Intelligent Network-Connected New Energy Vehicle Technology and Application Under the Dual-Carbon Strategy

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Abstract: In responding to the "dual carbon" strategy, intelligent networked new energy vehicle technology plays a crucial role. This type of vehicle combines the advantages of new energy technology and intelligent network technology, effectively reduces carbon emissions in the transportation sector, improves energy utilization efficiency, and contributes to the green transportation system through intelligent transportation management and collaborative work between vehicles, making significant contributions. This article aims to explore the development of intelligent network-connected new energy vehicle technology and applications under the dual-carbon strategy and lay the foundation for the future development direction of the automotive industry.

Keywords: Dual carbon strategy; Intelligent network connection; New energy vehicles

1. Introduction

Faced with the difficult situation of global warming, China has proposed the strategic goal of striving to reach the peak of carbon emissions before 2030 and achieve carbon neutrality before 2060, known as the "dual carbon" strategy. Under this framework, intelligent connected new energy vehicles, as representatives of new modes of transportation, have become the core carrier for implementing national strategies and promoting the transformation and upgrading of the automobile industry. It subverts traditional automobile design and usage models. It provides a reference for research and practice in related fields through advanced battery technology, drive technology, and highly integrated intelligent perception and decision-making systems.

2. The importance of intelligent networked new energy vehicle technology and application

2.1. Environmental protection and energy transformation

New energy vehicles are driven by electricity, which effectively reduces tail gas emissions and is conducive

to reducing the transportation industry's dependence on fossil fuels. It aligns with global carbon neutrality and China's "double carbon" strategic goals, helping to reduce greenhouse gas emissions and improve air quality. New energy vehicles have promoted the widespread use of electricity as an energy source in the transportation field. Together with wind energy, solar energy, and other renewable energy power generation technologies, they will help promote the transformation of the energy structure into clean energy [1].

2.2. Technological innovation and industrial upgrading

Intelligent connected cars integrate advanced autonomous driving, artificial intelligence, big data analysis, and other cutting-edge technologies to achieve a more efficient and safer driving experience, thus promoting the development of the automobile industry in the direction of high technology and high-added value. Internet of Vehicles (IoV) technology allows cars to interact with the external environment such as other vehicles, road facilities, and cloud service centers. It improves traffic efficiency and reduces energy waste caused by congestion through real-time traffic prediction, path optimization, automatic parking, and other functions.

2.3. Improvement of traffic efficiency

Through in-vehicle communication and central control systems, traffic flow can be precisely regulated and optimized, reducing invalid driving mileage and saving energy consumption. Intelligent networked new-energy vehicles support new business models such as shared and on-demand travel, improving vehicle utilization and reducing empty driving and inefficient use [2].

2.4. Social and economic benefits

Although the initial purchase cost of new energy vehicles is relatively high in the long term, the operating costs are low. As the technology matures and large-scale production is carried out, the overall economic benefits are expected to increase. Intelligent connected new energy vehicles have spawned a series of emerging industries and markets, such as battery manufacturing, charging pile infrastructure, in-vehicle information systems, and autonomous driving software development, providing new driving forces for economic growth.

2.5. Urban and social development

Intelligent, networked new energy vehicles are an important part of smart cities. Through deep integration with smart grids and smart transportation systems, they help build a more efficient and sustainable urban operation system. In public transportation and services such as public transportation and logistics, intelligent, connected new energy vehicles can bring more convenient and reliable service quality and help improve the quality of public life [3].

3. Key technologies for intelligent connected new energy vehicles

3.1. Chip technology

One of the core technologies of intelligent connected new energy vehicles is chip technology, which plays a vital role in the vehicle's computing power, communication capabilities, energy management, and advanced driver assistance systems (ADAS).

High-performance computing and control chips, central processing units (CPUs), and graphics processing units (GPUs) inside smart cars, as well as application-specific integrated circuits (ASICs) and field-programmable gate arrays (FPGAs) and other chips, form the basis of on-board computing, the core of the platform. For example, the Drive Orin series of chips launched by NVIDIA is a system-on-chip (SoC)

specially designed for autonomous driving. It has a powerful computing power of up to 254 tera operations per second (TOPS) and can handle complex depths. Learning algorithms process massive data collected from various sensors in real time to realize autonomous driving functions, including path planning, target detection, behavior prediction, etc. In addition, these chips are also responsible for controlling the efficient operation of the power battery management system (BMS), motor control unit (MCU), and other electrical systems of new energy vehicles, ensuring that the vehicle reaches the highest standards in terms of power output, cruising range optimization and safety [4].

Vehicles equipped with V2X communication and networking chips require strong wireless capabilities for real-time data exchange and network connections in intelligent connected cars. Qualcomm's Snapdragon automotive platform is a typical application case. This type of chip integrates advanced cellular communication modules. It supports 5G and C-V2X (Cellular Vehicle-to-Everything) technology, allowing seamless communication with other vehicles, infrastructure, and Cloud service centers. For example, through V2X communication, vehicles can obtain real-time traffic information and hazard warning signals and even achieve coordinated driving at complex intersections, effectively improving road traffic safety and efficiency. At the same time, such chips can also integrate in-vehicle entertainment information systems and remote service functions to provide users with a more intelligent and personalized driving experience.

3.2. Wireless communication technology

The development of intelligent connected new energy vehicles is inseparable from advanced wireless communication technology, which provides real-time and efficient information between vehicles (V2V), vehicles and infrastructure (V2I), and vehicles and cloud services (V2N) interaction channels.

Cellular Vehicle-to-Everything (C-V2X) is a vehicle wireless communication system based on cellular network technology. It includes direct communication (PC5) and network communication (Uu). In practical applications, the demonstration project jointly conducted by Audi and Huawei demonstrates how C-V2X technology can improve the safety and driving efficiency of intelligent connected vehicles. Through C-V2X technology, vehicles can receive and send information such as road conditions, traffic light status, and ahead accident warnings in real time to achieve collaborative driving between vehicles [5]. For example, when the traffic light is about to turn red, the vehicle will receive the signal in advance and slow down or stop smoothly in advance, avoiding unnecessary sudden braking, saving energy, and reducing intersection congestion and collision risks.

5G communication, with its high speed, low latency, and wide connection characteristics, brings new possibilities to intelligently networked new energy vehicles. Taking the cooperation between China Unicom and Chinese automobile manufacturers as an example, 5G technology has been successfully used in remote driving scenarios. Drivers can control remote intelligent connected cars in real-time through the remote control center. This technology is ideal for special scenarios such as mining operations, disaster area rescue, etc. It has extremely high practical value [6]. In addition, 5G technology also optimizes the vehicle's over-the-air (OTA) download technology to enable remote updates of onboard software and firmware. For example, Tesla's Model S, Model 3, and other models can receive the latest autonomous driving feature updates through the 5G network, eliminating the need for car owners to go to the service center in person and improving customer experience and service efficiency.

3.3. Sensing technology

The advancement and safety of intelligent networked new energy vehicles depend to a large extent on the various sensor technologies they are equipped with. These sensing technologies are like the "senses" of the car,

providing the vehicle with real-time and accurate environmental perception information.

As a sophisticated three-dimensional environment perception sensor, Light Detection and Ranging (Lidar) draws a three-dimensional point cloud image of the vehicle's surrounding environment by emitting laser pulses and receiving reflected signals, providing extremely accurate spatial information for autonomous vehicles. The self-driving taxis produced by Waymo use lidar technology extensively. For example, Waymo's vehicles are equipped with multiple lidar sensors on the top. They can accurately detect pedestrians, bicycles, other vehicles, and traffic signs in complex traffic environments, helping the autonomous driving system make accurate driving decisions, such as reasonable obstacle avoidance, accurate turns, safe lane changes, etc., thus greatly improving the safety and reliability of autonomous driving.

Millimeter wave radar is another sensor widely used in intelligent network-connected new energy vehicles. Its working principle is to use electromagnetic waves in the millimeter wave frequency band to measure the target's distance, speed, and angle information [7]. For example, the Tesla Model 3 uses a front-mounted millimeter-wave radar that can work in various weather and lighting conditions and is not interfered with by rain, fog, dust, and other factors, enabling long-distance detection of vehicles and pedestrians ahead. By real-time monitoring and tracking changes in the vehicle's speed, relative distance, and orientation in front, millimeter-wave radar provides key pre-collision warning information for Tesla's Autopilot automatic assisted driving system. Also, it assists in implementing advanced adaptive cruise control, automatic emergency braking, and other driving assistance functions.

3.4. Algorithm technology

One of the core competitiveness of intelligent, connected new energy vehicles lies in their advanced algorithm technology. These algorithms process data collected by various sensors and make accurate decisions.

The autonomous driving decision-making algorithm is the "brain" of intelligent connected cars. It is based on complex artificial intelligence technologies such as deep learning and reinforcement learning and analyzes sensor data in real time to plan optimal driving paths and action sequences. For example, Google's Waymo self-driving vehicles use a comprehensive decision-making algorithm that can integrate data from multiple sensors, such as lidar and cameras, in real time to build an accurate model of the surrounding environment. When faced with complex traffic scenarios, such as encountering a pedestrian suddenly crossing the road on a busy city street or a vehicle in front braking, this algorithm can instantly determine the risk level and quickly calculate the best response strategy, including slowing down, avoidance or other evasive actions to ensure safety and smoothness during autonomous driving.

In new energy vehicles, algorithm technology is also crucial, especially the energy management and optimization algorithms embodied in the battery management system. Models such as Tesla Model S and Model 3 use advanced battery management algorithms, which monitor battery status (including state of charge, temperature, health status, etc.) in real-time, combined with vehicle driving status, remaining range prediction, and charging needs. Multi-dimensional information can dynamically adjust battery charging and discharging strategies to effectively extend battery life and maximize cruising range and power performance [8]. In addition, this algorithm can be linked with the vehicle's navigation system, driving mode selection, etc., to plan charging plans in advance. During long-distance driving, the power output can be flexibly adjusted based on terrain, traffic flow predictions, and charging pile distribution to achieve energy saving and reduction.

4. Conclusion

Intelligent networked new energy vehicle technology is the automobile industry's future development direction

and an important means of achieving the dual-carbon goal. Through technological innovation, infrastructure construction, and policy support, we will promote the development of intelligent, connected new energy vehicle technology and applications and the automotive industry's green transformation and sustainable development. At the same time, promoting intelligent, connected new energy vehicles should focus on data privacy protection and security to ensure that user information is effectively protected.

Disclosure statement

The author declares no conflict of interest.

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