

Design of Safety Anti-collision Warning System of Volvo XC60

Huadong Zang¹, Yadong Chen²

¹ Suzhou Vocational Institute of Industrial Technology, Suzhou 215104, China

² Liaoning Tiefa Energy Co., Ltd, Tieling 112700, China

Abstract

Automobile safety index is one of the important parameters for consumers to buy vehicles, and more and more automobile consumers pay attention to the safety factor of vehicles. There are two kinds of automobile safety, one of which is active safety and the other is passive safety. Taking Volvo XC60 as an example, this paper discusses the in-vehicle application of the safety anti-collision warning system designed and developed in view of the frequent accidents in real road conditions, as well as the protection function of modern automobile safety system for people in the car in actual use.

Keywords

Cars; Safety; Collision Avoidance; Early Warning System.

1. Introduction

After entering the 21st century, automobile is an indispensable means of transportation for human beings. With the development of automotive electronics technology, the safety system design of modern automobiles is becoming more and more comprehensive. Up to now, many countries all over the world have applied many safety technologies to practical automobiles, among which the anti-collision system of automobiles is the most important one. Automobile safety anti-collision system is an indispensable part of modern intelligent automobile, and it is a device that can prevent the automobile from having an emergency collision. The most important thing of this kind of system is that it can automatically find obstacles or drivers that may come into accidental contact with the vehicle, so that the system can send out a warning, or take emergency braking safety measures, and finally play a role in protecting personal safety. With the constantly updated electronic technology, sound wave, radar and other high-tech, the research and design of automobile anti-collision warning is constantly changing. It can be seen that the safety warning of modern automobiles is designed by the cross-cooperation of professional technologies of various disciplines. The global traffic accident rate is getting higher and higher, so it has a broad market prospect for all kinds of automobile manufacturers to research and design automobile safety anti-collision system.

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2. Design of Automobile Safety System

2.1. Collision Warning Pilot Assist Navigation Auxiliary Information System

The most outstanding advantage of the collision warning Pilot Assist navigation assistant information system is that it can keep Volvo xc60 automatically following the car, keeping in the lane, actively braking and other driving operations under certain conditions. Pilot Assist automatic driving assistance system can be started when the car is running at a low speed (only 5 km/h per hour). After starting, the safety system can be adjusted at will from 0 km/h to 0-130 km/h, which means that you can use this function no matter in low-speed urban environment or in high-speed and unobstructed road conditions.



Figure 1. System Block Diagram

2.2. Full Speed Domain Automatic Braking ACC Adaptive Cruise System Rear Car Side Warning

Through real-time monitoring of road conditions (speed, position, distance, etc.), the system can automatically control the speed and acceleration of the vehicle, so as to realize automatic assisted driving. The system is mainly composed of sensors, ECU and actuators. Sensors can be used to find out the road conditions, and the emitted radar beams can be reflected back after hitting the surfaces of different objects, so as to determine the distance from the vehicle in front; The distance to that vehicle in front can also be detected by Doppler effect; The radar signal spreading outward in blade shape can determine the position of the vehicle in front according to the feedback angle. In actual driving (such as at intersections, when different vehicles meet and turn), many vehicles will be detected by radar detection. At this time, the lane is confirmed based on the steering angle sensor, yaw rate sensor signal, wheel speed sensor signal, etc. In addition, the camera is used to identify the lane identification line, and short-range radar, ultrasonic wave and on-board camera are used to give an early warning to the operation that affects safety, and take the initiative to brake when necessary to avoid the harm caused by accidents.



Figure 2. Automatic braking detection in full speed domain

2.3. LKA Lane Keeping Auxiliary Distance Monitoring Warning Rear-end Collision Preventive Protection System

LKA lane keeping assistance system can actively correct the vehicle and take measures such as steering intervention when the driver can't concentrate or the driver is fatigued. When the system detects that the driver operates the turn signal lamp, the system enters the passive mode (off mode). LKA system can also obtain images of road markings through the camera of the rearview mirror in the car, and calculate the approaching rate between the car body and the lane markings. If it is calculated that the car will cross the markings within a certain period of time (depending on the setting of the car factory), the system will give an alarm (possibly vibration or noise). The sensitivity of the system can be changed by software, and a warning sound can be issued when the lane marking is about to be crossed or when the line has already crossed. In addition, on narrow roads, the system will also allow drivers to slightly press the line when turning, so as to reduce the nuisance caused by the system to drivers.

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Figure 3. Lane keeping auxiliary distance monitoring

2.4. Emergency Avoidance Assistance

This system can be used in the range of 50-100km/h of vehicle speed. In case of emergency, the function of emergency avoidance assistance system will be started, and it can smoothly intervene the steering wheel, and enhance the avoidance effect by increasing the steering force or restraining the steering force. Any time the driver wants to take over the car again, he only needs to gently turn the steering wheel, and the second way is to press the button to turn off the assist mode. This is extremely convenient for the driver to operate.



Figure 4. Emergency avoidance assistance

2.5. Pavement Deviation Prevention System

Function When the vehicle is detected to deviate from the road, the new Volvo XC60 will tighten the front seat belt and keep this state until the vehicle stops. If the vehicle rushes out of the road, the energy absorption between the seat and the seat frame can reduce 1/3 of the vertical impact force when the vehicle falls, thus avoiding hurting people's spine. In terms of active safety, the new Volvo XC60 is also equipped with a number of safety technologies to avoid road separation. When the driver leaves the lane unintentionally, the lane departure assist system will make the steering wheel heavier by increasing the steering torque. The standard driving safety warning control system of the new Volvo XC60 also monitors and reminds drivers of fatigue and distraction. XC60 is equipped with a rest area interface to guide drivers to park in the nearest rest area.



Figure 5. Pavement deviation prevention system

2.6. Collision Warning Detection Driver Function

The collision warning system with automatic braking and cyclist-pedestrian detection function is designed to assist drivers to avoid collision when there is a danger of collision with pedestrians, cyclists and stationary vehicles in front or vehicles traveling in the same direction. To play the best role of the system requires that the system function of the cyclist be detected to receive as clear and unmistakable information about the human body and the contour of the bicycle as possible-this means that the bicycle, head, arms, shoulders, thighs, upper body and lower body can be identified in combination with the standard human movement mode. If the camera can't capture a large part of the rider's body or bicycle, the system can't detect the rider. Note: For this function to detect the cyclist, he/she must be an adult and ride an "adult bike". Bicycles must be equipped with a highly visible and certified rear-facing red reflector, and the reflector should be installed at a height of at least 70 cm above the road. This function can only detect cyclists coming directly from the rear and traveling in the same direction-cyclists coming from the rear or from the side at an angle cannot be detected. Bicycles running on the left or right edge of the virtual/extended boundary line of the vehicle may be detected later or cannot be detected. Sensors have limited ability to see cyclists at dusk and dawn-similar to human eyes. When driving at night and in tunnels, the camera sensor's ability to detect cyclists will be disabled-even if the street lights are on.

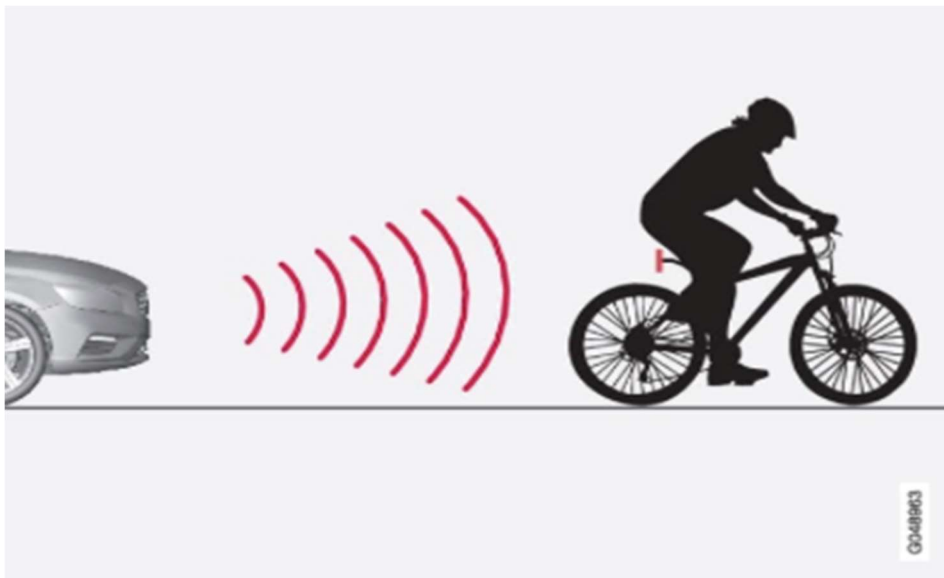


Figure 6. Collision detection driver

3. Maintenance and Maintenance of Volvo XC60 Car Safety System

Safety mode is a kind of protection state, which will be triggered when an important function of the vehicle is damaged by a collision, such as fuel line, sensors of any safety system or braking system. If the car has entered the safe mode, never try to repair the car by yourself or reset the electronic settings in the car. This may cause personal injury or cause the vehicle to malfunction. Each seat belt is designed for one person. If the seat belt has been subjected to a great pull, the pull suffered in an impact accident, the whole set of seat belts must be replaced. Even if the seat belt itself does not look damaged, some protective features may have been affected. In addition, if the safety is worn or damaged, the safety belt should also be replaced. The new seat belt must be in an approved form and designed to be installed in the same position as the original seat belt.

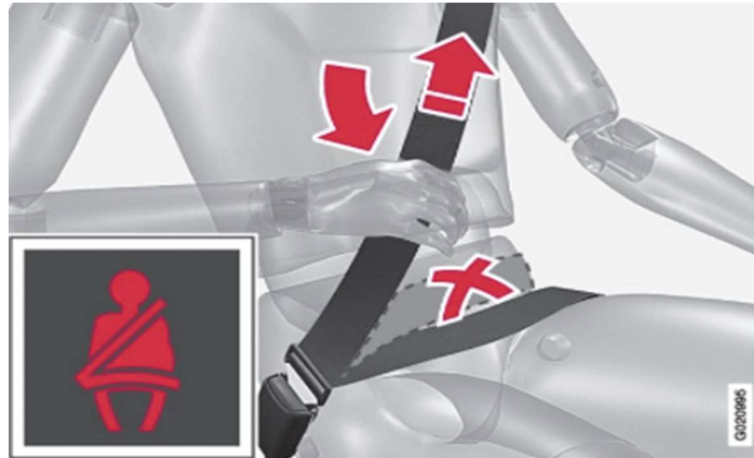


Figure 7. Car seat belt

4. Conclusion

The proportion of automobiles in daily life is getting higher and higher, so the safety performance of automobiles is particularly important. With the rapid development of science and technology, more and more safety systems are installed in automobiles to serve human beings. The new generation XC60 is bred for this, not the new design of exterior and interior, but the world's first intelligent security technology. The automobile safety system can prevent the potential collision of vehicles and minimize the harm. In the future development of automobiles, the automobile collision warning system is particularly important.

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