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Application Analysis of Computer Technology in Intelligent Vehicle Design

Jiansi Liu
School of Automotive Engineering
Zibo Polytechnic University
Zibo, Shandong, China

Abstract: The application of computer technology in intelligent vehicle design is mainly reflected in realizing the perception of driving environment, analysis of driver behavior, and control of vehicle systems through technologies such as sensors, artificial intelligence, and big data analysis. It improves the cost-performance ratio of automobile brands from aspects of safety, maneuverability, and comfort, helping them occupy a larger market share.

Keywords:computer technology; intelligent vehicle design; application; autonomous driving; sensor technology

1. INTRODUCTION

The application of computer technology in intelligent vehicle design can effectively enhance the intelligence and automation of vehicles, thereby providing people with a safer, more convenient, and more comfortable travel mode. This paper discusses the application and development prospects of computer technology in intelligent vehicles, aiming to promote the wide application of computer technology in intelligent vehicle design and contribute to the intelligent development of China's automobile industry.

2. OVERVIEW OF INTELLIGENT VEHICLES

Intelligent vehicles utilize advanced sensors, controllers, actuators, and software to achieve autonomous decision-making and operation under different environmental conditions. The basic components of an intelligent vehicle include a sensor system, a control system, an actuation system, and a user interface.

The sensor system is responsible for collecting various information inside and outside the vehicle, such as speed, acceleration, surrounding environmental conditions, and road conditions. This information is transmitted to the vehicle's control system, which processes it using a series of algorithms to make judgments and decisions, such as adjusting speed or changing driving direction.

The actuation system implements corresponding actions by operating the vehicle's steering, acceleration, and braking actuators according to instructions from the control system. The user interface allows drivers to interact with the vehicle system, providing necessary information display and control options to ensure drivers can intervene in vehicle control when needed.

Currently, intelligent vehicle technology is moving towards higher-level autonomous driving and broader Internet of Vehicles (IoV) applications. Autonomous driving technology is gradually transitioning from assisted driving (such as adaptive cruise control and automatic parking) to full autonomous driving, with various levels of autonomous vehicles being developed and tested.

The development of IoV technology enables intelligent vehicles to achieve real-time communication with other vehicles, transportation infrastructure, and cloud services, which not only improves road safety but also provides more personalized and convenient services for vehicles.

3. EVOLUTION OF INTELLIGENT VEHICLE TECHNOLOGY

The development of intelligent vehicle technology can be traced back to the late 20th century, when automobiles gradually integrated various electronic control technologies, such as Anti-lock Braking System (ABS) and Electronic Stability Program (ESP). With the advancement of science and technology, intelligent vehicles emerged, realizing the evolution from simple electronic auxiliary systems to comprehensive autonomous driving, which has had a significant impact on user experience.

In the initial stage, intelligent vehicle technology mainly focused on improving vehicle safety and convenience. For example, the introduction of on-board computer systems allowed automobiles to monitor and adjust key performance parameters such as speed, fuel consumption, and engine conditions, thereby achieving energy conservation, emission reduction, and lower energy consumption.

With the integration of the Global Positioning System (GPS), drivers could use this system for route selection and navigation, choosing the optimal driving route to enhance driving convenience and efficiency.

Entering the 21st century, intelligent vehicle technology ushered in a period of rapid development. Especially the wide application of sensing technology and communication technology enabled vehicles to better perceive the surrounding environment and make corresponding adjustments, achieving a higher level of intelligence.

For instance, the Adaptive Cruise Control (ACC) system can automatically adjust the vehicle speed according to the speed of the preceding vehicle to maintain a safe distance, eliminating the need for drivers to make timely operational adjustments. This upgrades the user's driving experience and improves the convenience and safety of the driving process.

With the continuous progress of intelligent technology, the Advanced Driver Assistance System (ADAS) was developed. This system includes various functions such as automatic parking, lane-keeping assistance, and traffic jam assistance. It realizes data interconnection through cameras, radar, and other sensors, creating a safer and more relaxed driving environment for drivers.

It also improves driving safety to a certain extent, and its comfort and convenience have been praised by most users, especially during long-distance driving.

In recent years, the application of artificial intelligence and machine learning has promoted the development of autonomous driving technology. Vehicles can not only perform simple automated tasks but also make complex decisions and learn. Although autonomous driving vehicles are still in the testing and gradual promotion stage, they demonstrate the future development direction of intelligent vehicle technology.

The application of autonomous driving technology has completely changed the user experience, transforming drivers from operators to vehicle managers. This will have a profound impact on vehicle design, transportation systems, and even the entire social model.

The evolution of intelligent vehicle technology has not only improved driving safety and convenience but also moved towards providing a comprehensive driving experience. With the continuous innovation and application of technology, future intelligent vehicles will continue to strengthen interaction with users, offering more personalized, intelligent, and emotional driving experiences.

4. APPLICATION OF COMPUTER TECHNOLOGY IN INTELLIGENT VEHICLE DESIGN

4.1 On-board entertainment and information system

Multimedia entertainment: The on-board entertainment system can play audio and video files to meet the entertainment needs of drivers and passengers. These systems are usually equipped with high-definition displays and high-quality audio, supporting multiple media formats and interfaces. Drivers and passengers can select favorite music, movies, radio, or other media content through touch screens or voice control. Meanwhile, the on-board entertainment system can connect to mobile phones or other mobile devices to expand entertainment functions.

Navigation and map services: The on-board information system provides navigation and mapping functions to help drivers plan the optimal driving route and provide real-time navigation guidance. These systems use satellite navigation systems (such as GPS) for positioning, and combine map data and traffic information to provide accurate navigation instructions. In addition, the on-board information system can offer nearby Point of Interest (POI) search, real-time traffic conditions, and route planning functions to provide more comprehensive driving information.

Voice assistant and intelligent control: On-board entertainment and information systems are usually equipped with voice assistants, which can control system functions through voice commands. Drivers and passengers can use voice commands to select music, adjust volume, send text messages, or make phone calls, reducing distraction caused by operations. Furthermore, the on-board system can integrate with smart home systems to achieve remote control and intelligent home management.

4.2 Vehicle fault diagnosis

Fault detection and diagnosis: The vehicle fault diagnosis system monitors the operating status of various vehicle components by collecting data from various sensors, such as engine speed, temperature, and air pressure. When the system detects abnormal signals or preset fault indicators, it triggers an alarm and records relevant fault information. Subsequently, computer algorithms analyze and interpret this data to perform fault diagnosis and determine possible causes of the fault.

Fault codes and warning lights: When the vehicle fault diagnosis system detects a fault or abnormal condition, it generates corresponding fault codes and prompts the driver through warning lights on the vehicle dashboard. These fault codes can help technicians quickly locate and resolve problems. In addition, some intelligent vehicles can send fault information to manufacturers or maintenance stations via wireless connections to obtain timely support and assistance.

Remote diagnosis and maintenance: Computer technology also enables remote diagnosis and maintenance. Through on-board communication technologies such as on-board phones, Bluetooth, and the Internet, the vehicle fault diagnosis system can conduct remote communication with suppliers or maintenance stations. Technicians can remotely access the vehicle's fault data, status information, and system settings to perform remote diagnosis and maintenance, thereby improving maintenance efficiency and reducing vehicle downtime.

4.3 Application in autonomous driving systems

In the design process of intelligent vehicles, computer technology plays an important role in autonomous driving systems. This mainly includes deep learning, computer vision, sensor fusion, path planning, and control systems, as detailed below:

Deep learning, as a very important technology in the field of artificial intelligence, is applied in autonomous driving by training the vehicle on driving environments such as roads, traffic signals, obstacles, and climate conditions. This enables the autonomous driving system to make correct driving decisions during vehicle operation.

Through computer vision technology, autonomous vehicles can recognize and process image and video information to perceive and understand the surrounding environment. This helps autonomous vehicles drive safely under complex road conditions and different weather conditions.

Autonomous vehicles are usually equipped with multiple sensors, such as radar, LiDAR, and cameras. Through sensor fusion technology, data from these sensors can be integrated to form a comprehensive perception of the surrounding environment, which helps improve the perception accuracy and robustness of autonomous vehicles.

Path planning is a basic technology in autonomous driving. It mainly uses computers to analyze and process relevant information collected by sensors, then intelligently plans the path. This allows autonomous vehicles to plan safe, efficient, and smooth driving paths in complex road networks, helping improve the driving efficiency and safety of autonomous vehicles.

Through the control system, autonomous vehicles can achieve precise control of various aspects such as vehicle attitude, speed, and steering. This helps ensure the stability and safety of autonomous vehicles under various driving conditions.

5. CONCLUSION

Computer technology has a broad application field in intelligent vehicle design and is an inevitable trend in the future development of the automobile industry. To actively respond to the call for an environment-friendly and resource-saving society, while emphasizing the level of intelligent vehicle design, we should also strengthen the promotion and application of intelligent vehicle design technologies to promote the healthy and sustainable development of the automobile industry.

6. REFERENCES

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