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Research and Application of Control Algorithm Based on Intelligent Vehicle

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Abstract

Cars are becoming more and more common in today's society, and people are increasingly relying on cars when they travel daily. In developed countries, more than 50% of goods are transported by car, and passenger transportation is as high as 60%. Nowadays, it is necessary to refer to the per capita car holdings to evaluate whether a country's industry is developed. Therefore, the number of cars is increasing day by day. At the same time, environmental pollution and traffic accidents caused by automobiles are becoming more and more serious. In the automotive engineering world, it is extremely urgent to solve a series of negative problems brought about by automobiles. Since the mid to late 1980s, many countries have begun to do some research on smart car systems. The smart car is a comprehensive system that integrates multiple levels of assisted driving and environmental awareness. With the progress of research, nowadays smart cars can complete the functions of roadblock recognition and security. This article is based on the research of intelligent cars, and conducts a more in-depth discussion on the control algorithms of smart cars, hoping to help the development of smart cars.

Keywords: Intelligent car; control algorithm; research; application

1. Introduction

At present, the control algorithms of intelligent vehicles are mainly based on three theories, namely, the control algorithm theory based on neuro-fuzzy technology, the control algorithm theory based on artificial neural network technology and the control algorithm theory based on fuzzy control theory. In addition, autonomous navigation

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technology and modern control theory have also played a very important role in the research of control algorithms for smart cars. According to the requirements of smart cars in different environments, the control algorithm will have different focuses.Looking back at the research on the control algorithm of smart cars, the time was first pushed to 1988. At that time, it was mainly responsible for the key laboratory of the Department of Computer Science of Tsinghua University. It successfully studied the first true THMR smart car in China, which has automatic The image recognition system, in turn, enables vehicle navigation. Figure 1 below is the first smart car in China.

Figure 1 THMR smart car

2. Theory of Intelligent Car Control Algorithms

2.1 Theory of control algorithm based on neural fuzzy technology

The neuro-fuzzy technology mainly involves two research fields: neural network and fuzzy control. The research content and research form of these two fields are very different, but the ultimate research goal is to realize artificial intelligence. In the research of neural network technology, there are still relatively large problems in knowledge reasoning in countries all over the world. In the research of fuzzy control, knowledge acquisition is very difficult. The research of neural fuzzy technology control algorithm combines neural network technology and fuzzy control technology, so that neural network technology and fuzzy control technology can cooperate with each other. Neural network technology can simplify the acquisition of knowledge, and fuzzy control technology optimizes the control conditions.[1] Today, even in highly unstable and very complex environments, neuro-fuzzy techniques can achieve good control. It is precisely because of this feature of neuro-fuzzy technology that related research in the automotive industry at home and abroad is becoming more and more popular.

1.2 Control algorithm theory based on artificial neural network technology

The so-called artificial neural network technology is simply to apply the intelligent behavior of the human brain to the research of smart cars. Artificial neural network technology can provide many different ideas from the previous models and nonlinear systems, breaking the conventional operation and realizing intelligent driving. The most outstanding achievement of artificial neural network technology is the realization of intelligent manipulation, which can simulate the driver's driving process and can avoid obstacles in real time and select the best driving path. We all know that the main behavior of the driver in the process of car manipulation is path selection and direction control. Therefore, as long as the artificial neural network technology highly imitates the driver's path selection and direction control, it will add a lot of color to the research of intelligent driving.

1.3 Control algorithm theory based on fuzzy control theory

The realization of fuzzy control theory is that for a whole team of vehicles, the simple expression is a whole team of

vehicles with fuzzy control theory. The first car can control the spacing of all the vehicles behind. This research is carried out in an environmental closed-loop system. The fuzzy control theory can be divided into two types: vehicle control and driver control. At present, the research has achieved valuable research results. The manipulation of the car itself is a very complicated process, and the driver's control and judgment of the car is based on a vague understanding. For example, the speed of the car, fast, fast, slow, very slow, etc., each driver's feeling of speed may be different, so the study named this fuzzy thinking based on the driver is called fuzzy control theory. The entire fuzzy control theory controls the target through fixed language conditions. The specific rules of control are specially developed by researchers, which fully embodies human intelligence.

3. Analysis and Selection of Control Algorithms

3.1 Analysis of control algorithms

At present, the more mature control algorithms studied mainly include intelligent control, modern control and classic control. Intelligent control is a relatively advanced stage of development. It is a comprehensive control algorithm that integrates information theory, system theory and artificial intelligence cybernetics. The most prominent feature of intelligent control is that it can realize intelligent control of intelligent machines without the help of human power. In the field of intelligent control, there are mainly expert control systems, genetic algorithm optimization techniques, neural network technologies, etc., which are very practical and effective. Modern control theory mainly solves the related control problems of time-varying systems through state equations. In the study of time-varying systems, it can be found that the output is often interfered by the input quantity, so solving this control problem can greatly improve the practical application of modern control theory in military and national defense theory. Classical control is one of the most widely used and widely used methods. The limitation of classical control is that the algorithm can only solve the problem of linear steady system through transfer function, and can not solve some nonlinear system problems. Classical control is mainly used in the process of industrial production, which can greatly improve the efficiency of industrial production.[2] The most representative of the classical control methods is the PID control algorithm, which is efficient and widely used. Figure 2 below is the control block diagram of the PID control algorithm.

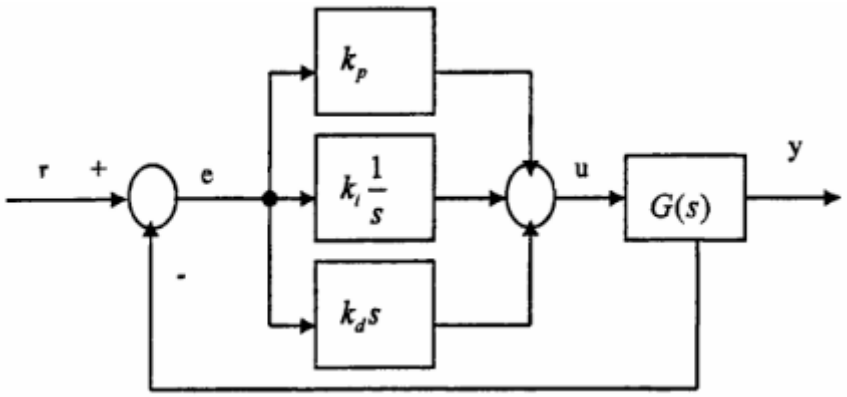

Figure 2. PID control block diagram

3.2 Selection of control algorithm

The choice of control algorithm depends mainly on the purpose. If it is mainly to realize artificial intelligence control, reduce human participation, reduce human work pressure and reduce the risk of manual work, intelligent control algorithm is the most suitable. If it is mainly to solve the problem that the output is disturbed, the algorithm of modern control theory should be chosen. However, if the target requirements for the application are not very strict and do not require an exact mathematical model, then the classical control method can be chosen, especially the more representative PID control algorithm.[3] The PID control algorithm linearly combines the differential, integral and proportional for control purposes.In summary, we should choose different types of control algorithms for different types of control

requirements. On the one hand, it can guarantee the validity and timeliness of the algorithm, and it can also provide a clearer direction for the later research, and make some reference for the later development.

4. Application of Intelligent Vehicle Control Algorithm

4.1 The *application* of the car itself

4.1.1 Autopilot

At present, fully automatic cars have been successfully developed, and the types are quite rich and diverse. However, there are still many imperfections in fully-automobile vehicles, so related research institutions such as Italian universities and Japanese mechanical engineering laboratories are undergoing technological innovation. In China, the first fully-automated car was implemented on the campus of Tsinghua University, and the National University of Defense Technology improved the speed of self-driving cars on this basis. All in all, the auto-driving car is currently undergoing a very rapid development and will soon achieve even more impressive achievements.

4.1.2 Intelligent speed control

In some relatively developed countries in Europe, when they study smart cars, they can adjust the speed of the car as one of the indicators to measure the safety of the car. At present, the Swedish research has begun to carry out this research. The main idea is to use the satellite positioning system or the roadside signal to connect with the vehicle's map navigation to automatically control the speed of the vehicle. Through research and the addition of intelligent speed control, the incidence of smart car traffic accidents has been reduced by 20%, making a great contribution to the development of smart car industry.Intelligent speed regulation is very necessary for the car in the process of driving. Because there are many situations in real life, the speed adjustment during driving is not very timely. For example, if the driver is suddenly sick or has an emergency, the driver has no time to respond. If the car can automatically adjust the speed at this time, then the car will avoid accidents. Drivers and occupants will not be affected.

4.1.3 Preventing impact

When the car is driving, the impact is a very serious traffic accident. Therefore, many automobile companies have been actively introducing anti-collision car driving systems in recent years. The first action was the Mitsubishi Motors Corporation of Japan, and Toyota, Nissan, and Honda began to study the car driving system to prevent impact. [4]The driving system for preventing collision mainly includes: nighttime obstacle alarm, driver's slamming alarm, automatic braking system, lane positioning system, and pitch control system. Preventing impact is an inevitable eternal research topic in the future of smart car research, because the effectiveness of this system is directly related to the driver's life safety and even the entire transportation system. A few days ago, the US Department of Transportation and General Motors Corporation reached a consensus and invested $35 million to conduct in-depth research on the anti-collision system of smart cars.

4.2 Application of public transportation

The best application of smart cars in public transportation should be the CiViS automated car driving system announced by the French company IrisBus. [5]The CiViS automatic operating system can directly realize the automatic navigation of the car by identifying the identification of the road surface. Today, this CiViS automation has been applied to French buses. At the same time, the US auto industry did not fall behind. The transportation department of California actively cooperated with the research, and the automatic bus development situation was also very good.

5. Conclusion

The future development direction of smart cars is undoubtedly very extensive. Because the development of smart cars can not only reduce traffic congestion, but also reduce the occurrence of many vicious traffic accidents. In addition, the

promotion of smart cars can also reduce the driver's driving pressure and improve the rider's ride experience. All in all, the research of smart cars will not only increase the convenience of transportation, but also accelerate the development of China's automobile market, and thus improve the competitiveness of China's automobile market. This is of great significance to the development of our country in the international arena.

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