Proposal for Master Thesis on
“Coordination of Multiple RadCom Units for Smooth V2V Communication”

Department of Electrical Engineering (E2)

Description
A state-of-the-art proposed solution for Intelligent Transportation System safety and efficiency is the combination of both mmWave radar and mmWave communications, called as joint radar-communications (RadCom), which reuses radar hardware for wireless vehicle-to-vehicle (V2V) communication [1]. RadCom is expected to become an inevitable technology for autonomous driving, due to its potential for reducing the delay and interference between radar systems and communication systems, whilst providing a ‘see-through driving’ (Fig.1). It offers not only reduced hardware, but also efficiency in spectrum and energy consumption. However, automated vehicles are equipped generally by several radars and one question which awaits solution is as follows: “For a smooth V2V communication in a RadCom system, how should the MAC coordination of multiple RadCom units conducted in an efficient way?” The channel sharing should be designed in such a way that the cross-layer radar data (velocity, range, angle) should be utilized in coordination of multiple RadCom units to decrease the delay at intersections and reduce interference, for both radar and communications.

Objectives
In this thesis, we are interested in simulating a RadCom system in vehicular networks with multiple RadCom units per vehicle (for example, one at each side). The thesis will include & target the following steps:
1) Protocol design: A RadCom ad-hoc medium access control protocol will be designed for both radar and communication, which utilizes radar data and provides smooth V2V communication whilst reliable radar sensing. Literature will be reviewed [2,3] and a RadCom protocol will be implemented for medium access control.
2) Performance evaluation: Performance with and without RadCom for various inputs (such as number and speed of vehicles, communication bandwidth, SNR, etc.) will be simulated and various performance metrics (such as communication data rate, delay, localiztion accuracy, etc.) will be evaluated.

Project Group
This is a thesis suitable for a group of two students.

Prerequisites
Programming background for C and Matlab. Familiarity with object-oriented programming is beneficial, but not required.

Specific outcomes
Students will be exposed to problems about the state-of-the-art radar communications technology regarding autonomous driving. Meanwhile, students will learn about vehicular network simulations and protocol development.

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References