

# Electric Autoped Design using Solar System as Transportation Media

Amani Darma Tarigan<sup>1</sup>, Pristisal Wibowo<sup>2</sup>, dan Adi Sastra Tarigan<sup>3</sup>

<sup>1,2,3</sup> Universitas Pembangunan Pancabudi

<sup>1,2,3</sup> Jl. Gatot Subroto, Km. 4,5 Sei Sikambing Medan, 20122

**Abstract:- Autoped is a transportation media that can be used to transport a person or an object from one place to another. In addition to its slim size, another strength of autoped is that it can be used everywhere. However, its weakness is that it is not equipped with a device to operate the vehicle. It is operated only by pushing it forward using the power of foot and not by using pedal or machine as other conventional vehicle. Based on these facts, the researchers attempt to innovate using Solar Panel to charge the battery. The installation of 20 Wp solar panel can generate maximum voltage of 19.5 Volts during sunny weather. The process of battery charging requires 4.135 hours for a 12V battery with the capacity of 12 Ah. Therefore, the electricity consumption can be minimized especially during the charging process. This Electric Autoped can be utilized as a transportation replacement for short distant transportation and to replace the fossil fuel energy.**

**Keywords:-** *Electric Autoped, Solar Panel, Electric Motor.*

## I. INTRODUCTION

The world of automotive industry has vital role in our life. This industry supports the activities in the field of industry and personal life. Cars and motorcycles have become the most favorite transportation to help create a better life.

A vehicle uses propulsion engine as the main basis which requires fuel as energy that converts liquid to kinetic energy. However, the amount of fuel as main commodity has been decreasing in production and has been claimed to be environmentally unfriendly energy.

Bicycle is not a priority vehicle for public and its function nowadays has been shifted to premium sport vehicle. It has been innovated into various models and sizes, one of which is autoped.

Autoped is a transportation media that can be used to transport a person or an object from one place to another. In addition to its slim size, another strength of autoped is that it can be used everywhere. However, its weakness is that it is not equipped with a device to operate the vehicle. It is operated only by pushing it forward using the power of foot and not by using pedal or machine as other conventional vehicle.

There are some ideas to generate alternative electrical energy source which can be utilized to operate the autoped. One of which is by developing solar power plant because the sun is the easiest source of energy to find. It is expected that

this solar power plant can be used as alternative energy source to operate the autoped.

This research discusses solar power plant system that will be implemented to operate the autoped. The solar power plant will generate the electrical energy source as the main energy. By using solar panel as energy converter from sunlight to electricity, a battery will also be used as the main electrical power storage. This system is expected to provide ease of electrical autoped operation.

## II. LITERATURE REVIEW

### A. Solar Cell

Solar cell or Photovoltaics is electricity semiconductor that can directly and efficiently convert light to electricity. This Photovoltaics effect was discovered by Becquerel in 1839, he detected a photovoltaics when he exposed one of the electrodes to light in electrolytes. This device is individually used as a light detector on a camera, either combined in series or parallel, to obtain a desired value of electrical voltage as electricity generator [1].

### B. Inverter

Inverter functions to turn Direct Current (DC) generated by solar panel into Alternating Current (AC) which has been used in electronics. In selecting an inverter, Watt-hour capacity needs to be considered. It is recommended to choose an inverter that has suitable capacity so it can function optimally [2].

### C. Voltage Sensor

Voltage is a parameter in the world of electronics both in digital and analog. It is an analog unit so the voltage in analog electronics can be directly processed or converted to other forms or level. While in digital world, the discrete voltage will be converted either using ADC (Analog to Digital Converter) or DAC (Digital to Analog Converter) [3].

### D. LCD (Liquid Crystal Display)

LCD (Liquid Crystal Display) can be used to display things related to microcontroller activities, one of which is to display the text consisting variety of characters. It is widely used because of its various functions and easy programming [4].

### E. SCC (Solar Charge Controller)

Solar charge controller is a component of solar power plant that functions to regulate the battery charging (when the battery should be charged and keeping batteries from overcharging) and regulate current coming from the solar

panels going to the battery as well as the current coming out from the battery. Solar charge controller usually consists of one input (2 terminals) connected to solar panel output, 1 output (2 terminals) connected to the battery or accumulator, and 1 output (2 terminals) connected to electrical load. It is impossible for DC current coming from the battery to get into the solar panel because diode protection only passes through the DC current from solar panel to the battery [5].

### III. RESEARCH METHODS

#### A. Research Flowchart

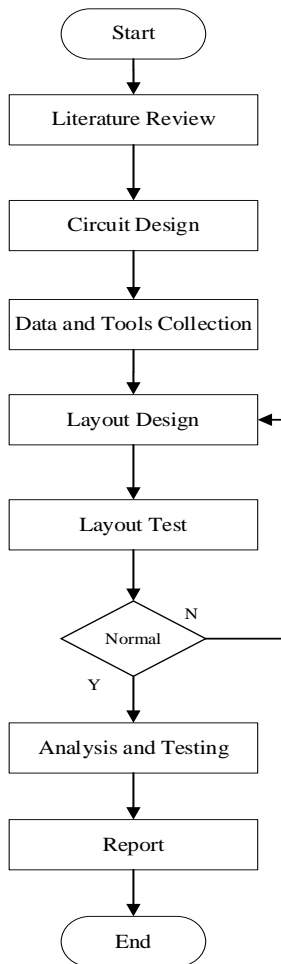


Fig 1. Research Flowchart

#### B. Type and Scope of Research

This quantitative research uses discrete data and continuum data, namely data is obtained in the form of numbers collected from literature and experiment or measurement. The research is limited to the utilization of Renewable Energy.

#### C. Data Collection Technique

Data obtained can be classified into three categories namely facts, opinion, and ability. This research aims to find out the charging potential of solar panel in scooter which is measured through test or experiment. Therefore, data were collected by conducting observation and experiment or

measure the charging of solar panel in scooter to draw the conclusion.

#### D. Data Analysis Method

Data were analyzed by using evaluation method which was conducted by comparing events, activities and products with determined standard materials.

### IV. RESULTS AND DISCUSSION

#### A. Research Equipment

Table 1. Equipment Specification

No	Equipment	Specification
1	Solar Panel	20 Wp
2	Battery	12V/5Ah
3	SCC	12-46 V
4	Brushless Motor	36 v
5	DC Motor Controller	-

#### B. Equipment Installation



Fig 2. Preparation for Equipment Installation



Fig 3. Preparation for Equipment Testing

#### C. Testing Results

Equipment testing was conducted to obtain suitable data for the research. Data obtained, such as:

Table 2. Solar Panel Testing Result

Time	P1			
	SCC (Volt)	Multi (Volt)	Index UV	Weather (°C)
11.00	18.7	18	7 per 10	28
12.00	18.8	18	10 per 10	30
13.00	20.3	19,5	Extreme	31
14.00	19.7	19	Extreme	32
15.00	18.9	19	7 per 10	30
16.00	18.7	18	5 per 10	30

Based on the result of voltage measurement in extreme weather of 31°C as showed in table 4.4, it can be seen that the highest voltage generated by solar cell is 20.3 Volts in Solar Charge Controller (SCC) and 19.5 Volts in Analog Multimeter at 1 pm while the lowest voltage is 18.7 Volts in 4 pm. In a slightly cloudy weather, the highest voltage generated by solar panel is 19.2 Volts in SCC and 18 Volts in Analog Multimeter while the lowest voltage is 14.4 Volts in SCC and 14 Volts in Analog Multimeter at 11 pm.

Table 3. Battery Testing

Time (Minute)	P1		P2		P3	
	LCD (Volt)	Multi (Volt)	LCD (Volt)	Multi (Volt)	LCD (Volt)	Multi (Volt)
10	35.08.00	36	35.07.00	35.05.00	35.07.00	35.08.00
20	-	35.05.00	-	35.02.00	-	35
30	-	35.05.00	-	35	-	35

The measurement was conducted to compare direct measurement result from the battery when the DC Brushless motor was loaded with 36 volts.

Therefore, the charging duration should be 4.135 hours.

V. CONCLUSION

From the designation and experiment conducted in this research, it can be concluded:

1. An electric scooter which has been designed can run properly using battery as source of energy.
2. Source of battery charging can be modified using solar panel as renewable energy.
3. 20 wp solar panel can generate the highest voltage solar cell which is 20.3 Volts in SCC and 19.5 in a sunny weather.
4. 36 Volts DC motor requires 3 pieces of 12V batteries with the capacity of 12 Ah in series connection as main power source.
5. The length charging duration is 4.135 hours for one battery usage.

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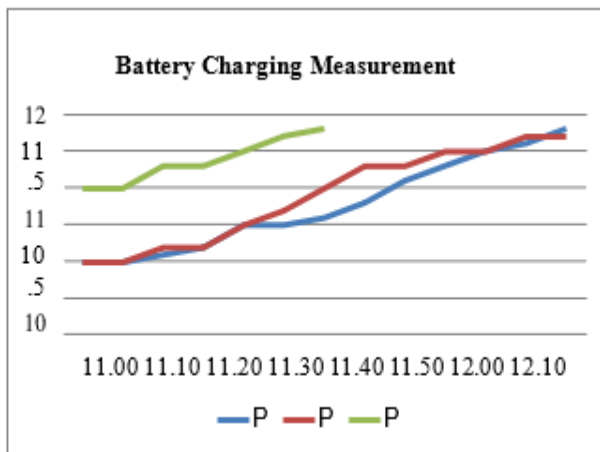


Fig 4. Battery Charging Graphic

From the measurement result, it can be seen that there is an increase in voltage from 10 Volts to 11.8 Volts namely in the amount of 1.8 Volts. The charging speed depends on the weather condition during the process of charging. If the weather during the charging process is cloudy, the solar panel receives less sunlight and the voltage generated will also be small. This condition will influence the battery charging.

The measurement of charging duration result is  $T_b = P_a / P_s$ , with  $P_a$  = Battery Power (Watt), and  $P_s$  = Solar Cell Power (Watt).

So,  $P_a = 3.5 \times 12 = 42$  Watts

$P_s = 0.57 \times 17.82 = 10.1574$  Watts

So,  $T_b = 42/10.1574 = 4.135$  hours for one battery.

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