



Review Article

Analysis of Anti Error Pedal System

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To cite this article:

Wensheng Sun, Junxin Zhang, Zhihao Li, Guochen Cui. Analysis of Anti Error Pedal System. *International Journal of Management and Fuzzy Systems*. Vol. 4, No. 2, 2018, pp. 35-40. doi: 10.11648/j.ijmfs.20180402.15

Received: July 9, 2018; **Accepted:** July 27, 2018; **Published:** August 27, 2018

Abstract: In order to study the status quo of the accelerator misoperation system, the advantages and disadvantages of the system and the mitigation of the current traffic accidents, this paper summarizes the system by consulting the domestic and foreign literatures on the field research. With the increasing number of motor vehicles, the development of automobile safety technology has been urgent, and the active safety technology has become the focus and trend of the development of automobile safety technology. As one of the active safety technologies of automobile, it can avoid or reduce the situation that drivers want emergency brake but mistaken the throttle and cause traffic accidents. At present, there are relatively few researches on this aspect at home and abroad. So there are many key technologies for preventing misoperation of the throttle, so the driver often needs to be perfected. When it is very close to the front obstacle and needs brakes, it causes traffic accidents by stepping on the accelerator pedal as a brake pedal due to momentary tension. Finally, although there are still some questions about the system, this system has great potential because the development of technology will eventually be solved, the system has great potential to increase the probability of safe driving.

Keywords: Automobile Active Safety, Casualty Accident, Preventing Maloperation on Accelerator, Automatic Brake System

1. Introduction

1.1. Background of Research

With the increasing number of motor vehicles, the vehicle brings human convenience to the human life and brings the hidden danger to the human life, and the traffic accident is the unnecessary loss of the human life and property. From 1896 A total of about 34000000 people worldwide died in traffic accidents since the first death of pedestrians and motor vehicles in 2003. Road traffic accidents, and more than 500 thousand people die in traffic accidents every year, and about 10 million others are injured. China's traffic accidents also increase year by year with the rapid increase of car ownership. In 2010, the total number of traffic accidents in China was increased. 3906164 road traffic accidents were reported, including 219521 road traffic accidents involving casualties, resulting in 65225 deaths, 254075 injuries and a direct loss of 930 million yuan. Road traffic accidents bring great losses to families, collectives and countries, so road traffic safety has become an important public safety problem all over the world.

In March 2, 2010, the UN General Assembly passed a resolution announcing the ten year of road safety action from 2011 to 2020. The resolution points out that the goal of action for ten years is to stabilize and reduce global road mortality through more activities at the national, regional and global levels. Therefore, the development and improvement of vehicle safety technology should not be ignored by road traffic safety status and traffic accident analysis methods [1].

The safety technology of automobile includes two aspects: active safety technology and passive safety technology. Active safety technology optimizes the man-machine environment of vehicle driving control system by designing more reasonable and effective internal structure of automobile, and avoids accidents actively. The role of passive safety technology is when accidents occur in automobile accidents. Try to protect the driver and reduce the degree of injury.

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accidents actively. The role of passive safety technology is when accidents occur in automobile accidents. Try to protect the driver and reduce the degree of injury [2]. The passive safety technology such as seat belt and airbag can reduce the casualties of the personnel to a certain extent, but can not avoid the occurrence of accidents absolutely. Therefore, active safety technology has become the focus and trend of the development of automobile safety technology, and has been paid attention to by the government, automobile enterprises and consumers. Since 1970, the systems with automatic braking functions used in automobiles include brake anti lock system (ABS: Anti-lock Braking System), drive anti skid control system, adaptive cruise control, active collision avoidance system, vehicle lateral stability control system, brake auxiliary system and so on. Using radar and sensors collect vehicle driving informations and take measures to intelligent analysis [3].

The technology of preventing maloperation on accelerator is one of the active safety technologies of automobiles. When drivers are very close to the front obstacle and need to brake, they cause a traffic accident by stepping on the accelerator pedal as a brake pedal due to momentary tension. The research shows that if the car automatically reduces the collision speed from 60Km/h to 50Km/h when the driver is mistakenly stepping on the accelerator, the impact force will be reduced by about 30%, and the risk of the driver is greatly reduced or the accident can be avoided [4]. Some anti mistake accelerator system can judge the obstacle information (such as car distance, speed, accelerator pedal acceleration), apply the counterforce to the accelerator pedal when the vehicle enters the safe distance, and prevent the driver from stepping on the wrong pedal. Order, assist the driver to handle. From the point of view of intelligence and automation, the STC12 C5 A60 S2 MCU is used as the core [5]. To prevent erroneous operation on accelerator pedal by car driver due to emergency situations in drive [6].

1.2. Research Significance

According to statistics, traffic accidents caused by incorrect stepping on the accelerator account for about 12.6% [7] of major traffic accidents. Therefore,

When the driver wants to step on the brake and mistakenly step on the throttle in an emergency, it can be perceived by the mistaken step on the throttle system and assist the driver to take safety measures to avoid the occurrence of traffic accidents or to reduce the degree of casualties. At present, such as BMW, Audi and other advanced imported cars with electronic throttle, similar functions have been installed [8-9], but for domestic vehicles, in this respect, there are still a lot behind, and the low end cars in the domestic wire throttle have a large amount. The scholars put forward many plans and ideas for the automobile with pull throttle.

As a vehicle active safety technology, the key technology of preventing false step on the throttle is still in its infancy, especially in China. At present, the main shortcomings of automobile anti error pedal system are: (1) single sensor, and affected by road conditions and weather, can not accurately judge the situation in front of the vehicle; (2) short range range;

(3) can not identify the target. Therefore, it is necessary to study the anti maloperation accelerator system as a research topic in the field of automotive active collision avoidance technology, and further study it. The significance of the research is to develop an automatic brake system with independent intellectual property rights, prevent the car from mistakenly stepping on the throttle under emergency conditions, and avoid a series of public traffic safety problems caused by the driver's mistaken trample of the throttle into the brake in emergency, and improve the auto active safety technology of our country, in order to improve me. The international competitiveness of China's automobile manufacturing industry is of great significance for promoting the development of road traffic in China.

2. Domestic and Foreign Research Status of Vehicle Anti Maloperation Accelerator System

2.1. Judging the State of Automobile Safety

In the automobile anti error pedal system, the information of vehicle state or front obstacle information (mainly driving information) is transferred from the sensor to the central control system. The central control system coordinates all aspects of the information, determines the vehicle safety state according to the set automobile safety state determination logic, and gives the corresponding brake. Car signal. The judgement technology of vehicle safety state is one of the key technologies in the whole system. At home and abroad, there is a relatively simple condition to judge whether the valve is mistaken to step on the throttle. Most of the methods are used to measure the time difference or rate difference between the accelerator pedal and set a threshold as the critical value of traffic safety [10]. Additional conditions such as increasing the distance between self driving vehicle and obstacle in front of the system can increase the reliability and accuracy, and reduce the false positive rate of the system.

If the data processing of the system combines two or more than two factors, it is called multisensor information fusion technology. Multi-sensor information fusion technology is used to detect information through the sensing functions of various sensors, to optimize the information redundancy of sensors in time and space by using some criteria, and to make up for the shortcomings of each sensor, so that the processing of information can be optimized. Multi sensor information fusion divides the data fusion model into two layers: low processing layer and high processing layer. The low processing layer includes direct data processing, target detection, classification and recognition, target tracking, etc. the high level layer includes situation estimation, threat estimation and further adjustment of fusion results.

Compared with the single sensor system, multi sensor information fusion has great advantages in target monitoring, recognition and navigation. The main technical features are: good robustness, expansion of space and time coverage,

increasing the credibility, reducing the fuzziness of information, improving the system detection ability and improving the space. Inter resolution improves the reliability and correctness of the system [11].

2.2. Acquisition of Information About the Obstacle in Front of the Car

The key technology of obstacle information acquisition is the distance measurement between the vehicle and the front obstacle. At present, the ranging methods of vehicles usually include ultrasonic ranging, infrared ranging, laser ranging, machine vision distance and radar ranging [12]. The method of ultrasonic distance measurement is low precision, small range range, and is used to manufacture reverse radar. Although infrared distance measurement is simple in structure and low in price, its precision is low, its distance is near, and its direction is poor, it is easily affected by the weather. At present, the commonly used ranging techniques in automobile collision avoidance technology include machine vision ranging and radar range finding, and the latter can be divided into laser radar ranging and millimeter wave radar ranging [13].

The distance between the vehicle and the front obstacle is obtained by processing the image information of the external objects in real time by machine vision measurement. Although the method has a strong adaptability, high recognition and wide detection range, the number of pixels of the CCD camera is limited and the measurement precision is low, and the amount of data processing of the signal processing is low too[14]. Compared with machine vision ranging technology, radar ranging technology has good real-time performance, high precision and long distance measuring range. Compared with the laser radar, the millimeter wave radar avoids the problem that the measurement performance is easily disturbed by the environmental factors, and realizes the remote

detection of the obstacles and the identification of the road conditions. For short-range detection and recognition in the range of tens of centimeters to a few kilometers, it belongs to radar proximity technology. Compared with remote detection, millimeter wave near sensing technology is characterized by the existence of target body effect, easy proximity range finding, short signal processing time, small volume and light mass. Millimeter wave radar is used as the ranging sensor. Its basic task is to find targets and measure target parameters.

2.3. Research on Automatic Brake Mechanism

To avoid traffic accidents, the automatic braking mechanism will start after receiving the brake instructions of the central control unit.

In order to realize the function of automatic braking, there are two main methods: (1) increasing the hydraulic pressure of the main pump; (2) the control of the structure of the vacuum booster is controlled so that it can be equivalent to the effect of the tread force without the pedal force. Yik has designed a set of hydraulic auxiliary braking devices, such as accumulator, oil pump and solenoid valve [15]. Figure. 1 is a schematic diagram of an automatic increase of the pressure structure of the brake master cylinder, which is installed between the brake master cylinder and the wheel cylinder. When the car is running normally, the oil pump is closed and the emergency braking oil road is closed. Only when the brake is made, the oil of the brake wheel cylinder will flow from the normal oil path to the brake wheel cylinder. When the oil valve is judged to be mistaken, the oil pump opens and does not work in the normal way without artificial braking. The oil pump will pump the oil in the main cylinder to the cylinder in the direction of the dotted line in the diagram. The oil pressure of the brake wheel cylinder is increased, and the automatic brake is realized.

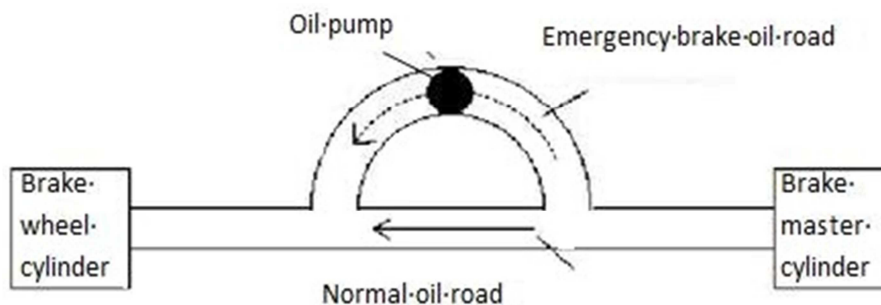


Figure 1. Hydraulic auxiliary brake device.

Wang Jianqiang and others of Tsinghua University reformed the ordinary vacuum booster. Using the mechanical characteristics of the electromagnet to design the circuit casing and optimize the parameters, by adjusting the current of the electromagnet coil to produce the thrust, instead of the pedal force of the artificial brake, the whole working process of the booster in the braking process [16].

3. Research on Key Technology of Preventing Misoperation of Throttle System

3.1. Analysis of the Determinant Factors of Mistakenly Stepping on the Throttle

The function of the auto brake system is that the system can

automatically brake and cut off the oil road when the driver is mistakenly stepping the throttle to the brake. There are two actions involved in the whole judgment process: step on the accelerator and auto brake. To judge whether or not to step on the throttle and to realize the automatic brake function, we should base on the structure of the gasoline supply and the principle of braking, and find out the factors of judging the mistakenly stepping on the throttle and the object of the final

control.

Figure 2 is a schematic of the injection system. Air enters the injection system, the fuel nozzle is supplied by the nozzle, and the mixture of air after atomized gasoline is burned to provide the engine's power. The opening of the fuel injector is controlled by the electronic control unit of the automobile, and the throttle position sensor detects the opening of the throttle valve.

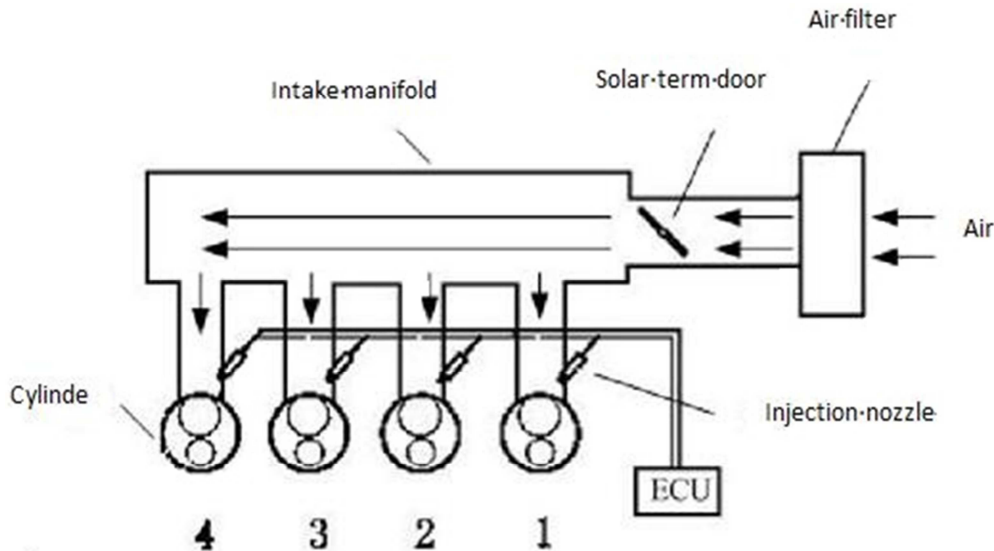


Figure 2. Schematic diagram of the fuel injection system.

The air-fuel ratio of the mixture affects the adequacy of combustion. Generally speaking, 1kg gasoline needs 14.7kg air for complete combustion. If you limit the throttle opening or reduce the fuel injection volume of the fuel injector, the car will slow down. In addition, throttle valve is connected to the accelerator pedal. The throttle opening reflects the depth of the accelerator pedal position, and there is a linear proportional relationship between the throttle pedal and the accelerator pedal. The change of throttle opening can reflect the speed or acceleration of the accelerator pedal. The definition of stepping on the accelerator can be distinguished by the speed or acceleration of the pedal. Therefore, judging whether or not to step on the accelerator can be achieved by obtaining the change rate or the two change rate of throttle opening. Cutting off the fuel injector makes the mixture in the fuel injection system unable to fully burn. It can be used as a means of vehicle deceleration.

The decision to miss the accelerator is not only related to the change rate of throttle opening rate of the car, but also to the vehicle condition of the outside world. To determine whether the vehicle is dangerous or not, we should consider the relative distance between the vehicle and the target information in addition to the false acceleration of the vehicle.

In most studies, the two conditions are identified by the system, such as the time of the accelerator pedal, the position of the accelerator pedal or the speed of the accelerator pedal, to identify the driver's normal trampling of the throttle and the emergency brake pedal. The time for stepping on the accelerator pedal is a criterion for judging the lag of the

reaction. The distance between the brake pedal and the safety is not high with the position of the accelerator pedal as the parameter, and the velocity change is not obvious compared with the acceleration of the accelerator pedal.

3.2. Detection of Distance Information of Front Obstacle

The distance sensor is used to detect the distance from the front obstacle. The performance and precision of vehicle ranging sensor will affect the performance of the whole system to a great extent, so it is necessary to study the measurement method of vehicle ranging. The medium of electromagnetic ranging includes two kinds of microwave and laser. According to wavelength, microwave can be divided into decimeter wave, centimeter wave, millimeter wave and sub millimeter wave. Using different ranging media, the nature of ranging is totally different. Therefore, the range medium should be determined according to the need of measurement [17].

The acceleration of the pedal when the car overtook was similar to that of the pedal when the accelerator was mistaken. In order to prevent the car from mistakenly stepping on the accelerator system, the acceleration of the pedal is mistaken for the mistake of stepping on the throttle. The quality of the braking system is the key to whether the car can run safely. The main functions of the braking system include slowing the car down, stopping at a predetermined distance, not running off and not leaving the tail. Its main structure mainly includes control mechanism, transmission mechanism, brake pressure regulating

mechanism, brake and so on. The braking system of automobile is divided into 4 kinds of braking systems, including vehicle braking system, emergency braking system, parking brake system and auxiliary braking system [18]. In the process of driving, the main use of the braking system is to reduce the speed or stop the car. In order to keep the transformation process as simple as possible, the emergency braking method should be based on the original braking system.

To achieve the purpose of deceleration, there are two kinds of automatic braking and closing throttle. Because the operation of closing the throttle is relatively simple, the principle of automatic braking system is mainly studied. The principle of automatic braking is based on the pressure difference between the vacuum chamber and the pressure chamber and the balance position principle of the vacuum booster.

The working principle of the vacuum booster [19]: in the initial state, the vacuum valve opens, the air valve closes, the front cavity and the rear cavity of the vacuum booster are in the vacuum state; the brake pedal push rod is subjected to the driver's force, the air valve opens, the vacuum valve closes, the atmosphere flows from the ventilator into the rear cavity of the vacuum booster and the front cavity. The pressure is less than the rear cavity, so that the push rod pushes to the left under the drive of the diaphragm; when the brake is stable, the vacuum valve and the air valve are closed; when the brake is released, the diaphragm is pushed to the right reduction under the drive of the back spring. Therefore, the key point in the design of automatic braking is to control the pressure difference between the front cavity and the back chamber.

4. Conclusion

The design of anti maloperation accelerator is still in the initial stage of research and development. In addition, the rationality and stability of each module design, the accuracy and response time of the whole system need to be further improved. Summarize the research progress of others in this project, and put forward the following prospects for the follow-up work of the project:

(1) set up the control panel to realize the acceleration threshold of stepping on the accelerator by mistake. In this way, the acceleration threshold of the wrong accelerator can be further adjusted according to the driver's driving level, which is more humanized.

(2) in many papers) because of the experimental conditions and financial constraints, and taking into account the safety of the experiment, the actual vehicle test is a static obstacle, and no dynamic pedestrians or vehicles are chosen. In the next step of the research project, the experimental conditions should be created to increase the dynamic front obstacles on the premise of ensuring the safety, so that the data of the experiment will be more substantial.

(3) integration of machine vision technology into the system. As another sensing technology, machine vision can extract the feature parameters of the target. It has a good application prospect in object recognition and shape matching.

Adding the image sensor to the system can improve the ranging accuracy of the system.

(4) expand the function of the system. It can classify the dangerous degree of vehicle when driving and increase the speed of automatic adjustment with the distance between cars.

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