Autonomous Driving Ackermann-Steered Vehicle

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Abstract

In this bachelor's thesis we will be presenting a research and education platform for autonomous vehicles with Ackermann geometry, which we will be calling **ADAM-V**[1]. The model of autonomy is based on the idea of Simultaneous Localization and Mapping - **SLAM** for map building and localization. We'll be using a modified version of the **ROS**[2] navigation stack for path planning and navigation. We will build the 2D map of the enviroment that contains static obstacles using a **LiDAR**[3] sensor.

The navigation stack is hierarchical, the proposed algorithms for it are a Dijkstra algorithm for global planning and an algorithm based on Timed Elastic Bands for local planning. The vehicle will find the optimal path to the destination and will be capable of avoiding obstacles that were not initially represented on the map, recalculating it's local trajectory if needed. Localization is achieved using a Monte Carlo algorithm. Sensor fusion is done using Kalman filtering. A convolutional neural network is used for detection and classification of the surrounding objects.

ADAM-V is a scalable platform that depends only on the robot's kinodynamics. The main applications for ADAM-V are in the automotive industry, where a higher level of autonomy is wanted, in the agricultural industry, where there is a need for autonomous agricultural machinery that can undertake specific activities, in retail, where robots that can automate warehouse and delivery processes are developed and in the academic environment, where ADAM-V is a perfect research platform for rapid testing of state-of-the-art algorithms and technologies.

[1]**A**utonomous **D**riving **A**cker**m**ann-Steered **V**ehicle
[2]**R**obot **O**perating **S**ystem
[3]**Li**ght **D**etection **A**nd **R**anging