# VEHICLE SAFETY: TECHNOLOGIES AND THEIR IMPORTANCE IN ACCIDENT PREVENTION AND PASSENGER SAFETY

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**Abstract**

*In the current days the population has increased; along with that, the usage of vehicles has also increased. Every day we get the news of at least 5 to 10 accidents in their cities. To avoid this, vehicle safety has emerged as an important measure to reduce the owning of the rising number of accidents. The main goal of vehicle safety systems is to prevent or reduce accidents to nil and ensure the passengers are safe from accidents. Various vehicle technologies are implemented for safety measures such as Anti-lock Braking Systems (ABS) and Advanced Driver Assistance Systems (ADAS). These safety systems are classified into passive safety systems and active safety systems. Passive safety systems will minimize the injuries during the accident, and active safety systems will prevent the accidents. In this paper the vehicle safety technologies and their importance, along with applications and future enhancements, are discussed.*

***Keywords:*** *Vehicle Safety, Road Safety, Airbags, ABS, ADAS, Active Safety, Passive Safety, Accident Prevention, Intelligent Vehicles, Passenger Safety.*

## Introduction

In the world, road accidents are increasing and causing more death and injury. According to global vehicle safety, millions of accidents are taking place due to traffic, lack of vehicle safety, an increase in the number of vehicles, and human error.

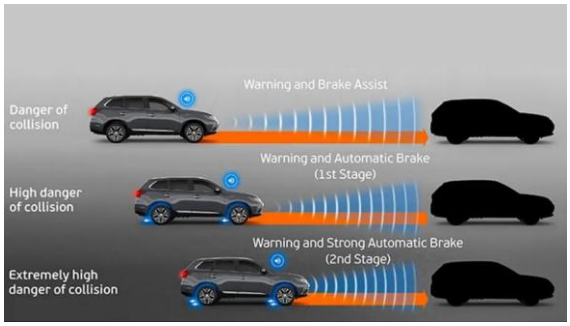
Hence, to reduce the accident risk, the vehicle safety systems are designed and try to minimize the injuries. With the modern advancement of technology, the AI safety system helps the driver to control and

protect them as well as the passengers. Vehicle safety systems are classified into active safety systems and passive safety systems. These two systems are important and always work together to implement vehicle safety.

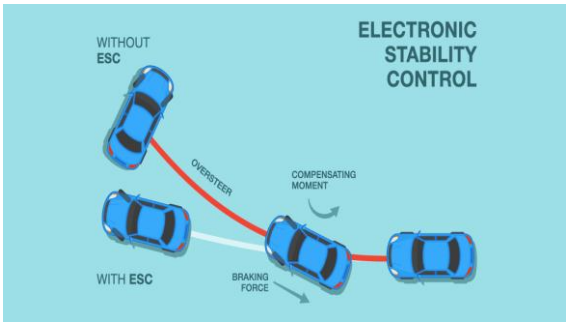
### Active Safety Systems

Active safety systems help in the prevention of accidents by guiding the drivers to control the vehicle. It is the advanced technology that can avoid or reduce the accidents in the vehicle driving. It improves the performance of the vehicle's safety, and the risk of a traffic accident is reduced.

Chassis active control technology is usually used as controlling technology in vehicle safety. It includes an Anti-Lock Braking system (ABS) that prevents the wheels from locking during sudden braking. Electronic Stability Control System (ESC): It improves vehicle stability by detecting and reducing loss of traction. It has dynamic behavior and controls the vehicle while driving, reducing the probability of traffic control.

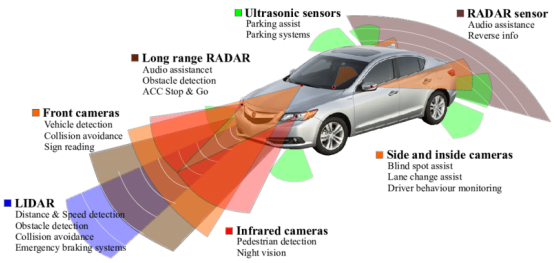



Anti-Lock Braking system (ABS)




**Electronic Stability Control System (ESC)**

Security early warning technology uses the sensor to prevent road accidents. It includes Advanced Driver Assistance Systems (ADAS); it detects the information of the road environment using sensors such as ultrasonic, vision, and radar sensors. Using the road information, the analysis is done to reduce the occurrence of accidents, and the remainder is sent to the driver. Visual sensors help in the detection of the surrounding environment, and driver operation will be controlled. It acts as a security warning before the danger; the instruction will be given to the driver.



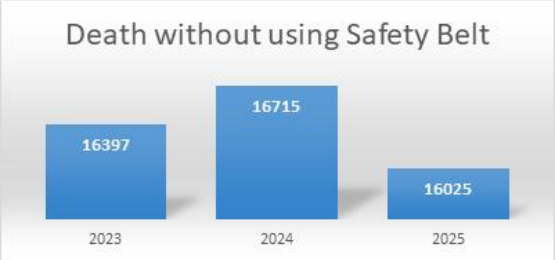

**Advanced Driver Assistance Systems (ADAS)**

**Passive Safety Systems**

Passive vehicle safety technology is a static system but helps the driver and vehicle by protecting the driver and people inside or outside as much as possible and also minimizes the damage by using the protection devices. Nowadays almost all vehicles are mounted with protection devices such as airbags and pre-tightening seat belts, especially the 4-wheelers; for two devices, the helmet and hand-holding options will be given.

**Safety belt:** It was invented by Chaire L. Strath in the year 1935. It is commonly used in the vehicles, especially in four-wheelers. It has been a major protection device used for a long time. And it is the most commonly used protection device. It prevents the occupants from being hit or being safe from the second collision.

Safety belt survey rates are 25%, which is very low in India. Which highlights that gap in the drivers about the awareness of safety belts. Without using a safety belt, approximately 45% of deaths have been recorded, and 50% of injuries are recorded. According to Ministry of Road Transport and Highways (MoRTH) data, the graph has been plotted.

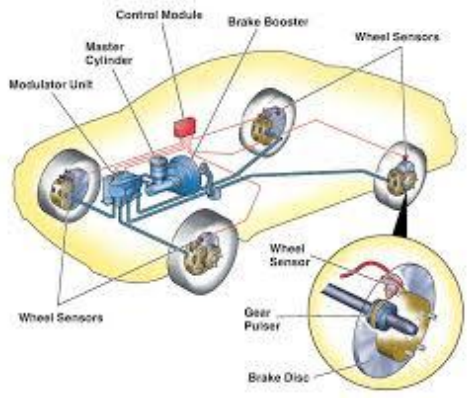



**Airbag:** It was first invented by the Swedes in the 1950s, and it was used by Americans. Some people started to develop the airbags in the 1970s. In 1972 General Motors produced large-scale airbags. In the 1980s, a greater number of four-wheelers, especially cars, started to use airbags. Again, General Motors, in 1996, developed the first side-impact airbag. Currently airbags have become a common safety device.

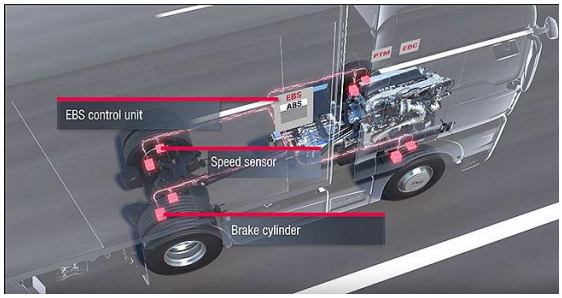
Airbags are a very important safety device. As a passive one, it reduces the injuries. During the collision, the airbags create the soft cushion between the passengers and the hard part of the vehicles to keep them safe from injuries. Side collisions will have less chance and lower the accident death.

**Applications of Vehicle Safety Systems**

**1. Cars:** To safe it includes Airbags, Seat belts, Anti-lock Braking System (ABS), Lane assist & parking sensors, Electronic Stability Control (ESC)

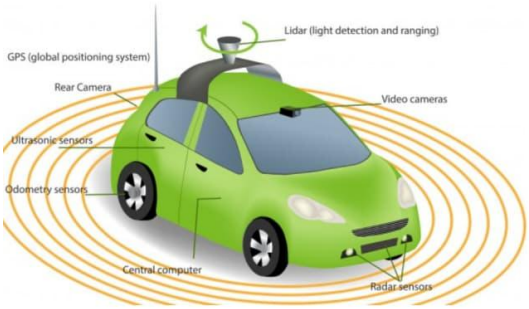


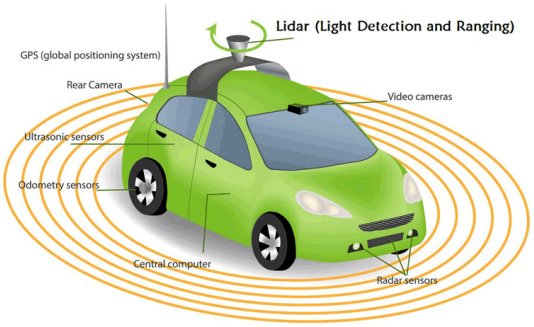

**2. Buses:** To safe it includes Emergency exits, Fire safety systems, ABS & stability control, Passenger alert systems




**3. Trucks:** To safe it includes Anti-lock braking system, Electronic braking systems, Rear-view cameras, Collision warning systems.

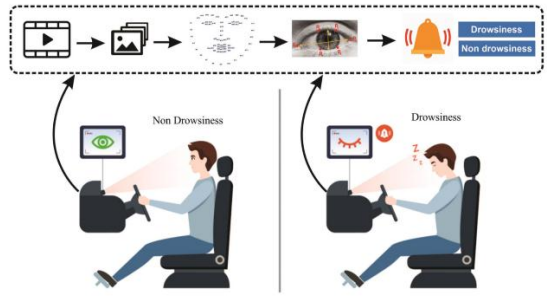

**4. Autonomous Vehicles:** To safe it includes Sensors (LiDAR, radar, cameras), Automatic emergency braking, Adaptive cruise control, Artificial intelligence-based navigation




## Future Enhancement

The Driver Monitoring System can be implemented where it can detect the driver distraction by using cameras or sensors. Give the warning alerts to prevent accidents. And Artificial Intelligence in vehicle will be included to Enables decision-making done by the system, support for the auto driving features and improve the safety.





### Advantages of Vehicle Safety Systems

- Increase the rate of Saving lives
- Reduces accidents rate
- Improves driving safety with lot of advancement.

### Conclusion

Vehicle safety systems are important in the transportation sector because they prevent accidents and save or protect people's lives. Accidents are prevented mainly from active safety systems, and passive safety systems will reduce the injuries, together giving maximum security for both passengers or drivers and vehicles.

The modern technologies such as ADAS and ABS will help in the improvement of vehicle safety. In the future, enchantment of vehicles will provide better protection and reduce accidents by a high percentage.

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