Review of Safe Speed and Safe Distance warnings produced in SASPENCE and INSAFES demonstrators of European Framework Programme 6 Integrated Project PReVENT

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ABSTRACT

In European Framework Programme 6, the Integrated Project PReVENT (www-prevent-ip.org) aimed at the development of new advanced driver assistance systems. Among these, the safe speed and safe distance functions have been developed in subproject SASPENCE and later integrated with other functions in subproject INSAFES.

The safe speed and safe distance functions are based on the comparison between what the driver is doing and what he should ideally do. For this purpose an ideal manoeuvre, which satisfies a number of requirements concerning safety, comfort and mobility, is computed as an optimal control problem. It was named the "reference manoeuvre". It represents a motion plan that complies within the envelope of driver acceptance criteria and physical constraints. The criterion of the optimal control is a penalty function that embodies all the requirements for comfort safety and mobility. It will be briefly outlined since the resulting ideal plans come straight from it.

The strategies for issuing warnings to the driver are based on a suitable norm, which measures the difference between the ideal and actual motion. In normal driving conditions a fair match between the two is observed and no warning is produced. However when large differences between actual and ideal accelerations are found the driver is warned he should decelerate or even brake (the most important warning channel is a haptic accelerator pedal). As soon as the driver reacts, and produces the correct value of deceleration the warning disappears (which means he will be able to reduce his speed in time to properly negotiate a curve or to adapt to the speed of the vehicle in front).

In this paper a review of the generation of warnings is done with respect to two scenarios: a) a curve b) an obstacle. For different values of distance, (to vehicle or to curve) and speed, the ideal manoeuvre is computed and the norm, which measures the difference with driver behaviour (it means that different actual accelerations are imagined for each case), is computed and mapped onto the three-dimensional space distance-speed-actual acceleration. These maps are different if different driving criteria are chosen for the optimal control problem. They give an overall picture of the system performance, at least in the two representative scenarios. The setting of thresholds for different types of warnings shows the regions where warnings appear.

These maps are intended for both a global evaluation of system performance as well as a tool for comparison with experiments made with subjects. The latter will provide the demanded or aimed behaviour.

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