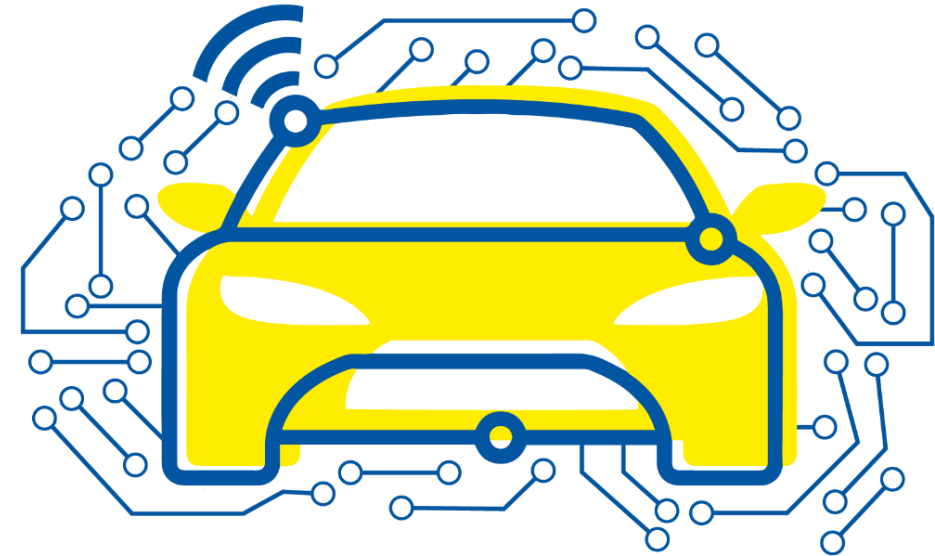# Automated and Connected Driving Challenges

Section 2 – Sensor Data Processing

Localization

Challenges

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Institute for Automotive Engineering

Localization – Challenges

Challenges in Vehicle Localization

Increasing accuracy requirements on different Guidance Levels for Automated Driving

Navigation	Guidance	Stabilization

10 m   0,01 m

Road-Level

Image: businessrole.us

Lane-Level

Image: towardsdatascience.com

Sub-Lane-Level

Image: univdatos.com

Localization – Challenges

Challenges in Vehicle Localization

Increasing accuracy requirements on different Guidance Levels for Automated Driving

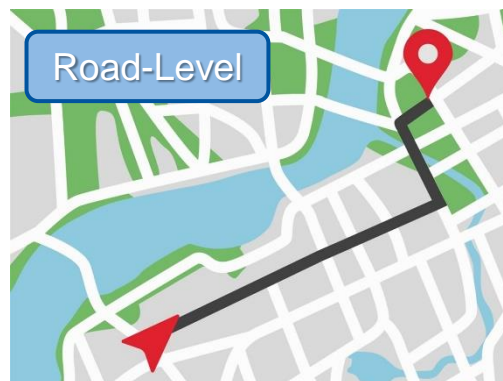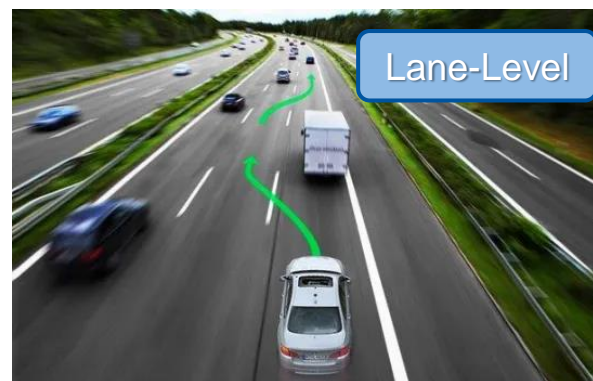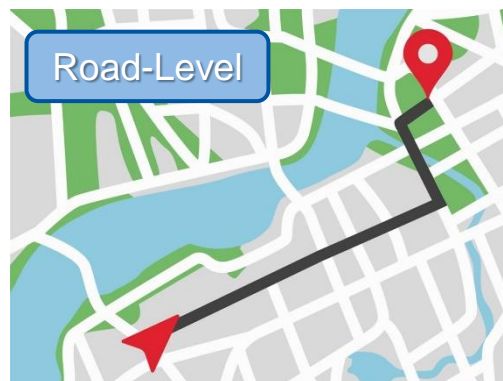| Navigation	Guidance	Stabilization

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Localization – Challenges

Challenges in Vehicle Localization

Availability and quality of GNSS signals
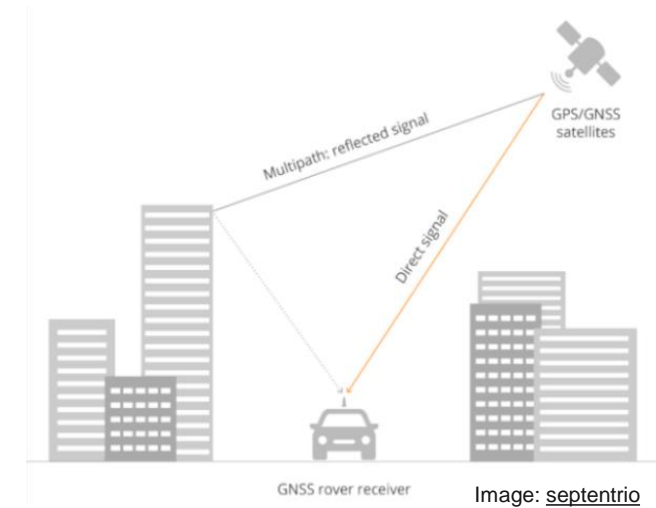

Image: septentrio

Image: gpsworld.com

Localization – Challenges

Challenges in Vehicle Localization

Availability and quality of GNSS signals

- <u>Sender-specific</u>
  - Satellite outages
  - Orbital errors

- <u>Signal propagation</u>
  - Atmospheric effects
  - Refraction, diffraction, absorption
  - Multipath effects

- <u>Receiver-specific</u>
  - Situational occlusions
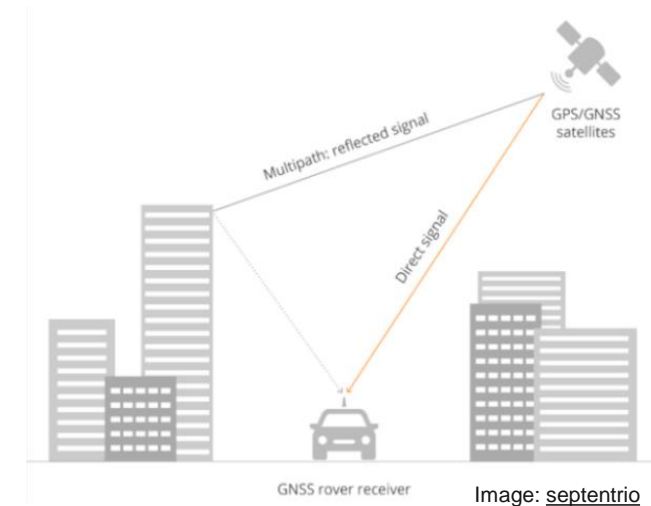 - Antenna effects
  - Hardware delay

Image: <u>septentrio</u>

Image: <u>gpsworld.com</u>

Localization – Challenges

Challenges in Vehicle Localization

Impaired landmark detection with visual sensors

- <u>Weather conditions</u>   Fog, rain, snow

- <u>Lighting conditions</u>   Glare in low sun conditions

- <u>Impaired sensors</u>   Dirt, ice

- <u>Occlusions</u>   Dynamic objects

- <u>Changing landmarks:</u>   Damages

Image: <u>valeo</u>

Image: <u>ulm-news</u>

Image: <u>forbes.com</u>

Image: <u>ADAC</u>

Localization – Challenges

Mitigation of Challenges

Orthogonal performance capabilities

- Different approaches often complement each other well
- Impairment of one method is positively correlated with good performance of another

Examples

- Clear sky in the countryside with only few landmarks
- Numerous landmarks when sky is occluded in cities

→ **Fusion of information from different sensors and approaches helps mitigate individual weaknesses**

Image: Wikimedia

Image: Wikimedia