ON INTERACTIVE CONTROL FOR INTELLIGENT COLLISION EVASIVE EMERGENCY INTERVENTION IN SMART VEHICLES

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Master of Science

by

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Declaration

The work submitted in this thesis is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any other degree, and is also not being concurrently submitted for any other degree.

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Date: 29/01/2007

I endorse the declaration by the candidate.

UOM Verified Signature

29/01/2007

Dr. Sisil Kumarawadu
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Abstract

This research study focuses on finding a solution for collision avoidance of smart vehicular systems. The main paradigm that is used to establish the solution is the interactive control of vehicular systems for negotiating a collision scenario for taking evasive actions. In this study, an interactive controller proposed negotiates collision scenarios between two vehicular systems leading to cooperative maneuvers. Thus, the interactive control actions lead to some maneuvers mutually beneficial to both the vehicles. The objective of this study is to develop a fully operational intelligent interactive controller for the smart vehicles. An Inter-Vehicle Communication (IVC) system plays a pivotal role in exchanging the necessary information in between the vehicles. The IVC system is assumed to be with enough versatility for dealing with multiple collisions in the channel transmitting information.

This study is focusing on the vehicles outside the usually considered platoon environment. It is considering for emergency intervention maneuvers for collision evasive solutions.

The hierarchical differentiation in control of the participatory vehicles is done by using the Master-Slave concept. The master is given more power in comparison to the slave. But these states are moment-bound and are to change fast.

There are two main controllers which have been developed for braking and steering. The two controllers are based on Adaptive Neuro-Fuzzy Inference System (ANFIS). The top tier of this controller includes all important auxiliary functional components for processing the primary sensory variables. The ANFIS controller has been offline trained in the Matlab-7 environment.

A simulation study has been done for the controllers in the Matlab/Simulink environment for various categories of collisions between the two vehicles. Even though the above paradigm is discussed for two participatory vehicular sub-systems, it is emphasized, that the same approach can effectively be extended without any major conceptual breakthrough to any number of vehicles for reliable evasion of collisions. In similar way, multiple vehicles can be considered as a multiplication of the number of pairs of vehicles for applying the results of the above study.

Two fully autonomous prototypes were realized with full capability for testing intelligent interactive collision avoidance trials. Here, all sensor types and equipment were tested for expected functionality to be used in the integrated environment. To this end, software were developed for testing each component in the provided platform.

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