Proposal Title

Adaptive control algorithms that provide fast and accurate vehicle control for vehicles with various characteristics.

Overview

This project will design, implement, and evaluate an adaptive controller used in Autoware.

Project Details

By default, Autoware uses PID control for longitudinal control and MPC for lateral control. PID control requires three gains to be set, and MPC requires an accurate vehicle model and various parameters to be set. It is time-consuming and difficult to set parameters based on an accurate vehicle model and considering the meaning of each parameter and the characteristics of the controlled vehicle. If Autoware had a feature to automate these parameter settings, it would enable even those who do not have knowledge of parameter settings to quickly create controllers that match vehicles with various characteristics, contributing to make autonomous driving more widespread. However, such feature has not been implemented in Autoware.

In this project, adaptive control will be developed and integrated with Autoware, which determines control parameters and models appropriate for the controlled vehicle based on previously obtained driving data.

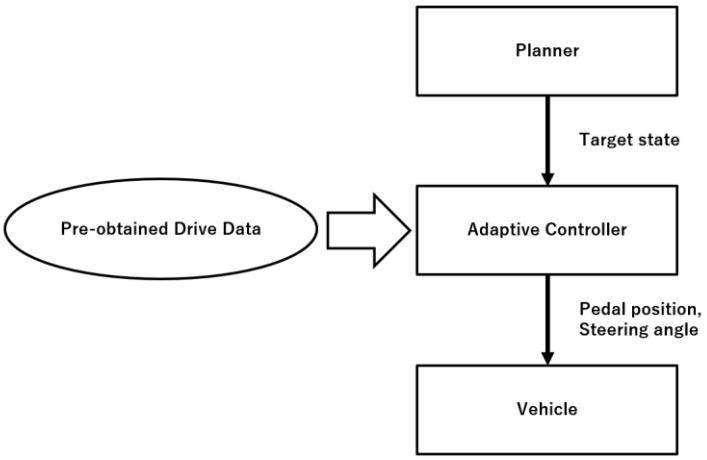

Figure: Adaptively designing a controller from pre-obtained operational data.

Currently, the algorithms we are considering implementing are listed below.
・Adaptive Control
・Neuro PID
・Adaptive Network based Fuzzy Inference System(ANFIS)
・Adaptive Pure Pursuit（APP）

In addition, this project will use AWSIM to set up and evaluate vehicles with various characteristics and driving courses to compare them with the default controller implemented in Autoware. Furthermore, the control error boundedness will be shown, if possible, based on Lyapunov direct method, etc.

Once implementation and evaluation we will contribute the code to the open source Autoware project.

Expected Output

By the end of the challenge, we aim to accomplish the following:
・Integration of proposed system with Autoware software stack
・Build a system to adaptively update controller parameters using AWSIM and Autoware.
・Comparison of the performance of the proposed controller with the default controller in Autoware.
・Links to open source code repository containing the project source code as well as documentation for installation and running the code.