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Trajectory Planning and Tracking for Connected Autonomous Electric Buses: Optimization and Lattice-Based Dynamic Programming

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KEYNOTE SPEECH

***Abstract*—Connected autonomous electric buses must coordinate lane changes and speed decisions with traffic signals and surrounding human-driven vehicles while accounting for energy consumption, passenger comfort and safety. This plenary presentation described a two-stage trajectory planning and tracking approach developed within the e-MATS project. The first stage determines lane level maneuvers, reference speeds and trajectory geometry under vehicle, traffic light and inter-vehicle constraints. Trigonometric reference profiles connect these discrete planning decisions to the continuous-time cruise control formulation of the second stage, which incorporates energy use and tracking errors.**

The presentation reviews the underlying vehicle and traffic signal models and illustrates the trajectory planning approach using simulation results. It next introduces recent results on spatial lattice-based dynamic programming, including the discrete state representation, admissible lane and speed transitions, backward Bellman recursion, forward trajectory reconstruction and an outer search over the desired yaw angle. The reported six scenario simulation results provide the basis for discussing the influence of traffic light signal and lane conditions. Particular attention is given to the distinction between offline planning and online execution, and to the steps required for real-time replanning, uncertainty handling and integrated validation of planning and tracking.

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Keywords—control, neural networks, optimization, reinforcement learning, servo systems, tower crane systems

SHORT BIO

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