**You**: Good morning, everyone, my name is Priti, and today I will be giving seminar on topic titled as “**Advanced Driver Assistance Systems, or ADAS, in modern vehicles**”. This seminar is guided by Dr. N. B. Dhaygude.

**What is ADAS?**

**You**: Advanced Driver Assistance Systems (ADAS) are electronic systems which help drivers in driving and parking.

ADAS help to automate the Driving.

These systems use sensor data, real-time processing, and control mechanisms to increase driver safety and vehicle control.

90 % percentage of accidents are happening only because of driver negligence. ADAS help to reduce these accident numbers.

**Main goal of ADAS?**

**You**: Aim of ADAS is to reduce human error. And make driving safer and comfortable.

**Types of ADAS**

ADAS can be classified into two main types:

1. **Passive ADAS**: Passive ADAS just warn the driver but do not take control.

Ex. Lane Departure Warning (LDW) and Blind Spot Detection (BSD).

1. **Active ADAS**: Active ADAS can take Action along with the driver.

Ex. Autonomous Emergency Braking (AEB) and Adaptive Cruise Control (ACC).

**Levels of Automation**

**You**: ADAS can also be classified based on the level of automation:

* **Level 0**: No automation
* **Level 1**: Driver assistance
* **Level 2**: Partial automation
* **Level 3**: Conditional automation
* **Level 4**: High automation
* **Level 5**: Full automation

**Key Technologies Behind ADAS**

The key technologies used in ADAS include:

1. **Sensor Technologies**: Camera systems, radar (Radio Detection and Ranging), LiDAR (Light Detection and Ranging), ultrasonic sensors, GPS, and IMU.
2. **Electronic Control Units (ECUs)**: High-performance microcontrollers or System on Chips (SoCs) that process sensor data.
3. **Communication Protocols**: CAN, LIN, FlexRay, Automotive Ethernet, and V2X (Vehicle-to-Everything).
4. **AI & Algorithms**: Artificial Intelligence and Machine Learning models that process sensor data for pattern recognition and decision making.

**Important ADAS Features**

1. **Adaptive Cruise Control (ACC)**: ACC Maintains a safe distance from the vehicle ahead by automatically adjusting the car's speed. It uses radar and camera sensors and is ideal for highway driving.
2. **Lane Departure Warning (LDW) & Lane Keeping Assist (LKA)**: Alerts the driver or corrects the vehicle if vehicle is out of its lane. LDW gives audio/visual warnings, while LKA actively steers the vehicle back into the lane.
3. **Automatic Emergency Braking (AEB)**: Detects collisions with another vehicle or object and automatically applies brakes to prevent or mitigate impact. It works at both low and high speeds and is critical for urban safety.
4. **Blind Spot Detection (BSD)**: Monitors areas not visible to the driver and alerts if another vehicle is present in the blind spot. It typically uses side-mounted radar sensors and helps in lane changing and merging.
5. **Traffic Sign Recognition (TSR)**: Reads traffic signs using cameras and displays them on the dashboard or Heads-Up Display (HUD). It detects speed limits, no-entry signs, and enhances driver awareness.
6. **Parking Assistance**: Helps in parallel or perpendicular parking using sensors or even automating the parking process. It includes rear-view cameras, ultrasonic sensors, and auto-park features, reducing parking stress.

**Challenges in ADAS**

1. **Sensor Fusion Complexity**: Integrating data from cameras, radar, LiDAR, and ultrasonic sensors.
2. **Environmental Limitations**: Performance can be affected by weather conditions such as fog, rain, and snow.
3. **Real-Time Processing**: The need for ultra-fast decision-making to ensure safety.
4. **Cost and Power Constraints**: High-end sensors and ECUs are expensive.
5. **Cybersecurity Threats**: ADAS is vulnerable to hacking and spoofing.

**Applications of ADAS**

1. **Continental AG**: Offers adjustable cruise control, collision protection, and blind-spot detection.
2. **Delphi Technologies (Aptiv)**: Utilizes LiDAR technology for high-resolution 3D mapping of the vehicle's environment.
3. **Robert Bosch GmbH**: Specializes in sensor fusion technology, gathering data from multiple sensors.
4. **Mobileye**: Uses high-resolution camera systems to gather detailed visual data for accurate environment perception.

**Conclusion**

**You**: In conclusion, Advanced Driver Assistance Systems are crucial for enhancing driver safety and vehicle control. They leverage advanced technologies to assist drivers and reduce accidents. Despite the challenges, the future of ADAS looks promising with continuous advancements.