SUCCESS STORY

Foresight Safety®
Sharing drivers' state to prevent dangerous situations
Programme: COMET – Competence Centers for Excellent Technologies

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FORESIGHT SAFETY® – SHARING DRIVERS' STATE TO PREVENT DANGEROUS SITUATIONS

NOVEL SAFETY FUNCTIONS AND SIMULATION INFRASTRUCTURE ALLOW AUTOMATED VEHICLES TO RECOGNIZE DRIVERS' INTENTIONS AND FORESEE POTENTIAL DANGERS IN MIXED TRAFFIC CONDITIONS.

When automated vehicles will be circulating alongside traditional ones, they will need to recognize human driving behavior in advance to prevent dangerous situations. Currently, drivers' ability to foresee and prevent critical situations is linked to their ability to assess well in advance states and intentions of other traffic participants. However, such a skill is still missing in current assisted or automated driving functions. *Recent results at VIRTUAL VEHICLE show that sharing drivers' information is the key to provide automated vehicles the ability to foresee potentially dangerous situations and fill this gap.*

Project content and goals

While traditional vehicle safety systems can detect dangers and react to them, Foresight Safety® helps automated vehicles recognize potential hazards and prevent the occurrence of dangerous situations.

Current vehicle assistance systems avoid obstacles using sensors and perception algorithms to detect when an object is on a collision course. Then, sophisticated techniques allow the prediction of future trajectory and eventually trigger the reaction of safety systems.

However, in human driving similar obstacle avoidance processes occur only in a limited number of scenarios. Instead, with our perception, planning and control abilities we continuously assess the situation around and beyond the vehicle, and plan the future trajectory according to the surrounding traffic and environmental conditions. *In other words, we do not react to possible collision courses, we prevent them.*

This is possible thanks to our ability to assess and infer the intentions and specific states (e.g., distraction) of

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other traffic participants. For example, experienced drivers typically glance at neighboring drivers to infer their intentions, assess risks and prevent hazards.

Foresight Safety® is designed to imitate this human ability, thus complementing existing vehicle safety systems with an improved prediction of future vehicle trajectory, based on shared drivers' intentions and psychophysical conditions.

Key Facts

Results of driving simulation studies conducted at VIRTUAL VEHICLE have indicated that drivers adopt a different strategy when information about safety-critical states of neighboring drivers are shared. For example, they tend to anticipate lane change and braking maneuvers to increase the safety margins between their own vehicle and a preceding vehicle with a distracted driver (Figure 1).

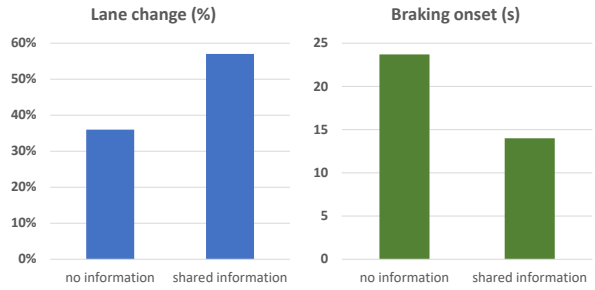

Figure 1. Driving strategy. When informed that the preceding vehicle has a distracted driver ("shared information") lane is changed more often (+60%) and braking starts earlier (-40%), compared to when no driver's information is available.

A novel test infrastructure has been developed to enable networked driving simulation, i.e., interconnected driving simulators from which different drivers control their respective vehicles in a shared virtual scenario. This system also allows the monitoring and sharing of driver's state and help researchers to analyze driving behavior, providing new insights on cooperative road safety. The system is also conceived for connecting remote driving simulators, creating virtually unlimited possibilities for studying drivers-vehicles interactions.

Impact and effects

Current Foresight Safety® uses state-of-the-art Augmented-Reality Head-up virtual display to provide an intuitive visual highlight as soon as the unsafe state of the remote driver is detected (Figure 3). This system is being further developed to significantly reduce road accidents already in current driving conditions, whenever drivers do not have direct access to mutual information and intentions.

Figure 3. AR HUD. The vehicle with a distracted driver is visually highlighted on the windshield using augmented reality.

The new driving strategy is also used to design the target behavior of a Foresight Safety® control algorithm for automated driving. This predictive algorithm includes constraints that incorporate drivers' states into the decision logics to optimize future vehicle trajectories accordingly.

Aware of the potential of such a solution, VIRTUAL VEHICLE is accelerating the development of prototypes and cooperation with suppliers to embed in driving assistance systems a safe and secure exchange of driver-related information.

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Project coordination

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