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Low-Cost Parking Lot Mapping and Localization for Home Zone Parking Pilot

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Abstract : Home zone parking pilot (HPP) is a fast-growing segment in low-speed autonomous driving applications. It requires the car automatically cruise around a parking lot and park itself in a range of up to 100 meters inside a recurrent home/office parking lot, which requires precise parking lot mapping and localization solution. Although Lidar is ideal for SLAM, the car OEMs favor a low-cost fish-eye camera based visual SLAM approach. Recent approaches have employed segmentation models to extract semantic features and improve mapping accuracy, but these AI models are memory unfriendly and computationally expensive, making deploying on embedded ADAS systems difficult. To address this issue, we proposed a new method that utilizes object detection models to extract robust and accurate parking lot features. The proposed method could reduce computational costs while maintaining high accuracy. Once combined with vehicles' wheel-pulse information, the system could construct maps and locate the vehicle in real-time. This article will discuss in detail (1) the fish-eye based Around View Monitoring (AVM) with transparent chassis images as the inputs, (2) an Object Detection (OD) based feature point extraction algorithm to generate point cloud, (3) a low computational parking lot mapping algorithm and (4) the real-time localization algorithm. At last, we will demonstrate the experiment results with an embedded ADAS system installed on a real car in the underground parking lot.

Keywords : ADAS, home zone parking pilot, object detection, visual SLAM
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