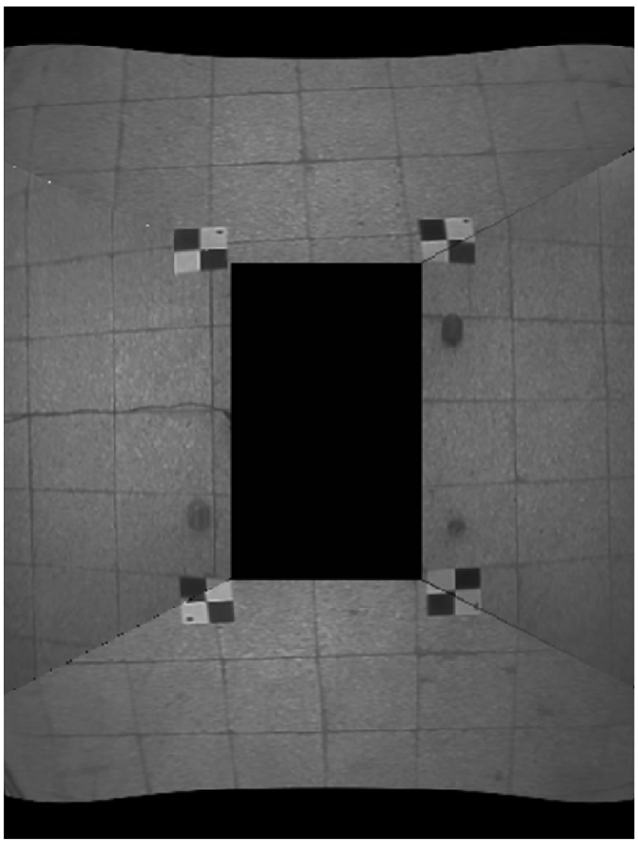
A Retrofittable Birdseye View Camera System for Vehicles

Panoramic park assistant system is a driver assistance system that generates a bird's-eye-view image of a vehicle using cameras installed on the vehicle. Fish-eye cameras are the most suitable type of cameras for such an application considering their wide field of view. However, it is necessary to correct images collected from fish-eye cameras due to considerable radial and tangential distortion compared to pinhole cameras. In this work, the calibration of over the counter fish eye cameras are explained. Collected images are corrected after calibration. Then, stitching methods for joining different images taken with the same type of camera are investigated, compared and implemented. Finally, bird's-eye-view of an rectangular object is generated using images taken from four sides of the said object. Result of this work is a design framework for a retrofittable and user calibrable camera system.



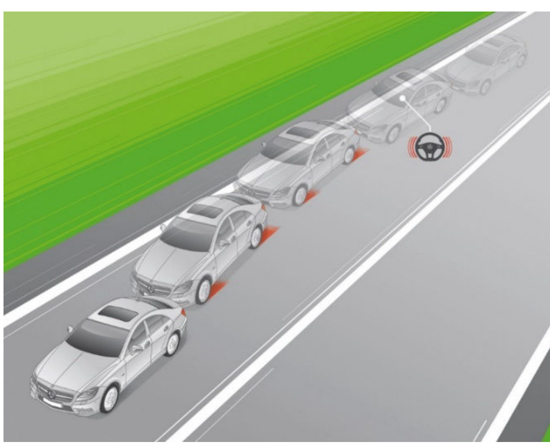
Project leader: Dr.-Ing. Emir Kutluay

Development and Simulation of a Coordinated Intervention Approach for Enhancing the Performance of Lane Keeping Assistant System

The goal of this project is to design a system which intervenes through cooridnated actuation of the front and rear axle tires in order to enhance the performance of lane keeping assistant system, which can be found in modern upper class vehicles. Necessary vehicle models and control strategy will be developed in order to coordinate the steering angle intervention and the braking of the lane facing tires, both of which are currently utilized in various applications.

Lane keeping assistant consists of three stages. First a sensor system, usually video camera, defines the lane in front of the vehicle and vehicles relative position with respect to the lane. In the second stage, data from the vehicle sensors is utilized to determine the lane crossing instance. In the third stage the system intervenes the dynamics of the vehicle in order to move the vehicle back into the lane. The intervention method for current applications are rotating the steering wheel independent of the driver [1] or braking the lane facing wheels [2, 3]. Alternative but not yet commercialized intervention methods are modifying the traction torque [4], in the case of the electric powered vehicles with separate hub motors, or modifying the rear axle steering angle, in the case of vehicle equipped with rear axle steering system [5]. The necessary conditions for an intervention is not just the vehicle leaving the lane. If the driver activates the directional indicators, the system assumes that the driver is intentionally leaving the lane, and does not intervene. Moreover the steering wheel torque or angle information is also tracked and analyzed in order to determine if the driver is performing the maneuver delibarately or performing an emergency maneuver, and in both cases the system does not interfere [1]. Lane violation can take place with different severities depending on the road curvature, steering wheel angle and speed of the vehicle. Thus, the amount of yaw moment in order to direct the vehicle back into the lane is variable as well. Vehicles with high yaw damping, e.g. heavy vehicles, tend to react later than passenger cars. Moreover road conditions have a strong effect on the reaction time. Wet and icy roads with lower friction coefficients will increase the reaction time.

Within the project, a parametric vehicle model, a vehicle control model which computes the deviation from the lane, a nonlinear steering model, a brake and hyraulic system model and a wheel slip controller will be developed. Then, test scenarios with respect to different lane approach possibilities, different road conditions, vehicle variables and parameters will be determined. In the next step, control strategy will be developed and implemented and be tested using the previously mentioned scenarios. The proposed system is to provide steering wheel intervention of the front wheels and brake intervention to one of the rear wheels in the case of a lane violation. With this novel approach control inputs will be allocated to two subsystems with respect to the longitudinal speed of the vehicle and the lane approach angle, enhancing the reaction time of the lane keeping assistance and thus, the system performance. The successful completion of the project and the developed control approach are planned to serve as foundation for a future product oriented development project.



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