Application of Electronic Technology in Automobile Safety System

Mengyin Li, Xinye Ge
Chongqing Aerospace Polytechnic College, 400021
2002511684@dlvtc.edu.cn

Abstract—This article analyzes the factors that affect the stability of the vehicle safety system. The research content of this article includes own factors, environmental factors, human factors. The author studies the specific application of electronic technology in the active safety processing, passive safety processing, and post-accident processing of automobile safety systems. The author analyzes the development of intelligent electronic technology, diversified development, energy-saving development and other trends. The purpose of this article is to give full play to the application value of electronic technology and improve the reliability of the operation process of the automobile safety system.

1. INTRODUCTION
During the operation of the automotive system, its performance and safety have always been the focus of user attention, and this is also the content of continuous research by automotive manufacturers. Judging from the current development situation, the richness of automotive safety systems is in a state of continuous optimization, and the types of technologies used are also increasing. Electronic technology, as a technological means with high research maturity, has good applications in the design of automotive safety systems. Sorting out the content that needs attention in the application stage of electronic technology can not only accumulate reliable application data, but also enrich the corresponding content in the safety system and improve the safety of the vehicle driving state.

2. FACTORS AFFECTING THE OPERATIONAL STABILITY OF AUTOMOBILE SAFETY SYSTEM

2.1. Own Factor
In the classification of factors that affect the performance of automobile safety systems, the impact of the vehicle's own factors is very direct. Car designers fully consider the safety of cars at the beginning of car design and manufacture, and try their best to improve their safety factors. However, in some traffic safety accidents, the number of traffic accidents caused by the defects of driving vehicles is still quite large. Car engine overheating, car tire damage, fuel tank leakage and other problems are all potential factors that affect the safe driving of cars. If the driver fails to discover and deal with the problem in time, it is very likely to cause a car accident. This requires designers to improve the safety of the car as much as possible when designing the car, and do their utmost to avoid injury to the driver and occupants in the event of a safety accident. In addition, during the production of vehicles, it is also necessary to pay attention to the quality control of each link, so as to improve the compliance of automobile production quality.
2.2. Environmental Factor
With the continuous improvement of the social and economic level, more families have their own cars, and the number of cars has increased significantly. The ensuing traffic jams have become more serious and the driving environment of cars has become worse and worse. At the same time, some car drivers and pedestrians will selectively ignore traffic regulations. This has further deteriorated the traffic environment, and the frequency of traffic accidents has increased. In addition, bad weather conditions will also have an impact on the safety of the car, such as thunderstorms and haze weather. People should try their best to avoid driving in the harsher weather, even if they are traveling by car, they must be vigilant. This is not only responsible for your own safety, but also responsible for the safety of others.

2.3. Human Factors
Judging from the accumulated data of automobile safety accidents in the past, the proportion of safety accidents caused by drivers' personal causes accounted for more than 70%. The driver's own car driving ability, psychological quality, safety awareness, etc. will all have an impact on car safety. At the same time, the driver's incorrect car driving style and bad car driving habits will also increase the probability of car accidents. Drivers should improve their car driving ability and safe driving awareness as much as possible, and should try their best to remain calm and drive safely in any driving environment. Besides, other advanced technologies need to be used to assist the system design in the design process of the automotive safety system to improve the reliability of the system movement.

3. Specific Application of Electronic Technology in the Operation of Automobile Safety System

3.1. Active Safety Processing

3.1.1. Automobile Braking Measures
As mentioned briefly above, active safety processing during the operation of the car safety system is a very important work content. In this process, the use of reliable vehicle braking measures to optimize the operating system is one of the basic content. The electronic braking force (EBD) developed from the use of electronic technology is currently the most widely used safety control method. The practical application principle of this control measure is to compare and analyze the axle load that occurs during the braking of the vehicle, and to adjust the braking force at the same time. This can make it possible to successfully complete the effective cooperation between the systems, thereby improving the safety of the car in the braking process. Otherwise, in the past, the automobile emergency braking system was affected by the friction coefficient of the road surface, and it was prone to sliding problems, which threatened the safety of the driver's life and property. Relying on the electronic technology, the braking system has strong flexibility. We can use this to reduce the negative impact of the limiting factors and improve the safety of the car's braking process.

3.1.2. Vehicle Driving Measures

![Comparison Chart of Vehicle with or Without ASR System](image)

Figure 1. Comparison Chart of Vehicle with or Without ASR System
In the process of electronic technology application, it also has a very good application in vehicle driving. At present, the more mature measure in practical application is the ASR system. The main function of this system is to control the running state of the driving wheels to obtain a stable driving force. As shown in Figure 1, when the vehicle is started on a smooth road without the ASR system, the wheel structure will slip. Moreover, as the slip rate continues to increase, the lateral adhesion that it brings is smaller, so that the stability of the car body is also reduced. At this time, it is easy for the traveling direction to shift. After assembling the ASR system, the traction that exists inside the system will be used in conjunction with the ABS system. When the vehicle slips at low speed, the ASR system will send a message to the ABS system. At this time, the ABS system will use the wheel lock to reduce the slip. If the vehicle is slipping at high speed, the system will automatically complete the engine downshift and downshift processing after receiving the instruction. We can use this to stabilize the stability of the vehicle application state and avoid accident problems.

3.1.3. Vehicle Steering Measures
Electronic technology will also be used to assist the vehicle during its steering. In specific applications, its main role is to regulate the vehicle's steering so that it can maintain a stable state for processing. Moreover, the system uses sensors to perform statistics on parameters such as vehicle turning angle, acceleration state, and yaw rate during the application process. This can not only help the vehicle's general control system to understand the current operating state of the vehicle, but also based on the specific differences in steering goals. Relying on the braking system to adjust the working state of the wheels can ensure that the vehicle is turning at a high speed. It can complete the steering operation in a short time, thereby improving the safety of the system operation process.

3.1.4. Chassis Control System
The main function of the system in the use process is that it can adjust the operating state of the vehicle by means of automatic adjustment in response to the crisis situation that occurs during the operation of the vehicle, thereby ensuring the comfort and safety of the system itself. In this process, electronic technology participates in integrated control, which can realize automatic adjustment of the transmission by associating the transmission with the system. Moreover, this can also dynamically adjust the vehicle's control drive wheels according to the system's operating conditions. In addition, in this way, the actual operating status can be monitored and synchronized adjustments can be realized. In this way, after some unexpected problems occur, the transmission system will also respond in time, so as to play a role in stable operation. What'smore, the sensitivity of the system will also be adjusted during the operation of the system to make it more flexible to reduce the accident rate by 40%-60%.

3.1.5. Electronically Controlled Suspension System
Except to the above-mentioned active safety control methods, electronic control suspension systems are also applied to electronic technology. The main work content of the system is that the corresponding suspension hardness requirements of the vehicle are also quite different when the vehicle is at different driving speeds. This also puts forward more requirements on the safety of the vehicle driving state. Combining past experience, the vehicle has relatively small rigidity requirements under normal driving conditions. However, when the cars enter a sharp turn, the suspension needs to have a strong rigidity to meet the needs of the stable operation of the system. Electronic technology uses its sensitivity to dynamically adjust the stiffness of the suspension spring when it is combined with the system. This can have a good shock absorption effect, so that the vehicle can be in a stable working state. In addition, the electronically controlled suspension system designed based on electronic technology can also be combined with the current driving state, and the adjustment of the body's tilt state after completion. This is not only beneficial to improve the grip of the vehicle, but also can further improve the safety of the vehicle during driving.
3.2. Passive Safety Processing

3.2.1. Seat Belts and Airbags
The design of seat belts and airbags in the process of passive safety processing is a very important work content. In terms of seat belt design, an intelligent early warning system will be provided. When the driver starts the vehicle without wearing a seat belt, the system will provide an alarm. The alarm message will not disappear until the driver completes the action of wearing the seat belt. In order to cope with the inconvenience of wearing a seat belt when driving at night, some companies will also be equipped with a lighting system at the position of the lock to meet the basic requirements of wearing a seat belt in a dark environment. The design of the airbag is applied to the design of the smart airbag. Compared with the traditional airbag structure design, a sensor is added. This structure can not only supervise the driving state of the vehicle, but also use the scientific calculation mode to reasonably control the inflation volume of the airbag. We can use this to better protect the health of drivers and reduce mechanical damage by 30%-40%.

3.2.2. Fatigue Driving Alert System
Combining with previous statistics, it can be understood that in the investigation of the cause of traffic accidents, 23.65% are caused by driver fatigue. Therefore, in order to reduce the probability of such problems, designers will also use electronic technology to complete the optimization of the fatigue driving warning system, thereby reducing the probability of driver fatigue driving and improving the safety of the road traffic environment. In the original early warning system design, 4 hours was used as a limit to monitor the vehicle travel time. After this time has elapsed, the system will give an early warning to remind the driver to rest. At this stage, the upgraded early warning system is to supervise the steering driver's driving conditions such as heartbeat changes and steering operation stability, so as to determine whether the driver is currently in a fatigued driving state. In this way, the system can make prompts in time to reduce the incidence of fatigue driving problems [1].

3.2.3. Smart Car Speed Check
As the speed of the vehicle increases, its braking distance will also be appropriately extended. If the operation exceeds the maximum speed limit, the response time given will be reduced when encountering some emergencies, and the harm caused by the accident will also increase exponentially. Relying on the intelligent vehicle speed check set by electronic technology, the instantaneous speed of the vehicle can be monitored in practical applications. After exceeding the maximum speed limit, it will prompt the driver to reduce the driving speed. Moreover, the system also has a traffic signal recognition function that can prompt the driver of traffic information signs within 500 meters. The system can adjust the speed of the vehicle according to the relevant information obtained by the recognition to reduce the probability of traffic accidents [2].

3.2.4. Vision Blind Zone Warning
There are blind spots in the field of vision when the vehicle is driving. For example, when a large truck is in operation, its right side belongs to an important blind spot of vision. If a small car overtakes at this time, a traffic accident is prone to occur. According to statistics, the proportion of traffic accidents caused by blind areas of vision is also around 5%. Electronic technology will be associated with the vehicle monitoring system in the application process. Its function is to detect the blind area of the vehicle during driving, and collect corresponding data for sorting. For example, the reversing system that is currently used more often is a manifestation of the blind spot monitoring system. Some automobile manufacturers also use ultrasound to detect obstacles on the left and right sides. This can also greatly reduce the probability of dangerous accidents and ensure the safety of the driver’s life and property [3].
3.3. Handling after the Accident

3.3.1. GPS Rescue System
The occurrence of traffic accidents has the characteristics of uncontrollability and great social impact. After a traffic accident, how to rush to the scene of the accident in the shortest possible time to actively rescue the injured is also a content that needs to be paid attention to in the development process. In the application process of electronic technology, the GPS system will be installed in the vehicle to locate the accident location of the vehicle in time. This also greatly reduces the vehicle rescue time and provides more timely treatment for the wounded. According to statistics in 2018, compared with previous rescue methods, the current rescue time cost of vehicles with GPS positioning system has been reduced by 30%-50%. With the automatic alarm device in the car and the monitoring equipment along the route, the accident location can be located faster, and the treatment rate of the injured has also increased by 10%-30% compared with the previous year [4].

3.3.2. Door Lock Emergency Release System
Except to the application content mentioned above, electronic technology also has a good application in the door lock emergency release system. After more than 70% of traffic accidents occur, the doors and windows of vehicles will be in an irregular state. This will increase the difficulty of opening the door and miss the best time to rescue the wounded. Relying on the emergency release system of the door lock set by electronic technology, when the vehicle encounters a collision accident, the sensor will transmit the information to the main control department as soon as possible. In this way, the vehicle door is opened, thereby creating a good rescue environment and speeding up the rescue of the trapped persons. For example, when the vehicle enters the lake while driving, and after colliding with other vehicles, it creates good escape conditions for the trapped persons, and protects the life safety of the persons on the vehicle to the greatest extent [5].

4. The Development Trend of Electronic Technology in Automobile Safety System

4.1 Intelligent Development
In the future development of electronic technology, the primary development trend is intelligent development, which is embodied in the following directions. First, information recognition is intelligent. In the increasingly complex road environment, the types of road information signs that drivers need to master are also increasing. The intelligent system can help the driver to accurately identify, and at the same time give the driver reasonable prompts, thereby improving the safety of the driving process. Second, the operation is intelligent. For example, the unmanned driving technology system is becoming more and more mature. This also requires the system to have stronger intelligence and sensitivity, which is also the focus of the next stage of research [6].

4.2 Diversified Development
In the future development process of the system, it will also develop in a diversified direction, which is specifically manifested in the following aspects. (1) Functional diversification. In the future development of automotive safety systems, in addition to the above-mentioned functions, other functions will be expanded. Such as intelligent assistant function, danger recognition, etc. The smooth realization of these functions will further enhance the safety of the system's working status. (2) Diversified performance. Judging from the current development situation, people have a higher pursuit of individualization, which will also be reflected in the design of vehicle systems, such as the customized services promoted by some auto companies. In this way, the actual demand for vehicles will be better met during the development process, and the stability of the system operation process will be improved [7].
4.3 Energy-saving Development
Except to the above development trends, in the future performance development, the system will also be promoted in the direction of energy saving. For example, the "tram" that is currently in use is one of the important representatives. Compared with gasoline or diesel, rechargeable cars are more energy-efficient and cause less environmental pollution, which is one of the main development directions. Meanwhile, other new energy vehicles are being tested, such as solar vehicles and ethanol vehicles. The continuous integration of these clean energy sources also requires adjustments to the system's energy efficiency, so as to improve the endurance of the car itself and reduce the energy consumption of the car [8].

5. Conclusion
To sum up, in the process of economic development of the automotive industry, electronic technology has good application value, which is also an important guarantee for improving automotive safety systems. Judging from the current application situation, there is still more room for development in electronic technology, and there are still many contents that need to be further improved. In this regard, it is also necessary to do a good job in the improvement of details in the future development, so as to achieve the purpose of continuous optimization of the system.

REFERENCES
[1] Liao Xiangyang. Application analysis of automotive electronics technology based on smart sensors[J]. Digital World, 2020(11):278-279.
[2] Pei Li. Application research of electronic technology in automobile safety system[J]. China Equipment Engineering, 2020(19):210-211.
[3] Wang Man, Mei Youzhong. Analysis of the development and countermeasures of automotive electronic technology from the perspective of intelligent security[J]. China Equipment Engineering, 2020(17): 122-123.
[4] Zhang Fuquan. The application of electronic technology in automobile safety[J]. Equipment Manufacturing Technology, 2020(02): 140-142+161.
[5] Feng Hanwei. Analysis of the application of power electronics technology in the automotive field [J]. Management and Technology of Small and Medium-sized Enterprises (Mid-Saturday), 2020(01): 186-187.
[6] Yan Bingyan. Application research of electronic technology in automobile safety system[J]. Industrial Innovation Research, 2019(11):253-254.
[7] Chen Ying. Application of electronic technology in automobile safety[J]. Times Report, 2018(11):181-183.
[8] Xiang Yuxin. Application of electronic technology in automobile safety[J]. Electronic Technology and Software Engineering, 2018(01):245-247.