



SNS COLLEGE OF TECHNOLOGY



(An Autonomous Institution)

COIMBATORE-35

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UNIT IV: INTRODUCTION TO AUTOMATED, CONNECTED AND INTELLIGENT VEHICLES

TOPIC: **Sensor Technology for Advanced Driver Assistance Systems**



Advanced Driver Assistance Systems (ADAS) rely on sensor technologies to monitor a vehicle's surroundings, enhance situational awareness, and improve road safety. These sensors collect data that supports functions such as lane-keeping, collision avoidance, adaptive cruise control, and parking assistance.

Introduction

- **What is ADAS?**
Advanced systems designed to enhance vehicle safety and assist drivers.
- **Importance of Sensor Technology**
 - Enables real-time environment monitoring
 - Improves decision-making and automation

Key Sensor Technologies

- Cameras
- Radar
- LiDAR
- Ultrasonic Sensors
- Infrared Sensors
- Inertial Sensors
- GPS/GNSS
- V2X Communication



Camera Sensors

- **Functionality:** Visual data capture for lane, object, and traffic sign recognition
- **Types:**
 - Monocular
 - Stereo
 - 360-Degree
- **Applications:** Lane Departure Warning, Surround View Monitoring
- **Visual:** Example of lane detection through a camera



Radar Sensors

- **Functionality:** Detects objects, measures distance and speed
- **Types:**
 - Short-Range (parking, blind spots)
 - Long-Range (adaptive cruise control, collision warning)
- **Advantages:** Works in poor visibility
- **Visual:** Radar detection zones



LiDAR Sensors

- **Functionality:** High-resolution 3D mapping using lasers
- **Applications:** Obstacle detection, path planning
- **Advantages:** Precision and accuracy
- **Challenges:** Cost, weather sensitivity
- **Visual:** Example of a LiDAR point cloud



Ultrasonic Sensors

- **Functionality:** Close-range object detection using sound waves
- **Applications:** Parking assistance, low-speed collision avoidance
- **Advantages:** Cost-effective, compact
- **Visual:** Ultrasonic sensor placement on a car



Infrared Sensors

- **Functionality:** Detects heat signatures
- **Applications:** Night vision, pedestrian detection in low-light conditions
- **Visual:** Infrared image showing pedestrians



Inertial Sensors

- **Functionality:** Measure acceleration and orientation
- **Types:** Accelerometers, Gyroscopes
- **Applications:** Stability control, rollover detection
- **Visual:** Diagram of inertial sensor functionality



GPS and GNSS

- **Functionality:** Real-time location tracking
- **Applications:** Navigation, geofencing, route planning
- **Enhancements:** RTK positioning for accuracy
- **Visual:** Map with GPS route overlay



V2X Communication Sensors

- **Functionality:** Communication between vehicles, infrastructure, and networks
- **Applications:** Traffic management, hazard warnings, cooperative driving
- **Visual:** Diagram of V2X communication system



Sensor Fusion in ADAS

- **What is Sensor Fusion?**
Integration of data from multiple sensors for enhanced reliability
- **Benefits:** Improved detection, reduced false positives, comprehensive awareness
- **Visual:** Flowchart of sensor fusion

Future Trends

- Solid-State LiDAR
- AI and Machine Learning
- Edge Computing
- 5G Connectivity for V2X
- Visual: Trend timeline



Conclusion

- **Summary:**
 - Sensors are the backbone of ADAS.
 - Integration and advancements in technology continue to enhance safety and automation.
- **Call to Action:** Explore future innovations in sensor technologies.



...THANK YOU