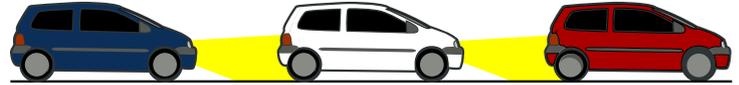


## Bachelor Thesis

# Augmenting Urban Platooning with Visible Light Communication

Cooperative Adaptive Cruise Control (CACC), often-times referred to as *Platooning*, has been extensively investigated as a vehicular networking application.



Platooning is a safety application which combines techniques from control theory, traffic engineering, and wireless communications. Existing research so far has demonstrated that platooning can improve multiple aspects of transportation on roads, including improved safety, better road utilization, reduced travel time, lower fuel consumption, and less emissions.

For the most part, platooning has been considered for freeway scenarios only. However, initial research in the field has shown that platooning can also be beneficial in the context of urban scenarios, particularly at intersections controlled by traffic lights. If platooning is used here, throughput is increased due to the almost simultaneous reaction time of vehicles.

For platooning to work, however, efficient and reliable communication between vehicles is mandatory. Radio-based communication technologies like IEEE 802.11p/DSRC have been considered as the primary communication technology to realize platooning. Nevertheless, in dense urban scenarios with high vehicle density channel congestion becomes an issue. In such cases one can take advantage of highly directional and easily attenuated communication technologies such as Vehicular Visible Light Communication (V-VLC). The confined nature of the light, together with the small collision domain owing to the directionality of V-VLC, can be highly beneficial to platooning.

Schettler et al. [1] have already demonstrated first improvements for platooning in freeway scenarios. Following their work, the benefit of V-VLC can be assumed to be even more pronounced in urban scenarios.

## Goals of the thesis

- Investigate the performance of traditional radio-based platooning in typical urban scenarios using a network simulator and identify scenarios where traditional radio-based approaches deliver sub-par performance.
- Develop and evaluate a protocol combining a traditional radio-based approach and V-VLC to overcome the identified shortcomings.

## Keywords

Vehicular Visible Light Communication (V-VLC), Platooning, OMNeT++ Vehicular Network Simulation

- [1] M. Schettler, A. Memedi, and F. Dressler, “Deeply Integrating Visible Light and Radio Communication for Ultra-High Reliable Platooning,” in *15th IEEE/IFIP Conference on Wireless On demand Network Systems and Services (WONS 2019)*, Wengen, Switzerland: IEEE, Jan. 2019.