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Akademin för informationsteknologi

Modelling and Simulation for Evaluation of Cooperative Intelligent Transport System Functions

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Abstract

Future vehicles are expected to be equipped with wireless communication technology, that enables them to be "connected" to each others and road infrastructures. Complementing current autonomous vehicles and automated driving systems, the wireless communication allows the vehicles to interact, cooperate, and be aware of its surroundings beyond their own sensors' range. Such systems are often referred to as Cooperative Intelligent Transport Systems (C-ITS), which aims to provide extra safety, efficiency, and sustainability to transportation systems. Several C-ITS applications are under development and will require thorough testing and evaluation before their deployment in the real-world. C-ITS depend on several sub-systems, which increase their complexity, and makes them difficult to evaluate.

Simulations are often used to evaluate many different automotive applications, including C-ITS. Although they have been used extensively, simulation tools dedicated to determine all aspects of C-ITS are rare, especially human factors aspects, which are often ignored. The majority of the simulation tools for C-ITS rely heavily on different combinations of network and traffic simulators. The human factors issues have been covered in only a few C-ITS simulation tools, that involve a driving simulator. Therefore, in this thesis, a C-ITS simulation framework that combines driving, network, and traffic simulators is presented. The simulation framework is able to evaluate C-ITS applications from three perspectives; a) human driver; b) wireless communication; and c) traffic systems.

Cooperative Adaptive Cruise Control (CACC) and its applications are chosen as the first set of C-ITS functions to be evaluated. Example scenarios from CACC and platoon merging applications are presented, and used as test cases for the simulation framework, as well as to elaborate potential usages of it. Moreover, approaches, results, and challenges from composing the simulation framework are presented and discussed. The results shows the usefulness of the proposed simulation framework.