Lessons learned: Integration of Autoware.AI at our demonstrator

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Research Automated Driving
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Motivation

- Platform to evaluate/compare in-house solutions
- Established AD stack to share solutions
- Using a compatible simulation environment
Use Case / Autoware

Driving on campus from A to B

Integration of Autoware into one research vehicle
➢ Localization / navigation map
➢ Autoware / Dataspeed Interface
➢ Local planner

Driving on university campus (Graz)
Vehicle / Hardware

1x Long Range Radar
Continental ARS408

1x Lidar
Ouster OS1-64

Localization:
Novatel RTK-GPS / ProPak6
Positioning < 5cm, 100Hz via TCP/IP

1x Mobileye
1x RGB Camera

x86 Computer
Ubuntu 16.04 / ROS Kinetic
Vehicle

[Images of vehicle components and the exterior of a car with 'Virtual Vehicle Automated Drive' branding]

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Department E

Autoware Tutorial

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Autoware / Overview

- Map
- Localization
- Object Detection
- Path Planning

HD map creation

Lidar localization

Global planning

Local Planning
Autoware / Mapping

- Mapping for localization (without RTK-GPS)
  - Lidar with 64 layers (Ouster OS1)
  - NDT mapping

- HD map
  - Browser based tool for mapping (Tier IV)
  - Vector Map (lanes, borders, etc.)
Autoware / Localization

Lidar based / 64 Layers / 10 Hz / Voxel Grid 1m
ADAS-Kit Dataspeed Inc.

Universal Lat/Lon Controller Interface

- Controller for drive-by-wire interface (execution on Dataspeed ECUs)
- Velocity / yaw or curvature control (/twist_cmd)

```
bool clear
bool enable_pedals
bool enable_steering
bool enable_shifting
bool shift_from_park
float64 linear_velocity
float64 linear_accel
float64 linear_decel
float64 yaw_command
float64 angular_accel
float64 lateral_accel

uint8 YAW_RATE_MODE=0
uint8 CURVATURE_MODE=1
uint8 steering_mode
```
Simulation Environments

**Dataspeed Simulator (Gazeboo)** / [dataspeed_dbw_simulation]
- ROS interface/behaviour like real vehicle
- Scenario generation

**CARLA**
- Focus: sensor fusion, object prediction
- Vehicle control

**Autoware Simulator (wf_simulator)**
- Focus: Path Planning algorithms
- Function development only based on ground truth data

**ROSBAGs**
- Focus: parametrization perception
- no closed loop
Our next steps

➢ Digitalization Graz University of Technology Campus for Carla
  ➢ Campus based on recorded point cloud.
  ➢ Same VectorMap (OpenDrive Map) in simulation and real vehicle.

➢ Extension of the CARLA-Ros-Bridge
  ➢ No difference between simulation and real vehicle.
  ➢ Same Datasead interfaces.

➢ Contribute to the community!
THANKS TO THE FOUNDATION!

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