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History of the Introduction of Electric Cars, Advantages and Disadvantages

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ABSTRACT: In this article, the role of electric cars today, the history of development, the principles of operation of electric car parts, the advantages and disadvantages of electric cars of today and the next generation have been discussed.

KEYWORD: Electric car, electric motor, asynchronous motor, history of electric cars, electric cars of the future, accumulator battery, inverter, internal combustion engines.

All sectors and sectors of the economy of our republic are rapidly developing, making a great contribution to the well-being of our people and the prosperity of our country. In the 21st century, as a result of the development of new technologies and increased attention to environmental protection, the production of electric cars began to increase. Electric cars are becoming more and more popular in the automotive world. These quiet, relatively environmentally friendly and efficient vehicles are expected to replace internal combustion engines in the near future. [1]

Electric motors date back almost as long as gasoline and diesel-powered internal combustion engines. Two centuries ago, the Hungarian inventor Anosh Yedlik invented the electric motor in 1828. It was designed to move vehicles that do not have a large weight. In 1834, the American blacksmith Thomas Davenport created an electric locomotive that ran on a circular track. Only in 1859, the French physicist Gaston Plante invented the first lead-acid battery and laid the foundation for the development of the automobile industry. In 1891, in America, a 6-seater electric car with a speed of 23 km/h was produced.

In 1900-1910, electric cars began to spread widely. For example, 38% of the total number of cars in the USA are electric cars, 40% are steam-powered cars, and 22% are gasoline-powered cars. From 1910, Henry Ford began to produce gasoline-powered cars, and the number of gasoline-powered cars began to increase.

The environmental problems of the 1960s and the energy crisis of the 1970s due to rising oil prices rekindled interest in electric cars.

But by the 1980s, interest in them decreased again, because their technical and economic indicators did not meet the requirements.

Mass production of electric cars dates back to the end of the 90s and the beginning of the 2000s.

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Since then, the produced electric cars can be divided into 4 generations.

The first generation includes electric cars created on the basis of ordinary cars. In them, only the internal combustion engine was replaced by an electric motor with an inverter, and batteries were installed instead of the fuel tank and trunk. They also have a classic transmission. The distance and speed of movement were not high. [2]

The second generation of electric cars was partially similar to cars with internal combustion engines, in which the classic transmission was abandoned. In the electric cars Kia Soul EV 2014 and VW E-Golf 2015, the batteries are located in the front seat and in the center tunnel. These electric cars can cover an average distance of 100 km on a single charge.

The third generation of electric cars begins with the production of the Tesla Model S sedan. In this electric car, for the first time in the world, the batteries are located under the floor of the cabin, and separate electric motors are installed on each axle. Placement of accumulator batteries under the floor made it possible to increase its capacity.

The use of a two-motor scheme led to the electric motors being light and compact, as well as increasing the overall power, improving dynamic and economical characteristics.

In the fourth generation of electric cars, using 800-volt batteries instead of 380-450-volt batteries, they have the ability to cover more distance in one charge and fast charging (Porsche Taycan, Hyundai and KIA cars on the E-GMP platform).

Cars with an internal combustion engine have more than 10,000 parts, and electric cars have no more than 1,000. Simplicity and reliability allow the electric car to occupy the world market. In 2021, sales of electric cars will increase by 43% in the global market. In 2020, electric cars accounted for 5% of all cars sold. By 2025, this indicator is planned to increase by 17%, and by 2030, it will increase by 30%. Lithium-ion batteries are installed in modern electric cars. A battery with a capacity of 100 kW allows a car with a mass of 2 tons to travel more than 500 km.

Today, when using electric cars, the following abbreviations are used:

EV - Electrical Vehicle;

BEV - Battery Electrical Vehicle;

FCEV - Fuel Cell Electrical Vehicle;

HEV - Hybrid Electrical Vehicle.

Electric cars run on alternating current. The alternating current generator was invented by Nikola Tesla 100 years ago. Electric current is the direction of movement of electrons under the influence of an electric field. When the motor runs on constant current, the electrons move only in one direction. When working with alternating current, the electrons can periodically change their position. Direct current is in the form of a straight line, while alternating current is in the form of curved lines. In an electric car, direct current is converted to alternating current. [3]

Principles of operation of electric car parts.

The main unit of every electric car is an electric motor. Modern electric cars use brushless electric motors. Among them, the most efficient is the alternating current synchronous electric motor. But these electric motors are relatively expensive and more complicated to control, so they are used in expensive and powerful electric cars. For example, Porsche Taycan or Jaguar I Pace.

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Most electric cars (Tesla Model S, Audi e-tron, etc.) use asynchronous electric motors. These have a lower efficiency, but are easier to manage.

Let's consider the operation of an asynchronous motor.

An induction motor consists of two main parts: the stator and the rotor. A rotor is a simple set of electrically conductive rod ends that are short-circuited with rings. A three-phase alternating current is supplied to the stator. A three-phase alternating current passes through the coils and creates a rotating magnetic field. A Tesla motor creates a quadrupole magnetic field. This rotating magnetic field induces a current in the rotor shaft, which causes the rotor to rotate. In an induction motor, the rotor always rotates slightly slower than the electromagnetic field. An asynchronous motor has no brushes or permanent magnets, but it remains reliable and powerful. The advantage of an asynchronous motor is that its speed depends on the frequency of the alternating current. Thus, by simply changing the frequency of the current in the power supply, we can change the speed of the driven wheels. This makes electric vehicle speed control easy and reliable. Engine power is provided by a frequency-adjustable transmission, which in turn controls engine speed.

The speed of the engine can be changed from 0 to 18000 min. This is the most important advantage of electric cars over electric cars. An internal combustion engine only provides useful torque and power output over a limited speed range, so connecting the engine directly to the driven wheels is not a good idea. To change the speed of the transmission, it is necessary to enter a variable transmission. In an asynchronous motor, on the contrary, it works efficiently in any speed range. Thus, a variable transmission is not required for electric cars. In addition, the internal combustion engine does not create direct rotational motion. The reciprocating motion of the piston is converted into a rotary motion. This creates serious problems for mechanical balance. Also, unlike an induction motor, an internal combustion engine does not start on its own. In addition, the power of the internal combustion engine is always uneven. A lot of additional details are needed to solve this problem. In the case of an induction motor, it is possible to obtain direct rotational motion and uniform output power. Many details of the construction of the internal combustion engine are not needed here. As a result, asynchronous motors have excellent response speed and a high specific power per unit weight of the vehicle, exhibiting extremely high vehicle performance. However, an induction motor is powered by a battery. The battery produces direct current, so it must be converted to alternating current before powering the engine.

An inverter is used for this purpose. This electronic device controls the frequency of the alternating current and also the speed of the motor. In addition, the inverter can also change the amplitude of the alternating current, which in turn sets the output power of the motor. In other words, the inverter is like the brain of an electric car. [4]

Now let's look at the *battery pack*. It might surprise you, but this is a simple set of lithium-ion cells used in our daily life. The elements are combined in a block and connected in parallel to provide the power needed to start the electric car. Glycolic coolant passes through metal pipes through the gaps between the battery cells. This Tesla innovation effectively cools the system by using many small elements instead of a few large ones, minimizing the possibility of hot spots and even distributing the temperature more evenly, resulting in longer battery life. Elements are combined into removable modules. The battery has 16 such modules, which consist of 7000 cells. The heated glycol is cooled as it passes through a radiator mounted on the front of the engine. Among other things, you can see that when such a flat battery pack is mounted close to the ground, it lowers the car's center of gravity. A low center of gravity significantly improves vehicle stability. The accumulator also covers the lower part of the vehicle along the entire width and provides structural rigidity against side impacts. [5]

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There are 3 levels of battery charging. Level 1 charging at home with a voltage of 120 volts. In this case, 1 hour of charging will cover 3-8 km of travel. Level 2 requires a special charger. It is charged with a voltage of 220-240 volts. 1 hour of charging will cover 16-40 km. Level 3 is the most effective and fastest. It is charged with constant current. The battery can be charged to 80% in half an hour. You can see that the engine output speed is reduced in two steps.

Switching to rear gear in an electric car is also very simple, for this it is enough to change the sequence of phases in the engine. The sole purpose of an electric motor gearbox is to reduce the rotational speed and, as a result, to increase the torque. The second component of the transmission is the differential, to which power is transferred after deceleration. This is a simple free differential. However, such differentials have traction adjustment problems. Why does such an advanced car use a free differential instead of a high resistance differential? Because the free differential is more reliable and transmits more torque. Traction adjustment problems with a free differential can be effectively overcome by two methods: selective braking and rapid short-term disconnection from the power source. In an internal combustion engine, such shutdowns by cutting off the fuel supply are not fast enough. However, in an induction motor, the electrical power can be switched off quickly, which is an effective means of controlling the traction force. In an electric car, this process is carried out according to a modern algorithm and with the help of sensors and controllers, in other words, electric car motors have replaced a complex mechanical system with highly sensitive software. Did you know that you can drive an electric car with just one pedal? This is possible due to its powerful or cooperative braking system. This system allows you to save a lot of kinetic energy of the car in the form of electricity without losing it in the form of generated heat. In an electric car, after you release the gas pedals, the regenerative braking starts. At the same time, during regenerative braking, the asynchronous motor acts as a generator. It shows how the wheels drive the rotor of an induction motor. We know that in an induction motor, the rotor speed is less than the speed of the electromagnetic field. To turn a motor into a generator, you need to make the rotor speed higher than the electromagnetic field speed. The inverter plays an important role here by adjusting the frequency of the current and keeping the speed of the electromagnetic field lower than the speed of the rotor. This generates electricity in the stator coil and produces more electricity than is needed to run the electric car. With the generated excess electricity, after changing it, it can be stored in the battery. During this process, an electromotive force acts against the rotor, so the driven wheels and the machine slow down. Thus, the speed of the vehicle can be easily controlled while driving with one pedal. The brake pedal can be used to bring the electric car to a complete stop. As you already know, electric cars are much safer than cars with internal combustion engines. The cost of maintaining and driving an electric car is also much lower. [6]

As a conclusion, the following advantages and disadvantages can be said about the use of electric cars:

Advantages: high efficiency, high sensitivity, noiseless, environmentally friendly, low maintenance and operating costs, increased safety, high power and torque. Although new electric cars are more expensive than regular gasoline cars, when monthly payments, maintenance, insurance and fuel are taken into account, electric vehicles can be seen to be more profitable. Six popular electric car brands of Hyundai, Ford, Kia, Volvo and Nissan were analyzed by car, and one electric car used for one year can prevent atmospheric air pollution with an average of 1500 kg (CO)2 of carbon dioxide. Each gasoline-powered car emits more than 3 tons of carbon dioxide gas, 93 kg of hydrocarbons, 0.5 tons of carbon monoxide, and about 30 kg of nitrogen oxides into the atmosphere when it travels 15,000 km. These indicators are slightly higher in cars running on diesel fuel. Studies have shown that electric cars are better for the environment, emitting fewer greenhouse gases and air pollutants than cars that run on gasoline or diesel. It is formed during the production of electricity to ensure their movement. A major advantage of electric cars is their potential contribution to improving air quality in cities. Electric cars do not emit carbon dioxide gas during movement. Another advantage is that electric cars can significantly reduce the noise level, which is important for cities. Studies

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show that electric cars are better for the environment than cars that run on conventional gasoline or diesel fuel. If an electric car is powered by renewable energy sources, this electric car is 100 percent environmentally friendly.

Disadvantages: it takes a long time to charge (an hour), a small reserve of power, a high price.

Адабиётлар:

1. Decision of the President of the Republic of Uzbekistan dated April 4, 2022 PQ-190 "On measures to reliably ensure human safety on highways and drastically reduce the number of deaths".
2. Mirgani Fayziev, Saydulla Kalauov, Jumaniyez Ismatov. Psychological aspects of safe driving. Har. Edu.a.sci.rev. 0362-8027 120 Vol.2. Issue 1 Pages 121-128. 10.5281/zenodo.6554045.
3. Kholdarov, F. E. U. (2022). INNOVATIVE INTELLECTUAL APPROACH IN THE SYSTEM OF SPECIAL TRANSPORT VEHICLES. *Academic research in educational sciences*, *3* (TSTU Conference 1), 124-129.
4. Qulmuhamedov J.R., Muhitdinov A. Structure of transport means; Study guide - T., 2019.
5. Ibrahimov, I. B. (2022). ANALYSIS OF ROAD TRANSPORT INCIDENTS, THE CAUSES OF THEIR OCCURENCE AND CURRENT WORKS ON PREVENTION. JOURNAL OF POLITICAL SCIENCE, LAW AND INTERNATIONAL RELATIONS, 1(2), 75-80.
6. Umarbekovich, O. F., & Urazimbetovich, A. N. (2022). PREVENTION OF TRAFFIC INCIDENTS USING MODERN INFORMATION COMMUNICATION TECHNOLOGIES. SCIENTIFIC JOURNAL OF SUSTAINABILITY AND LEADERSHIP RESEARCH ONLINE, 2(9), 148-154.
7. Kulmuhamedov J.R., Muhitdinov N. F. Driver's rights and obligations: Instructional manual. - T., 2008.

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