Sensory Enhancement to Retrieve Driving Control - *Master Assignment*

This assignment is part of a research-project to develop an improved driver-interface for partial automated driving and is co-sponsored by *Ford Motor Company* in Köln (Cologne), Germany.

Introduction
Based on advanced technologies, passenger vehicles are able to drive automatically. To do this reliably, technical boundary conditions have to be fulfilled. Examples are recognition of road lines or the availability of a target vehicle. Although car driving is appealing to many people, automation raises comfort during tiresome conditions, like traffic jams. In such circumstances automated driving could also improve traffic efficiency. However, road situations and traffic behaviour offer highly dynamic circumstances, which continuously influence whether boundary conditions are or are not being met. Therefore transitions in which a driver needs to retrieve control are likely to occur – and they might occur regularly and unexpectedly. An example is entering a road section with failing road-lines or a vehicle in front which suddenly merges to a neighbouring lane. As drivers remain responsible for safe driving, they need to be able to retrieve control any time. However, with increasing automation the role of the driver changes from actively operating to passively monitoring the system. This reduces driver's readiness and causes a potential dangerous situation Therefore driver interfaces need to be developed that support drivers with their supervisory task and help them to retrieve control quickly and correctly.

As a first approach for developing such interface, three key elements have been defined:
- **Activation and de-activation** of the driving support
- Providing **continuous status information** on automation mode and instruct driver's about their role
- **Sensory enhancement to direct attention** towards the required (traffic) event, especially at the moment driver's intervention is needed

At the current stage of the project we are looking for students who develop solutions for the third element: sensory enhancement to direct driver's attention to relevant situations on the road. Preliminary ideas include the use of a LEDs at the windshield which light up (The length and intensity of the lit up LED-stroke could be an indication for proximity and criticality of an event), using tactile or visual enhancements provided with the seat-belts or steering wheel, etc.

Lane ends and requires driver's intervention after automated driving.

Examples to project proximity and criticality in the windshield

The assignment: After consultation, the assignment is intended to cover a selection of most aspects like:
- (Literature) research and review of existing technologies and methods for sensory enhancement
- Ideation and fast prototyping for solutions which cover sensory enhancement intended to support drivers while retrieving control.
- Research on how sensory enhancement could help to perceive information on location, proximity, criticality and nature of a traffic 'event'.
- Applying a development approach with iterative steps of prototyping and evaluations.
- Pragmatic and hands-on approach to realise a functional demonstrator for a most promising solution.
- Cooperation in setting up a test. As a test bed a driving simulator with driving scenarios relevant for partial automated driving (including transitions of control) is available.
- Executing a test as 'proof of principle' and provide conclusions and recommendations on the proposed solution(s).
- Thesis to explain and underpin the applied approach and results.

Suggestions on your approach for the project are welcome. For assessment and review of (prototyped) solutions a driving simulator is available.

Driving simulator facility with relevant driving scenarios is available.

Who we are looking for? Students preferably from the following programmes:
- Human Media Interaction
- Industrial Design Engineering
- Electrical Engineering

Creativity and affinity with software programming as well as electrical (engineering) prototyping is certainly advantageous. After consultation, adaptation of the assignment to personal interests might be possible. Within the project developers from Ford and researchers from University of Twente work together. Good communication skills are therefore required.

What we offer:
- Opportunity to work on a challenging subject, at this moment highly relevant for the automotive industry
- Access to driving simulator and facilities within VR laboratory
- Tutoring support and working in close contact with researchers inside and outside the university
- Opportunity to exchange with Ford, visit them and present your work

Application and more information
If you need more information, feel free to contact *Arie van den Beukel*. See contact details below. To apply for the assignment send an (e-)mail with your motivation for this assignment. Include information that provides prove of relevant skills, experience and motivation. Although informal, a selection procedure with interview will be applied to match the assignment with an appropriate candidate. Reactions are therefore preferred (but not limited) *until July, 2nd*.

For inspiration, take a look at:
conti-online.com/www/automotive_de_en/themes/passenger_cars/ov_automated_driving_en
googleblog.blogspot.nl/2014/05/just-press-go-designing-self-driving.html

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