DICA-VE - Driving Information in a Connected & Autonomous Vehicle Environment: Impacts on Safety & Emissions

Margarida C. Coelho, Fernando Neto, Jorge Bandeira, Paulo Fernandes, Eloisa Macedo, José Santos
Centre for Mechanical Technology and Automation (TEMA), Department of Mechanical Engineering, University of Aveiro, Portugal, {margarida.coelho; fneto; jorgebandeira; paulo.fernandes; macedo;jps}@ua.pt

Research Project

Integrating connected and autonomous vehicle (CAV) technologies with the existing road environment leads to important challenges. Their biggest potential is the improvement of the urban mobility, road safety, and reduction on energy use and emissions. Communications between vehicles offer relevant opportunities to reduce driving volatility, which are characterized by hard accelerations and decelerations, sudden movements (such as lane changes) and higher circulation speeds than the recommended for a certain area or road condition.

This 36-month project main objective is to develop an integrated research focused on advanced algorithms to reduce driving behavior volatility through safety warnings and emissions reductions in a connected vehicle environment. A particular attention will be given to the interaction of motor vehicles (including autonomous vehicles) with vulnerable road users (pedestrians and cyclists).

The essence of assessing driving volatility aims the capture of the existence of strong accelerations and aggressive maneuvers. Alerts and warnings can enable calmer driving, reduce volatility and potentially improve road safety, traffic flow performance, fuel consumption and emissions. A fundamental understanding of instantaneous driving decisions, distinguishing normal from anomalous ones, is needed to develop a framework for optimizing road transportation impacts.

Thus, the research questions are:

1) Which strategies are adopted by each driver when he/she performs short-term driving decisions and how can these intentions be mapped, in a certain road network?

2) How is driver's volatility affected by the proximity of other road users, namely pedestrians or cyclists?

3) How can driving volatility information be integrated into a platform to alert road users about potential dangers in the road environment and take control previously to the occurrence of crash situations?

4) How can anomalous driving variability be reduced in autonomous cars, in order to prevent road accidents and have a performance with a minimum degree of emissions?

Finally, the specific deliverables of this project will be: 1) a complete and micro characterization of individual driver decision mechanisms; 2) a prototype of a driver warning and control assist mechanism to be applicable in connected or autonomous vehicles.

The National Strategy for Intelligent Specialization vision for 2020 is based on key pillars, which are directly or indirectly addressed in the DICA-VE. Thus, it is considered that it is aligned with the following axes: "Transport mobility and Logistics: Secure and sustainable transport" and "Mobility and urban space"; "Automotive, Aeronautics and Space: Advanced Technologies Applied to the Automotive Sector"; and "Energy: Efficient Transport".

KEYWORDS: Driving volatility, safety, emissions, vulnerable road users
PERIOD: 29th of November 2018 – 28th of November 2021
ACKNOWLEDGEMENTS: The authors acknowledge the support of Strategic Project TEMA UID-EMS-0048-2013-FCT and CENTRO-01-0145-FEDER-022083. DICA-VE project (POCI-01-0145-FEDER-029463) is funded by the European Structural and Investment Funds (FEEI) through the Competitiveness and Internationalization Operational Program - COMPETE 2020 and by National Funds through FCT - Foundation for Science and Technology, I.P, in its State Budget component. J. Bandeira also acknowledges the support for the Scholarship SFRH/BPD/100703/2014.