Autonomous Driving Sensor Testing

In this project, different sensors of autonomous vehicles are tested in real-world driving. In a first step, a vehicle is equipped with all necessary hardware for autonomous driving. The accuracy of RADAR and LIDAR sensors is determined with experiments and emulations in the laboratory of METAS. Following the laboratory experiments, field tests will be realized with the sensor equipped vehicle under different environmental conditions. The project aims at producing sensor data and detecting objects while driving on real streets under different weather, light, and contamination conditions. The produced big data for autonomous driving should be processed in real-time and stored in a suitable big data architecture, so that all the events during the field tests can be later analyzed and reproduced easily. A further aim of the project lies in the detailed analysis of the sensor data in order to reduce information storage requirements to the essential.

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Introduction

Autonomous vehicles have the potential to positively influence future traffic behavior [1].

- Increase in transport safety
- Save time for individuals
- Improve traffic flow
- Usage as utility vehicles such as taxis
- Reduction of environmental pollution

Nevertheless, the new technology opens social, legal, economical, and technical questions. A significant technical question concerns the necessary minimum technical requirements for self-driving cars to make them street-legal. In this project, the focus is testing the autonomous driving sensors in real-world driving under different weather, light, and contamination conditions. Data analysis and big data storage tools will be used on the gathered sensor data to improve the objection detection of the sensors.

Procedure

1) Set up a *Lexus RX 450h* car with autonomous driving hardware and software.

2) Test the accuracy of the RADAR and LIDAR sensors in emulation under different environmental conditions.

3) Conduct real-world field tests of the sensors on the vehicle.

4) Implement real-time data analysis and big data storage for the produced sensor data.

5) Identify crucial sensor data for analysis and storage.

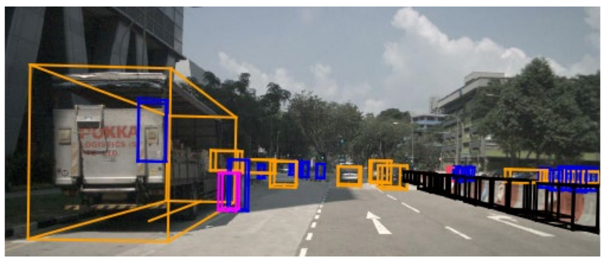

Figure 1: Object detection (data from [2]).

Methodology

Figure 2: RADAR simulation at METAS.

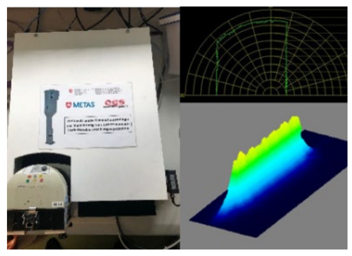

Figure 3: Scanner Characterisation at METAS.

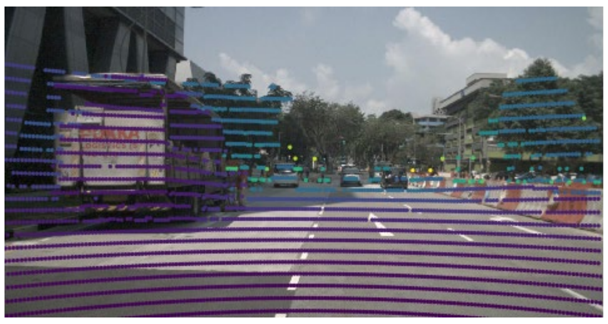

Figure 4: LIDAR point cloud and front camera image fusion (data from [2]).

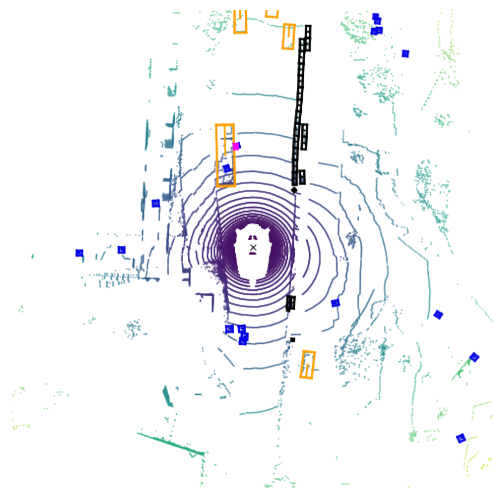

Figure 5: LIDAR point cloud from aerial perspective (data from [2]).

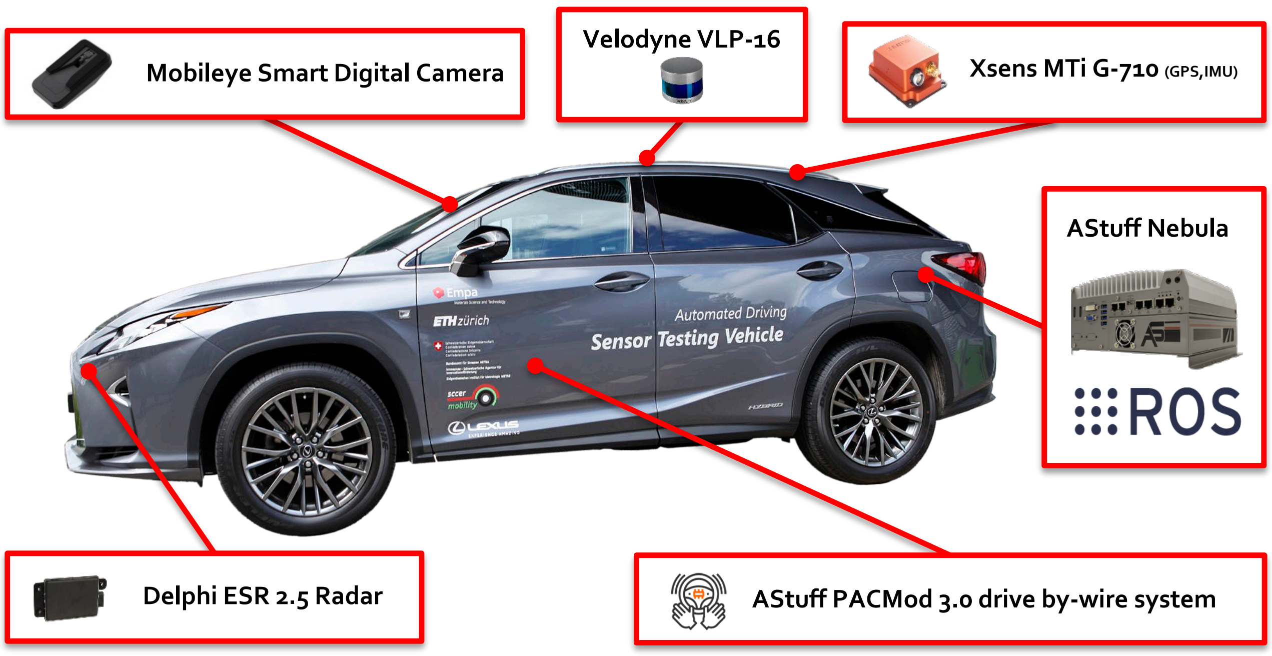

Figure 6: Lexus RX 450h with autonomous driving sensor and computing equipment [3].

Outlook

This project focuses on testing the sensors for autonomous driving in field tests, where a human driver is controlling the car. In a next step, it is planned to use the gained sensor data and information to implement autonomous driving algorithms, so that the vehicle can drive fully autonomously.

References

[1] M. Markus, et al. *Autonomous Driving. Berlin, Germany: Springer Berlin Heidelberg* 10 (2016): 978-3.
[2] H. Caesar, et al. "A multimodal dataset for autonomous driving". arXiv preprint arXiv: 1903.11027, 2019.
[3] AutonomouStuff (2010). Accessed at August, 08, 2019. [Online] Available: https://autonomoustuff.com

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