amount of the solar spectrum they can utilize. [15]. Early versions of thin film amorphous silicon cells have been used for decades to power calculators.

III. METHOD

In Figure 3.1 the block diagram of disabled car we made whose implementation is seen. Disabled car can work both with electric and solar energy. Each of the solar panels that are used are in the size of 570x740x3.5mm, at the power of 50W can produce 22 Voltage in a day when the weather is clear and sunny, 18V when there is no sun. by connecting sun batteries in series, 36—44 Voltage was produced, this voltage, via regulator, was linked to batteri poles to charge batteries.

In Figure 3.3, regulator circuit is an element which adjusts the maximum of 36-44 voltages coming from coupled in series solar panels to 24 voltage D.C. which is necessary for batteries. Attained voltage depending on sun’s condition may not always be 36-44 voltage. At the same time it is not possible to obtain a stabile voltage constantly. For this reason, using regulator in the circuit is important to stabilize the voltage and charge the batteries with stabile voltage. Because regulator circuit was designed as 12V/24V, first its connection was made with batteries. In this situation, regulator will perceive 24 voltage otomatically. Then, when a connection is provided to solar panels, batteries will start to be charged. If its required from regulators, exit for load can also be provided.
In Figure 3.4, gel battery is seen. Gel batteries are produced by silicon gel technology which provides better performans and longer lifetime in cold environment temperatures. Gel batteries are equipped with special separator and are fully close, maintenance free batteries. Gel batteries have high reliability and quality.

IV. RESULTS AND CONCLUSIONS

In Figure 4.1, the car developed for disabled people is seen. With this study, our targeted purpose came true. Batteries can be charged by solar energy which has no cost except from the first costs and a walking disabled can use the car without a cost. Two batteries can be charged in 12 hours when electricity is used. During this charging time consumed energy is 0.5KW. The price of 1KW electric energy is 0.183$. Accepting that each charging time is a day, daily and monthly costs are shown in Table 4.1. There is no cost other than the costs of first implementation. In this system that we made the total cost of sun panels are approximately 375$. When the table is examined it can be implied that this cost can be compensated in almost a year.

<table>
<thead>
<tr>
<th>Charging time</th>
<th>Power drawn from the battery</th>
<th>The Energy used</th>
<th>Price (1 KW/h) = 0.183$</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Day (12 hour)</td>
<td>500W</td>
<td>0.5 KW*12 =6KWh</td>
<td>6*0.183$</td>
<td>1,11$</td>
</tr>
<tr>
<td>One Month (12*30 =360 hour)</td>
<td>500*30 =15000W</td>
<td>0.5<em>30</em>12 =180KWh</td>
<td>180*0.183$</td>
<td>33,45$</td>
</tr>
<tr>
<td>One Year (12*365 =4380 hour)</td>
<td>500x365 =182500W</td>
<td>0.5<em>365</em>12 =2190KWh</td>
<td>2190*0.183$</td>
<td>406,8$</td>
</tr>
</tbody>
</table>

In Table 4.2 the values obtained when there is no sun, weather was partly cloudy and sunny. Best result was obtained when it is sunny. For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

<table>
<thead>
<tr>
<th>Sun’s Status</th>
<th>Current</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no sun</td>
<td>0.5A</td>
<td>25V</td>
</tr>
<tr>
<td>Partly Cloudy</td>
<td>2A</td>
<td>30V</td>
</tr>
<tr>
<td>Full Sunshine</td>
<td>4A</td>
<td>44V</td>
</tr>
</tbody>
</table>

In Table 4.3 the state of current and flow into electric source

<table>
<thead>
<tr>
<th>Electrical Energy</th>
<th>Current</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4A</td>
<td>24V</td>
</tr>
</tbody>
</table>
TABLE IV. CURRENT AND FLOW VALUES OF DISABLED CAR AT FORWARD AND REVERSE GEAR ON STRAIGHT AND SLOPING ROAD

<table>
<thead>
<tr>
<th>Gear Status</th>
<th>I. gear Forward</th>
<th>I. gear back</th>
<th>II. gear forward</th>
<th>II. gear back</th>
<th>III. gear forward</th>
<th>III. gear back</th>
<th>IV. gear forward</th>
<th>IV. gear back</th>
<th>V. gear forward</th>
<th>V. gear back</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight on the road</td>
<td>1A</td>
<td>5A</td>
<td>5A</td>
<td>5A</td>
<td>8A</td>
<td>5A</td>
<td>10A</td>
<td>5A</td>
<td>13A</td>
<td>8A</td>
</tr>
<tr>
<td>Slope</td>
<td>12A</td>
<td>8A</td>
<td>24A</td>
<td>8A</td>
<td>27A</td>
<td>8A</td>
<td>29A</td>
<td>8A</td>
<td>30A</td>
<td>8A</td>
</tr>
</tbody>
</table>

In Table 4.4, the currents that disabled car draw according to its gears situation on straight and rough roads. In straight and rough road it generally draws less current on reverse gear.

As a result, the disabled who uses the car working with sun panel will avoid to be dependent on electric energy whose cost increases day by day and compensate his/her needs by not needing anybody to charge the batteries.

REFERENCES