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ELECTRIC SYSTEMS IN SULA ELECTRIC CARS IN SULA ELECTRIC CARS' SUBANG STATE POLYTECHNIC

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ABSTRACT

The making of electric cars in POLSUB is intended to be further developed by the junior level and as a medium for applying the electrical system to SULA electric cars. The right method for applying the electrical system to Sula's electric car16 is by reading the wiring diagram. Wiring diagram reading is useful to produce a neatly arranged wiring system and can reduce the obstacles contained in the electrical system in electric cars Sula. The results obtained from electrical installations on electric cars Sula produce a final voltage of 49.79 and watt hours 53.2 in a distance of 10 Km. From these results it can be concluded that the electric car is included in the category of energy saving.

Keywords: SULE electric cars, electrical system

INTRODUCTION

Vocational education aims to produce students who are experts in their fields, one of the fields of vocational education is implemented in polytechnics. Polytechnic is a higher education that creates engineers to improve the quality of human resources [1].

Electric cars are one of the breakthrough innovations in the highly developed automotive world. Added by Khumaedi [2] Electric cars have several potential advantages when compared to ordinary internal combustion engine cars. The main thing is that electric cars do not produce motor vehicle emissions. The working principle of an electric car is the controller input obtained from the accelerator and brake pedals. This controller provides the appropriate signal to the electronic power converter which regulates the flow of power between the electric motor and the battery [3]

One of the stages in making an electric car is the wiring controller installation stage. Added by Fathurrozak [4] Installing wiring controller is the process of assembling the electrical components in an electric car so that the vehicle can run using electric power sent from the battery to the controller component so that it is changed from electric power to rotational power which can be adjusted the amount of current through the throttle component to move the electric motor in accordance with the desired speed.

The development of electric cars at the Indonesian tertiary level is very fast developing. Many electric cars are made to participate in the competition of the Indonesian Electric Car Competition (KMLI) in every tertiary institution. There are many different types of universities, universities that have electric cars for KMLI competitions including: UNY, UGM, UII, ITS and UNJ. In West Java, there are also many universities that have electric cars including: Indramayu State Polytechnic, Subang University, TEDC Polytechnic, Bandung State Polytechnic [5].

In the electrical system of an electric car, consisting of several components needed for the installation of the installation process. According to Khumaedi [2] a brushless direct current (BLDC) electric motor is a motor that has good efficiency, is more reliable, has a longer and cheaper life. Motor that has a rotor in the form of a permanent magnet and a stator in the form of a winding to produce a magnetic field. Changing the polarity of a BLDC motor is done electronically using a hall-effect sensor and a rotary encoder. Batteries are electrochemical cells consisting of a pair of electrodes (cathodes-anodes) and electrolytes, these cells function as a source of electrical energy obtained as a result of the conversion of chemical

energy through the redox reaction (reduction and oxidation) Hidayat [6].

Throtlle is one of the main completeness devices on the prototype of an electric car that functions as a speed regulator on the drive, which is a brushless motor. Zuhfrianto [7] Controller is an electronic circuit that regulates the speed of an electric motor that is by regulating the amount of current and voltage to the electric motor, so that the rotational speed (RPM) in accordance with the wishes of the driver through the speed pedal (Throttle) speed pedal usually contains a potentiometer or variable resistor. Fatkhurrozak [4] MCB (Mini Circuit Breaker) is an automatic safety device used to limit electrical current. This safety device can also be useful as a switch. In use, these safeguards must be adjusted to the amount of electricity installed. Wijaya [8] work accidents can be avoided if technicians who do practical work comply with established rules.

RESEARCH METHOD

The SULA electric car construction process will be carried out from January 2, 2019 until completion. The SULA electric car is housed at the Subang State Polytechnic Directorate, Mechanical Maintenance and Repair Workshop.

In the initial stages, researchers conducted a literature study to search for data by field observations to experts, as well as searching data through journals and articles related to material about the electrical system, preparation of tools and electrical materials to assemble the electrical system, after that the validation stage was making wiring diagrams and ask for opinions from experts and get authorization from experts in the field of electricity that can be tested for truth, then the stage of working on a process where the installation of components in the electricity. Performance test is a process where the electrical system on the electric car has been installed all. The research stages can be seen in Figure 1.

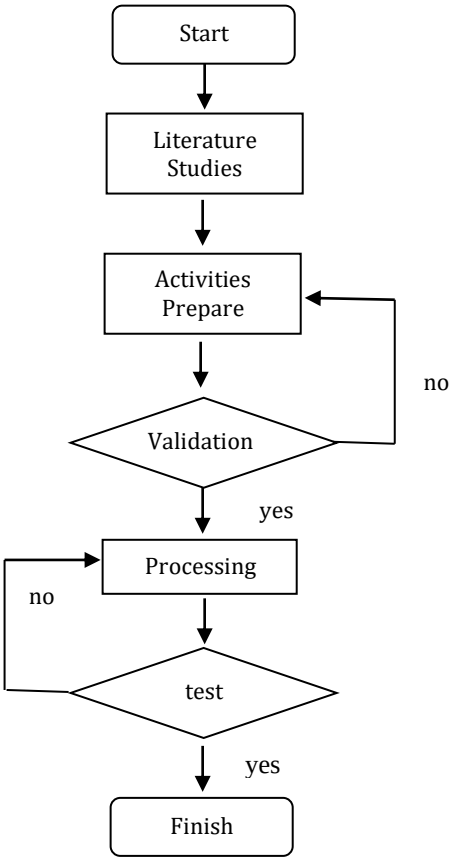

Figure 1. Research Stages

RESULTS AND DISCUSSION

Tools and Materials

Electricity preparation in the installation process requires tools and materials to assemble the electrical system. After that, make a wiring diagram that must be validated first with the experts. The following are tools and materials and wiring diagrams that have been prepared. Added by Efendi et all [9] it was made clear by adhan that preparation was needed in the process of making the circuit so that the system ran well.

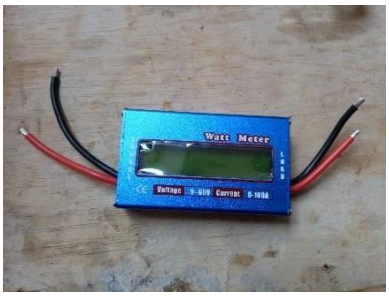

Figure 2. Watt Meter

The Watt Meter in the Sula electric car circuit serves to measure the working voltage and current. In addition, the watt meter is an indicator when the battery usage has weakened.

Figure 3. Battery Vise

The battery vise is used as a link between the cable and the battery terminals. Battery accu used is made from brass. This brass material is very good for delivering electric current that flows.

Figure 4. Battery

Accu on Sula's electric car is used as a source of electricity storage. The battery used has a capacity of 12 Volts and 32 Amperes.

Figure 5. Soldering Iron

Soldering is used for connecting cables. The cable connection must be done with flux added material or called Tinol.

Figure 6. Cutting Wirring

Cutting wiring is used to cut the ends of the cable that will be connected and heated skun. Cutting wiring has a gap for various types of cable diameter sizes

Figure 7. Screwdriver

Screwdriver is used to tighten the bolts found in the electric system of the Sula electric car. The screwdriver used in the electrical system is a screwdriver (-).

Figure 9. Combination Pliers

Combination pliers are used to clamp objects, for example to tighten the lock from the skun by using a combination pliers

Figure 9. Throtlee

Throtlee is to regulate the current flowing. Throtlee is useful for adjusting the desired rotation speed on an electric motor.

Figure 10. On/Off Lever

The On / Off lever is useful for connecting the electric current to the electric system of Sula's electric car

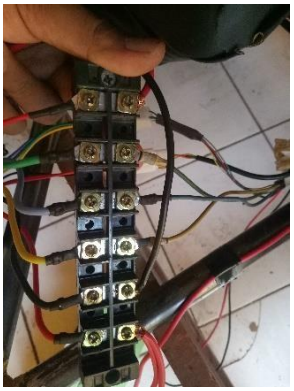

Figure 11. Terminal

Terminals are used to permanently connect electrical current to the cable.

Figure 12. MCB

MCB used in Sula's electric car functions to break the flow of electricity. MCB can also be used as a safety to prevent overload.

Figure 13. Socket

Socket is used to connect multiple cables. The socket must be adjusted first with the initial socket available.

Figure 14. Controller

The controller on Sula's electric car functions as a control system that forwards commands from other components to run the electric motor. Added by [10] the electrical system assembly process is required the application of occupational safety and health in order to reduce the risk of accidents

Figure 15. Motor Listrik

The electrical system assembly process is required the application of occupational safety and health in order to reduce the risk of accidents..

Figure 16. Battery Charger

The Accu charger is used to fill the electrical energy needed by the battery to be able to flow electric current in the electric system of Sula's electric car

Figure 17. Cabel

The cable is used as a medium for conducting electric current that works on Sula's electric car. cables used are red and black. For the diameter of the cable, there are two types, namely 0.75 mm and 1.5 mm.

Figure 18. Rivet Rope

Rivet straps are used to tie a cable path to the Sula electric car. Besides rivet straps can also make the wiring path to follow the shape of the car frame.

Figure 19. Tinol

Tinol is useful as an added material when connecting a cable. Tinol can glue cable connections and tidy up the messy cable connections. preparation of tools and materials is used to support the implementation process of making electricity system electric car Sula. the research team then developed an electricity scheme which will be used later.

Electrical Wiring Diagram

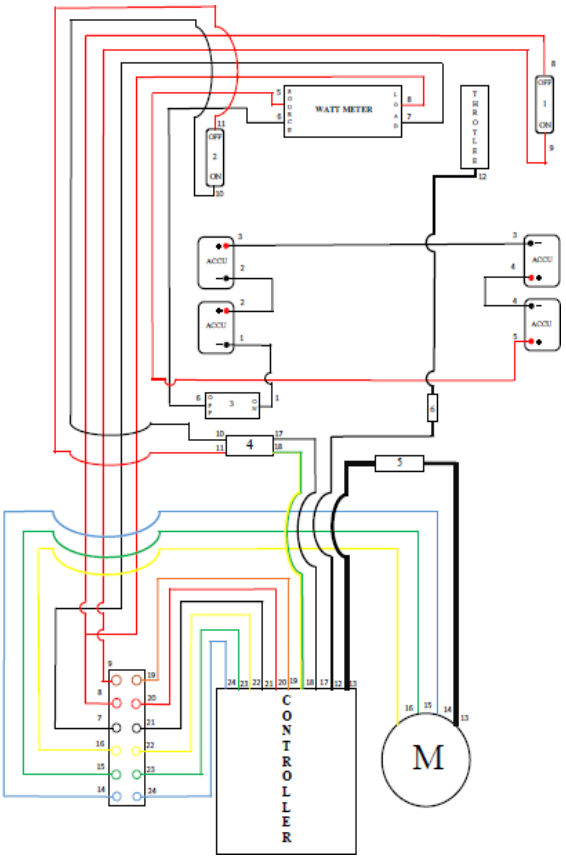

Figure 20. Electrical Diagram Wiring

Explanation of the Wiring Diagram Symbol:

1. Watt Meter: Watt Meter is a measurement tool for Voltage and Current that works on electrical circuits
2. Controller: Controller is a tool to regulate all forms of electrical system activity in the car
3. M: M is a BLDC motor that functions as an electric car drive
4. Accu: Accu is an electric current source storage device in Electric Cars
5. Throtlee: Throtlee is a gas pedal that

serves to regulate the speed of an electric car

6. Number 1: Number 1 is an On / Off lever that functions to run the electrical system.
7. Number 2: Number 2 is an On / Off or reverse switch that functions to reverse the electric motor.
8. Number 3: Number 3 is the MCB that serves to provide safety to the circuit or as a circuit breaker.
9. Number 4: Number 4 is a reverse switch socket that connects the On / Off lever with the Controller.
10. Number 5: Number 5 is a hall sensor socket that connects the controller with the electric motor.
11. Number 6: Number 6 is a Throtlee socket that connects the gas pedal to the Controller.

Validation

Validation is a process whereby the author makes wiring diagrams and requests opinions from experts and gets authorization from experts in the field of electricity that can be tested for truth. At this stage of validation, validators who are experts in the electrical and electrical fields include; Galih Riyan B, Mr Arip Supriadi and Mr Arifin. The validator is a workforce from the Subang District Vocational Training Center (BLK), which of course is competent in its area of expertise.

One of the results of the validation is from Mr. Galih Riyan B who has expertise in the field of electrical, electrical engineering. Concludes that the wiring diagram on the Sula electric car should be adjusted to the internationally accepted electrical standards.

Figure 21. Valiation

Electrical Installation

Electrical installations must pay attention to the wiring path contained in the wiring diagram, so that the desired results are in accordance with what has been prepared. The following are the steps when installing electricity:

Battery Stringing

The first thing to do is to assemble batteries. The battery circuit uses a series circuit because the Sula electric car requires a voltage of 48 volts which can be seen in Figure 22.

Figure 22. Baterry Stringing

Making Jumper Circuits, Installing them on the Accu & Accu Negative Output Cable Installation on the MCB

The output circuit of the battery uses a black wire for negative and a red wire for phase. Then the negative output cable from the black battery is connected to the MCB so that the electrical circuit has a safety in case of a short circuit.

Figure 23. Making Jumper Circuits

Connecting the MCB with the Watt Meter Input, Making the Phase Kettle and Connecting the Output Cable.

After the negative output cable from the battery is attached as shown, it is continued by connecting the MBC with the watt meter input using a black cable, then making a series of phase cables from the battery output with the red cable to the input of the watt meter. Then connect the output cable from the watt meter using solder to strengthen the cable connection. The process of connecting the cable matches the color of the cable according to the wiring diagram with Input Watt Meter, Making Circuits and Connecting Output and Phase Cables.

Figure 24. Linking MCB with Watt Meter Input

Performance Test

Battery efficiency

Figure 24. Preliminary Battery Efficiency Test Initial Data

Figure 26. Data Akhir Uji Efisiensi Baterai Lanjutan

Afif research results [9] Each type of battery has specifications, advantages and disadvantages of each. When will the user have a type the battery then many factors must be considered. The importance of initial costs, life time, mass, volume,

temperature sensitivity, maintenance access and access to products all play a role in battery selection.

Based on the results of trials on the efficiency of using batteries with a distance of 10 Km on Sula '16 1.0 electric car. Get an efficient battery usage of 53.2 Wh. This indicates that the Sula'16 1.0 electric car is classified as an energy efficient car. The efficiency obtained is due to various factors, namely the weight of the car, acceleration and electrical systems.

Wh = V x I

Wh1= 51,44x32 = 1646,08 (watthours early before use)

Wh2= 49,79x32 = 1593,28 watthours early before use)

Wh = Wh1 – Wh2 = 53,2 Wh

CONCLUSION

Electrical installations on Sula electric cars get the results of wiring diagrams that have been approved by experts. So that the contents of the data in the wiring diagram can be justified. Efficient use of batteries in Sula electric cars that use 800 Watt electric motors with battery storage capacity of 12 Volts and 32 Amperes. Getting pretty good results that is 54.40 Wh.

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