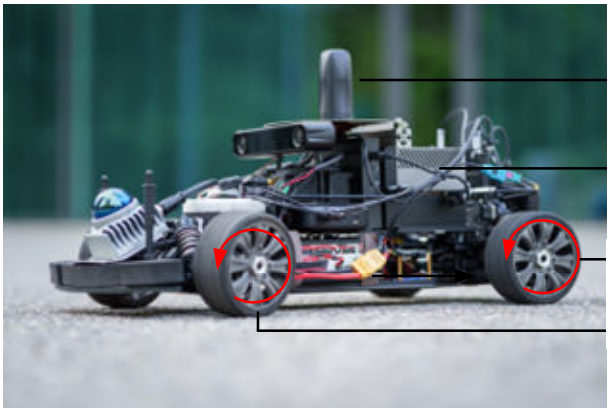
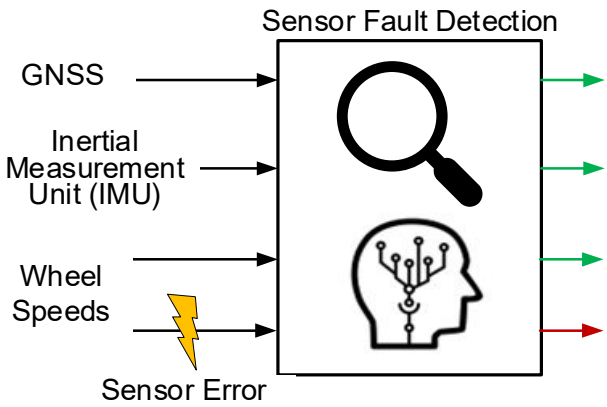
Deutsches Zentrum
DLR für Luft- und Raumfahrt

Proposal for a thesis (Master's):

Analysis and Implementation of Fault Detection Algorithms for Vehicle Dynamics Variables





Problem Statement:

The Vehicle System Dynamics and Control team at the Institute of Vehicle Concepts is currently developing a new 1:8 scale test vehicle. The development goal is to increase the robustness and safety of autonomous driving functions through reliable sensor data processing.

The vehicle is equipped with a variety of sensors, including wheel speed sensors, IMUs (inertial measurement units) and GNSS (global navigation satellite system) receivers. These provide essential information for vehicle control and are crucial for the safety and performance of the vehicle. However, failures, drifts or incorrect measurements by the sensors can have problematic effects on the controllers. There is also a risk that sensor data could be deliberately manipulated by external cyber-attacks, for example through interference signals.

The aim of this work is to develop and implement algorithms to reliably detect and isolate errors in order to ensure the integrity of the sensor data. Both model-based and data-driven and hybrid approaches will be considered and evaluated in terms of their suitability for safety-critical applications.

A test vehicle is available for data generation and experiments.

Tasks:

- Literature review on current methods of fault detection (model-based, data-driven, hybrid), as well as research on types of faults in sensors for driving dynamics variables
- Generation of test data and error scenarios
- Implementation of promising error detection algorithms in Python or Matlab/Simulink
- Evaluation of the algorithms on a real-world data set
- Documentation of the results

Objectives

- Review of error detection algorithms for vehicle dynamics measurement variables in the literature
- Implementation of suitable methods for error detection for vehicle dynamics sensor data.
- Performance evaluation of the selected approaches based on real data.

Requirements:

- Good knowledge of control engineering
- Good knowledge of machine learning
- Knowledge of Matlab/Simulink, Python
- Desirable: Basic knowledge of vehicle dynamics

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