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HYBRID VEHICLE DESIGN FOR DISABLED AND IT'S CONTROL

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***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 weater and in sunny weater 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 constituted 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 voltage 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.

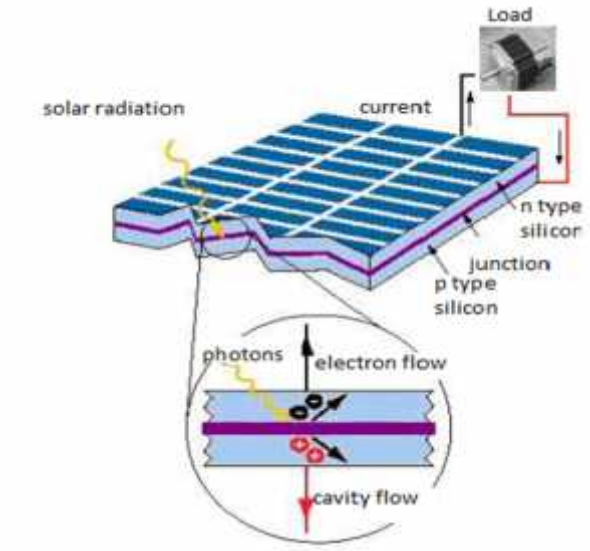

Fig. 2.1. One of Solar Photovoltaic Effect[19].

The crystalline compound cadmium-telluride (CdTe) is an effective solar cell material it is a very strong absorber of light and has a band gap almost perfectly tuned to match the solar spectrum. To create a p-n junction for solar cells a layer of cadmium sulfide is added to the CdTe. Because of its effectiveness a CdTe solar cell uses only about 1% of the semiconductor material that bulk silicon cells use[16]. CdTe solar cells are generally somewhat less efficient than bulk silicon cells, but have lower costs associated with them due to the smaller amount of material used and inexpensive production methods[17]. It remains to be seen how the production of CdTe solar cells will be affected in the future by supply constraints. CdTe is a toxic carcinogen and some concerns have been raised about the danger of solar cells made with CdTe. These concerns have been countered by noting that the Cadmium contained in one square meter of a CdTe cell is less than that within a size-C NiCd flashlight battery and that the CdTe is very well sequestered by the encapsulation of the cell [18].

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 prosuce 22 Voltage in a day when the wheather 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.

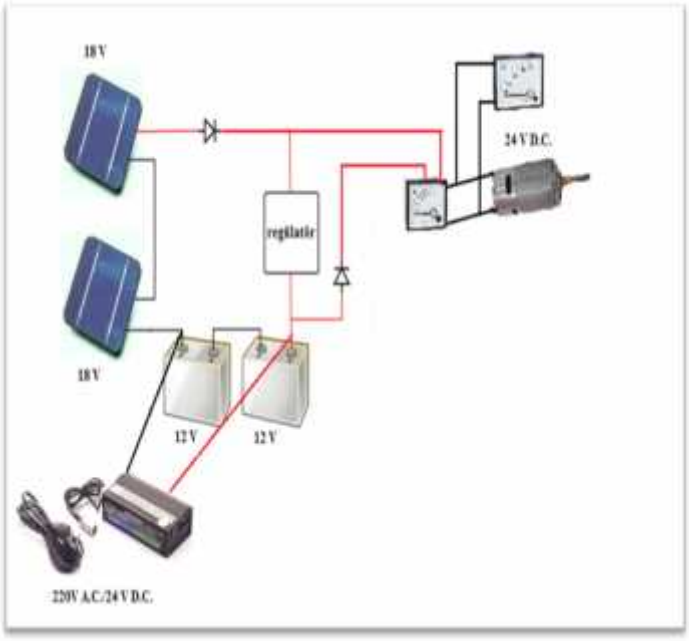

Fig. 3.1. Block diagram of disabled car which was developed for walking disableds and works with solar energy and electricity

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 stabil voltage constantly. For this reason, using regulator in the circuit is important to stabilize the voltage and charge the batteries with stabil voltage. Because regulator circuit was designed as 12V/24V, first its connection was made with batteries. In this situation, regulator will percieve 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.

Fig. 3.2. The appearance of the solar panels

Fig. 3.3. View of the regulator circuit

Fig. 3.4. Gel battery structure

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 I. DAILY, MONTHLY AND ANNUAL COST OF ELECTRIC ENERGY USED FOR THE DEVICE

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

Fig. 4.1. Last version of Developed Disabled Car

Thinking that all the regions of our country can benefit from sun light, it can clearly be seen that this study is convenient for its purpose. As a result the disabled car working with solar energy provides convenience to the user in terms of costs and usage.

TABLE II. SOLAR PANELS' CURRENT AND FLOW DRAWING STATE ACCORDING TO POSITION OF SUN

Sun's Status	Current	Voltage
There is no sun	0.5A	25V
Partly Cloudy	2A	30V
Full Sunshine	4A	44V

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 III. STATE OF CURRENT AND FLOW INTO ELECTRIC SOURCE

Electrical Energy	Current	Voltage
	4A	24V

TABLE IV. CURRENT AND FLOW VALUES OF DISABLED CAR AT FORWARD AND REVERSE GEAR ON STRAIGHT AND SLOPING ROAD

Gear Status	I. gear Forward	I. gear back	II. gear forward	II. gear back	III. gear forward	III. gear back	IV. gear forward	IV. gear back	V. gear forward	V. gear back
Straight on the road	1A	5A	5A	5A	8A	5A	10A	5A	13A	8A
Slope	12A	8A	24A	8A	27A	8A	29A	8A	30A	8A

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.

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