



COLLEGE OF ENGINEERING
AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

Caner Mutlu

for the degree of Doctor of Philosophy (Ph.D.)

“Space-Time Graph-Based Vehicular Trajectory Planner: An Autonomous Intersection Management System”

November 12th, 2024, 3:00 p.m.

Room # EE303

777 Glades Road

Boca Raton, FL

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ABSTRACT OF DISSERTATION

Dissertation Title: Space-Time Graph-Based Vehicular Trajectory Planner: An Autonomous Intersection Management System

Abstract: Every passenger vehicle must rely on a safe and optimal trajectory to eliminate traffic incidents and congestion as well as to reduce environmental impact, and travel time. Autonomous intersection management systems (AIMS) enable large scale optimization of vehicular trajectories with connected and autonomous vehicles (CAVs). The first contribution of this research study is – a novel approach – the fastest trajectory planner (FTP) method which is geared for computing the fastest waypoint trajectories via performing graph searching over a discretized space-time (ST) graph (G_t), constructing collision-free space-time trajectories with variable vehicular speeds adhering to traffic rules and dynamical constraints of the vehicles. The second contribution of this research study is – an application layer V2V solution – the coordinator-based distributed trajectory planning method which is proposed for complementing the FTP method in decentralized scenarios. The proposed system elects a single leader CAV among all the collaborating CAVs without requiring a centralized infrastructure and manages the vehicular network. The leader vehicular agent calculates and (re-)assigns a trajectory for each node CAV over the vehicular network for the collision-free management of an unsignalized road intersection. The proposed FTP method is tested in a simulated road intersection scenario for carrying out trials on scheduling efficiency and algorithm runtime. The resulting trajectories allow high levels of intersection sharing, high evacuation rate, with a low algorithm single-threaded runtime figures even with large scenarios of up to 1200 vehicles.

BIOGRAPHICAL SKETCH

Born in Türkiye

B.S., Florida Atlantic University, Boca Raton, Florida, 2017

M.S., Florida Atlantic University, Boca Raton, Florida, 2020

Ph.D., Florida Atlantic University, Boca Raton, Florida, 2024

CONCERNING PERIOD OF PREPARATION & QUALIFYING EXAMINATION

Time in Preparation: Year – 2020-2024

Qualifying Examination Passed: Semester Fall 2021

Published Papers:

1. Mutlu C., Cardei I., and Cardei M.: Space-Time Graph Planner for Unsignalized Intersections with CAVs, The 16th Annual International Conference on Combinatorial Optimization and Applications, 2023, Hawaii, USA.
2. Ionut Cardei, Caner Mutlu, Mihaela Cardei, Space-time graph path planner for unsignalized intersection management with a V2V agent coordination architecture, Theoretical Computer Science, Volume 1020, 2024, 114871, ISSN 0304-3975, <https://doi.org/10.1016/j.tcs.2024.114871>.