Digital Single Market

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Assisting drivers, saving lives

Every year Europeans drive off on their summer holidays in ever-safer cars, but traffic accidents remain an intrinsic and tragic part of driving. European researchers and engineers are contributing to the development of highly automated vehicles to avoid accidents, increase fuel-efficiency and make being on the road less stressful and more comfortable.

 [1]

More than 35 000 people are killed in around 1.5 million accidents on Europe's roads each year and, for every death, there are an estimated 4 permanently disabling injuries, 10 serious injuries and 40 minor injuries. Though deaths have been reduced by the introduction of safety features, from seat belts to airbags and better-designed crumple zones, most of the focus until now has been on mitigating the effects of a crash rather than avoiding one. But an emerging group of automotive technologies that use computer, sensor and actuator systems to assist and even take over driving from the driver aim to prevent accidents in the first place.

Already in use in some vehicles, advanced driver assistance systems (ADAS), as they are known, range from night-vision dashboard displays to collision-avoidance systems that alert drivers to obstacles on the road. Now researchers and engineers have designed a scalable architecture to implement ADAS for some of the most critical aspects of driving as a key step towards highly automated vehicles. Perhaps most importantly, they are implementing it in such a way that drivers will experience the benefits of increased safety, comfort and efficiency from automation while still being in control. Some of the features could be in use commercially within five years.

'Many drivers dislike the idea of automation; they fear they will no longer be in charge of the vehicle. What we are proposing gives them a choice,' explains Reiner Hoeger, the director of engineering governance at the Automotive Systems and Technology department of Continental Automotive in Germany.

Dr Hoeger coordinated the EU-funded 'Highly automated vehicles for intelligent transport' [2] (HAVEit) project, overseeing a team of researchers and engineers from 17 universities, research institutes and

companies, including Volvo Technology, Volkswagen and Continental, who set several important milestones on the road to more automated, and ultimately safer, vehicles. Their approach focused on implementing a high degree of automation during extreme driving situations in which drivers are often most at risk of having an accident, such as negotiating road works or while stuck in stop-and-go traffic.

Using existing sensor and actuator technology combined with onboard computers and new algorithms, the system lets drivers select between three automation modes which the computer dynamically makes available when road conditions permit. In the first mode, the driver steers the vehicle alone, assisted only in times of need by existing ADAS systems. In 'partly' or 'semi-automated' mode, the vehicle drives with longitudinal automation, so the driver no longer needs to accelerate or brake, much like a kind of advanced adaptive cruise control. When 'high automation' is activated, lateral automation comes into play and the driver no longer has to steer.

Keeping the driver in the loop

'Each mode has to be manually selected by the driver. It's not done automatically because it could lead to confusion, and the driver can always take over control from the system at any time,' notes Dr Hoeger.

However, unlike other approaches, the HAVEit system does not simply switch off an ADAS feature in the event of an impending and potentially critical situation. Instead, it adopts a progressive, step-by-step approach to transfer control back from the automated system to the driver.

'Every half second our system models the surroundings, interprets what's going on and creates an extrapolation for the next two seconds and decides whether the automated functions can handle it or not. If the system can't stay in control, for example if the line of sight is too short, then the driver is brought back into the loop,' the project coordinator explains.

A camera inside the vehicle continuously monitors the driver and the onboard computer determines their state of awareness. In the assisted and semi-automated modes, the driver's interaction with the vehicle, such as steering corrections, are also taken into account. If the system detects that the driver is drifting off to sleep, not paying attention or becomes distracted, it will try to alert them through lights, sounds or vibrations to stay attentive. And, if there is no reaction, it will go into a fully-automated 'safe state', e.g. slowing down the vehicle, carefully pulling over to the side of the road and coming to a halt.

Through this novel optimum-task repartition between driver and computer, the system provides an ever-alert, virtual co-driver who can lend a hand when needed, and, in either extreme or monotonous situations, take control. Given that an estimated 97 % of accidents are caused by driver error, having a second, virtual set of eyes and hands behind the wheel is certain to make driving safer.

In one application, demonstrated at the project's final event in Sweden in June, the project partners showed how the system can help drivers negotiate roads that are under construction, where bollards, concrete barriers, multiple signs and limited clearance between obstacles and other vehicles can cause confusion and create a high-stress environment. In another test, the team showed how it can help relieve the monotony of being stuck in a traffic jam.

In stop-and-go traffic, for example, the system will take over much of the process of following the vehicle in front in a queue. It uses radar and cameras to detect distances and accelerates and brakes as necessary to stay in the traffic flow, relieving the monotony for the driver. A similar degree of

automation is possible on long stretches of highway with little traffic.

'Applications such as automated queue assistance could be the first to be implemented commercially in vehicles. All the demonstrated technologies have real value for drivers and could help make automated driving technology more widely accepted,' Dr Hoeger says.

Getting drivers to accept automation systems in vehicles is one of the key obstacles addressed by the HAVEit project. Most drivers think they drive well, and don't like the idea of losing autonomy to a computer. However, if they can be shown that driving with a degree of automation in some circumstances will not only be safer but also more comfortable and less stressful, then they are more likely to accept the technology. The HAVEit project, which received funding from the EU's Seventh Framework Programme, proved that it can also save them money.

An active green driving application developed by project partner Volvo Technology and demonstrated on an hybrid bus equipped with sensors, digital maps and GPS satellite navigation, showed that, by 'coaching' the driver to take certain actions and automatically preparing for road conditions in advance, fuel consumption can be reduced by up to 8 %.

'We were careful to consult drivers throughout the project about what they thought of the technology and the applications and we tested it with them in simulators, the overall response was overwhelmingly positive,' Dr Hoeger notes. 'If you think back, there used to be a big debate about the benefits of cars with automatic versus manual transmissions, now many people happily drive automatics. I think we will see the same happen with the introduction of automation into vehicles: it will be increasingly accepted as people get more used to it and experience the benefits.'

Useful Link:
- 'Highly automated vehicles for intelligent transport' project [2]
- HAVEit Project data record on CORDIS [3]

Related Articles:
- Could EU-funded study herald the dawn of a new transport era? [4]
- Spanish engineers offer new formula to calculate reduction in road accident deaths [5]
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Country: GERMANY

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