Mechanical Engineering Thesis Defense

Optimal path design for initial region classification for parallel parking based on geometrical methods for 2-WS and 4-WS systems

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Abstract

The need for autonomous cars has never been stronger, and for a vehicle to be completely autonomous, multiple components must work together, one of which is the capacity to park at the end of a mission. The goal of this thesis project is to design and execute an automated parking assist system (APAS). Traditional Automated parking assist systems (APAS) may not be effective in some constrained urban parking environments because of the parking space dimension. To overcome this kind of challenge, a novel four-wheel steering (4-WS) vehicle for automated parallel parking is proposed in the thesis. In the proposed novel APAS first, a suitable parking space is first identified through ultra-sonic sensors which are mounted around the vehicle, and then depending upon the vehicle's initial position, various compact and smooth parallel parking paths are generated. An optimization function is built to get the smoothest (i.e., the smallest steering angle change and the shortest path) parallel parking path. With the full utilization of the 4WS system, the proposed path planning algorithm can allow a larger initial parking area that can be easily tracked by the 4WS vehicles. The proposed APAS for 4WS vehicles makes the automatic parking process in restricted spaces efficient. To verify the feasibility and effectiveness of the proposed APAS, a 4WS vehicle prototype is applied for validation through both simulation and experiment results.

July 1, 2022; 4:30 PM;
Zoom Link: https://asu.zoom.us/j/87472629430