Localization for automated driving

Dr. Martin Haueis
Head of Vehicle Localization, Research and Development, Daimler AG
Autonomous Driving: Environmental perception and digital maps let the car understand its driving path

Georeferenced offboard data supports sensor-based environmental perception. Digital maps provide the vehicle with planning and localization information.
A localization module relates the georeferenced offboard data in real time from maps to actual vehicle sensor data from, e.g., cameras or radar.

Functional requirements for the localization module are derived from the needs of the sensor fusion module and onboard situation analysis; localization module must be automotive grade, safety qualification according to ISO 26262.
Localization for autonomous driving depends on the use case

- **Highway**: e.g. GNSS, Maps
- **Urban**: e.g. Maps, GNSS
- **Indoor**: e.g. Maps, Infrastructure

There is no single technology for localization in all use cases. Different use cases result in different requirements for maps, infrastructure, and context understanding. GNSS contributes to real-time localization of the vehicle as well as to map making.
Requirements for vehicle localization in autonomous driving challenge today’s technology.

**Accuracy**
- Accuracy
- Start-up time
- Integrity measures

**Robustness**
- Real road environment
- Map quality
- Spoofing

**Safety**
- Functional Safety Requirements (ASIL)
- Automotive RAIM

**Integration**
- Package (Automotive)
- Assembly constraints
- Computing constraints

**Price**
- Component
- Services for correction data
- Map

**Reliability**
- Hardware is automotive grade

Today’s GNSS solutions do not yet meet autonomous driving requirements: Necessary to requalify existing solutions (automotive spec, ASIL), decide on integrity of solution and provide appropriate correction data services.
Advanced sensor fusion to merge the environmental model and GNSS / Infrastructure measurements

Increasingly, fused vehicle sensor information (e.g. camera, radar) and positioning engines (GNSS) will boost localization performance and map learning capabilities. Vehicle fleet will become mapping fleet.

* Simulation done in cooperation with DCAITI, Berlin
Up-to-date maps for autonomous driving will need accurate georeferenced vehicle probe data.

Increased positioning accuracy of vehicles will revolutionize future map quality: NDS incremental map update already introduced, first description of HERE Sensor Ingestion published in 2015.

https://company.here.com/automotive/new-innovations/sensor-ingestion/
Contact

Martin Haueis
Dr. sc. techn.

Head of Localization and Datamanagement

Daimler AG
G024-BB
71059 Sindelfingen/Germany

Phone +49 7031 4389227
martin.haueis@daimler.com