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Production of Electricity using Solar Cell at 6.0 Volts

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ABSTRACT

The Sun is the only planet which enables to produce light in tremendous amount. It is utilized to cater the need of our energy by means of converting light energy into electrical energy. The Sun is naturally a source of heat energy by using the fission process inside it, enabling it to generate vast amounts of heat energy. We used the solar panel or photovoltaic (PV) panels on which surface the sun light falls after successfully falling on its surface the solar (Photon) energy converts into electrical energy i.e., photon conversion into electrical energy. The generated electricity can be stored in batteries or it can be utilized directly. Our previous work entitled production of electricity using solar cell, International Journal for Research in Applied Science & Engineering Technology (IJRASET) Vol.9 issue VIII, Aug. 2021 pp548-552, using solar panel at small scale approximately 2.4 Volts.

In our present investigation we are able to produce electricity upto 6.0 Volts and maximum power 36.04 Watts. Moreover, we planned to design it for large scale production of solar energy using large sized photovoltaic panels.

Keywords : Solar Energy, Photons, Sunlight, Photons, Photovoltaic Panels.

I. INTRODUCTION

Growing global population, industrialization the demand of energy per capita increased continuously [1-6]. The suitable solution to overcome on the energy crisis is solar energy. A solar energy is available naturally and there is no environmental pollution as well [7-9].

Solar energy utilized to generate electricity using solar cells or panels. This acts as source of renewable energy on the Earth. The solar power play vital applications in various fields including solar electric power generation, industries, solar panel based running vehicles, space application and other numerous uses. The solar energy is considered as alternative energy source in the future [10].

Our primary source of clean, abundant energy is the sun. Solar energy is radiant light generated from the Sun that is harnessed utilizing a wide range of technologies including solar power to generate electricity [11], solar water heating, solar architecture [12]. The rotation of the sun is made evident by the

sunspots that cross the solar disk in about two weeks, then disappear, and then reappear at the opposite limb (or curved edge) two weeks later. The observations of the sun reveal that different parts of the Sun rotate at different speeds. The Sun, or luminosity, is 4×10^{26} watts. This is found by measurement of the solar constant, the energy received per square meter (1,360 watts/m ^{2}) by a surface perpendicular to the direction of the Sun at a distance of 1 astronomical unit and multiplying by the surface area of a sphere of radius 1 AU. The term *solar constant* implies a belief in a constant luminosity output for the Sun, but this may not be completely correct. The Maunder minimum, an era of very few detectable sunspots in the century after their discovery in 1610, suggests the solar sunspot cycle was not in operation at this time. Other evidence suggests the presence or lack of a solar cycle is related to changes in the solar luminosity output. Past ice ages of the Earth could be the result of a diminished solar luminosity output. Monitoring of the solar constant in the last decade from spacecraft suggests there are variations on the order of one-half percent. Thus, our Sun perhaps is not as constant a source of energy as was once believed [13].

The temperature of the solar "surface" (the photosphere) can be defined in several ways. Application of the Stefan-Boltzman Law (energy emitted per second per unit area = σT^4) yields a value of 5,800 K. Wien's law, which relates the peak intensity in the spectrum to the temperature of the emitting material yields T = 6,350 K. This discrepancy between the two values results for two reasons. First, the emitted light comes from different depths in the photosphere and thus is a mixture of emission characteristics of a range of temperatures; thus, the solar spectrum is not an ideal black body spectrum. Second, absorption features significantly alter the spectrum from the shape of a black body spectrum.

The strongest absorption features were first studied by Fraunhofer (1814) and are called **Fraunhofer lines**. Absorption lines from over 60 elements have been identified in the solar spectrum. Analysis of their strengths gives temperatures at different depths in the photosphere and chemical abundance ratios [14-15].

II. EXPERIMENTAL METHOD

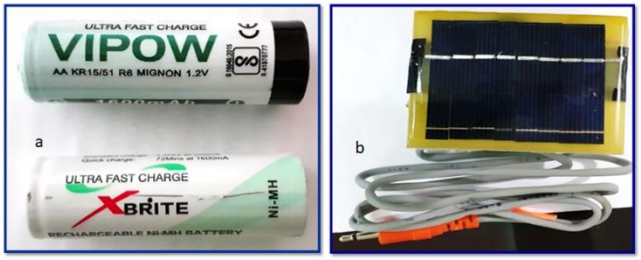

Figure 1. (a) Battery 1.2 (b) solar panel or photovoltaic module or solar cell.

We installed the solar panel in front of department of Physics, in such a way that there is maximum sunlight falls on its surface so as to photoelectrons generates from the surface of solar panel and it stores in batteries.

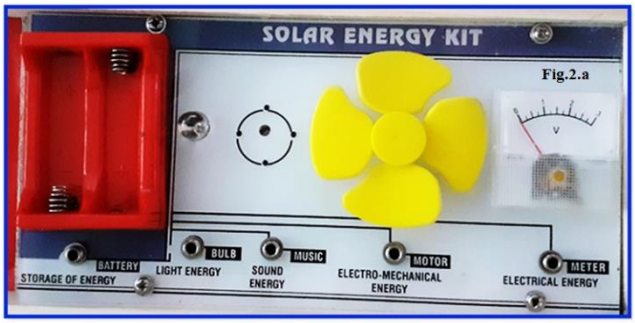

Fig.2 (a)The solar related components mounted in wooden block as shown in fig.2a.

Figure 2(a) represents the all required components can be assembled in wooden box or block. First there is three slots are fitted to put 1.2 V five batteries to store generated electricity from sunlight. After that light energy-LED, sound energy-speaker, electromechanical energy-fan, electrical energy-volt meter were constructed in series as shown in above fig.2(a)

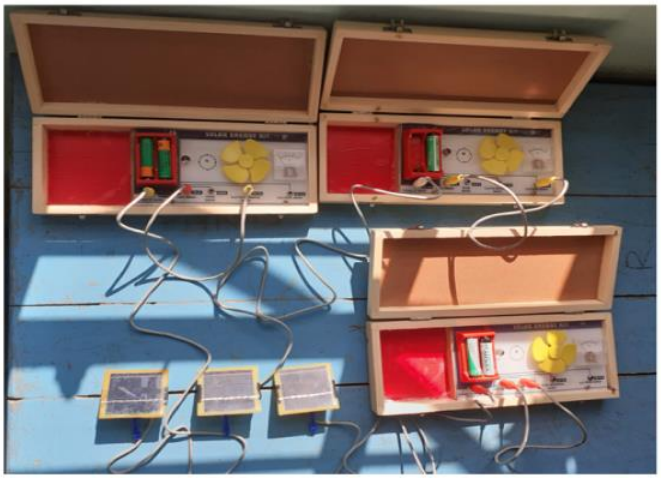

Fig.3 Experimental setup assembled and connected by B.Sc.T.Y.(optional Physics) students.

We studied the production of electricity using solar cells by means of connecting solar panel to its allied electrical components as shown in above figure 3. The five solar cells were fitted in three slots with capacity of 1.2 V each cell. The reported data for solar panel as shown in table 1.

III. RESULT AND DISCUSSION

The Sun

The energy that we receive from the Sun dictates the environment on Earth that is so important to humanity's existence. But to astronomers, the Sun is the only star that can be studied in great detail; thus, studying the sun is vital to the understanding of stars as a whole. In turn, the study of stars shows us that our Sun is merely an average star, neither exceptionally bright nor exceptionally faint. Evidence from other stars has also revealed their life histories, allowing us a better understanding of the part and future of our particular star [16-21].

The solar diameter equals 109 Earth diameters, or 1,390,000 kilometers. What we see when we look at the sun, however, is not a solid, luminous surface, but a spherical layer, called the photosphere, from which the bulk of the solar light comes (see Figure 4). Above the photosphere the solar atmosphere is transparent, allowing light to escape. Below the photosphere, the physical conditions of the material of the solar interior prevent light from escaping. As a result, we cannot observe this interior region from the outside. The solar mass is equivalent to 330,000 earth masses, or 2×10^{30} kg, for a mean or average density (mass/volume) of 1.4 g/cm ^{3}[22-27].

The solar cells or photovoltaic (PV) cells implies photo means light and voltaic means electricity. It converts directly sunlight into electricity. A module is a group of cells and electrically connected and packaged into frame called as solar panel as well.

The main feature of the solar cell is the voltage of the cell does not depend on the size of cells its constantly changing due to variations in light intensity. The current in device is directly proportional to light intensity.

Table 1: Experimental data from solar panel

Time in Minutes	Steady solar panel exposed in sunlight		
	Voltage (Volts)	Current (Amperes)	Power (Watts)
05	0.1	0.13	0.01
10	0.2	0.21	0.04
15	0.3	0.32	0.09
20	0.4	0.44	0.16
25	0.5	0.52	0.25
30	0.6	0.63	0.36
35	0.7	0.74	0.49
40	0.8	0.81	0.64
45	0.9	0.92	0.81
50	1.0	1.02	1.00
55	1.1	1.18	1.21
60	1.2	1.23	1.44
65	1.3	1.39	1.69
70	1.4	1.44	1.96
75	1.5	1.57	2.25
80	1.6	1.64	2.56
85	1.7	1.79	2.89
90	1.8	1.85	3.24
95	1.9	1.97	3.61
100	2.0	2.02	4.00

105	2.1	2.11	4.41
110	2.2	2.23	4.84
115	2.3	2.34	5.29
120	2.4	2.44	5.76
125	2.5	2.58	6.30
130	2.6	2.69	6.80
135	2.7	2.73	7.31
140	2.8	2.84	7.85
145	2.9	2.97	8.44
150	3.0	3.01	9.00
155	3.1	3.12	9.78
160	3.2	3.25	10.20
165	3.3	3.38	10.90
170	3.4	3.43	11.56
175	3.5	3.54	12.45
180	3.6	3.67	12.98
185	3.7	3.76	13.70
190	3.8	3.82	14.44
195	3.9	3.94	15.28
200	4.0	4.07	16.10
205	4.1	4.12	16.80
210	4.2	4.25	17.28
215	4.3	4.38	18.52
220	4.4	4.44	19.52
225	4.5	4.57	20.40
230	4.6	4.68	21.31
235	4.7	4.79	22.09
240	4.8	4.84	23.11
245	4.9	4.95	24.16
250	5.0	5.02	25.04
255	5.1	5.15	26.07
260	5.2	5.22	26.88
265	5.3	5.34	28.28
270	5.4	5.51	29.32
275	5.5	5.56	30.31
280	5.6	5.60	31.41
285	5.7	5.71	32.59
290	5.8	5.80	33.69
295	5.9	5.90	34.84
300	6.0	6.00	36.04

*Previously published data from voltage 0.1 to 2.4 Volts and current from 0.13 amperes to 2.44 amperes respectively.

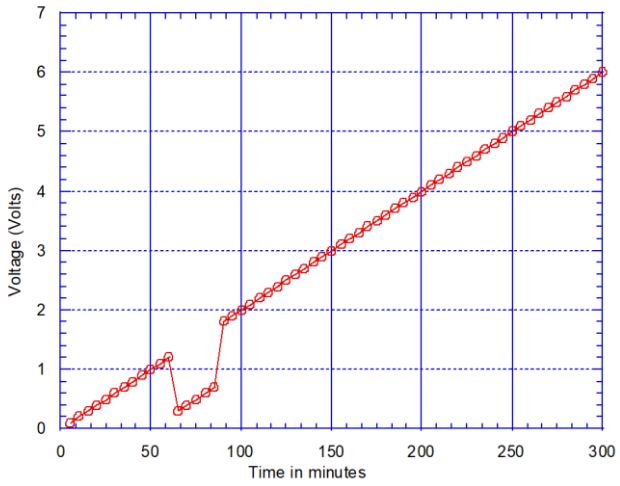

Fig.4 The variation of time in minutes versus voltage in Volts.

The figure 4 indicates the plot of variation of time in minutes versus voltage in Volts obtained from solar panel when it is exposed to sunlight. There is continuous increase in voltage 1.3 volts after that there is sudden decrease 0.3 volts as shown in fig.4.Again it gradually increases 0.6 and onwards it suddenly increases 1.7 volts. After that continuous increase in voltage was observed upto 6.0 volts as shown in above plot 4.

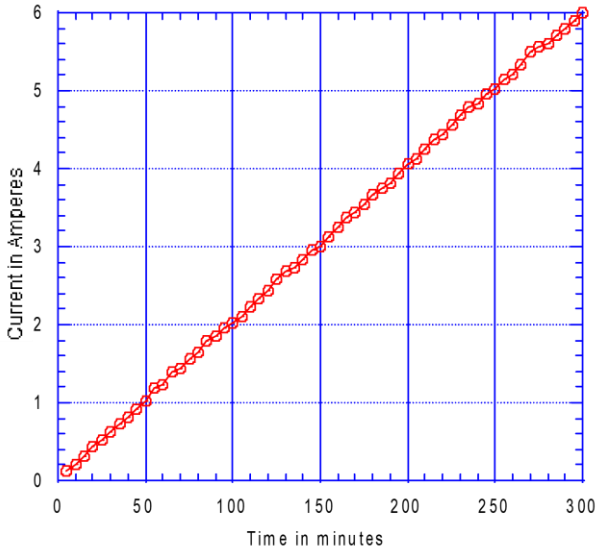

Fig.5 The variation of time in minutes versus current in Amperes

The figure 5 shows the graph of variation of time in minutes versus current in Amperes obtained from solar PV panel when it is exposed to sunlight. There is continuous increase in current upto 6 amperes with variation of time upto 300 minutes as shown in above fig. 5.

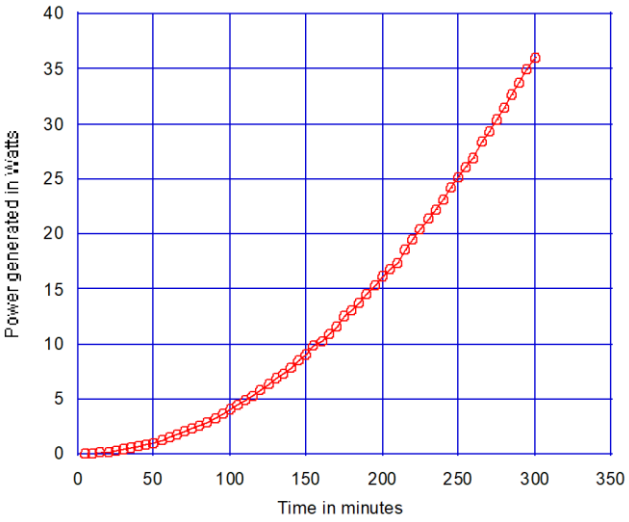

Fig.6 The variation of time in minutes versus power in Watts

The figure 6 represents the plot of variation of time in minutes versus power in Watts, obtained from solar panel when it is exposed to sunlight. There is continuous increase in power from 0.01 Watts to 36.04 Watts as shown in above fig.6.

IV. CONCLUSION

We used the solar panel or photovoltaic (PV) panels on which surface the sun light falls after successfully falling on its surface the solar (Photon) energy converts into electrical energy. The generated electricity can be stored in batteries or it can be utilized directly. Reading data from solar panel shows that there is voltage and current initially increases after some time it decreases again it continuously increases. However, the power in Watts remains continuously increases. However, the solar panel continuously absorb the photons from sunlight and generates the electricity. The 1.2 Volts five batteries having total 6.0 Volts voltage developed in the assembled circuit with 6.0 Ampere current. The total power generated from 6.0 V is 36.04 Watts as shown in table 1. Also, the figures 4 and 6 confirms it respectively.

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