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Implementation of Micro Usb Charger TP4056 and Battery Indicator LED in Portable Solar Charge

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Abstracts

Mobile is a communication tool that is needed in today's era of globalization. The source of the cellphone's power is the battery which if the power goes out and the battery runs out, it is necessary to charge the battery to turn it back on. In this study, a portable solar panel-based charger was designed as an alternative to charging batteries without using a power source. The method used is research and development where this research produces a product. The results obtained indicate that the highest intensity value at 11:00 WIB is 5986 cd, the highest current value before entering the current stabilizer and voltage amplifier circuit is 0.004 A and the highest voltage is 5 V, for the current value after entering the current stabilizer and amplifier circuit. the overall voltage value is the same, namely 0.002A and 4V. This simple portable solar cell phone charger is able to supply power to the Nokia 215 Dual SIM for 5 hours and 30 minutes. There is an LED indicator on the portable solar charger where during the charging process it will be red, then after it is full it will be blue, and when it is running out it will be orange.

Keywords: Micro USB Charger, Solar Panel, Battery

1. Introduction

The rapid development of information and communication technology makes people unable to stay away from their gadgets, one of which is mobile phones. As it is known that one of the components in the cellphone is the battery. The battery has a limited capacitance so that if the cellphone is used for hours it will cause the battery power to weaken. To recharge the battery requires a charger that is connected to the power line from PLN. But if you are outside which makes it difficult to access electricity, it will cause its own problems. Therefore we need a cellphone charger that can be carried everywhere without worrying when there is no access to electricity.

Most of the portable chargers that are currently developing use a power source as a charger. With the depletion of world fossil fuel reserves and global issues, many parties are trying to popularize renewable alternative energy, one of which is by utilizing energy from sunlight into electrical energy that is environmentally friendly so that it will not have a negative impact [1].

To convert sunlight energy into electrical energy, a device called a solar panel is needed. A solar cell or solar cell is a device or component that can convert sunlight energy into electrical energy using the principle of the photolytic effect. The photoelectric effect is a phenomenon in which a material will release electrons when the surface of the material is exposed to light. The energy of the electrons released from the material is highly dependent on the energy of the light shining on it, while the number of electrons released does not depend on the energy but depends on the intensity of the light shining on the surface of the material [2]. The greater the intensity of the light that illuminates the greater the number of electrons that are released from the material. The number of electrons released determines the amount of current generated. The greater the current generated, the greater the power generated.

Referring to the previous research conducted by Dewi Yuanan Dewi & Antonov [3] with the title Utilization of Solar Energy as a Backup Supply in the Basic Electrical Laboratory at the Padang Institute of Technology; Yuni Rahmawati [4] with the research title Portable Solar Mobile Charger; and Siahaan dkk [5] with the title Implementation of Solar Panels Applied in Remote Areas in Residential Houses in Sibuntuon Village, Habinsaran District. So the author wants to make a Portable Solar Charger, and measure the intensity of sunlight on the voltage and current generated by the solar panels used in the Portable Solar Charger and test the charging time of the cellphone battery. In this study, it is different from the previous one where in this study using a micro USB TP 4056 and the addition of a battery charging indicator light.

2. Experiments Procedure

Type of research

This research is included in the category of development research because this research produces a product. Development Research is an attempt to develop an effective product for school use, and not to test theory.

Data Collection Method

Data retrieval is done by measuring the output terminals of the solar panels. To get the solar panel output voltage, the measurement is using a multimeter connected in parallel to the positive (+) terminal output to the negative (-) terminal, while to take the output current from the solar panel by directly connecting the multimeter measuring instrument in series to the positive terminal (+) solar panel output. To measure the intensity of sunlight, the measurement is carried out by measuring the intensity of sunlight using a light intensity measuring instrument.

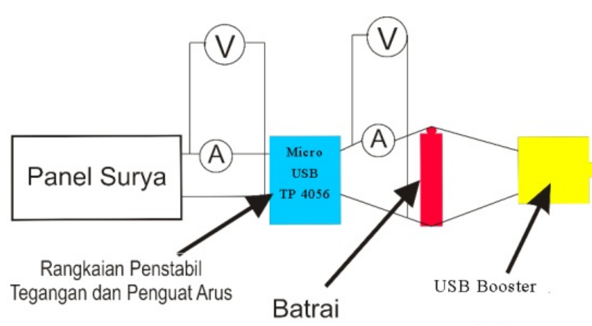

Figure 1. Solar Panel Measurement Circuit

The equipment used to collect data in the manufacture of this research include: 5V solar panel, voltage stabilizer circuit and current amplifier / Micro USB TP 4056, USB Booster, 1A Schottky diode, On-Off switch, multimeter, 3.7 V lithium Ion battery , measuring light intensity, as well as terminals / cables.

3. Result and Discussion

Research on the Implementation of Micro USB Charger TP4056 and LED in Portable Solar Charger as a battery indicator is used to determine the relationship between the intensity of sunlight with current and voltage, besides that it is used to determine how long this portable charger is able to charge cellphone batteries. The solar cell used in this study uses a polycrystalline type, 5 VDC, 220 mA, and has a cross-sectional area of 11 x 6.9 cm.

Measurement of current and voltage on solar panels is carried out at two locations, namely before and after entering the voltage stabilizer and current amplifier circuit. The following table measures the intensity, current and voltage before entering the voltage stabilizer and current amplifier circuit. While the table for measuring intensity, current and voltage after entering the voltage stabilizer and current amplifier circuit is shown in table 2.

Table 1. Measurement of current and voltage intensity before entering the voltage stabilizer and current amplifier circuit

NO	Time (WIB)	Light Intensity (Lux)	Current (A)	Volt (V)	Power (W)
1	09:00	5768	0.0015	4.7	0.00705
2	10:00	5973	0.0035	4.7	0.01645
3	11:00	5986	0.0040	5.0	0.02000
4	12:00	5933	0.0030	5.0	0.0150
5	13:00	5879	0.0020	4.8	0.0096
6	14:00	4911	0.0015	4.6	0.0069
7	15:00	4089	0.0010	4.5	0.0045

Table 2. Measurement of Current and Voltage Intensity After Entering the Voltage Stabilizer and Current Amplifier Circuit

NO	Time (WIB)	Light Intensity (Lux)	Current (A)	Volt (V)	Power (W)
1	09:00	5768	0,002	4	0,008
2	10:00	5973	0,002	4	0,008
3	11:00	5986	0,002	4	0,008
4	12:00	5933	0,002	4	0,008
5	13:00	5879	0,002	4	0,008
6	14:00	4911	0,002	4	0,008
7	15:00	4089	0,002	4	0,008

Through Table 2 measurement of intensity, current and voltage before entering the voltage stabilizer and current amplifier circuit, the highest intensity value was obtained at 11:00 WIB, which was 5,986 lux, during the period 09:00 WIB to 15:00 WIB the highest current value was 0 .0040 A while the highest voltage value is 5 V. The current and voltage values occur at 11:00 WIB. So the average voltage and current produced is:

$$\sum I = 0,0165 \text{ A}$$
$$\sum V = 33,3 \text{ V}$$
$$\sum Intensitas \text{ Cahaya} = 28529 \text{ lux}$$
$$n = 7$$

$$\bar{I} = \frac{\sum I}{n} = \frac{0,0165 \text{ A}}{7} = 0,00236 \text{ A}$$

$$\bar{V} = \frac{\sum V}{n} = \frac{33,3 \text{ V}}{7} = 4,76 \text{ V}$$

$$\text{Intensitas Cahaya} = \frac{\sum Intensitas\ Cahaya}{n} = \frac{28529 \text{ cd}}{7} = 5505,57 \text{ lux}$$

A cross-sectional area of the solar panel of 0.00869 m2, the power that can be captured by the solar panel is 1.1 W. After calculating it is known that the average voltage current value is 0.00236 A, the efficiency value of the solar panel is

$$\eta = \frac{V.I}{P.A}$$

$$\eta = \frac{4,76\ .\ 0,00236}{1,1\ .\ 0,00869}$$

$$\eta = 1,175\%$$

The current and voltage values after entering the voltage stabilizer and current amplifier circuits from 09:00 WIB to 15:00 WIB are 0.002 A and 4 V. These values are constant which indicates that the voltage stabilizer and current amplifier circuits are working optimally. In Figure 4.3 it can be seen that the liner current and voltage mean that the greater the value of a current that enters the circuit, the greater the value of a voltage. But at a certain time, namely at a voltage of 4.7 v, it has two current values, namely 0.0035 A and 0.0015 A, this is contrary to the conception that the higher the value of a voltage, the higher the current value.

Based on the previous results of research, the highest fall was at 11:00, while the weather factor was the cause, namely at 11:48 WIB, there was a change in the weather, which was originally direct sunlight on the solar panel to be covered in a few minutes by black clouds. In addition, there are other factors that influence this research, namely the placement of a luxmeter (a tool to measure light intensity) meaning that if the luxmeter is placed before the 5-minute test, the light intensity value obtained is not as valid as the luxmeter that is placed 10 minutes before the test is carried out . This is because when placing the luxmeter next to the solar panel requires adjustment to the perfect sunlight. Likewise, the solar panels for which this test is carried out need to be placed 10 minutes before current and voltage measurements are taken either before or after entering the voltage stabilizer and current amplifier circuit.

The cellphone used for testing this research is the Nokia 215 Dual SIM with a capacity of 1100 mAh and the voltage is 3.7 V, the time it takes for the Portable Solar Charger to fully charge the cellphone is 5 hours 30 minutes. There is an orange LED indicator that states the process of charging the cellphone. After testing the Nokia 215 Dual SIM mobile phone, testing the Portable Solar Charger Mobile battery until it runs out, the results state that when the Portable Solar Charger battery runs out the LED will blink, with this indicator the USB Booster circuit has been successful.

4. Conclusion

The highest light intensity value is at 11:00 WIB, which is 5986 lux, the highest current value before entering the current stabilizer and voltage amplifier circuit is 0.004 A and the highest voltage is 5 V. For the current value after entering the current stabilizer and voltage amplifier circuit as a whole the value is the same, which is 0.002 A and the voltage is 4V. The efficiency value obtained in this study was 1.175%.

Portable Solar Mobile Charger can fully charge the Nokia 215 Dual SIM mobile phone in 5 hours 30 minutes. The LED indicator installed on the TP4056 Micro USB circuit gives two signals, namely if the LED is red, the Portable charger is charging the battery connected to the solar cell, while the blue LED indicates that the solar cell battery is full. The LED indicator installed in the USB Booster circuit also gives two signals, namely when the LED color is orange without flickering, indicating that the solar panel battery is full and can be used, while if the LED is orange with flickering, the solar panel battery will run out. Factors that influence include weather factors, placement of solar cells and luxmeters (tools for measuring light intensity).

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