

# Determination of BLDC Motor Capacity for AL QORNI Electric Car Drive

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## Determination of BLDC Motor Capacity for AL QORNI Electric Car Drive

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### ARTICLE INFO

### ABSTRACT

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The study's objectives were to: determine the type of Brushless Direct Current (BLDC) motor that is right for an electric car drive system with a capacity of one passenger, and Knowing the capacity of the BLDC motor used as an electric car drive system with a capacity of one passenger. This research uses Research and Development (R&D) level 1. The research subjects taken are students and lecturers of Vocational Education, Automotive Technology and Electrical Engineering, Ahmad Dahlan University, totalling eight students four lecturers. Ahmad Dahlan University "AL-QORNI " electric car is planned to use an electric motor type Brushless Direct Current (BLDC) with a capacity of 2000 watts which works with voltage of 49 volts - 96 volts.

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### Introduction

The rapid development of science and technology gave rise to an idea to make alternative vehicles a substitute for oil-fueled vehicles, namely, environmentally friendly renewable vehicles. Electric-based vehicle drives have been developed to replace the combustion motor or work simultaneously; these vehicles are electric vehicles and hybrid electric vehicles (Emadi et al., 2008), (Sanz et al., 2018). An electric car is a car that is driven by a DC electric motor, uses stored electrical energy in a battery or storage area energy (Wikipedia, 2021). For the discourse of environmentally friendly cars, it can be applied to vehicles used to cars as a driving source.

The use of electric cars is considered more effective because, apart from not causing pollution, the construction is more straightforward, smoother, durable, and has high energy efficiency than oil-fueled vehicles. The overall efficiency of an electric car is 48% in electric car, whereas in an oil-fueled vehicle, it is only about 25% efficiency. Thus, driving a vehicle with the same weight as an electric vehicle will only require much lower energy (Indoenergi, 2012). Based on electric cars research, reaching a distance of up to 120 kilometers involves a fee of only IDR 75,000. Meanwhile, if you use gasoline, it will cost twice as much (Seva, 2020).

With the above background, a concept of making an electric car with a capacity of one passenger will be born. Along with the times, the need for motors that have high efficiency, high torque, high speed and can be varied, and low maintenance costs are increasing. It's just that the motors used in general today, namely DC motors and induction motors, have not been able

to meet these needs. DC motors have high efficiency because of the DC voltage on the rotor to drive the motor.

This study aims to: (1) determine the type of BLDC motor that is right for an electric car drive system with a capacity of one passenger. (2) Knowing the capacity of the BLDC motor used as an electric car driving system with a capacity of one passenger.

Based on the descriptions above, the researchers are interested in conducting a study titled "Determining the Capacity of a BLDC Motor to Drive an AL-QORNI Electric Car, Ahmad Dahlan University".

### Method

This research on the design of direct current brushless motor capacity (BLDC) uses a research and development design ( Research and Development ). Richey and Client (in Sugiyono, 2017, p. 39) (Suyitno, 2018) argue that "the focus of design and development research is analysis from start to finish, which includes design, production and evaluation. Researchers use level 1 research and development, where Researchers researched to produce a plan. However, it was not continued by making a product and testing it because it was still in the design stage of what capacity the BLDC motorbike was suitable for the AL-QORNI electric car.

### Result and Discussion

Validation data by design experts are used to obtain input about the design being developed. The input results are used as consideration for design feasibility. As a design expert, Alfian Ma'arif ST, M.Eng as the validator, the validation time was held on January 2020 at the AL-Qorni workshop, Ahmad Dahlan University. The design validation uses a design description that contains an electrical design drawing and is attached with a design description to determine the feasibility of the AL-QORNI electric car electrical design on Figure 1 and Table 1.

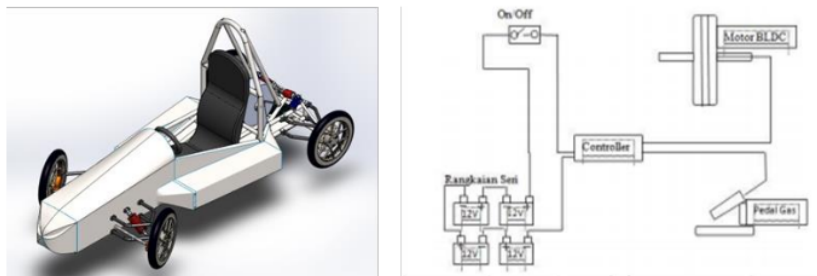


Figure 1. The Electrical Design of the AL-QORNI Electric Car

**Table 1.** assesment The Electrical Design of the AL-QORNI Electric Car

No	The assessment aspect	Skor		
		PS	ST	SA
1	Display	15	20	3
2	Alignment of form	3	4	3
3	Emphasis	8	8	4
4	Unity	7	8	3,5
5	Communicative	8	8	4
6	Harmony	4	4	4
7	suitability of the theme	8	8	4
(Σ) amount		53	60	3,53

In this case, the magnitude of the validation results carried out by design experts by Alfian Ma'arif ST, M.Eng is 3.53. The assessment scale uses a scale of 4 and is included in the perfect category. Experts also provide input in the form of revisions to the design. It is refined by giving an electrical circuit SKEMA to the AL-QORNI electric car frame design, and the researcher has revised it.

#### Selected motor type

Researchers chose the Brushless Direct Current (BLDC) electric motor of the various electric motors available. Motor type BLDC is used and installed in the rear frame and then connected with chains to drive the axle.



**Figure 2.** 2000-watt BLDC

Yakob Liklikwatil (2014: 11) explained that an electric motor is a motor that works by electric power. The motor's moving (the rotating horizontal) caused their force and torque provided by the primary energy. The glance motor rotates due to the electromagnetic power and torque in the air gap inside the engine. BLDC electric motors for the transportation system must meet the following criteria: have large torque and the speed is easy to set (Hughes, 2006), (Yedamale, 2002), (Condit, 2010).

The advantages of BLDC compared to other motor types include:

- a. High-Speed Operation, a BLDC motor can operate at speeds above 10,000 rpm under loading and unloading conditions.
- b. Responsive & acceleration, the rotor of the Brushless DC motor has low rotor inertia, which allows this motor to accelerate, decelerate and reverse direction quickly.

- c. High Power Density, BLDC motor has the highest running torque per cubic inch of any other DC motor.
- d. High reliability, BLDC motors do not have brushes, so this type of motorbike has a high enough resistance and a lifetime to reach 10,000 hours of use.
- e. Free is better to fight the power characteristic round
- f. f.High efficiency and long-lasting or more remaining life long
- g. Virtually silent when operated

#### **BLDC motor capacity**

According to(Wilberg, 2003) The BLDC motor is a DC motor exchanged the inside and outside. Within other words the coil is on the outside and the magnet is there on the inside Researchers chose a BLDC motor with a capacity of 2000 watts, which can work at a voltage of 48 V ~ 96 V. The speed that this motor can produce is 30 km / h ~ 70 km / h. This motor is capable of producing a torque of 85Nm ~ 135Nm.

#### **Controller**

According to (Wiberg, 2003), motor Normal DC is very easy for control speed and direction. For just enough speed control provide a variation of the input voltage. For change direction, simply reverse the polarity. Speed is often controlled by pulse width modulation for DC motors and Brushless motor. The controller is one part of the most vital BLDC motor, in which all the parameters input is processed at the this. Researcher chose Kelly Controller KEB72451 controller can be programmed to connect with laptop or PC and adjust according to taste spec (Suyitno, 2005; Suyitno, 2019). Peak Current, working voltage, throttle sensitivity, torque/speed mode, etc. One trivial but very functional thing is that this controller is equipped with a system for turning the motor into reverse (backwards and forward).



**Figure 3.** Kelly Controller KEB72451

### **Conclusion**

From the results of this research and development, it can be concluded that the Ahmad Dahlan University " AL-QORNI " electric car is planned to use an electric motor type Brushless Direct Current (BLDC). Ahmad Dahlan University's " AL-QORNI " electric car uses BLDC with a capacity of 2000 watts which works with a voltage of 49 volts - 96 volts.

Based on the results and conclusions of the researchers, there are several suggestions given, including selecting the appropriate components to maximize car performance. In designing the electrical design, it is necessary to pay attention to the vehicle's total weight because it dramatically affects the motorbike's performance. Do more in a comparative study to get a reference about electric cars.

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