Real-time Prevention Tool Integrating Volatility and Environmental Impacts

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***Abstract*— In Europe, the number of road traffic deaths and injuries is still far too high and the European Union is committed in improving road safety and move closer to the target of approaching zero road fatalities by 2050. For that purpose, new strategies based on the Safe System approach to preventing deaths and serious injuries for all road users should be developed. Road transport is a major source of pollutant emissions. In particular, it is responsible for the emission of harmful pollutants such as nitrogen oxides (NOx) and carbon dioxide (CO_2), which has serious impacts in global warming [1].**

It is known that driver behavior can play a key role in what concerns road crashes and pollutant emissions. Such impacts increase when associated to aggressive behavior, experiencing high and extreme levels of fuel consumption, speed and acceleration. A deep understanding of driver behavior should be an important step to improve road safety. Various studies have been conducted to identify driver's behavior under many contexts such as, traffic, roadway and weather conditions. An issue that has not been so explored is an analysis of drivers' volatility [2-3]. Volatility can be defined as the extent of variations in driving, which can be characterized by accelerations/braking, lane change and also unusual high speed for roadways conditions. Therefore, particular attention should be given to developing preventive tools, anticipating dangerous situations and warning the driver that may be efficient solutions to avoid an occurrence.

In [4], an advisory system was developed on a driver's simulator to warning the driver. However, there is no preventive tool in the literature that integrates volatility and environmental impacts. The main objective of this work is to develop a decision support system to evaluate driver volatility and provide instantaneous and integrated information on safety and emission impacts to the driver. To validate our application, we used real traffic, dynamic and on-road emissions data collected from probe vehicles on two highways of different specificities (e.g., slope, relief and traffic volumes). A simulation-based approach through Vissim COM API using Matlab was constructed in order to give to the driver warnings regarding safety and emissions. Markov Decision Process (MDP) was used to support the decision on safety and the Vehicle Specific Power (VSP) methodology was used for estimating pollutant emissions.

Keywords — driving behavior; safety; emissions; Markov Decision Process.

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