Modelling of a Hybrid Vehicle for Autonomous Vehicles Research

Ala J Alnaser, Onur Toker, Abigail Bowers

Department of Applied Mathematics, [2]Department of Electrical and Computer Engineering
Florida Polytechnic University
Lakeland, Florida, USA
aalnaser@floridapoly.edu, otoker@floridapoly.edu, abowers @floridapoly.edu

Abstract

In this paper, we consider modelling of a hybrid vehicle for autonomous vehicles (AV) algorithm development, simulation, and verification. Our research platform is a Ford Fusion plugin hybrid vehicle with drive-by-wire conversion done by Dataspeed Inc. The vehicle is equipped with steering, throttle, break, wheel speed and several other sensors and actuators all connected to the vehicle CAN network. Furthermore, we have lidar, radar and multiple camera sensors, and a vibration resistant GPU desktop. We will drive the research vehicle both on the campus and on local highways and generate a rich dataset for various modelling studies. Our preliminary test results show that existing hardware is capable of recording all relevant CAN network activity without any data packet loss. We have explored linear differential equation-based models including the air friction but planning to explore both nonlinear and AI based more complex models. All of these vehicle models are planned to be executed on an external hardware accelerator, Speedgoat Performance Real-Time Target Unit, with full MATLAB/Simulink integration. In the full version of the paper, we will present both experimental results and provide a detailed comparison between different modelling alternatives, computational demand, and modelling accuracy.

Keywords
Autonomous Vehicles, AI algorithms, Vehicle Dynamics

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