Development status and Prospect of parking assist system

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Abstract: Describes the origin and development of the vehicle parking assist system, summarizes the current parking assist system application and research status, and technical parameters and characteristics, analyses the advantages and deficiencies of the existing parking assist system, and its development prospect.

Keywords: Intelligent parking; parking assistant; development status; Prospect.

1. Introduction

From 1757 Watt invented the steam engine, to 1866, German engineer Nicholas Otto successfully produced a landmark in the history of the momentum of the vertical four-stroke internal combustion engine, and then to 1885, Karl Benz invented the world's first car[1]. Car is accompanied by the development of industrial development. After more than 100 years of continuous improvement and innovation, automobile development has experienced technological progress, product diversification period, product low price period, product globalization period, electronic intelligent period, etc[2]. In the 21st century, with the rapid development of science and technology, along with the development of computer, communication and sensor technology, the automobile gradually develops towards the electronic intelligentization, which is mainly embodied in the intelligent information system, security system, energy saving system and intelligent Auxiliary driving system and so on.

Vehicle parking assist system is an auxiliary driving system. It mainly uses sensors and other devices to detect the surrounding environment of vehicles in real time. After processing the data, the driver can provide decision support information or make decision control directly to the vehicle. Intelligent system, not only to help drivers quickly and safely complete the parking operation, reduce the driver's driving burden, improve driving safety, but also effectively improve the car's intelligence and increase the economic value of the car. Among the many ancillary products in the car, the parking assist system characterized by smart parking is attracting more and more attention, and the supporting parking assist system is also one of the important markings of high-grade vehicles.

With the development of science and technology, more and more parking assist system towards intelligent and automated development.

2. Application Status of Parking Assistant System

Volkswagen AG (German: Volkswagen) developed automatic parking assist system referred to as PLA. From the PLA system 1.0 first generation to the PLA system 1.5 second generation, to today's PLA2.0, is already the Volkswagen's third generation of automatic parking assist system, and has matured in the Passat and other models. Its innovative, diverse functions not only enrich the customer's driving experience, but also for the public company has brought considerable economic benefits. PLA's main function is automatic parking and parking assist, PLA autonomous control of vehicle steering, with the driver of the throttle, brake and gear operation, the car parking in place. As shown in Fig. 1, the system is equipped with six ultrasonic sensors, which measure the parking space in real time even if the PLA system is turned off. One or more truck moves into place during parking or out of the parking space. Parallel parking, the length of parking spaces for the body length of +0.8 m; vertical parking, the parking spaces for the width of the body width of 0.7m; When parking out, the length of parking space is + 0.5m. In the brake assist area, the ESP system is activated to reduce the loss when the car is too high or when there is a collision hazard[3].
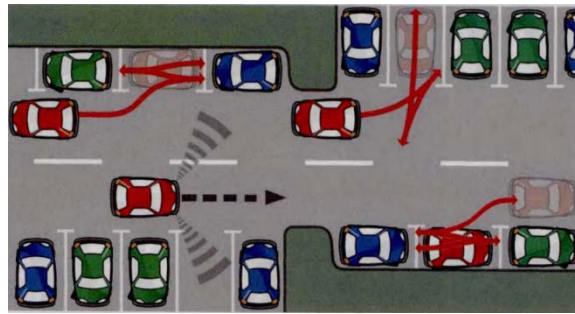
Fig. 1 PLA2.0 Parking diagram

BMW's BMW535Li comes with a parking assist system called the "parking assistant" [4], as shown in Figure 2, start the system just press the button on the panel. Product specifications on the minimum parking distance parking requirements parallel to the car length + 1.2m, not too much on the lateral distance requirements. The minimum speed required for system start-up is 35 km / h. Enter the parking assist status, the driver simply according to the system prompts, switch gears, and pay attention to reversing radar reminder, control the brake can be.

Fig. 2 BMW535Li Parking Assist Start Button

BMW is also showing in 2015, a set of named automatic remote control parking system parking assist system, the system can completely without the need for driver control, automatically parked the car parking spaces. The system also supports remote control of car keys or smart watches. The system was first applied to a new generation of BMW 7 Series sedan [4].

Japan's Toyota Group's Lexus LS460L comes with parking assist system known as the "intelligent parking assistants IPA" [5]. System start on the speed requirements are less than 15 km per hour. When the vehicle through the idle parking spaces, the driver brake parking and hanging down after the block, select the parking position on the screen, the system automatically take over the steering wheel, as shown in Figure 3. The driver simply release the brake pedal and to ensure that the speed does not exceed 5.5 km per hour, the system can automatically parked in place. The "Intelligent Parking Assistant IPA" is more user friendly than other parking assist systems, providing the driver with an optional parking position, such as left or right in front of the parking space. Humanized intelligent design not only get the favor of many car enthusiasts, is to improve the security of parking.

Fig. 3 LS460L system start button is located on the steering wheel

Shanghai Volkswagen launched Skoda Hao Yue, the front bumper on both sides of the front almost 180 ° position on the two ultrasonic sensors, real-time scanning on both sides of the road, automatically find the right parking spaces. The driver only need to control the brakes, the vehicle automatic control operation, you can park in place, while the corresponding display car parking situation, easy to observe the driver.

3. Research Status of Parking Aid System

Wang Kaide and Jiang Haobin in 2014 designed a safety monitoring and path correction with a parking assist system, the use of safety monitoring and path correction to prevent parking hazards. The system consists of environment information acquisition module, vehicle speed signal acquisition module, strategy module (main controller), voice prompt module and security monitoring module. Which consists of lateral ultrasonic distance sensor and tail ultrasonic distance sensor. The speed information acquisition module is composed of wheel speed sensor. The two modules collect information to provide information to the policy module and safety monitoring module for information processing, effectively identify and then The voice prompt module sends commands to the driver to make the decision [6].

In 2012, Huang Xianbo and Zhou Suli of Tongji University used the CAN module in Simulink to simulate the parking process and used VC ++ library function to get the information of steering wheel angle and vehicle trend. Optimize an optimal parking path, and real-time refresh and on-board display, guide the driver to complete the parking operation [7].

Wuhan University of Technology in 2015 Li Xiaoliang and Wang Yuling use of fish-eye camera around the vehicle information displayed on the vehicle display for driver parking reference. They first according to the size of the vehicle and the different bodies, through experimental optimization of the fish-eye camera installation location to ensure that by four fish-eye camera 360 ° around the vehicle environment, bird's eye view of the information displayed on the car display, And its display effect was optimized [8].

2011 Su Yanxia and Yang Shengbing analysis of reversing the main reason for the accident is the "backsight" bad. To this end, they designed a smart distance based on the intelligent parking system. The system uses the PIC16F877A microcontroller as the core, uses the principle of ultrasonic distance measurement, real-time detection of the distance between the rear and obstacle, the digital tube display, according to the actual situation, such as sound and light alarm signal, with low cost, high precision [9].

In 2013, Zhou Zhongyou and Yu Hai of Huzhou Vocational and Technical College put forward a parking assistant system which can display the wheel position information. The system can display accurate and intuitive wheel angle, position and the number of turns of steering wheel in real time. Staff parking to provide data assistance. The system consists of single-chip, angle tilt sensor, step-up chip and LCD panels and other devices [10].

4. Analysis and Prospect of Parking Assist System

A wide range of parking assistance system currently available, according to the vehicle parking mode manual and automatic distinction, can be divided into two categories: One is the driver-driven operation as the main body, parking assist system to provide environmental data as a reference; The other is intelligent automatic parking, vehicle parking assist system for the computer to provide environmental data, computer decision-making control, the implementing agencies in accordance with the instructions parking in place, under normal circumstances without the driver to operate. More detailed classification, the parking assist system can be divided according to its function: Parking sensor; parking image; automatic parking system; panoramic vision parking assist system.

Advantages of Existing Parking Assist System. The parking assist system is coordinated by several sub-systems, and the intelligent artificial intelligence is integrated to make the complicated reversing storage and side parking easier and more convenient, even without the driver's participation. operating. Has been applied to the real car parking assist system is simple, a key to start or hang upside down automatically when the start and provide real-time environmental information for the driver to make decisions or automatically by the system, simple and quick to solve the driver novice to worry about . The existing parking assist system has the following advantages: ① technology is mature, stable performance; ② convenient and quick operation; ③ system data processing capacity and so on.

Shortcomings of Existing Parking Assist System. ① vulnerable to environmental factors. The parking assist system is susceptible to environmental impacts in measuring parking spaces and subsequent parking. The present parking assist system is weak in identification of covers, floor recesses, loose shoulders, smaller dangerous items in the parking space, and so on. Unrecognized. Autumn and winter, the surface of the leaves and snow directly affect the sensor's echo signal, the system of parking spaces to determine the information, easily lead to misjudgment of miscarriage of justice.

In addition, the current parking assist systems are mostly used ultrasonic sensors or real-time video camera. These devices are generally installed in the front and rear bumper and other lower position, vulnerable to dirt, water droplets or snow and ice, etc., thus affecting the physical characteristics of ultrasonic sensors for video cameras is a direct impact on picture quality, so there parking security risks.

②System decision is restricted. The existing parking assist system to determine the parking spaces, not only by the impact of the surface environment, but also closely related to the system's algorithm. Roads on the road, a wide range of obstacles and different shapes, and artificial intelligence, after all, is to imitate the human will and can not completely imitate. Whether a parking assist system can recognize the parking space more humanely depends on the discrimination of the acquired information by the system program algorithm. For example, in the fork or building entrance, immature system will close the entrance gate near the gate as the ideal parking spaces.

③Environmental awareness of a single channel. Most of the current parking assist systems use ultrasonic sensors or real-time video cameras. A single environment-aware channel makes the system's perception of the surrounding environment of the vehicle limited, and the environment information it obtains is two-dimensional plane information, which needs to be discriminated according to the experience database and even recognized by the driver. In situations where the driver is overly dependent on the parking assist system, ambiguous context-aware information can have extremely dangerous consequences for the parking process.

Development trend. ①Multi-faceted more comprehensive environmental perception. With the development of sensor technology, the parking assistant system environment-aware equipment is not limited to ultrasonic sensors and video cameras. You can use a variety of sensors, more comprehensive orientation of the vehicle to the surrounding environment perception. Such as holographic image, virtual reality (VR) and the information of obstacle distance, shape, size and so on, the information will be displayed to the driver. Multi-faceted, more comprehensive environmental information will assist the driver in more secure parking.

②More intelligent decision-making module. The current parking assist system to determine the ideal parking spaces, mainly based on the echo signal of ultrasonic sensors. The system filters out the low debris that does not hinder the parking, and carries on the distance measurement to the obstacle, when the distance meets the condition, judges as the ideal parking place. The system can not be combined with traffic rules and the actual situation to determine. More intelligent decision-making module can be more user-friendly combination of traffic rules and other conditions on the parking spaces to determine, to achieve fully intelligent parking.

③ Human-computer interactive human intelligent parking. The date of human-computer interaction technology, people and machine communication is not limited to a button. Human-computer interactive user-friendly parking assist system will use the mobile phone APP, Bluetooth, wearable equipment and wireless networks and other means to achieve the driver and vehicle communication. In the future, the parking assist system can send members to designated locations and the vehicles themselves go to parking. When the driver needs a car, the vehicle automatically drove out of the library.

5. Summary

At present, the parking assist system has been widely used by most domestic and foreign automobile manufacturers, intelligent automatic parking assist system has become an important indicator of high-end models. With the development of sensor technology, holographic imaging and virtual reality technology, the future parking will be faster, more secure, more science fiction.

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