

## WHAT FUNCTIONS DOES THE CONTROL SYSTEM PERFORM IN AN ELECTRIC VEHICLE

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**Abstract:** The electronic control system starts working from the moment the car is started, checking the condition of the battery, engine, cooling system and many other parameters. It makes millions of decisions in a very short time to ensure the optimal performance of the electric car.

This article describes the control systems of electric vehicles, their components and their importance.

**Key words:** electric vehicle control system, driver, engine controllers, the system monitors the battery status, regenerative braking, anti-lock brakes, traction control systems, driving safety, automobile transport, road safety.

### Introduction

Road transport has become the most widespread means of transport in the world today. In terms of passenger and freight transport, road transport occupies a leading position compared to other types of transport. At the same time, the scale of the harm that road transport causes to the atmosphere, to human health and to the environment is also increasing. In terms of causing environmental damage to the environment, road transport leads in all types of negative impacts: air pollution - 95%, noise - 49.5%, climate impact - 68% [1].

One car “absorbs” more than 4 tons of oxygen from the atmosphere per year, and at the same time emits about 800 kg of carbon monoxide, 40 kg of nitrogen oxide and almost 200 kg of various hydrocarbons in exhaust gases [2].

Therefore, in recent years, electric cars have become increasingly popular due to their environmental advantages and cost-saving potential. These cars are powered by electric motors, rather than traditional internal combustion engines, which leads to reduced emissions and fuel costs. One of the most important features of electric cars is their control systems, which play a key role in controlling various functions and ensuring the efficient operation of the car.

Electric vehicle control systems are a complex network of electronic components that regulate and control various aspects of the vehicle's operation. These systems work together to control power flow, monitor battery performance, charge, control regenerative braking, control various safety functions, and ensure uninterrupted driving.

One of the main components of the control system of electric cars is power electronics. Power electronic devices help convert electrical energy into mechanical energy by controlling the electric motor that propels the vehicle. The engine management system controls the speed, torque and direction of rotation of the engine for optimum performance and efficiency [3].

The power electronics system typically includes components such as inverters that convert DC power from the battery to AC power for the engine, as well as DC-DC converters that reduce the battery voltage to power auxiliary systems. These components work in conjunction with the engine control unit, which monitors and regulates engine parameters based on input from various sensors. Electric vehicles rely on a charging infrastructure to replenish their energy reserves. Electric vehicle control systems provide efficient charging via AC or DC charging stations. AC charging typically requires an installed charging device to convert the incoming AC power into DC power suitable for the battery. The charge control system controls the charging process, monitors the battery condition, and adjusts the charging rate accordingly [4].

On the other hand, DC fast charging bypasses the installed charger and supplies DC power directly to the vehicle battery. At the same time, the control system regulates the charging process to prevent overheating and overloading of the battery. In addition, the control system facilitates communication between the vehicle and the charging station, allows for authentication and monitoring of charging parameters.

Electric vehicles often use regenerative braking systems, which convert kinetic energy generated during braking into electrical energy and store it in the battery. The control system plays a crucial role in controlling regenerative braking, optimizing the balance between regenerative and mechanical braking.

When the driver applies the brakes, the control system determines the required amount of regenerative braking based on factors such as vehicle speed, battery charge level, and road conditions. It also smoothly manages the transition between regenerative and mechanical braking, ensuring smooth and controlled deceleration.

Safety is also a top priority for electric vehicles in their design and operation, and the control systems include various safety functions to protect passengers and ensure vehicle stability. These safety systems use sensors, actuators, and control algorithms to detect and respond to potential hazards [5].

One of the most important safety systems is the electronic stability control system, which monitors vehicle dynamics and intervenes if necessary to stabilize the vehicle. If the system detects a loss of steering control, it selectively brakes certain wheels or controls engine torque to maintain stability.

The control system is also integrated with the anti-lock braking system to prevent the wheels from locking during braking, improving handling and reducing braking

distances. In addition, the control system interacts with other safety systems, such as traction control, launch assist and collision avoidance systems, to help make driving safer.

In addition to controlling the vehicle's basic functions, electric vehicle control systems also provide a user interface for the driver and passengers. These interfaces include displays, touch panels, voice recognition systems, and physical controls that allow users to access important information, adjust settings, and interact with the vehicle's infotainment system [6].

The control system processes user input and transmits the information to various subsystems and components of the vehicle. It ensures smooth integration of entertainment functions, navigation systems, climate control and other convenience-related functions and improves the overall user experience.

## Conclusion

In short, electric vehicle control systems are a complex network of components and algorithms that ensure the efficient and safe operation of electric vehicles. From power electronics and engine management to monitoring battery performance, charging processes, regenerative braking and safety systems, these control systems are crucial for the successful introduction and widespread use of electric vehicles.

As electric vehicles develop, control systems play an increasingly important role in increasing operational efficiency, increasing range and providing drivers with enhanced functionality. With the continuous development of technologies and the growing demand for environmentally friendly transport, these control systems will remain at the forefront of electric vehicle development.

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