ALP.Lab – Austrian Light Vehicle Proving Region for Automated Driving

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My very, very private approach to selfdriving cars
Static and Dynamic Ground Truth
How to calculate a trajectory and learn from real scenarios ...
... to avoid this?
Why ALP.Lab?
Comprehensive Test & Innovation Lab to test all levels of automated driving functions
The comprehensive Test-Lab to test all levels of automated driving functions

This project is supported by:

- Federal Ministry
  Republic of Austria
  Transport, Innovation
  and Technology

- FFG
  Forschung wirkt.
Society of Automotive Engineers (SAE) defined six Automation Levels

ALP.Lab Test-Region

Salzburg

Hungary

Slovenia

Testregion Kärnten

Testregion Lungau

Testregion Zalaegerszeg

Testregion Liezen

Obersteiermark West

Östliche Obersteiermark

Oststeiermark

Südoststeiermark

West- und Südsteiermark

Leoben

Red-Bull-Ring

Bruck/Mur

Graz

Salzburg

Maribor

A2

A9

S36

S35

S6

S7

Testregion

GLOBAL TOLLING SUMMIT
SEPTEMBER 5-7, 2018
Highway A2 with extended ASFINAG Infrastructure

- **A2 Laßnitzhöhe Graz Ost / Graz West**
- **Road infrastructure:**
  - Length: 23 km
  - Lanes: 3 + 3
  - Intersections: 2
  - Exits: 2
- **Physical & digital infrastructure:**
  - Cameras: 22
  - Radar sensors: 3 (coverage 1.6km)
  - Traffic detection: 8 Gantries
  - Variable message signs: 12
  - C-ITS G5 service
Static Ground Truth – ultra High Definition Map
LiDAR (Light Detection and Ranging)

LiDAR is a state-of-the-art method that measures distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor. It can be used to make digital 3-D representations of the surroundings to generate High Definition Maps.

(Source: JOANNEUM RESEARCH)
ASFINAG Radar Sensors
Autobahn A2 Graz West – Graz/Ost

Data Source:
ALP.Lab: Data & Service Cloud
ASFINAG: Radar
Joanneum Research: HD Map
Virtual Vehicle: Test Vehicle
Extraction and Sensor Fusion

Autobahn A2 Graz West – Graz/Ost

Data Source:
ALP.Lab: Data & Service Cloud
ASFINAG: Radar
Joanneum Research: HD Map
Virtual Vehicle: Test Vehicle
Fully digital integrated Testinfrastructur für AD (Autonomous Driving) und ADAS (Advanced Driver Assistance Systems)

- Model/Software/Hardware in the Loop
  Bring in scenarios from road tests into virtual environment to test SW and HW functions

- Driving Simulator
  Test the Human-Machine Interface (HMI) for ADAS/AD specific situations, e.g. hand-over from vehicle to driver

- Vehicle in the Loop (Driving Cube™)
  Automated system evaluation of a complete vehicle in a reproducible environment on a test bed

- Proving Ground Tests
  Individual desired scenarios and manoeuvres, e.g. EuroNCAP

- Public Road Tests
  Test in regional specific real-world scenarios

- Data and Cloud Services
  Data processing and management
  Analysing and reporting
  Simulation environment
The 4 USPs of ALP.Lab

- Austrian specific traffic situations
- Specific weather conditions
- Overall service package
- All necessary stakeholders on board
- Research & development
- Motorway and road operators
- Automotive industry
- Handle all needed allowances for data storage and processing

Comprehensive testing stages and tool chain:

- Data acquisition
- Test support cloud
- Tool chain
- 3D maps
- Ground truth static
- Test evaluation
- Scenario extraction
- Vehicle data
- Ground truth dynamic
- Rate Safety and comfort
- Data exchange
- Test monitoring
- Test control

All linked to a Data & Cloud Service
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Real World vs. DrivingCube vs. Model in Loop Testing

**Proving Ground**
- 2 scenarios
- ½ a day

**DrivingCube**
- 2 scenarios
- 5 minutes

**Simulation**
- Multiple scenarios

**Chart 1:**
- Y-axis: Desired Acceleration / (m/s^2)
- X-axis: Time / s

**Chart 2:**
- Y-axis: Delta Distance / m
- X-axis: Time / s

Source: Stefan Riedmaier - Kempten University