HMI design in vehicles based in usability and accessibility concepts

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Abstract. Presently, there are a great variety of systems to aid the driving task. Their objective is to optimize the safety, efficiency and comfort of the transport, improving the functionality of the cars and the highways using functionalities supplied by the Information and Communication Technologies. However, most of these technologies have not been designed following accessibility and usability principles. In this paper we describe the design and implementation of a new generation of Human-Machine Interface for road vehicles, based in user centered design and accessibility concepts.

Keywords: Intelligent vehicles, usability, accessibility, human-machine interface.

This work is part of a research project entitled "Sistema sensorial integrado y embarcado de ayuda a la conducción de vehículos automóviles" (SIAC), (CICYT TRA 2007-67786-C02-01) whose primary target is the development of a real-time algorithm that represents the surroundings of the vehicle, identifying possible risks and discriminating the possible false alarms, from the information provided by a set of sensors for recognition of the surroundings and the dynamics of the vehicle, as well as the data included in digital cartography.

Like part of SIAC, the primary target of this work is the definition of a user interface that allows transmitting the information generated by the system to the driver of a clear and effective form, with special focusing in groups of people with some reduced capacity, including an outpost people age. This interface will be designed following usability and accessibility principles and will be able to transmit the driver the necessary information to improve the safety level of the travel. In addition, it is necessary to mention that the development of the user interface will be based in visual inputs, designed for personalizing the information depending on the type of user and to increase the safety since will show the most excellent information at every moment. In this paper, we describe the development of this user interface that has been designed following accessibility and usability premises.

There is a great variety of driving aid systems whose objective is to optimize the safety, efficiency and comfort of the transport, improving the functionality of the cars and the highways using the Information and Communication Technologies. However, most of these technologies have been designed for engineers and designers, but have not taken into account the human factor nor have applied usability or accessibility

principles. The new generation of intelligent transport systems, suppose a step ahead since they are able to predict and avoid an accident that the driver by itself cannot manage, contributing to the achievement of the ambitious objective of the EU [1].

The technology selected to implement the Human Machine Interface (HMI) are the Head Up Displays (HUD) that consist of an optical system that show information of the line of sight of the driver. Consequently, the he does not have to turn aside the view of the highway centering his attention to the driving and improving the reaction time in unexpected situations or of danger. [2]

A large set of technologies and products have been developed and researched in the last years to transmit information to the drivers. Night vision systems [3], reduction of attention detection, e-call [4], collision avoidance systems [5], and lane change assistants [6] are some of these technologies developed.

In the developed system, we stand out the following results: the implementation of an effective user interface especially oriented to drivers with some type of reduced capacity, and the evaluation of its potential benefit to increase the security like for example, to personalize the information based on the type of user. This subject has a great importance within the project; to adapt the information to each type of driver we must make distinctions as far as the priority of each kind of information. But it is not a simple process, since the system will have different users, which causes that each group has particular needs and therefore, different priority under the same information. Old and young drivers and persons with auditory or visual disabilities are some of the users that have been considered as models to design the new HMI.

Accessibility and usability are one of the main desirable features in an in-vehicle HMI, improving the information that is perceived by the driver and consequently, the safety of driving, and considers the driver (the user) as the center of the design. Thanks to them more and more people transforms into "users" and they are added to the new technologies. This work is an advance in the automotive field since usability and accessibility are concepts slightly developed and to continue working under these premises is vital so that the systems can be used by all type of drivers, independently of their capacities and abilities.

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