HOLISTIC HUMAN FACTORS AND SYSTEM DESIGN
OF ADAPTIVE COOPERATIVE HUMAN-MACHINE SYSTEMS

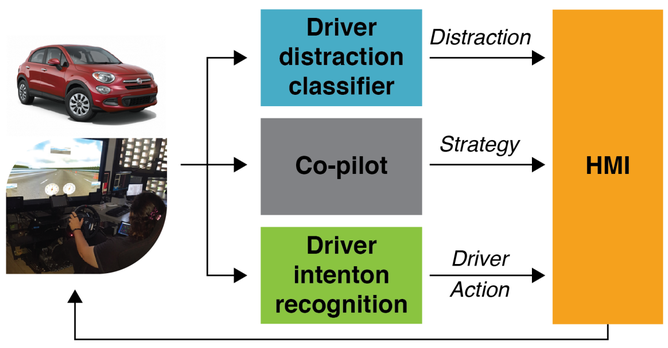
Adaptive Assistance AdCoS

Domain

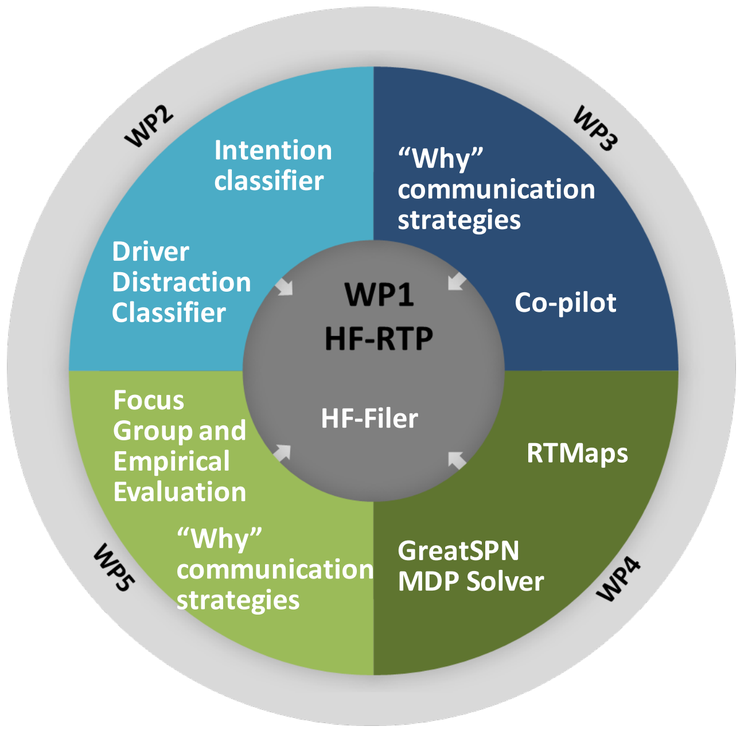
Motivation

Current ADAS applications (such as Blind Spot, Lane Departure Warning, Forward Collision Warning, etc.) are stand-alone systems, not interacting each other and without any adaptation capability to user's status and needs.

In HOLIDES project, we developed an AdCoS, named **Adaptive Assistance**, able to provide support to the driver, both in **longitudinal and lateral driving task**. In addition, this AdCoS can adapt its assistance strategies to the operator's **attentiveness** (visual distraction) and **intentions** (to change lane / overtake).



Applied MTTs



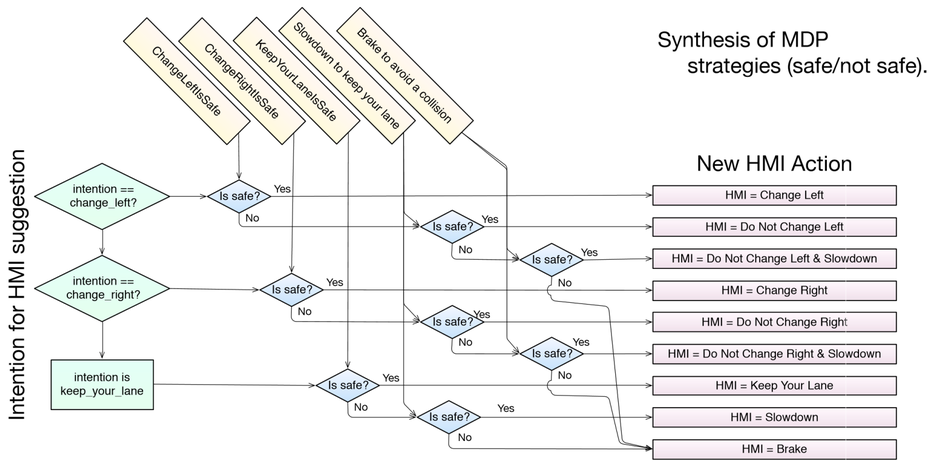
Current State: Tailored HF-RTP

The AdCoS is able to **provide assistance to the driver**, both in longitudinal and lateral driving task, **adapting its strategies to**:

- **External situations**: traffic conditions, dynamic and state of the other road users, related trajectories (e.g. vehicle braking in front of the host-vehicle, on the same path).
- **Internal situations**: states and desires of the human-agent (e.g. classification of the visual driver's distraction and his/her intention to change the lane.

This is achieved by implementing the following **functionalities** in the demonstrator :

- Lane-Change Assistant (LCA) and Overtaking Assistant (OA)
- Forward Collision Warning (FCW), including assisted braking.



The HMI in the complete version of the AdCoS is based on a **multimodal strategy** that considers three different **channels**:

1. Visual information on the "what" (e.g. "do not change lane on the left");
2. Haptic information on the "why" (e.g. "because a car is approaching very fast on the left");
3. Auditory warning in case of driver distraction .

We performed an **evaluation study** involving **30 real drivers.**

It aimed to **objectively measure the performance** of the **AdCoS** (i.e. the adaptive system) compared to the performance of the **baseline** (i.e. non-adaptive system).

Visual messages of the HMI.

Baseline
(blindspot, FCW)

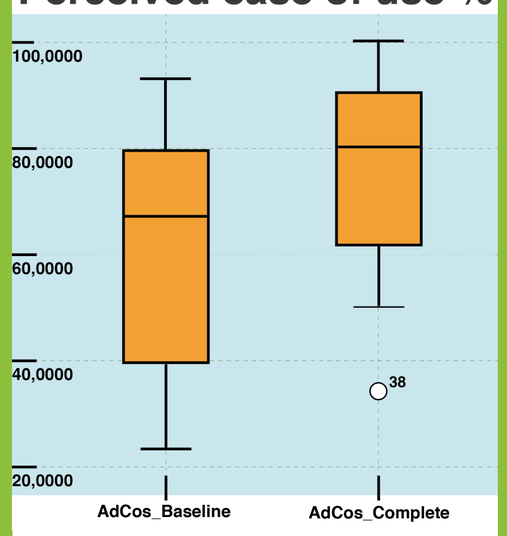
Results

Technical assessment

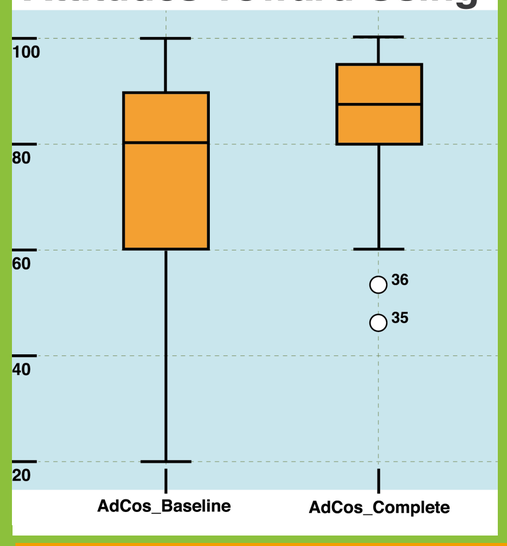
The AdCoS has improved all the performance indicators (PIs) related to safety by almost 50%, in particular for the most relevant ones, that is the PIs related to the total number of accidents in baseline and with AdCoS, as well as the time spent in critical region, with TTC ≤2s.

	Baseline	Complete
PI1 # of accidents	0,1724	0,0862
PI2 % driving time with TTC < TTC_min	0,0126	0,0069
PI3 average distance between vehicles just before the moment when the driver performs the lane change	73,5552	82,1026
PI4 average TTC when the driver starts pressing the brake	2,7134	3,3742

Perceived ease of use %



Attitudes Toward Using



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Consortium

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