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Safety factors in Advanced Driver Assistance System

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Abstract: As technology grows, we simplify the system for easy-to-handle automotive vehicle by adapting advanced techniques to make system automatic. Vehicle safety is a critical approach to achieving realistic long-term and short-term goals and targets as part of an integrated safe system. Advanced driver assistance systems (ADAS) are described as vehicle-based intelligent safety systems that have the potential to enhance road safety in terms of collision avoidance, crash severity mitigation and protection, and post-crash phases. This paper gives the current ADAS technologies that provide a more pleasant driving experience while being in line with safety considerations.

I. INTRODUCTION

Automobile industries are constantly thriving to improve safety measures to avoid collisions, while safety system is classified as two categories: Active and Passive safety systems. When an accident happens, the passive safety mechanism lessens the injuries suffered by the passengers. For instance, airbags and seatbelts have saved countless lives and established themselves as industry standards in the automotive sector. Systems that attempt to keep a vehicle under control and prevent accidents are known as active safety systems.
Levels of Automation is illustrated below.

- Level 0 - Only the driver takes complete decisions.
- Level 1 - The vehicle's advanced driver assistance system can occasionally help the driver with steering or braking/accelerating, but not both at once.
- Level 2 - In some circumstances, ADAS itself is in charge of steering, braking, and acceleration. The driver is required to keep a constant eye on the road and surroundings.
- Level 3 - Although the control is carried out automatically, the system may require that the driver regain control in urgent circumstances.
- Level 4 - The ADAS can control the vehicle and monitor the environment on its own; only in certain circumstances does the driver need to intervene.
- Level 5 - System has completed every task in its entirety. The people are just travellers.

Levels of ADAS Systems: There is literally level 0 no automation, level 1 to 5 (Fully automation) layers defined by society of automotive engineers.

II. ADAS SAFETY SYSTEM.

Advanced Driver Assistance Systems (ADAS) are safety systems created to eliminate human mistake from driving a variety of cars. ADAS systems use cutting-edge technology to aid the driver while they are driving and so enhance their performance. ADAS makes use of a variety of sensor technologies to understand the environment surrounding the car and, if necessary, either informs the driver or takes action.

There are many different ADAS technologies in use today, some of which are increasingly installed in cars as standard equipment. According to research, the safety benefits of seat belt reminders, alcohol interlocks, intelligent speed adaption (ISA), and electronic stability control (ESC) are substantial. As a result, these technologies are progressively being included into national safety policies and legislation.

1. Intelligent Speed Adaptation (ISA)

Advanced systems are used in "Intelligent Speed Adaptation" (ISA) to help drivers maintain the speed limit. The vehicle may "know" its location and the speed restriction on that route owing to technology that uses a global navigation satellite system, such as GPS, in conjunction with a speed zone database. If the car exceeds the speed limit, the ISA system alerts the driver visually and audibly.

2. Event Data Recorders in Vehicles.

Event Data Recorders (EDR) are gadgets used in cars that capture technical information about the car and the occupants for a brief period of time before, during, and after a triggering occurrence, usually an accident or near-crash event. These records,

sometimes referred to as "black-box" data, can be helpful in evaluating and reconstructing an accident. Engineers from Exponent have the particular education and technical know-how necessary to combine physical evidence with EDR data and create an exhaustive automobile accident reconstruction investigation.

3. Ignition Interlock device

A breathalyser for a person's car is called an ignition interlock device (IID) or breath alcohol ignition interlock device (BAIID). Before starting or continuing to operate the car, the driver must blow into a mouthpiece on the device. The device prevents the engine from starting if the calculated breath-alcohol concentration is higher than the set blood alcohol concentration, which varies by country. The ignition system of the engine is directly connected to the interlock device, which is situated within the car next to the driver's seat.

Fig 1: Ignition interlock device integrated in car (Source: Smart Start)

4. Electronics Stability Control (ESC)

When turning a corner, braking suddenly, or performing a quick manoeuvre, electronic stability control (ESC) helps keep a car from sliding and the driver from losing control of the car. The vehicle's brakes are immediately engaged using ESC technology to assist with steering. One of the most important active safety systems that are currently commonly installed in passenger automobiles and commercial vehicles is the ESC.

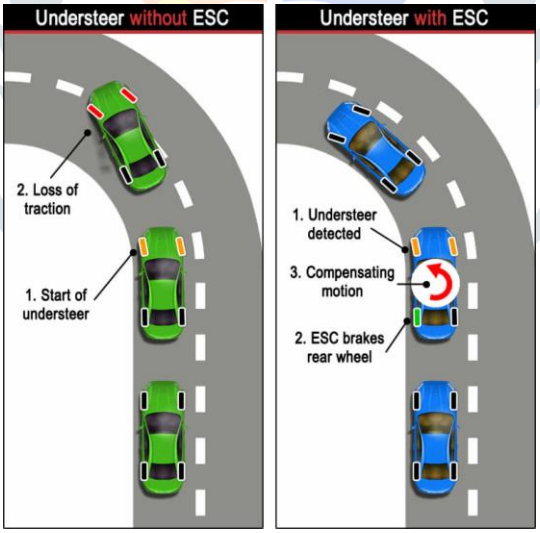

Fig 2: Electronics stability Control

5. Seat belt reminders

In car accidents, seat belts can significantly lower the risk of serious or fatal occupant injuries. Seat Belt Reminder (SBR) warning signs encourage more people to wear their seatbelts, which prevents accidents and saves lives as people periodically forget to do so. The highest authorities in the automotive industry have acknowledged the safety relevance of SBR devices for both front and back seat occupants.

6. Anti-lock Braking Systems (ABS)

The primary goal of ABS is to avoid skidding, which occurs when locked wheels from heavy braking cause a loss of steering and control. Many modern cars are now equipped with these technologies. This is not meant to shorten stopping distances; rather, it is meant to allow more steering in an emergency. When all crash severity levels and types are included, a meta-analysis of research studies demonstrates that ABS provides a relatively minor but statistically significant reduction in the number of crashes. Increases in rollovers, single-vehicle incidents, and collisions with immovable objects are statistically significant. There have been statistically substantial reductions in collisions with cyclists, pedestrians, animals, and turning vehicles.

7. Autonomous Emergency Braking Systems (AEB)

AEB systems apply brakes when they notice oncoming vehicles or other road users in order to either avoid a collision or lessen the severity of the impact. Early systems could only stop effectively to avoid a collision with a relative velocity of about 15 kph since these systems were relatively sluggish to analyse the data from the camera or LIDAR sensors. Modern systems are more efficient and can identify impediments at higher travel speeds. Additionally, earlier systems could only detect automobiles; however, more modern systems can now recognise PTWs, pedestrians, and cyclists, but with less accuracy.

III. Benefits of ADAS System.

Over time, ADAS has significantly contributed to a decrease in the number of auto accidents. It is primarily made to assure driver safety and improve and smooth out rides. Let's examine its numerous advantages.

- Enhancing safety features to encourage safe driving ADAS uses technology that help drivers by warning them about any potential threats in order to prevent collisions on the road.
- The ADAS system primarily functions as a co-pilot, warning the driver of any potential road hazards and assisting them in driving safely with the aid of several features.
- It also reduces the need for fuel. ADAS can save fuel consumption by up to 15% since it modifies the way the car is driven.
- The ADAS technology also lowers vehicle maintenance expenses by up to 6% by minimising collision risks and any damage on the car's brakes or tyres.

IV. The Future of ADAS System.

To improve the driving experience, modern automobile electronic hardware and software need sophisticated procedures and technologies. The Advanced Driver Assistance Systems are based here. ADAS has a promising future because it:

- Improves dependability
- Reduces costs by contributing
- Reduced development cycle length
- Increases everyone's level of road safety

Additionally, ADAS in the future will offer wireless network access that you can quickly install in the vehicles. In other words, improved car communication will make automated driving safer and more convenient.

V. Conclusion

One of the key new features in upcoming cars is the ADAS system. The protection of all road users and the accomplishment of long-term objectives and targets of road safety initiatives are significantly influenced by vehicle safety. Vehicle safety can be divided into two categories: primary safety, which includes measures aimed at preventing crashes and injuries, and secondary safety, which includes measures aimed at lessening injuries in the case of crashes and those that help with post-impact care. While new in-vehicle technologies have the ability to reduce the risk of crash injuries, they also carry the risk of increasing it due to increased driver attention and unintentional behavioural changes that may address one issue while causing another.

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