Luxoft SafeHMI for Driver Monitoring and Alerting

October 19th, 2016 | Dealing with driver distraction

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Agenda

- Driver Distraction
- Driver Monitoring
- Use Case Driver monitoring and alerting
- Logical Architecture
- SafeHMI Pedastrian alert flow sequence
- Demonstrator setup
- Video presentation of Driver monitoring and alerting UseCase

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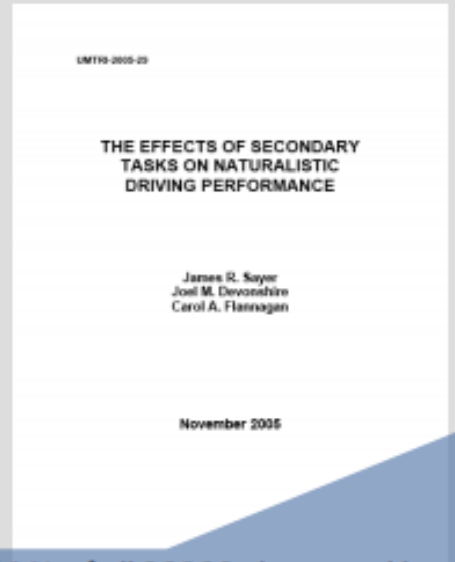
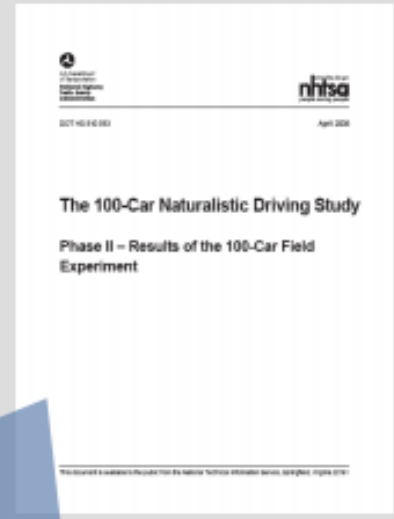
Driver distraction

Dealing with driver distraction.

Drivers engage in a large variety of activities.





1. In 54 % of all 20000 six-second baseline epochs drivers were engaged in tasks other than driving.
   ⇨ People may want to make use of the steadily increasing amount of time they spend in their vehicles.

2. "Reaching for a moving object" was shown to have the highest impact on the likelihood of crash or near crash followed by "external distraction", "reading", "applying makeup", and "dialing hand-held device".
   ⇨ **Driver distraction** must be regarded as a **societal problem**, not as a problem of a specific industry alone.

Source : ITU-T workshop , Geneva, Switzerland, 27 June 2013

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Driver distraction

Odds Ratio for Secondary Tasks in the 100-Car Study

Type of Secondary Task	Odds Ratio
Reaching for a moving object	**8.82**
Insect in Vehicle	6.37
Looking at External Object	**3.70**
Reading	**3.38**
Applying Makeup	**3.13**
Dialing a Hand Held Device	**2.79**
Inserting/retrieving CD	2.25
Eating	1.57
Reaching for a Non-Moving Object	1.38
Talking/Listening to a Hand-Held Device	1.29
Drinking from an Open Container	1.03
Other Personal Hygiene	0.70
Adjusting the Radio	0.50
Passenger in the Adjacent Seat	**0.39**
Child in Rear Seat	0.33

Odds ratio indicates the likelihood of an increase in risk associated with that activity.

Example:
Driver is 3.38 times more likely to be in a crash / near-crash while reading and driving than if she/he were just driving normally.

Source : ITU-T workshop , Geneva, Switzerland, 27 June 2013

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Driver Monitoring

Goal : Detection of driver distraction situation

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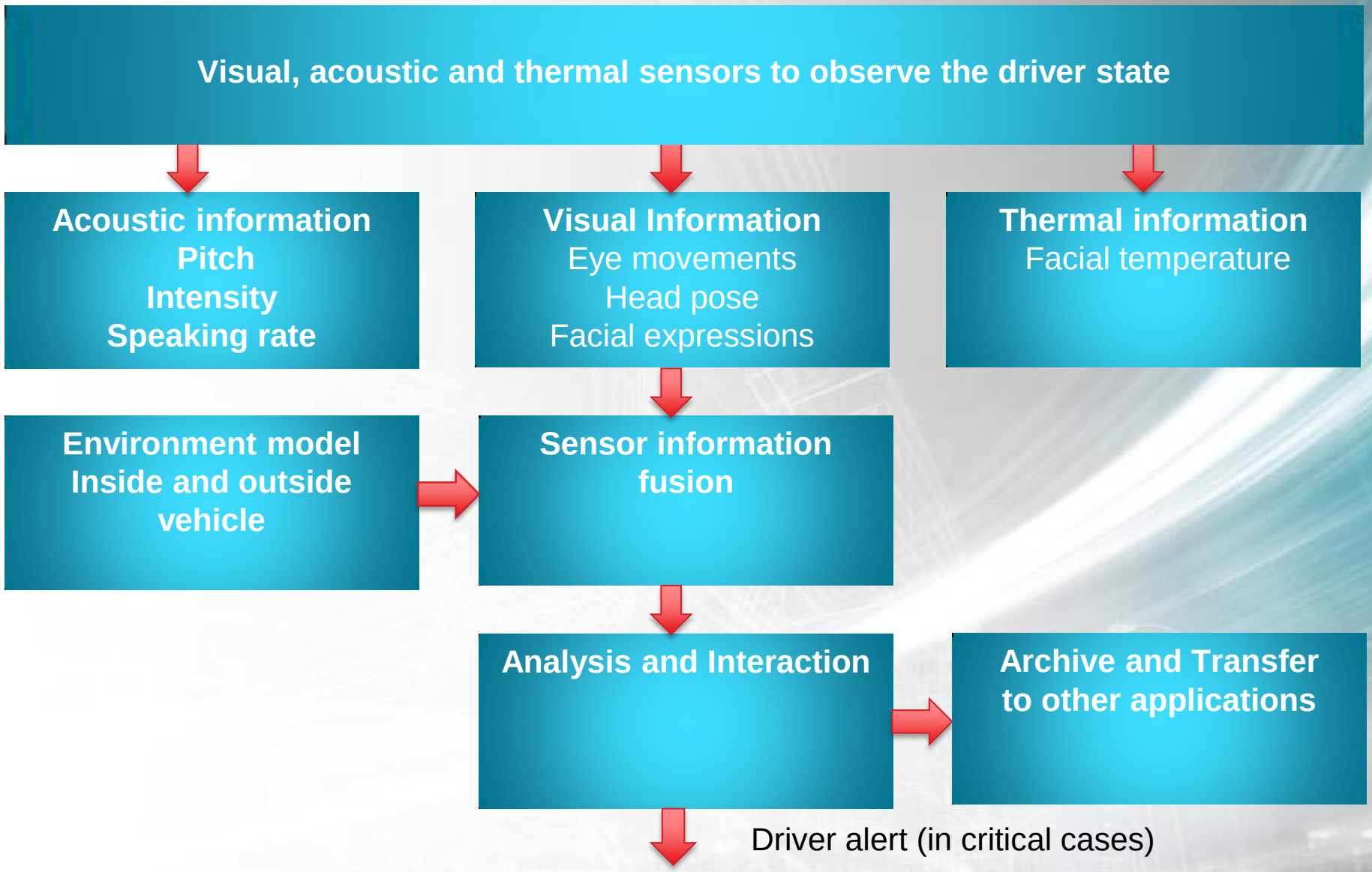
Driver Monitoring



Driver Monitoring

Eye Movements

- Saccades
  Movements of eyes that are aimed at focusing the visual attention to a different object.

- Fixations
  Movements of eyes which stabilize the retina on the object of interest.

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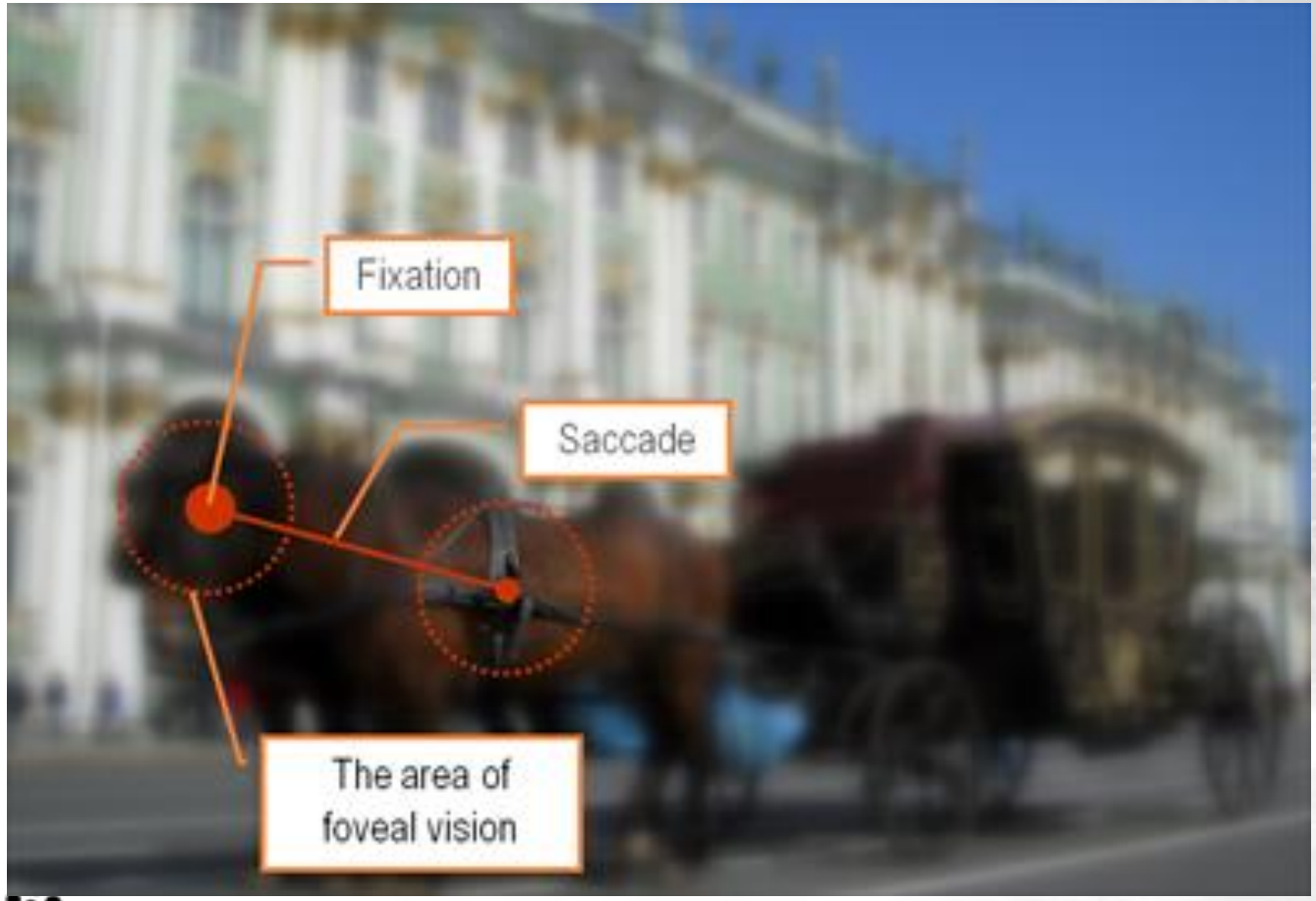
Driver Monitoring

Eye Movements



Stop length, when the eye fixates, varies from 100-600 ms
During stops the brain processes the visual information received from the eyes.
Saccades are jumps from fixation to fixation.
Average length of a saccade is about 20-40 ms.
During this period the eyes don't send visual information to the brain.

Source : www.tobii.com

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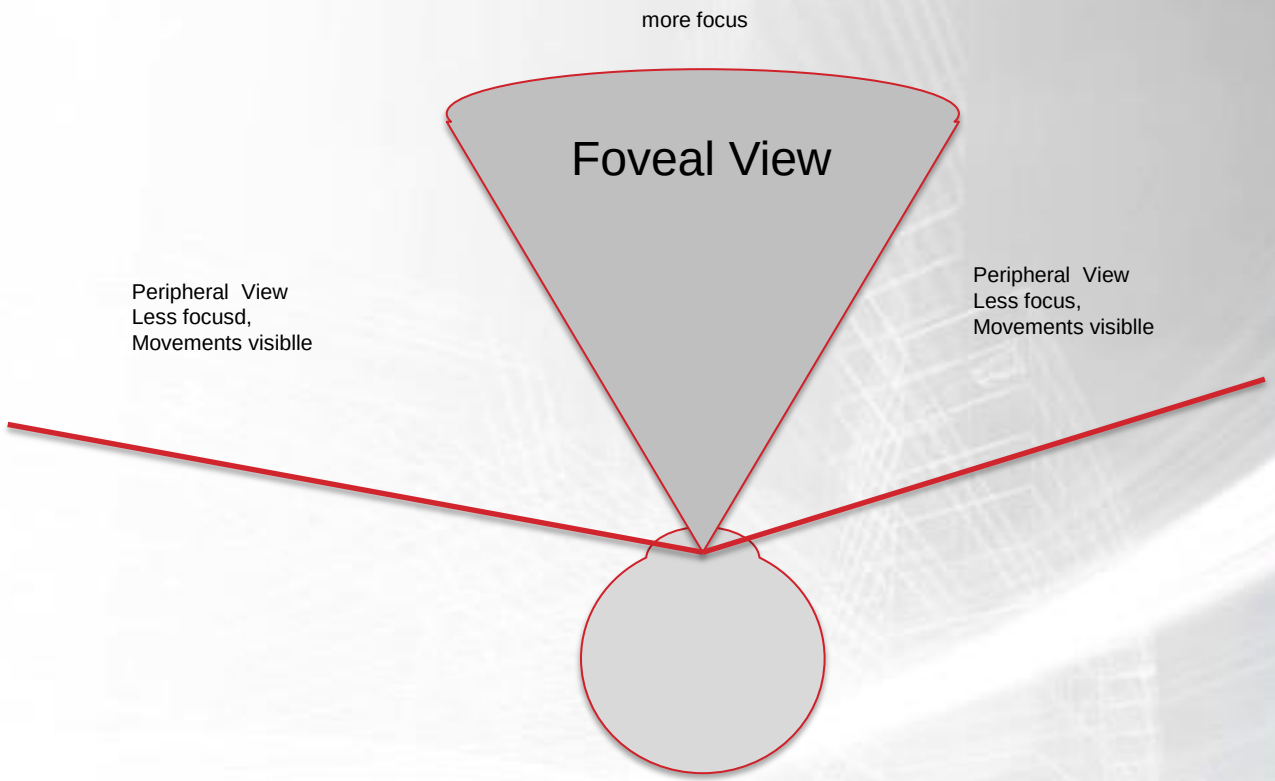
Driver Monitoring

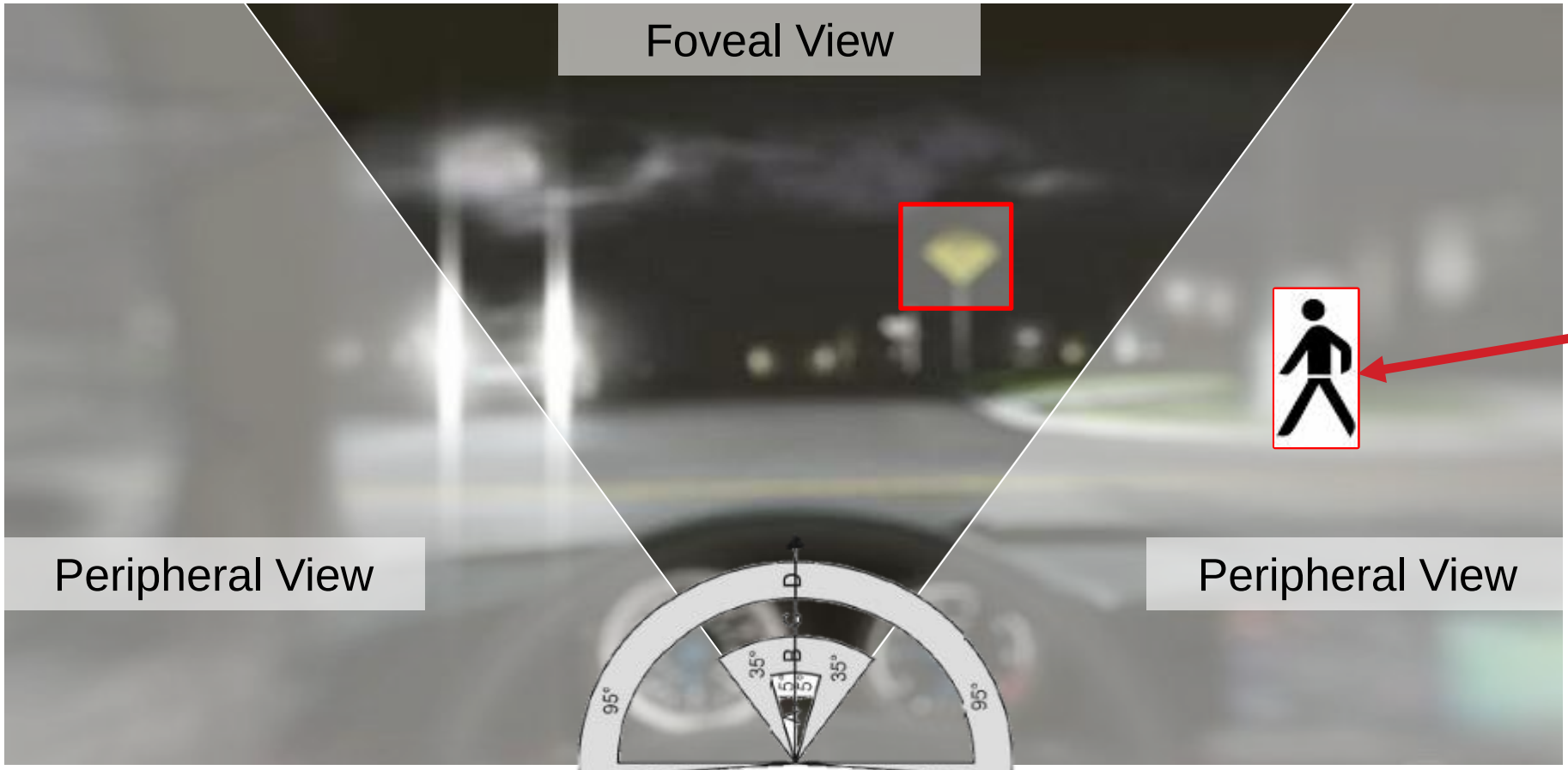
Foveal and peripheral view



Left human eye

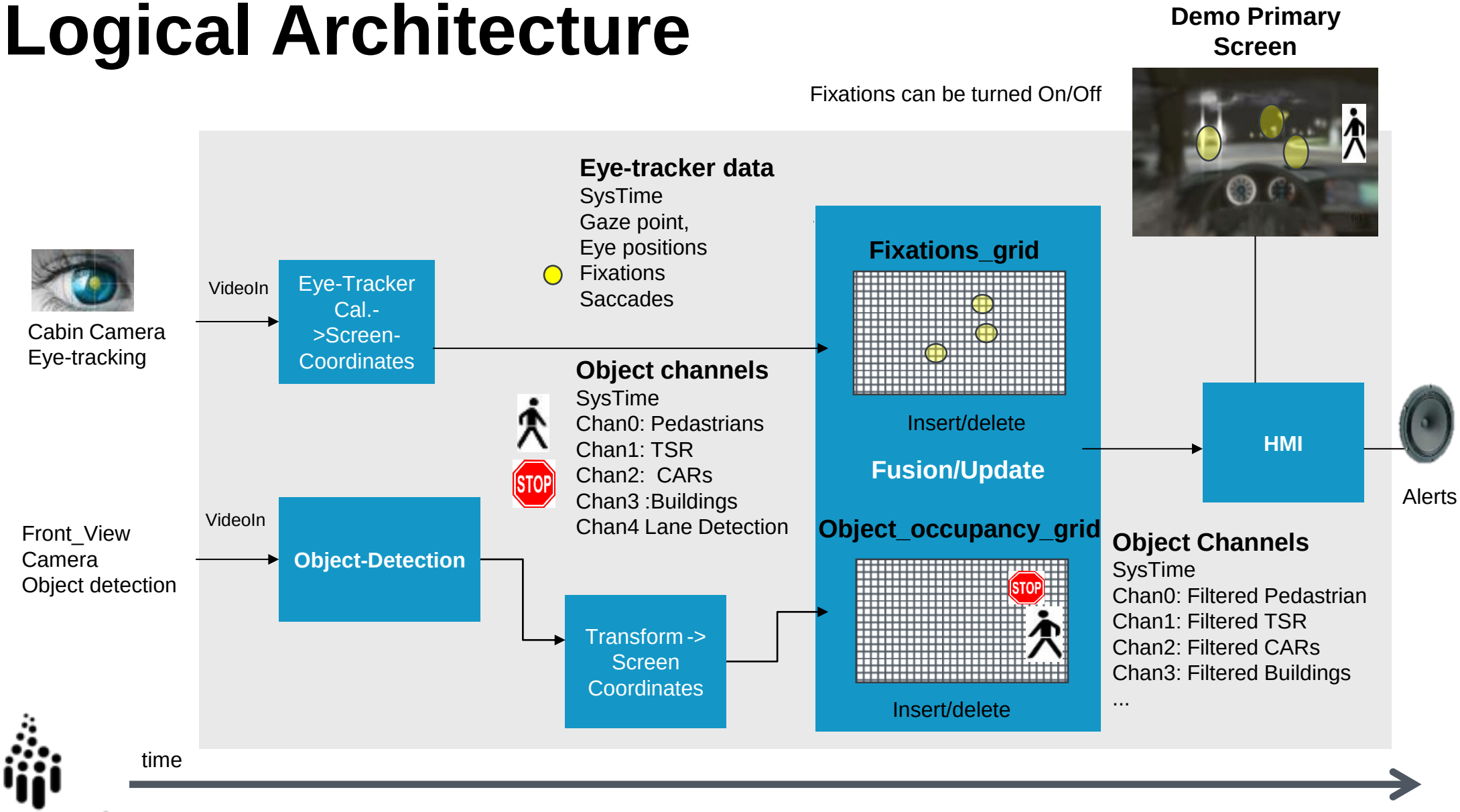
UseCase Driver Monitoring & Alert

Pedestrian outside foveal area detected
Driver alert (Audio/Visual)



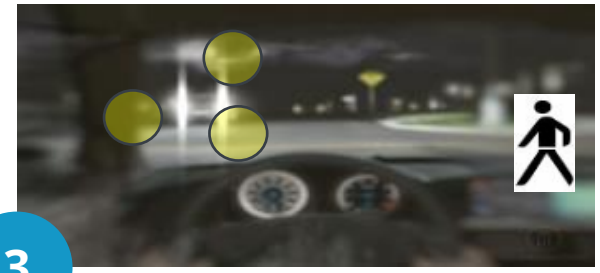
Driver Visual field

Logical Architecture

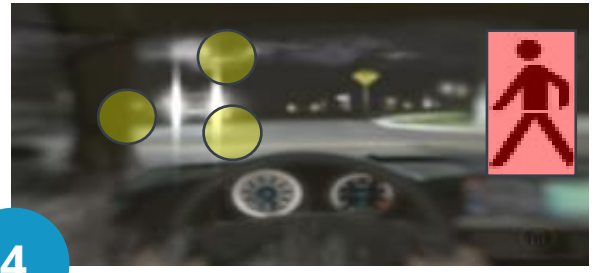


SafeHMI pedastrian alert flow sequence

Pedatrian appears
Not in foveal view

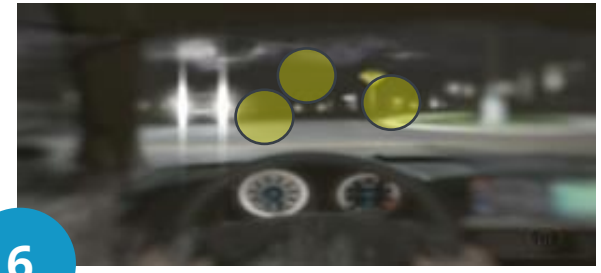


Pedatrian comes closer
Still not in foveal view



Pedatrian alert is risen

Driver recognises Pedastrian



Pedatrian alert is dropped

Legend

Fixation

Pedastrian Alert

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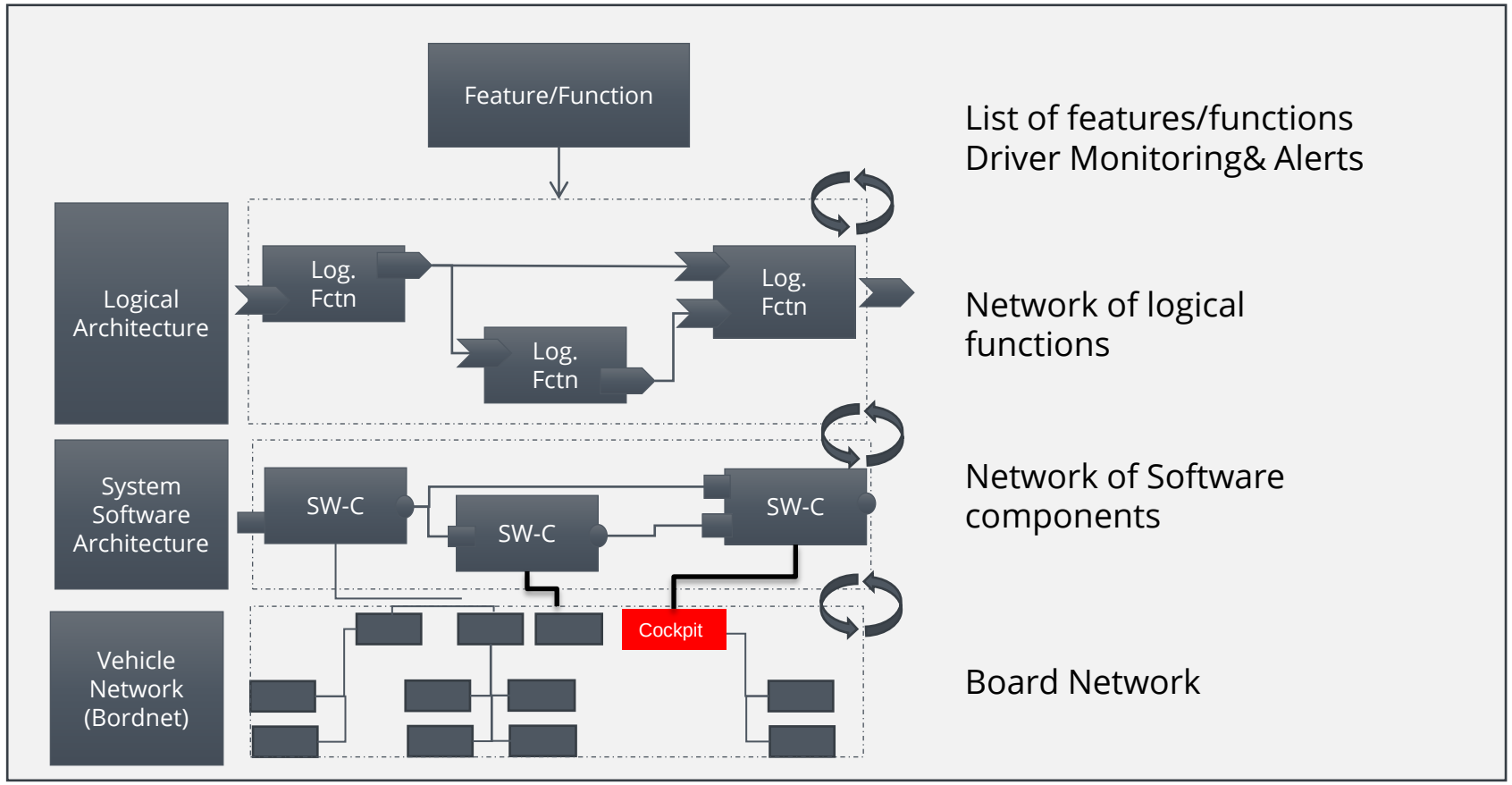
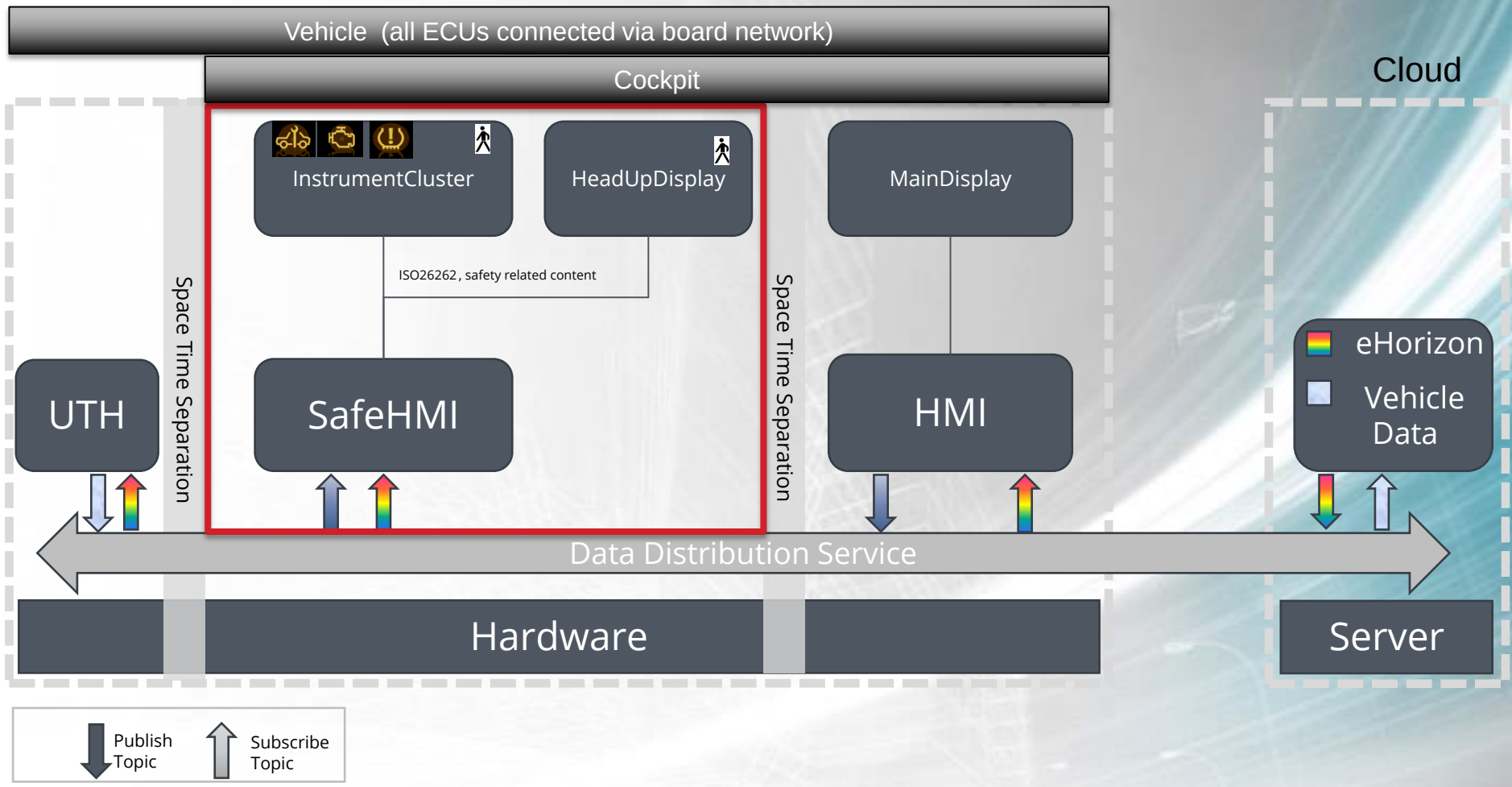
Next steps

Vehicle Architecture modelling



Next steps

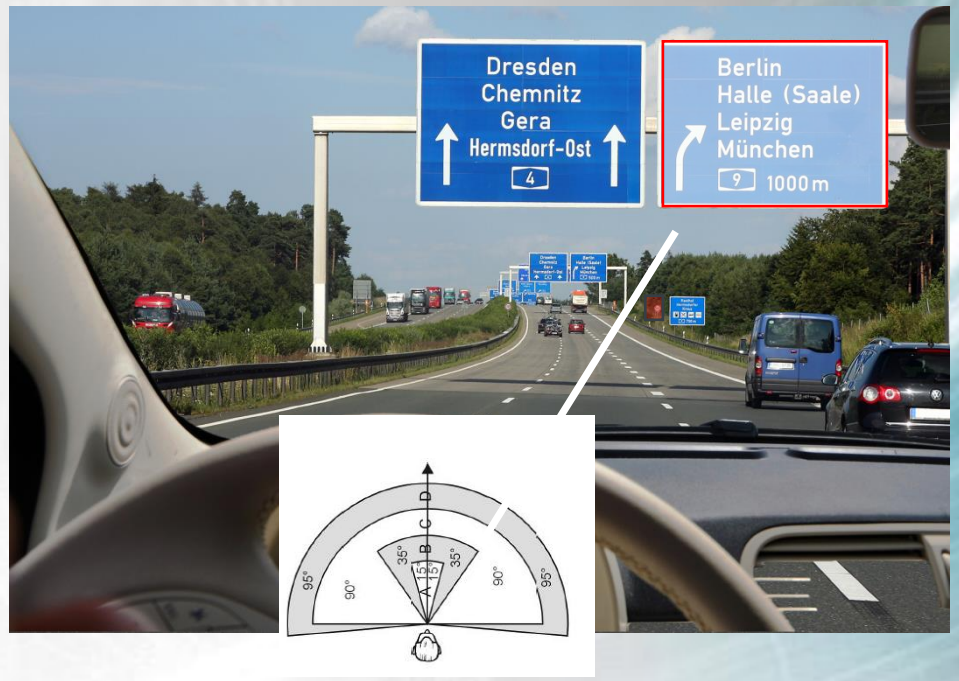
High Level Cockpit Architecture



Next steps

Further usecases for driver behaviour monitoring

- Drives according to speed limit
  Speedsignal
- Direction prediction
  Route/Destination
- Safe lane change prediction
  Side view traffic



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Demonstrator Setup

Modeling

3D City model

- add traffic signs,
- traffic lights,
- and cars according to the requirements

3D cabin model

- Dashboard
- Center stack

Camera(s)

- **In-vehicle**
- **Front View**

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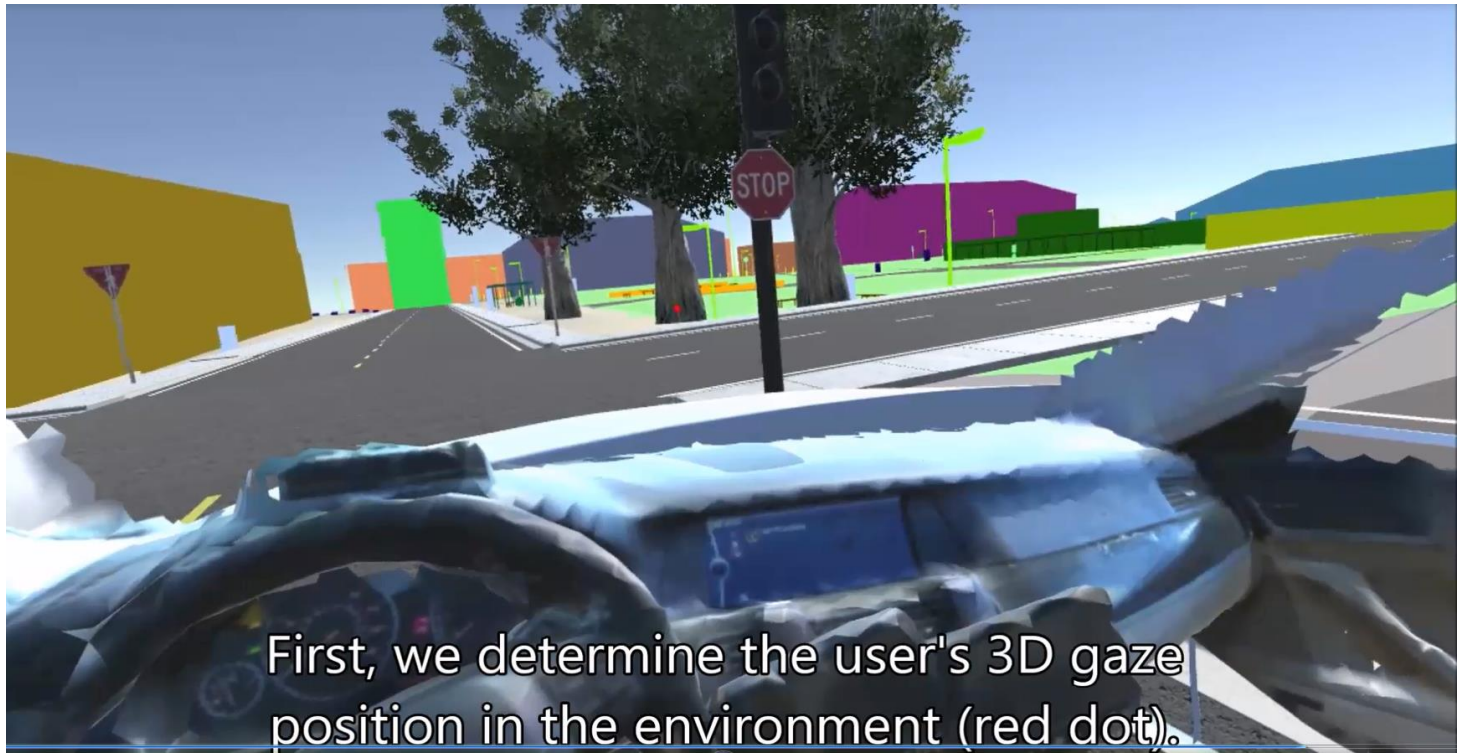
Demonstrator Video



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Next steps

- Requirements capture and ASIL classification
- Define Functional Architecture
- Define HW/SW-Architecture(s)
- Step planning for integrating concept into Cockpit Architecture

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This work was done in collaboration with
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Thank you!