ABSTRACT

Licentiate thesis

On Strategies for Reliable Traffic Safety Services in Vehicular Networks

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Abstract

Traffic accidents account for nearly 40,000 fatalities each year in the European Union and reducing this number relies on the successful coordination between several stakeholders in the traffic domain. Intelligent Transportation Systems (ITS), a marriage between information-, communication- and transportation technologies, is a promising platform for coordination between car manufacturers, infrastructure operators and policy makers. This thesis specifically focuses on systems in which wireless vehicle-to-vehicle and vehicle-to-infrastructure communication act as enablers for a new generation of cooperative safety systems.

Cooperative safety systems inherit the stringent reliability requirements of traditional non-cooperative safety systems while at the same time being subject to the unreliable characteristics of a distributed system linked by wireless communication. The thesis explores the design space of this new class of systems in terms of architectural components, applications and communication strategies with a focus on increasing the overall reliability. A high-level architecture is proposed that identifies key components such as a resource manager for cooperative monitoring of the quality of the wireless medium, a shared context database and a conflict resolution stage for driver warnings. The resource management component is further detailed and shown through simulations to be a viable mechanism for quality of service prediction at the expense of increased bandwidth usage. Finally the argument is made that exchange of only basic information between vehicles, but with detailed pre-shared models of driver behaviour, is a robust coordination strategy between nodes in the network. An implementation of the driver behaviour prediction strategy based on sequential Bayesian filtering is tested on vehicle trajectories extracted from a video sequence.