Unit - III

Advanced driver assistance system:

→ defined as vehicle based intelligent safety systems which could improve road safety in terms of crash avoidance, crash severity and protect, post crash phases

→ can also be defined as integrated in vehicle or infrastructure based system which contribute to ~~improve~~ more than one of these crash phases.

- Ex: Speed adaption, advanced breaking systems have the potential to prevent the crash or mitigate the severity of the crash.

- ADAS system provides assistance to the driver and improves driving experience.
- Its primary function is to ensure safety
- To function reliably, the ADAS must be able to recognize objects, signs, road surfaces and moving objects on the road and make decisions whether to warn or ~~take~~ act on behalf of a driver

Block diagram for ADAS system

Hardware

Lane departure warning / lane support systems

- Electronic warning systems that are activated if the vehicle is about to veer off the lane or the road
- Their effectiveness strongly depends on the reaction of the driver and on the visibility of the road markings
- It takes a mean driver reaction of about one second to react to the warning this time is insufficient, lane change and merging crashes can probably be avoided by intervening systems known as lane keeping assist.
- Its an automatic system which keeps the vehicle in its lane except if the turning indicator is on. and also on the visibility of the marking.
- Most of the existing system has only warning.

Collision Warning / Collision avoidance systems

- Its an automobile safety system designed to prevent or reduce the severity of a collision. also known as precrash system, forwad collision warning sym, or collision mitigating sym.
- It uses radar, laser and camera to detect an imminent crash.
- GPS sensors can detect fixed dangers such as approach stop signs through a location data base
- Once a collision is detected these systems provide a warning to the driver.
- when the collision becomes imminent they take action autonomously without any driver input.

- Collision avoidance by braking is appropriate in low speed vehicles
- Collision avoidance by steering may be more appropriate for higher speed vehicles
- Cars with collision avoidance system may also be equipped with Adaptive cruise control using some forwad looking sensor.

i) Forwad collision warning sym
ii) Reverse Collision warning "
iii) Multi-collision brake

i) Forwad collision warning sym:
- comprises a visual and audible warning that the driver is too close to the vehicle in front
- Warning depends on the distance bet" the vehicle in question and the vehicle ahead.
- The warning changes from "safe" to "critical" as the distance decreases

ii) Reverse collision system:
→ same with collision behind the vehicle

iii) Multi-collision brake
- This sym automatically apply full braking and actirate the hazard lights following a collision that has deployed airbag

The intention is to avoid secondary collision with another obstacle.

Pedestrian Protection sym

- In most accidents, the pedestrian collides with the front of the vehicle
- legal requirements and consumer protection tests for pedestrian protection have become strict over years.
- Pedestrian protection system includes Active safety such as sensors, cameras, and passive safety such as Pedestrian Airbag and Active Hood lifters

- Pedestrian Protection Airbag
  aims to mitigate the head impact in case of an pedestrian- vehicle accident and reduces the severity of pedestrian head injuries

- Active Hood lifters
  aims to mitigate head impact to hard structures beneath the hood ie engine suspension tower battery etc

Connected cars technology

- Its a car that is equipped with internet access and usually also with wireless local area network.
- This allows the car to share internet access with other devices inside as well as outside the car
- Often the car is ~~or~~ fitted with special technologies that tap into the internet or WLAN and provide additional features for the driver
- The cars will also be connected using Dedicated short Range Communication (DSRC) radios operating @ 5.9 GHz band with very low latency

- There are 5 ~~types~~ ways a vehicle can be connected to its surrounding and communicate with them

1) V2I "Vehicle to Infrastructure"
   - provides information about the Infrastructure to the driver.
   - communicates information about safety, mobility or environment related conditions

2) V2V 'Vehicle to Vehicle'
   - communicates information about speed and position of surrounding vehicles
   - through wireless exchange information
   - The goal is to avoid accidents ease traffic congestion

3) V2C 'Vehicle to Cloud'
- exchanges information and about and for application of the vehicle with a cloud system
- Uses IOT

4) V2P 'vehicle to Pedestrian'
- senses information about its environment and communicates it to other vehicles, infrastructures and personal mobile
- intends to improve safety and mobility on road.

5) V2X 'vehicle to Everything'
- interconnect all types of vehicles and infrastructures together
- This connectivity includes, cars, ships trains and airplanes

Categories of application
1) Single vehicle applications
2) Co-operative safety and efficiency applications

Connected car segment can be classified to 8 categories 1) Mobility Management
2) Commerce
3) Vehicle Management
4) Break down prevention
5) Safety
6) Entertainment
7) Driver assistance
8) Well being.

Goals of ISO 26262:

- Provides an automotive safety lifecycle (management, development, production, operation, service, decommissioning) and supports tailoring the necessary activities during these lifecycle phases.
- Covers functional safety aspects of the entire development process (including such activities as requirements specification, design, implementation, integration, verifica-

tion, validation, and configuration).

- Provides an automotive-specific risk-based approach for determining risk classes (Automotive Safety Integrity Levels, ASILs).
- Uses ASILs for specifying the item's necessary safety requirements for achieving an acceptable residual risk.
- Provides requirements for validation and confirmation measures to ensure a sufficient and acceptable level of safety is being achieved.[1]

Part 2: Management of functional safety

ISO 26262 provides a standard for functional safety management for automotive applications, defining standards for overall organizational safety management as well as standards for a safety life cycle for the development and production of individual automotive products.[6][7][8][9] The ISO 26262 safety life cycle described in the next section operates on the following safety management concepts:[2]

Hazardous Event

A *hazardous event* is a relevant combination of a vehicle-level *hazard* and an operational situation of the vehicle with potential to lead to an accident if not controlled by timely driver action.

Safety Goal

A *safety goal* is a top-level safety requirement that is assigned to a system, with the purpose of reducing the risk of one or more *hazardous events* to a tolerable level.

Automotive Safety Integrity Level

An *Automotive Safety Integrity Level* (ASIL) represents an automotive-specific risk-based classification of a *safety goal* as well as the validation and confirmation measures required by the standard to ensure accomplishment of that goal.

Safety Requirement

Safety requirements include all *safety goals* and all levels of requirements decomposed from the safety goals down to and including the lowest level of functional and technical safety requirements allocated to hardware and software components.

Parts 3-7: Safety Life Cycle

Processes within the ISO 26262 *safety life cycle* identify and assess hazards (safety risks), establish specific safety requirements to reduce those risks to acceptable levels, and manage and track those safety requirements to produce reasonable assurance that they are accomplished in the delivered product. These safety-relevant processes may be viewed as being integrated or running in parallel with a managed requirements

life cycle of a conventional Quality Management System:[10][11]

- An *item* (a particular automotive system product) is identified and its top level system functional requirements are defined.
- A comprehensive set of *hazardous events* are identified for the *item*.
- An *ASIL* is assigned to each *hazardous event*.
- A *safety goal* is determined for each *hazardous event*, inheriting the ASIL of the hazard.
- A vehicle level *functional safety concept* defines a *system architecture* to ensure the *safety goals*.
- *Safety goals* are refined into lower-level *safety requirements*.
  (In general, each safety requirement inherits the ASIL of its parent safety requirement/goal. However, subject to constraints, the inherited ASIL may be lowered by decomposition of a requirement into redundant requirements implemented by sufficiently independent redundant components.)
- "Safety requirements" are allocated to *architectural components* (subsystems, hardware components, software components)
  (In general, each component should be developed in compliance with standards and processes suggested/required for the highest ASIL of the safety requirements allocated to it.)
- The architectural components are then developed and validated in accord with the allocated safety (and functional) requirements.