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Development of Solar Powered Portable Tent for Flood Victims

Saharuddin Othman[1], Abdul Malik M. Ali [1] & A.B. Zurin Zuraida [2]
[1]Section of Electronics Technology
Universiti Kuala Lumpur British Malaysian Institute

Corresponding email: shahruddin @unikl.edu.my

Abstract: one of the most popular renewable energy sources is solar energy. The purpose of this project is to study on renewable energy and applied at Solar Powered Portable Tent for Flood Victims. This system is designed to generate electricity to support small appliances and to reduce overall cost. The equipment uses the thin-film solar cell as a source of energy which use as a power supply in the field and which is very excellent in the maintenance, supply and does not have noise, exhaust gas and exhaust heat The equipment consists of thin-film solar cell, solar controller circuit, inverter, car battery, rice cooker and tent. The thin-film solar cell generates the power into the car battery. The solar controller is already set up with the low voltage and high voltage. If the car battery drops until 9V, the solar will charge the battery until 12V and it will automatically cut off the solar from charging the battery. The inverter then converts the DC voltage from the car battery to the AC voltage. This design applies .for electrical usage in the tent such as lighting, laptop, charge cell phones and rice cooker.

Keywords: Portable electrical system, solar system, energy

1.0 INTRODUCTION

Renewable energy can be generally defined as source of energy that will not run out over time. However, it is unrealistic to expect the electricity supply utilities to plan the generation, transmission and distribution systems such that the supplies of electricity are never interrupted. Solar power provides an alternative to biomass-generated electricity, significantly reducing greenhouse gas emissions. Biomass and solar are the number one source of renewable energy in the country.

Nowadays, solar energy generation is becoming more and more important as a choice to conventional energy generation from fossil fuel. This is because solar power generates renewable energy, which are limitless, as compared to fossil fuel which are limited resources. Malaysia is one of the countries in the world that fight against climate change. The country's committed to reducing the carbon emissions brought by fossil fuel and has envisioned Green Technology to help conserve the environment for future generations [1]. The situation in Malaysia at large is no different. The government has also started to pay serious attention on the need to find and utilize renewable resources in addition to the current mix of energy supplies that it has. Apart from the apparent issues discussed, the country is also looking for ways to diversify the current energy resources. Although implementation of such project is going to be a long and tedious process, it is a worthwhile project to undertake in the long run consider that each hour, of every day, the sun supplies us with enough energy as the entire globe uses in a year. Solar power is an infinite resource, unlike coal, oil and gas. Don't need to worry about running out of sunlight in our lifetime [2].
Other solar technologies are passive. For example, big windows placed on the sunny side of a building allow sunlight to heat-absorbent materials on the floor and walls. These surfaces, then release the heat at night to keep the building warm. Similarly, absorbent plates on a roof can heat liquid in tubes that supply a house with hot water [3]. Solar energy is lauded as an unlimited fuel source that is pollution and often noise free. The technology is also simple and versatile. For example, solar cells generate energy in far- out places like satellites in Earth orbit and cabins deep in the Rocky Mountains as easily as they can power downtown buildings and futuristic cars [4]. But solar energy doesn't work at night without a storage device such as a battery, and cloudy weather can make the technology unreliable during the day. Solar technologies are also very expensive and require a lot of land area to collect the sun's energy at rates useful to lots of people. Despite the drawbacks, solar energy use has soared up at about 20 percent a year over the past 15 years, thanks

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to rapidly decreasing prices and increases in efficiency. Japan, Germany, and the United States are major markets for solar cells [5-8]. With tax incentives, solar electricity can often compensate for itself in five to ten years. Solar energy technology in Malaysia commonly uses stand-alone PV system. For flexible solar panels have a place in the world of tents they have to be lightweight, and they have to pull their weight; in other words, they have to benefit the bottom line. Textile manufacturers and scientists have been making on developing flexible solar panels using thin film technology. The construction of an extremely thin layer of a substance on a substrate since 1970s, but it is just recently that tented applications for solar panels are becoming viable options for tent manufacturers [9-12]. The solar power market is rapidly growing despite its cost. Because it has a longer lifespan compared to the other technologies, guarantees a long-term profit once it's installed, and greatest renewable energy source, more and more individuals plan to install solar technology to generate renewable energy that would be enough to power up home or business. A solar power technology of some type is also a good investment at some point, as this gives back up power, should you get a day or two of cloudy days, you will have reserve power stored up to use. However the objective of this project in it's to develop a solar powered portable tent for flood victims. Solar energy is the subjects of focus of this paper.

2.0 MATERIALS AND METHODS

There are couple of previous studies concerning solar energy distribution across the country. Both provided a considerable set of results on a countrywide basis. However, differences can be observed between these and the results achieved in this study. Unfortunately, as in the case of the wind, there is no properly recorded radiation data available for specific places throughout the country, except for one particular location, such as Kuala Lumpur. It is clear that the best source of information for evaluating the solar energy potential of a given location is radiation data.

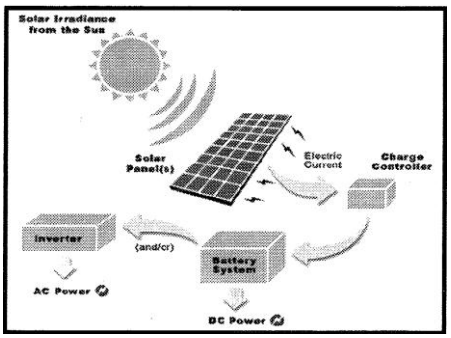

Fig. 1. Shows Solar System Block Diagram

This paper focuses on designing the solar powered portable tent for flood victims. It is only consists of hardware part which for input voltage is thin film solar cell and other circuit like PIC microcontroller and other related circuit.

The main device of this project is thin film solar cell as an input, battery and inverter. The thin film solar cell is use to detect UV light energy from sun which is the main sources. The film solar cell generates DC power from solar radiation to convert into electricity. Then the solar charge controller charged the battery and also prevents battery from being overcharging or damage. The LCD will display the battery voltage, high voltage that has been set at 12V, low voltage that has been set 11V. If the battery drop until 11V, the solar will charge the battery until it is become 12V and the solar charge controller will cut off. The inverter converts from the DC voltage to AC voltage. The battery will store energy and supply the AC power to the appliances.

A thin-film solar cell (TFSC) is a second generation solar that is made by depositing one or more thin layers, or thin film (TF) of photovoltaic material on a substrate, such as glass, plastic or metal. Thin-film solar cells are commercially used in several technologies, including cadmium telluride (CdTe), copper indium gallium diselenide (CIGS), and amorphous and other thin-film silicon (a-Si, TF-Si).

Film thickness varies from a few nano meters (nm) to tens of micro meters (μm), much thinner than thin-film's rival technology, the conventional, first-generation crystalline silicon solar cell (c-Si) that uses silicon wafers of up to 200 μm. This allows thin film cells to be flexible, lower in weight, and have less drag. It is used in building integrated photovoltaic and as semi-transparent, photovoltaic glazing material that can be laminated onto windows. Other commercial applications use rigid thin film solar panels, sandwiched between to panes of glass, used in some of the world's largest photovoltaic power stations shown in Table 1.

Thin-film has always been cheaper but less efficient than conventional c-Si technology. However, they significantly improved over the years, and lab cell efficiency for CdTe and CIGS are now beyond 21 percent, outperforming multi crystalline silicon, the dominant material currently used in most solar PV systems. Despite these enhancements, market-share of thin-film never reached more than 20 percent in the last two decades and has been declining in recent years to about 9 percent of worldwide photovoltaic production in 2013.

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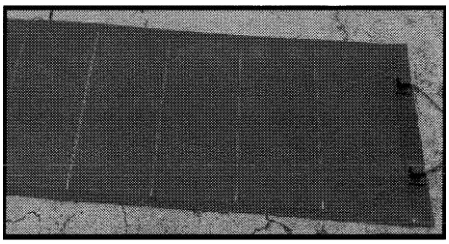
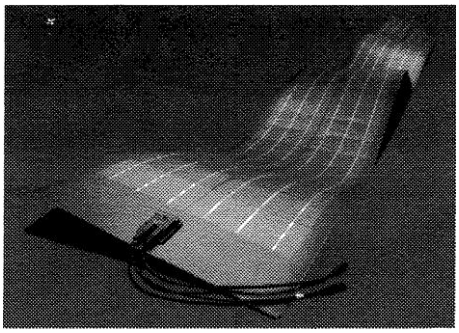


(a)



(b)

Fig. 2. Thin film solar cell or PV module (a) and (b)

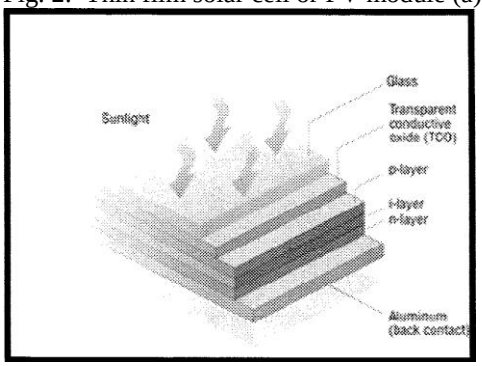
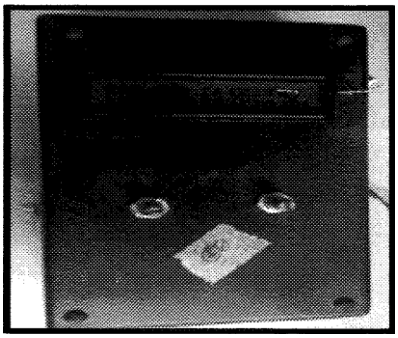


Fig. 3. Amorphous silicon

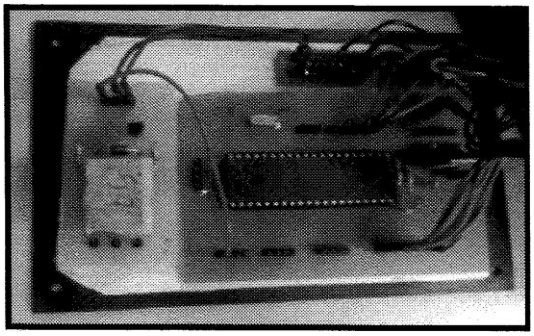
TABLE I
Datasheet for thin film PV module

Maximum power (Pmax)	83 Watt
Voltage at maximum power (Vmp)	16.7 Volt
Current at maximum power (Imp)	5Amp
Open circuit voltage (Voc)	22.5 Volt
Short circuit voltage (Isc)	6.35 Amp

Since the brighter the sunlight, the more voltage the solar cell produce, the excessive voltage could damage the batteries. A charge controller is used to maintenance the proper charging voltage on the battery. As the input voltage from the solar array rises, the solar charge controller regulates the charge to the batteries preventing any overcharging. Solar charge controller that adopts the most advanced digital technique and operates fully automatically. It has various unique functions and quite easy to use.



(a)



(b)

Fig. 4. (a) LCD display (b) Solar charge controller circuit diagram

PIC 16F877A-I/P microcontroller is used to control the whole program and the system. It is designed using flash technology. So the PIC can read/write program for more than 100,000 times. The PIC 16F877A has 8 K words or program memory. Since each word in the midrange family is 14 bits long the program memory can also be expressed as 14 Kbytes. The unit has 368 bytes of data ram and 256 bytes of EEPROM. It has 8 channels of A/D with 10 bit resolution. The unit has 8 bit timer/counter. In addition to this it has several different type series communications functions. OSC pin are connected to 20MHz crystal to execute every single line in the system. The used because this is the maximum frequency that the PIC can support. If over frequency the PIC will burn. Else if crystal speed less than 20MHz then PIC response speed will slower show in figure 4. The MCLR pin of the PIC is pull up to 5V through a 10KR resistor. The PIC can operate using 4.5V to 6.0V DC voltage. In the project is operating at 5.0 (by using7805). It is DIP layout (dual in line package) and is suitable for student project. It has 40 pins but only 33 I/0 pins can be set as digital input or digital output. The digital output of the PIC is 5V (for

signal 1) and 0V as signal 0. Any voltage less than 0V or more than 5V will damage the PIC.

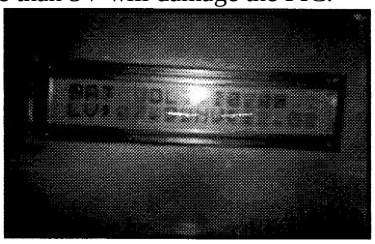


Fig. 5. Solar charge controller display

3.0 RESULTS

The solar powered portable tent for flood victims will be conducted for testing and experimental in order to test the performance, the ability of the drying thin film solar cell, battery charging of the battery. This process is requires to determine the performance and achievement of the project shown in Table 1 and Graph 1, 2, 3 and 4. In order to perform the test, thin film solar cell is located at the field where there is maximum intensity or high irradiance of sunlight. To measure the output, use multimeter to measure the voltage. By doing this method, the highest voltage and the lowest voltage produce compare to time is determined. Figure 5 shows the solar charge controller schematic diagram.

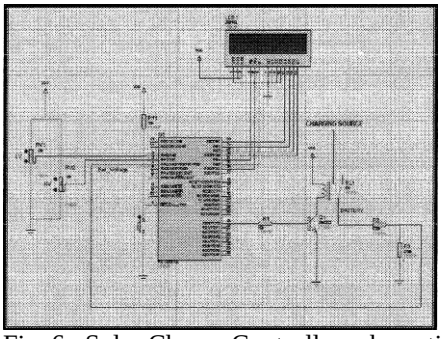
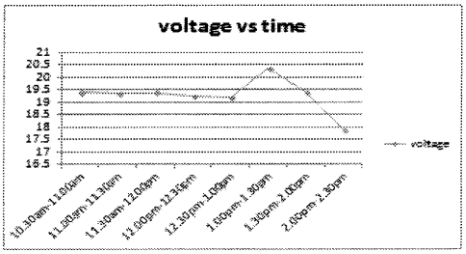


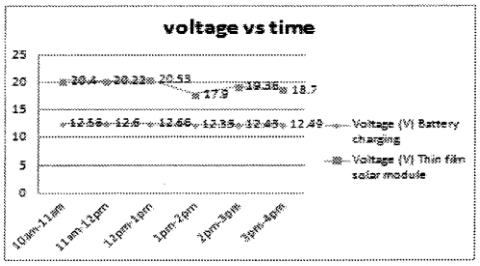
Fig. 6. Solar Charge Controller schematic diagram

TABLE 2
Data Collection for PV Panel

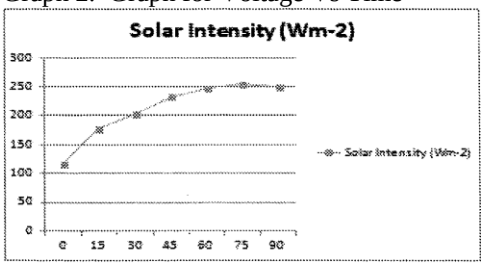
Time	Voltage
10.30am-11.00am	19.40
11.00am-11.30am	19.35
11.30am-12.00pm	19.38
12.00pm-12.30pm	19.26
12.30pm-13.00pm	19.20
13.00pm-13.30pm	20.34
13.30pm-14.00pm	19.40
14.00pm-14.30pm	17.86



Graph 1. PV panel result during experiment Voltage vs Time

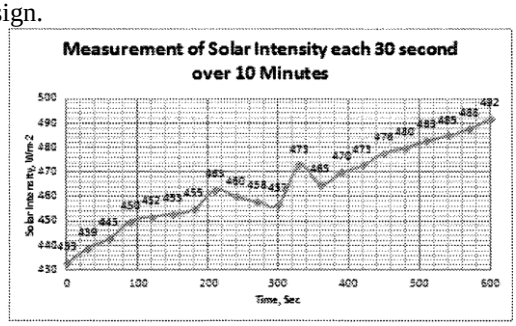


Graph 2. Graph for Voltage Vs Time



Graph 3. Graph for Solar Intensity

Based on the result and the testing for the solar charge controller the objective of this project has achieved. This device was successfully charge the battery. When the battery is fully charge, it will cut off the circuit from charging the battery. Therefore, with a lot of research on this device will improve from time to time. The testing process is a process to direct charge controller for photovoltaic system. The objective for this part is to test the output voltage produced by the solar module. The solar module is directly proportional to output voltage produced and charge battery. At the end of this chapter, this project has been upgrading their result for the quality performance of the design.



Graph 4. Graph for Measurement of Solar Intensity

From the result above, the time and voltage of the solar panel is important role. The result shows the measuring of output voltage for the thin film solar battery charging and output of the load. From the Graph 4 it is a result for drying the film solar module. Usually, the suitable times to produce high irradiance from the sun is in between 10am until 2pm. The result shows that the different output voltage of thin film solar module. At time 1.00pm to 1.30pm it has a high irradiance from the sun. So the output voltage is very high which is 20.34V From the Table 2 at time 1pm until 2pm, the output voltage of thin film solar module and the battery charging is less on that day because of cloudy weather. The intensity of radiation is very low is further affected by dust, fog and smoke. So it cannot absorb the power properly.

4.0 CONCLUSION

The project turned out to be successful. This solar powered portable tent for flood victims has been designed to help flood victims and to provide electricity supplies to the flood victims during flood season. Besides that, it generates the electricity using solar energy using green technology. It also can be used for the camping. This solar powered portable tent will give benefit to the community, especially to flood victims where it can be implemented during flood season to protect the victims. Sun lights gives energy to the solar module which will convert the energy into electrical power.

The heat that produce from the sun can also use to generate electricity. Throughout the project will gaining a comprehensive understanding and knowledge of how the solar cells can produce power. There are some limitations and problems occurred while doing this project and it must be prevented especially the component that has been used in this project, the thin film solar module, because it difficult to find the thin film solar module.

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