

UNIVERSITY OF SOUTH FLORIDA

Defense of a Doctoral Dissertation

V2V and V2I Based Safety and Platooning Algorithms for Connected and Autonomous Vehicles

by

Omkar Dokur

For the Ph.D. degree in Computer Science and Engineering

Connected Vehicles (CVs) make transportation safe by communicating with vehicles and the infrastructure in their neighborhood. CVs are embedded with onboard units (OBUs) which transmit basic safety messages (BSMs) containing the location, heading, and velocity information of the vehicle using vehicular ad-hoc networks. These BSMs can be used to warn drivers using various vehicle-to-vehicle (V2V) or vehicle-to-infrastructure (V2I) applications. CV technology also supports cooperative vehicular driving applications such as platooning where a group of vehicles can negotiate and drive jointly close to each other in a cooperative manner to form a platoon. In this work, first we have proposed a novel approach to detect relative position of CVs using BSMs. Using this approach, we developed algorithms for eight (8) V2V applications namely Forward Collision Warning (FCW), Emergency Electronic Brake Light (EEBL), Blind Spot Warning (BSW), Slow Moving Vehicle Warning (SMVW), Do Not Pass Warning (DNPW), Stationary Vehicle Warning (SVW), Platoon Negotiation, and Platoon Formation. We proposed algorithms for three (3) V2I applications namely Traffic Light Detection (TLD), Red Light Violation Warning (RLVW), and Wrong-Way Entry Warning (WWEW). To evaluate these algorithms, we extended CARLA, an open-source vehicle simulator (carla.org) to simulate vehicle connectivity.

Examining Committee

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Publications

1. **O. Dokur** and S. Katkoori, "Three Connected V2V Applications Based on DSRC Basic Safety Messages," 2022 International Conference on Connected Vehicle and Expo (ICCVEx), Lakeland, FL, USA, 2022, pp. 1-6, doi: 10.1109/ICCVEx52871.2022.9743088.
2. **O. Dokur**, G. Olenski, and S. Katkoori, "An Edge Computing Approach for Autonomous Vehicle Platooning". In Internet of Things. IoT through a Multi-disciplinary Perspective: 5th IFIP International Cross-Domain Conference, IFIP IoT 2022, Amsterdam, The Netherlands, October 27–28, 2022, Proceedings, pp. 332-349. Cham: Springer International Publishing, 2022. *Best Paper Nomination*.
3. **O. Dokur**, G. Olenski and S. Katkoori, "Slow Moving Vehicle, Do Not Pass, and Stationary Vehicle V2V Warnings Based on DSRC Basic Safety Messages," 2022 IEEE International Symposium on Smart Electronic Systems (iSES), Warangal, India, 2022, pp. 694-699, doi: 10.1109/iSES54909.2022.00154.
4. **O. Dokur**, G. Olenski and S. Katkoori, "Platoon Formation Based on DSRC Basic Safety Messages," 2022 IEEE International Symposium on Smart Electronic Systems (iSES), Warangal, India, 2022, pp. 700-705, doi: 10.1109/iSES54909.2022.00155. *Best Paper Award*.
5. **O. Dokur** and S. Katkoori, "Vehicle-to-Infrastructure based Algorithms for Traffic Light Detection, Red Light Violation, and Wrong-Way Entry Applications," 2022 IEEE International Symposium on Smart Electronic Systems (iSES), Warangal, India, 2022, pp. 25-30, doi: 10.1109/iSES54909.2022.00158.
6. **O. Dokur** and S. Katkoori, "CARLA Connect: A Connected Autonomous Vehicle (CAV) Driving Simulator," 2022 IEEE International Symposium on Smart Electronic Systems (iSES), Warangal, India, 2022, pp. 656-659, doi: 10.1109/iSES54909.2022.00146.

Robert Bishop, Ph.D.
Dean, College of Engineering

Ruth H. Bahr, Ph.D.
Dean, Office of Graduate Studies

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