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Electric vehicle power monitoring system based on IoT sensing architecture

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Abstract: At present, most of the vehicles in life are mainly based on gasoline and diesel, and with the gradual advancement of vehicle technology, but also accelerating global warming, countries have launched a variety of green energy to reduce the harm to the earth. Many vehicles have been developed into hybrid vehicles, and a large number of pure electric vehicles have been launched in recent years. On the other hand, many countries have begun to plan carbon footprint and carbon allowance management, and the emission of greenhouse gases or the use of green energy will be more regulated in the future.

Therefore, this research will take the electric stacker as the test target, measure the values of current and voltage, input the measured values into the program to calculate the carbon emissions produced during operation, and obtain the carbon emissions emitted by driving electric vehicles that are significantly smaller than the carbon emissions emitted by driving gasoline and diesel vehicles.

Keywords: Carbon Footprint, Carbon Rights, Internet of Things, Energy Management.

1. Introduction

Now people live in more and more convenient places, these are masterpieces of people's wisdom, in order to give agriculture and industry a place to develop, the originally forested places are razed to the ground; switching from the former means of transportation to today's common cars; when the weather is hot, people can also turn on the air conditioner to cool down, but all this comes at a price, that is, global warming.

Global warming is the excess of greenhouse gases in the atmosphere and oceans that makes the earth feel like a thick greenhouse where heat from the sun cannot dissipate, causing temperatures to rise; when air temperatures rise with ocean temperatures, glaciers melt and sea levels rise, the disappearance of lowlying areas across the country; tropical desertification, and extreme weather such as forest fires, droughts, and heat waves; under normal circumstances, trees convert carbon dioxide into oxygen, but for development, forests are razed to the ground and forests disappear, not only warming the climate The problem is compounded by an ecological crisis, with nowhere for animals to live, mass extinction and a food crisis, so the country has proposed many solutions to save the earth.

In the carbon reduction we are going to discuss, the most commonly heard method is to popularize electric vehicles.Electric vehicles are vehicles that use lithium batteries as power. They are divided into hybrid vehicles, electric vehicles, and fuel cell vehicles. With the application advantages of lithium battery high energy density, high repetitive cycle, light weight, and green environmental protection, the use of electric vehicles can not only reduce oil extraction and use, but also reduce greenhouse gas emissions and reduce air pollution.

Fig. 1 shows the trend of electrification in the global automobile market. It can be seen that the purchase of electric vehicles is on a steady upward trend, and the sales of electric vehicle parts are gradually increasing. It can be seen that due to the increase in demand for electric vehicles, more companies invest researched and manufactured more electric vehicle sales.

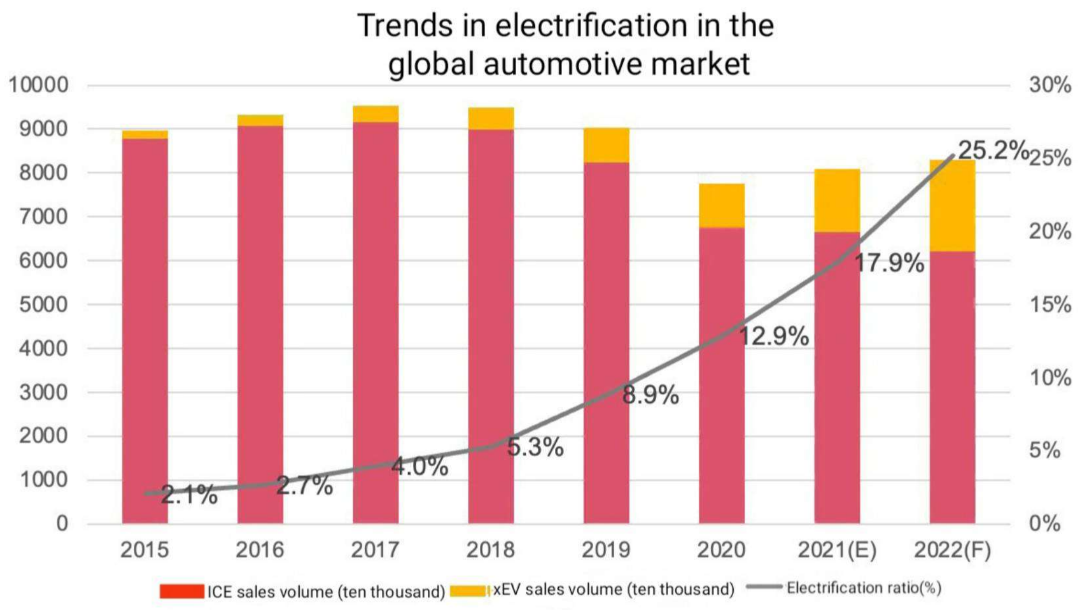

Fig. 1. Development trend of electrification in the global automotive market.(缺圖)

1.1 Background motivation

The popularity of electric vehicles is still considered inappropriate by some people, and the main source of power for electric vehicles is electricity, but the current supply of electricity is in short supply. Some countries use nuclear energy, but others burn coal to generate electricity, so much so that environmental groups believe it will also emit a lot of carbon dioxide, but not reduce air pollution. But in fact, coal is burned in a centralized way, and the pollution emitted is treated in a centralized manner. Unlike cars that run around, although there are catalytic converters to deal with pollution, the treatment efficiency is not high, and many cars are driven in densely populated areas, so most of the exhaust gas is absorbed by humans. Now that science and technology are more and more developed, solar energy, wind energy, hydropower and other power generation methods are slowly developing, not only pollution reduction, but also relatively cheap prices.

The emergence of electric vehicles has not been very long, the most famous electric car is produced by Tesla, because of the price, known as the toys of the rich, but gradually many companies will also reach into the electric vehicle market, as long as there are more companies, the price of electric vehicles will fall, but the problem of electric vehicles is not only expensive, but also many safety risks.

Because the main power source of electric vehicles is derived from the battery, the batteries currently used in electric vehicles are single cells, no way to run a long distance, if you need to use must repeat the charge and discharge, the battery will also be hot when using, and it will also vibrate or squeeze when driving, these conditions will cause a short life and damage to the battery, and even fire or explosion in more serious cases, etc. Therefore, in order to reduce potential safety hazards, safety standards, safety assessment methods, safety and reliability control in the battery manufacturing process, and improving battery safety and reliability through positive and negative electrode materials, electric throttling and separator optimization, etc., can ensure the safety, reliability and practicality of power source lithium batteries, and produce safe, low-cost, long-life batteries.

2. Methods

Fig. 2 is the flow chart of this study, when the driver starts the electric vehicle, the battery inside the electric vehicle will start to run, the shunt will disperse the current to all parts of the electric vehicle, and the voltage divider will disperse the voltage, according to the electrical voltage they need to transmit, when the driver in the process of driving the electric vehicle, the mileage will be transmitted back to the cloud, at the same time, in the cloud to calculate the number of kilometers in the driving process is equivalent to how much carbon emissions are reduced, you can also calculate the battery wear rate at the same time, it can increase the service life of the battery.

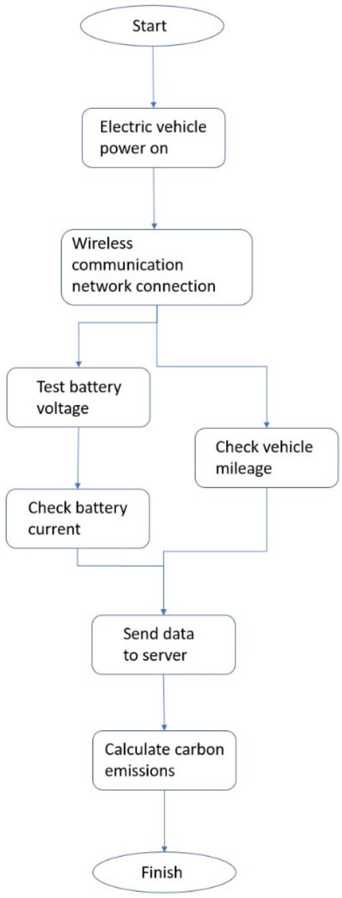

Fig. 2. Research flow chart.

2.1 Splitter

The shunt is made according to the principle of generating voltage across the resistance when the DC current passes through the resistance, and is connected in parallel with the current circuit of the measuring instrument to expand its measurement range; or components on which voltage is measured, and thus current is measured indirectly.

Shunts are widely used to expand the measurement current range of instruments, with fixed value shunts and precision alloy resistors, which can be used for communication systems, electronic machines, automatic control power supplies and other loops for current limiting, current sharing sampling detection.

2.2 Voltage divider

Common voltage dividers include resistor dividers, capacitive dividers, series resistor dividers, and shunt resistor dividers. For resistor dividers, DC voltage can be measured when selecting a high-impedance resistor and pulsed voltages at fast leads when low-impedance resistors are used. However, due to the influence of stray capacitance and thermal capacity, it is difficult to measure DC and steep pulses simultaneously. Capacitive voltage dividers cannot be used for DC voltage and low frequency voltage measurements. Series resistive capacitive voltage dividers easily suppress oscillation, but they also cannot measure DC voltages.

Fig. 3 is the architecture diagram of this study, when the driver starts the electric vehicle, the battery will transmit voltage and current to the voltage divider and shunt, the voltage divider and shunt will disperse the voltage and current to all parts of the electric vehicle, and during the driving process, the controller in the electric vehicle will transmit data to the cloud through LoRa, in the cloud, it will calculate how much carbon emissions will be added while driving and how much carbon emissions will be reduced compared to driving gasoline and diesel vehicles, and will also calculate the battery wear rate, battery charging and discharging data, which can increase the service life of the battery.

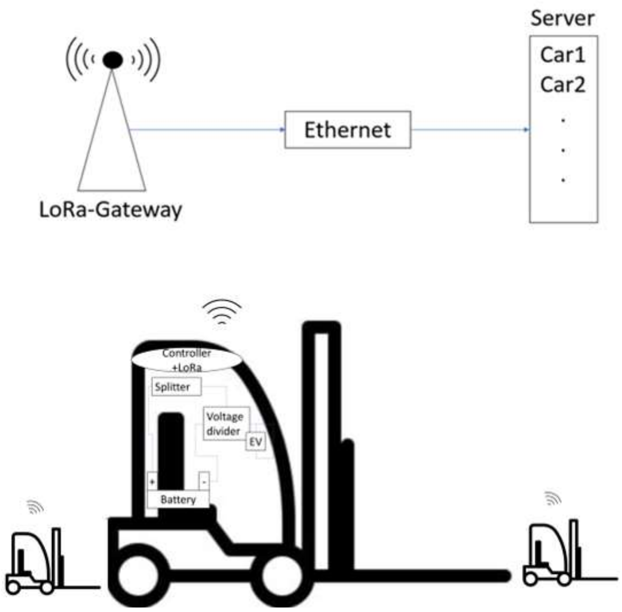

Fig. 3. Research architecture diagram.

Fig. 4 is the measurement data of this study, the value of voltage and current measured by the electric stacker, the orange line is the data of the voltage, and the blue line is the data representing the current, with the measured value, calculate the carbon emissions of the electric vehicle manufacturing, you can also know under what circumstances the voltage of the electric vehicle will be too large, if the voltage number continues to be too high, it will cause the efficiency of the battery to be reduced, accelerating the battery wear rate. Both electric and diesel vehicles were tested as forklift forklifts with a load of 1.5 tons.

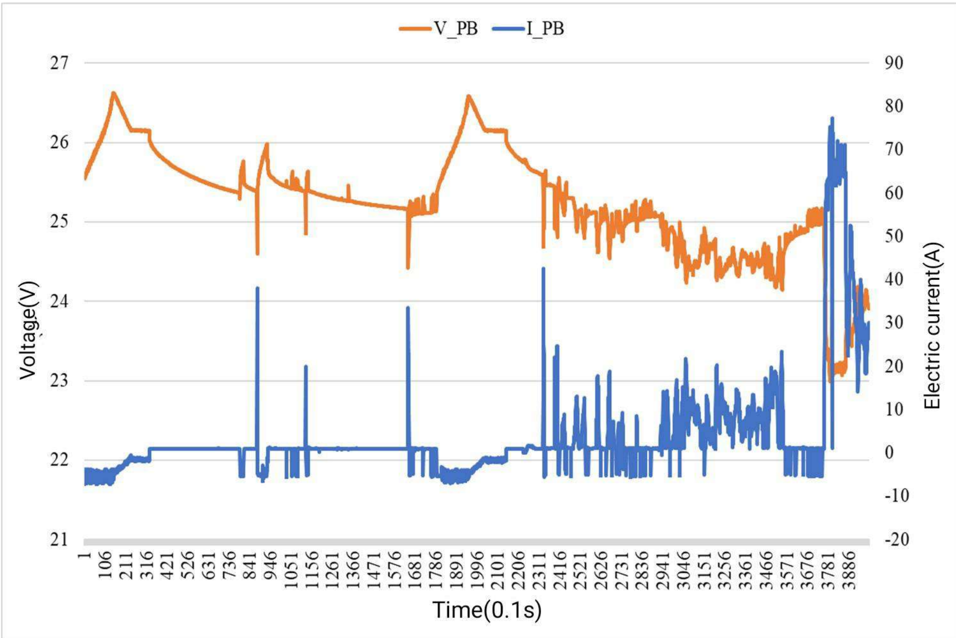

Fig. 4. Voltage and current diagram.(圖標要英文字)

3. Result and Discussion

TABLE I. Experimental results

Project	Diesel Stacker	Electric Forklift
Carbon emissions	2.66 kg/L	0.554 kg/kWh
Fuel consumption/power consumption	0.278 L/km	0.695 kWh/km
Carbon emissions	0.739 kg/km	0.385 kg/km

TABLE I shows that when the carbon emission per kilogram of diesel fuel is 2.66 kg/liter, the fuel consumption is calculated as when 70 liters can run 252 kilometers, and the fuel consumption can be obtained by obtaining 0.278 liters/km, and the carbon emission of the diesel forklift can be obtained by multiplying the data to obtain 0.739; the carbon emission of the electric forklift is calculated as 0.554 kg/kWh per kWh, and the power consumption formula when the electric vehicle is driving is the total kilometer/((voltage * capacity)/1000/0.8(Charging efficiency)), you can get 40/((24*240*8)/1000/0.8)=0.695 degrees/km, and the carbon emission per kWh * electric vehicle power consumption can obtain 0.385 kg/km.

4. Conclusions

From this study, it can be seen that when the driver drives the diesel forklift, it can produce about 0.7 kg of carbon emissions per kilometer, while driving the electric forklift produces only 0.3 kg of carbon emissions per kilometer, and diesel vehicles produce twice as many carbon emissions as electric vehicles, so it can be determined that driving an electric vehicle can reduce many greenhouse gas emissions.

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