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The Third Internationa Conference of Construction, Infrastructure, and Materials (ICCIM 2023)

Universitas Tarumanagara, Indonesia

27 July 2023

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PREFACE

Dear Distinguished Speakers, Guests, and Colleagues

We are pleased to welcome you to the Third International Conference of Construction, Infrastructure, and Materials (ICCIM), held in 2023. After two-year restrictions due to the COVID-19 pandemic, we are glad to hold this offline conference at our campus, Universitas Tarumanagara, Jakarta. The Third ICCIM follows the success of the previous ICCIM, while this year, we chose the conference theme: "Civil Engineering for A Liveable Environment". The topic has been brought to the attention of civil engineering to create a more humanized living environment.

We have received hundreds of abstracts and papers, which have been categorized into five different interests:

- Structural Engineering and Materials
- Geotechnical and Earth Sciences
- Green-construction Management
- Sustainable Transportation System
- Hydrological and Environmental Engineering
- Energy Friendly Infrastructure

Therefore, we acknowledge all authors that have dedicated their time to writing the papers and presenting them to this conference. Our gratitude is also conveyed to the distinguished keynote speakers who delivered an excellent speech: Prof. Dawn E. Lehman (University of Washington, USA); Assoc. Prof. Li Hai-Ting (Shanghai Jiao Tong University, China); Dr. H. R. Pasindu (University of Moratuwa, Srilanka); Dr. Wikke Novalia (Monash University, Australia); and Dr. Alfred J. Susilo (Universitas Tarumanagara, Jakarta).

We also appreciate the contributions from 9 university partners: Massey University (New Zealand), Nihon University (Japan), Universiti Tun Hussein Onn (Malaysia), Ubon Ratchathani University (Thailand), Universitas Kristen Petra (Surabaya), Universitas Atma Jaya Yogyakarta, Universitas Muhammadiyah Yogyakarta, Universitas Katolik Parhyangan (Bandung), dan Universitas Katolik Soegijapranata (Semarang), together with all sponsors of the ICCIM event.

We wish you a great conference and an enjoyable time in Jakarta. We hope to see you again at the next ICCIM.

Jakarta, 27 July 2023

Prof. Ir. Leksmono Suryo Putranto, M.T., Ph.D., IPM

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The impact of charging time of electric vehicle battery to costumer willingness to purchase

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Abstract. It was mentioned that only electric vehicles will be allowed to be operated in the new Indonesian capital in East Borneo. As we all understand, the emission of Carbon Monoxide which is resulted from fuel burning. The use of electric vehicle may reduce air pollution due to fuel burning up to 50%. The Ministry of Transport put an emphasize on research and development on this renewable source of energy, as it can reduce very large subsidy given to conventional fuel oil towards greener and more sustainable source of energy. Other advantages of using electric vehicles are its less noisy feature and its ability to be recharged relatively quickly. It is understood that home charging will take longer period than charging in charging stations. The objective of this research firstly is to understand the effect of charging period on customer decision to purchase electric vehicle. Secondly is to understand the effect of long charging period on customer decision to purchase electric vehicle. Thirdly is to understand what can be done by the government to encourage the use of electric vehicles. And lastly to understand whether electric vehicle is a durable goods.

1 Introduction

It was mentioned that only electric vehicles will be allowed to be operated in the new Indonesian capital in East Borneo. As we all understand, the emission of Carbon Monoxide which is resulted from fuel burning. The use of electric vehicle may reduce air pollution due to fuel burning up to 50%. The Ministry of Transport put an emphasize on research and development on this renewable source of energy, as it can reduce very large subsidy given to conventional fuel oil towards greener and more sustainable source of energy. Other advantages of using electric vehicles are its less noisy feature and its ability to be recharged relatively quickly. It is understood that home charging will take longer period than charging in charging stations. There were at least four objectives of this current paper. They will be presented in detail in the preceding chapters.

2 Objectives

The objectives of the present paper were as follow:

1. To understand the effect of charging period on customer decision to purchase electric vehicle.
2. To understand the effect of long charging period on customer decision to purchase electric vehicle.
3. To understand what can be done by the government to encourage the use of electric vehicles.
4. To understand whether electric vehicle is a durable goods.

3 Literature reviews

According to *Kamus Besar Bahasa Indonesia* [1] a car is a vehicle that is operated on the land and moved by machinery power, had four or more wheels, using fuels to operate.

There were three types of cars based on their type of fuels, i.e.:

1. Conventional car using fossil-based fuel, a non-renewable fuel. Therefore, a continuous use of it will reduce its reserved quantity and furthermore will increase fuel price. The formation of such energy source has been done in billion years because of photosynthesis in the era of Archean Eon. There were three forms of the main fossil-based fuel, i.e., coals [2]
2. Hybrid car is a vehicle using two types of fuel as the source of energy, i.e., electrical motor and conventional machine. This will result in better efficiencies compared to conventional car [3].
3. Electric car is a four wheels car which is operated using electrical motor from electricity from a battery. This vehicle is different compared with conventional car, generally utilizing petrol or diesel fuels. Electric car does not use any liquid fuel at all. As a result, it is fully dependent on the electricity [4]. According to Law No. 55/ 2019 Chapter 1 Verse 1 [5], an electrical motor is an electromagnetic equipment consuming electrical energy to supply mechanical energy

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Electrical Vehicle is a car generated by one or mor electrical motor, using electrical energy stored in a rechargeable battery or other storing energy devices. Electrical motor provides instant torque and creating strong and smooth acceleration. Electrical car is firstly produced in the 1880's. The electrical car has several potential advantages compared to the ordinary fuel machine. It has no motorized vehicle emission. Moreover, this type of car may also decrease the greenhouse gas emission as it does not require fossil fuel as its main generating power. In the end, the dependency on overseas fuel will be decreased, as for some developed countries such as United States and many European countries, the increase of fuel price could impact their economies. For developing countries, the high fuel price will affect their budget balance and furthermore will slow their economic development [6]. Battery is a device that can change its stored chemical energy into electrical energy. Almost all of electronic device such as mobile phone, laptop, torch, or remote-control use battery as their energy souces. By the existence of the battery, we do not have to connect electrical cable to activate electronic devices and therefore they become portable. In our daily life, we can find two battery types, i.e. One time battery use and rechargeable battery [7]. According to Kurniawan [8], the use of the battery in the electrical car is still under consideration, although its popularity has been increased in Indonesia. The reason is due to the cost of the battery change is still very expensive, even reach more than 50% of the value of the car itself. The owner needs to know how to reduce the potential of the battery damage. Considering that the decrease of the battery ability will also affect the function of the electrical car as a daily transport. The age of the electrical car battery could vary between different manufacturers. However, in average the electrical car battery could last, up to 10 to 15 years or in terms of the distance could be 200,000 km. the Nissan electrical car could last up to 10 to 12 years. There are many electrical manufacturers developing their technologies to develop more durable battery with the better performance. The Tesla electrical car will launch the electrical car which soul last up to 1.6 million km. According to Nofianti [9], there is an external factor that cannot be controlled, i.e., the temperature. Too cold or too hot will have negative impacts on the age of the battery of electrical vehicles. In the cold temperature, the distance travelled is shorter. As a result, its use in Indonesia is suitable. The excessive charging could trigger internal chemical change in the battery itself, and moreover affect the efficiency of charging. Keeping the battery empty is also not a brilliant idea. Most of the lithium-ion battery works the best when its capacity is between 50% and 80%. Charging the last 20% of the battery will takes longer duration compared to the first 80%. The average electrical car batteries can be used up to 1,000 full charges. Although yearly the battery age is decreased yearly, the battery can still be used until further years. After fully charged 1,000 times, the battery may only get 40% of its original ability. According to Adharsyah [10] up to year 2027, the development of the Indonesian electrical car may be minimum. Up to that year, the population of the electrical car might be between 5,000 and 10,000 units. This is a very small number compared to the overall conventional car populations reaching 15 million units. Nowadays, the price of the battery of the electrical vehicle is around US$ 200/kwh. An average medium size electrical vehicle (the size of the ordinary passenger car) uses a battery capacity of 60 kwh to travel 250-300km. The average price of the battery for a car is arround IDR 171.6 million (using rate of IDR 14,300 per US$. At that position (with no subsidy), the price of the electrical vehicle will be more expensive 30-35% compared to the conventional car. However, a prediction of the year 2027, the price of the battery will be decreased into half (100 US$/kwh). This means that the cost of battery for a car will only reach US$ 6.000 or IDR 85.8 million.

According to Wuling [11] electrical car has 10 important components, i.e.

1. Traction battery pack (Fig. 1).
2. Power inverter (Fig. 2).
3. Controller (Fig. 3).
4. Traction motor (Fig. 4).
5. Charger (Fig 5).
6. Transmission (Fig. 6).
7. Direct current (DC) converter (Fig. 7).
8. Auxiliary battery (Fig. 8).
9. Thermal cooling system (Fig. 9).
10. Charger pot (Fig. 10).

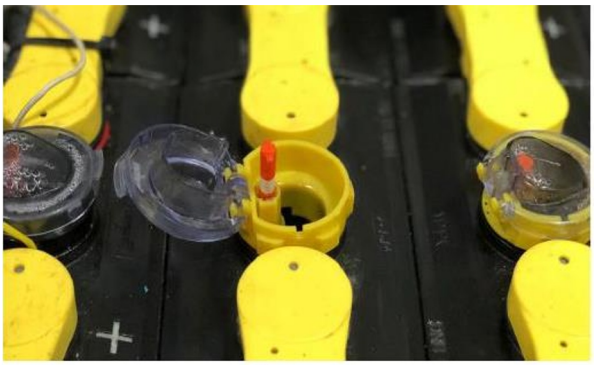

Fig. 1. Traction battery pack.

Fig. 2. Power inverter.

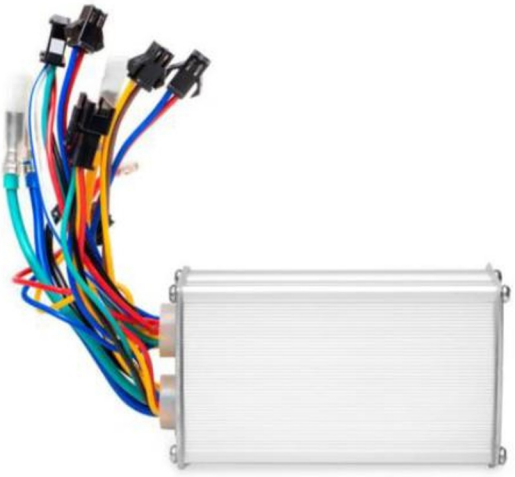

Fig. 3. Controller.

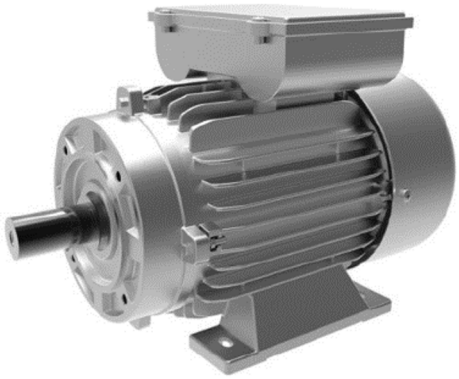

Fig. 4. Traction motor.

Fig. 5. Charger

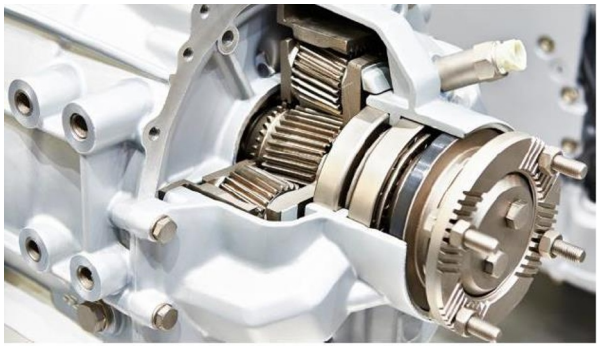

Fig. 6. Transmission.

Fig. 7. DC converter.

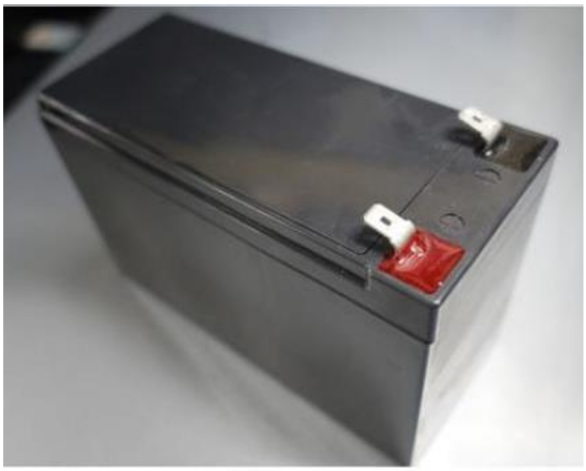

Fig. 8. Auxiliary battery.

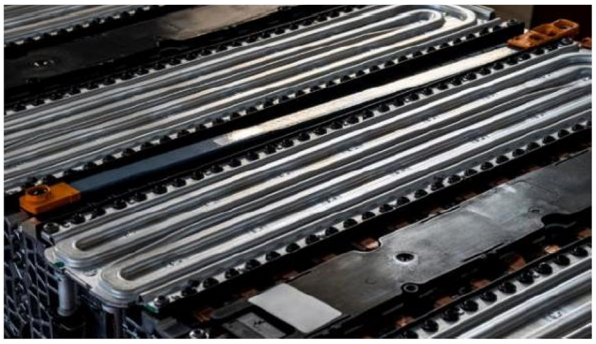

Fig. 9. Thermal cooling system.

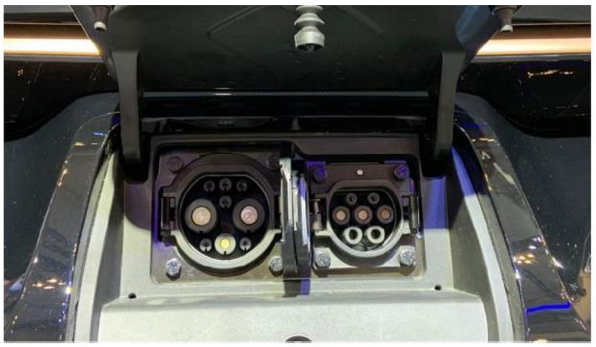

Fig. 10. Charger Pot

According to Nikola [12], in Indonesia, the General Station of Electrical Vehicle Charging (SPKLU) there are 3 systems of charging that can be chosen by the customer, i.e.:

1. Type 2 AC (Fig. 11) is plug that can bring output arround 3 to 50 kW. This connector charges the battery of the electrical vehicle using one phase

(230V) or three phase (400V) alternate current (AC). This type usually consists of 7 pins, i.e., 2 smaller pins and 5 larger pins. The first 2 rows consist of 2 pins for signalling, a pin in the middle for earthing and the other 4 pins used for resources.

2. Charger DC CHAdeMO is developed by 5 car manufacturers in Japan which have already tried to promote this type of plug in as the global standard. The idea was not successful. The European Parliement tried to regulate that the use of this connector disappears by stage and increasing the use of CCS. Nowadays, every fast charging station in Europe should have at least a CCS connector.
3. DC Combo CCS Type 2 (Fig. 12) Combined Charging System (CCS) is a very fast DC charging system. Within the design, there are 2 pins in the lower parts to charge. The other pins located in the upper part as a communication and conductor earthing) pins. It can supply electricity up to 350kW.

Fig. 11 Type 2 AC.

Fig. 12. DC combo CCS Type 2.

The followings are the procedures to charge an electrical vehicle in SPKLU, i.e.:

1. Find the nearest SPKLU (Fig. 13) through the Charge.IN application.
2. Visit the chosen SPKLU.
3. Install suitable gun for the car.
4. Tap an NFC card dor authorization.
5. Open Charge.IN.
6. Choose “charging” menu.
7. Scan QR Code at SPKLU.
8. Conduct payment.

Wait until the charging process done.

Fig. 13. General station of electrical vehicle charging (SPKLU)**.**

Instead of visiting SPKLU, ones could also charge their cars at home using wall charger (Fig. 14).

Fig. 14. The wall charger at home.

According to Herdianto [13], one of the facilities is available to be installed at home, i.e., the wall charger at home (7 kW). The market price is about IDR 17 million plus installation charge a certification from the National Electricity Company (PLN). The followings are the procedure to use the Wall Charger [14], i.e.:

1. After installation process finish, the charger might be plugged in the car until a click sound heard as an indicator that the charger connector is correctly plugged in.
2. Afterward, one should turn on the charger using a special card provided by the car manufacturer.
3. By looking at the indicator lamp, one can monitor whether the charger is functioning or not. When it is moving, the charging is on progress. When the charging process is done, the charging port can automatically open. For safety precaution when the charger is plugged out from car, the charging process is stopped.

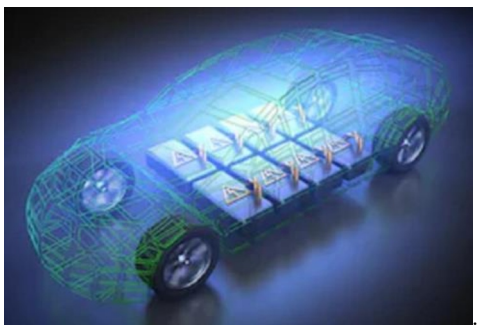

Fig. 15. An example of the electrical car battery.

4 Literature reviews

To get the respondents view on the electrical vehicle battery, we conduct data collections using a google form. The form consists of 2 parts. The first part was general data (name, contact number, age, gender, address, car use identity, and monthly expenditure for car).

The second part was the perception data as follows:

1. Perception on electrical vehicle (knowledge on the electrical vehicle, reason for interest on the electrical vehicle, knowledge on the difference between electrical and ordinary vehicles, and perception whether electrical vehicle could reduce the pollution).
2. Interesting factors (the better design of the electrical vehicles, operational cost of electrical vehicle is cheaper, maintenance of electrical vehicle is easier, electrical vehicle is environmentally friendly, and electrical vehicle is noiseless).
3. Facilities (electrical vehicle use is easier, more comfortable as charging can be done at home, and the SPKLU can be find in many locations)
4. Government (government support the development of electrical vehicle, government provides subsidy for electrical vehicle, and government conduct mass socialization of electric vehicle).
5. Charger (knowledge on long duration of battery charging, and knowledge on alternative solution on the long duration of battery charging).

Data Analysis will be conducted using one sample t-test and independent sample t-test facilitated in SPSS (Statistical Package for Social Sciences). The one sample T-Test is intended to test whether, a certain statement is the same or different with a certain test value. The independent sample t-test is intended to test whether a pair of statement (e.g., between gender, age, job, the intensity of car use, and the total monthly expenditure to operate the car, etc.).

Before the data is ready to be used, the following test will be conducted:

1. Normality test. One of the available tests is using Kolmogorov-Smirnov test. To be normal, the data should have significant value more than 0.05. Another methos is using P-P plots. If the data are scattered linearly near the linear line, then one can decide that the distribution is normal enough.
2. Validity test. As we use Likert scale (1 for strongly disagree, 2 for disagree, 3 for agree and 4 for strongly agree), the validity test should use Spearman Test, instead of Pearson Test. A valid item should at least be significant at 0.05.
3. Reliability test. This test is intended to check whether the answer of the respondents was consistent in certain construct. To be reliable the Cronbach Alpha coefficient should be at least 0.6 In SPSS, it might be useful to use “if item deleted” option, to check whether if we remove certain item, the reliability can be increased to at least 0.6.

5 Concluding remarks

This is ongoing research. Therefore, no conclusion and recommendation can be made at this stage.

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