

# Automatic Parallel Car Parking

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## Abstract

A car capable of automatic parallel parking has been developed within the framework of the French program PRAXITELE. This program aims to design a novel urban transportation system based on a fleet of electric cars capable of autonomous motion [1]. The cars are four wheel vehicles with front driven and steering wheels. Such a vehicle is subject to nonholonomic constraints: its kinematic equations involve derivatives of the vehicle's coordinates and are non-integrable. This complicates the on-line motion planning and control of such an autonomous vehicle. The developed automatic parallel car parking operates successfully on flat ground where a pure rolling contact without slippage between the wheels and the ground occurs.

The motion control problem for automatic parking involves: localizing the parking bay, placing the vehicle at a start location beside the bay, and performing the parking maneuver (motion into the parking bay). The approach developed for automatic parallel parking of a nonholonomic vehicle is presented in [2] and [3]. The key idea is to carry out a "Localization-Planning-Execution" cycle until a specified "parked" location of the vehicle relative to its environment is reached. For localization and collision avoidance, an ultrasonic sensor system is used. Feasible controls (steering angle and longitudinal velocity) that correspond to a nominal motion leading to the "parked" location are planned and executed in real time. Once the motion has been carried out, the sensor data is used to decide whether the "parked" location has been reached and the parking maneuver is complete.

## References

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