Cruising Control of Electric Vehicle Using Situation Transition Based Driving Assistant

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Thesis Abstract

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Thesis Title

Cruising Control of Electric Vehicle Using Situation Transition Based Driving Assistant

Thesis Summary

The increase of the number of cars registered around the world created several problems such as environment concerns or road traffic deaths. This thesis aims at proposing solutions to the road fatalities by using active driving assistance and remote control of road vehicles. The active driving assistant acts by offering an automated support to the human driver through torques on the pedal and steering wheel of the controlled vehicle. This support has a better reaction time and is not subject to focus loss. Application of remote control enables to shorten the duration of continuous driving sessions and to reduce the exhaustion of the driver. However remote control implies a communication time delay that can be a source of accidents. This is the reason why this thesis proposes a combination of remote control and active driving assistant that can react to the controlled vehicle's surrounding without time delay.

Chapter 1 presents the motivations of the thesis, the principle of the proposed driving assistant, and outlines some related works and the framework of this thesis.

Chapter 2 describes the methods used to analyze the car's environment to detect and locate possible threats. Several types of objects are detected through the use of a stereo camera system and different computer vision processes, which combination is design to improve the quality and speed of the detections. Methods to reach that real-time computation are described. Moreover, an information sharing protocol is also introduced.

In chapter 3, the methods used to compute the assisting torques based on the representation of the detected dangers by virtual potentials are explained. A control sharing is created between the human driver and the automated support. In order to improve the efficiency of the proposed method the effects of both the human and algorithm on the control of the car are modulated thanks to a fuzzy logic engine.

Chapter 4 describes the small and large scale vehicle systems used to validate the proposed method. A one seated electric vehicle was modified to enable the application of both driving assistant and remote control. This vehicle is used to test the behavior of the driving support in case of line crossing. However, it would be dangerous to test collision avoidance using a vehicle of this size and mass under remote control with time delay. That is why a 1/10th scale car is used to conduct those tests.

The results of the conducted experiments are analyzed in chapter 5, in order to verify if the proposed driving assistant offer the desired behavior. Moreover, it is difficult to choose evaluation criteria able to sort different propositions of driving assistant in function of their efficiency. This is why a method is proposed to realize such evaluation depending of the desired goal of the driving assistant.

Chapter 6 concludes the thesis, summarizes its results and contributions, and proposes possible directions for future work.