



# Driver-Vehicle-Environment monitoring modules

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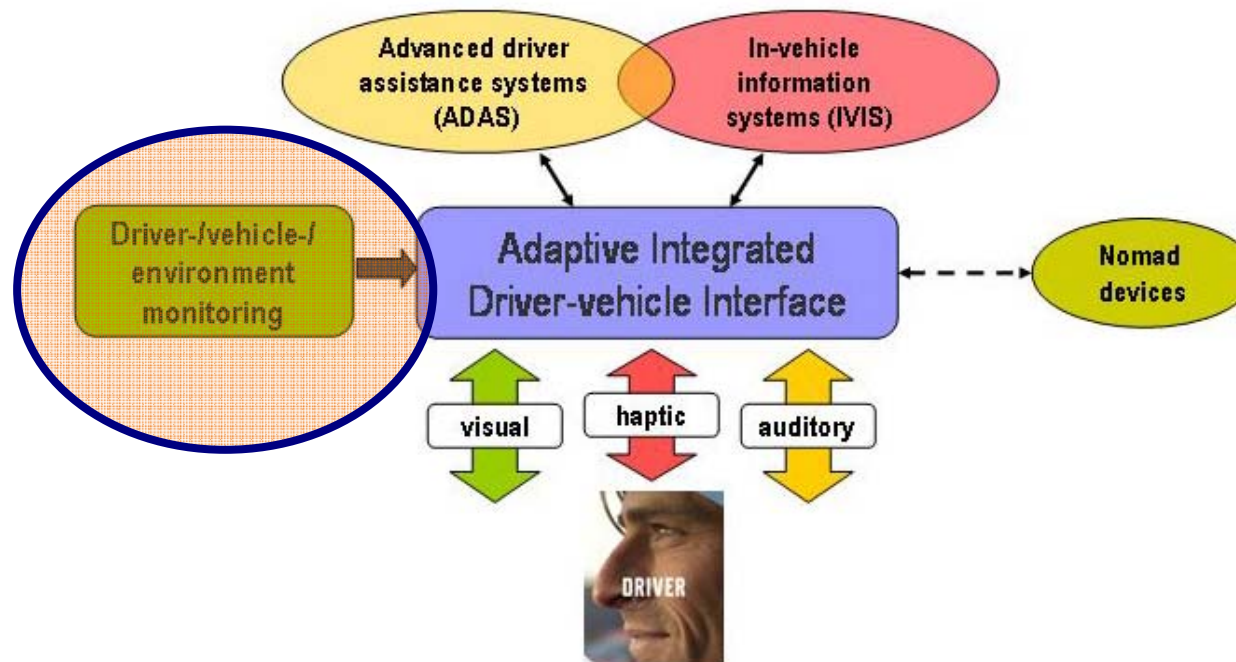
# AIDE Driver – Vehicle – Environment module: the problem that addresses



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*The objective is to develop techniques for real-time monitoring of the driver-vehicle-environment state, in order to enable real-time adaptation of the driver – vehicle interface.*



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# DVE detected conditions



DVE parameter	Explanation
<b>Driving demand</b>	Driver's "level of availability" to receive and process information, according to the requirements of the current driving task (not available ⇔ high driving demand).
<b>Driver Distraction</b>	Cognitive load or shift of visual attention away from the road ahead, induced by an external event or a secondary task.
<b>Driver impairment</b>	The physical ability of the driver to drive (fatigue, sleepiness, etc.).
<b>Driver intent</b>	The driver's intention, e.g. for a lane change.
<b>Traffic and environmental risk</b>	The total level of risk concerning the environmental and the traffic conditions (environment type, traffic density, environmental conditions etc.).
<b>Driver profile</b>	A stored user profile combined with a user's driving record in terms of user's preferences and driving behaviour.

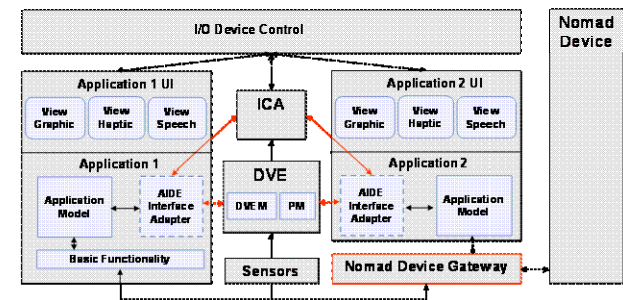
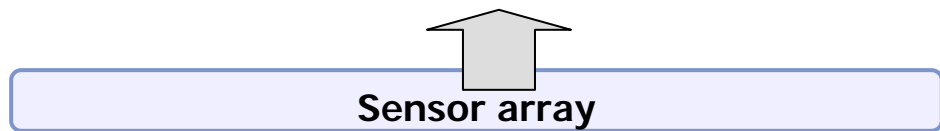
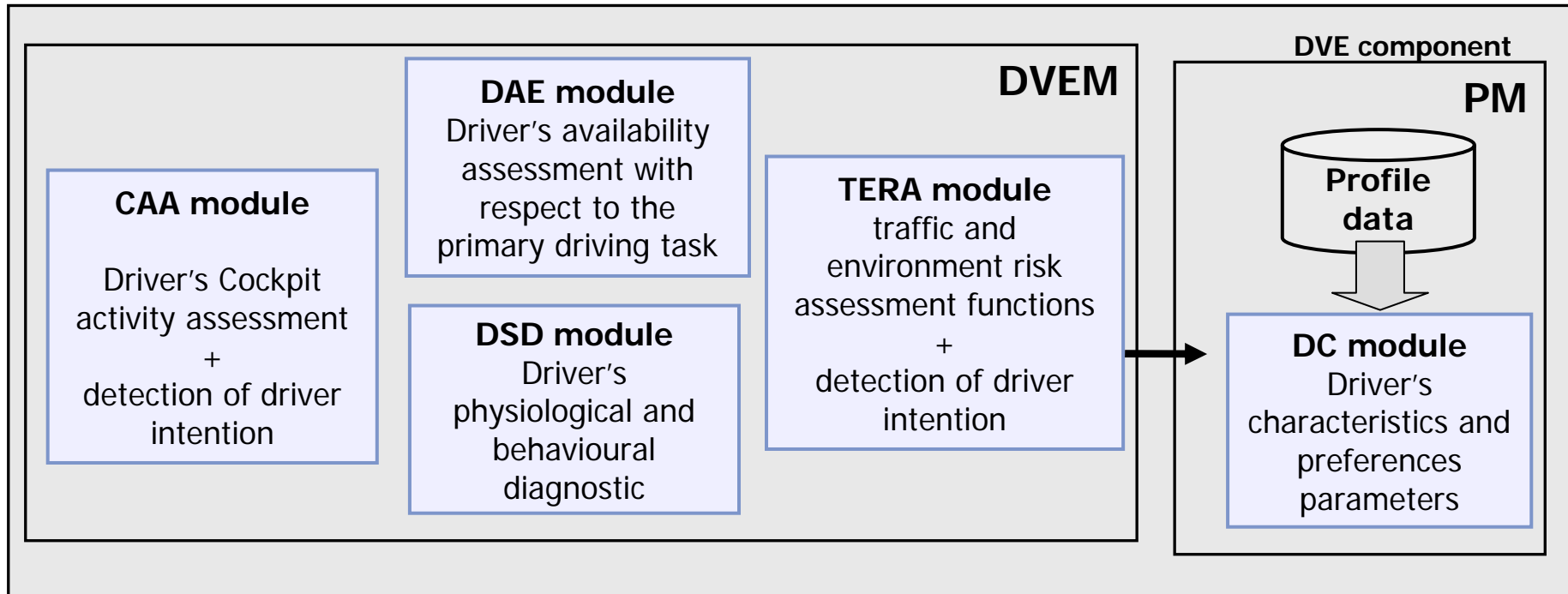


# Functional architecture of DVE modules



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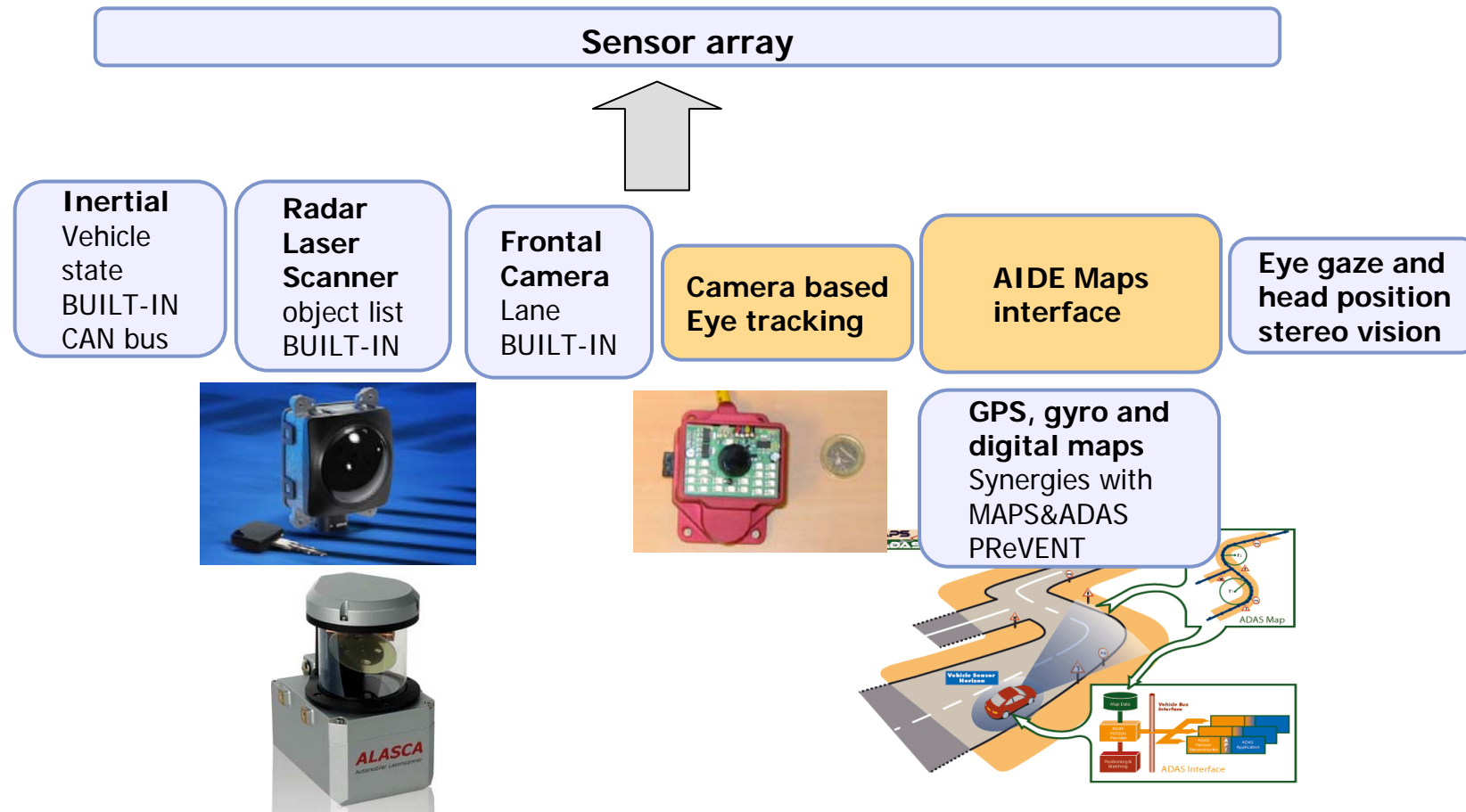
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# Sensor definition and adaptation



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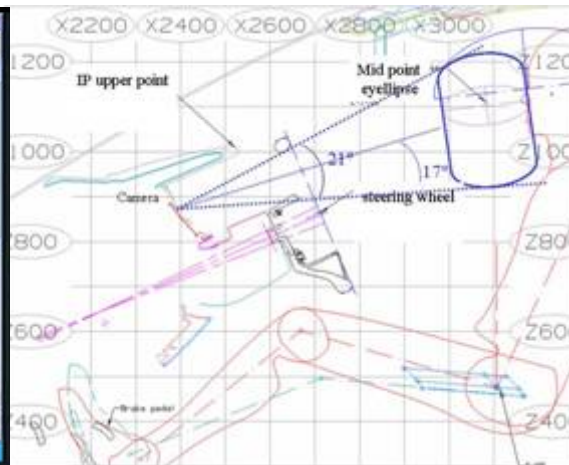
# Eyelid sensor



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- The Eyelid sensor is a vision based system which processes the video flow of the driver's face to provide the eye opening and blink behaviour signals.
- Physically the sensor is composed of a camera including a set of pulsed near infrared (NIR) LEDs placed in the instrument panel linked to a laptop which processes the image flow provided by the camera.



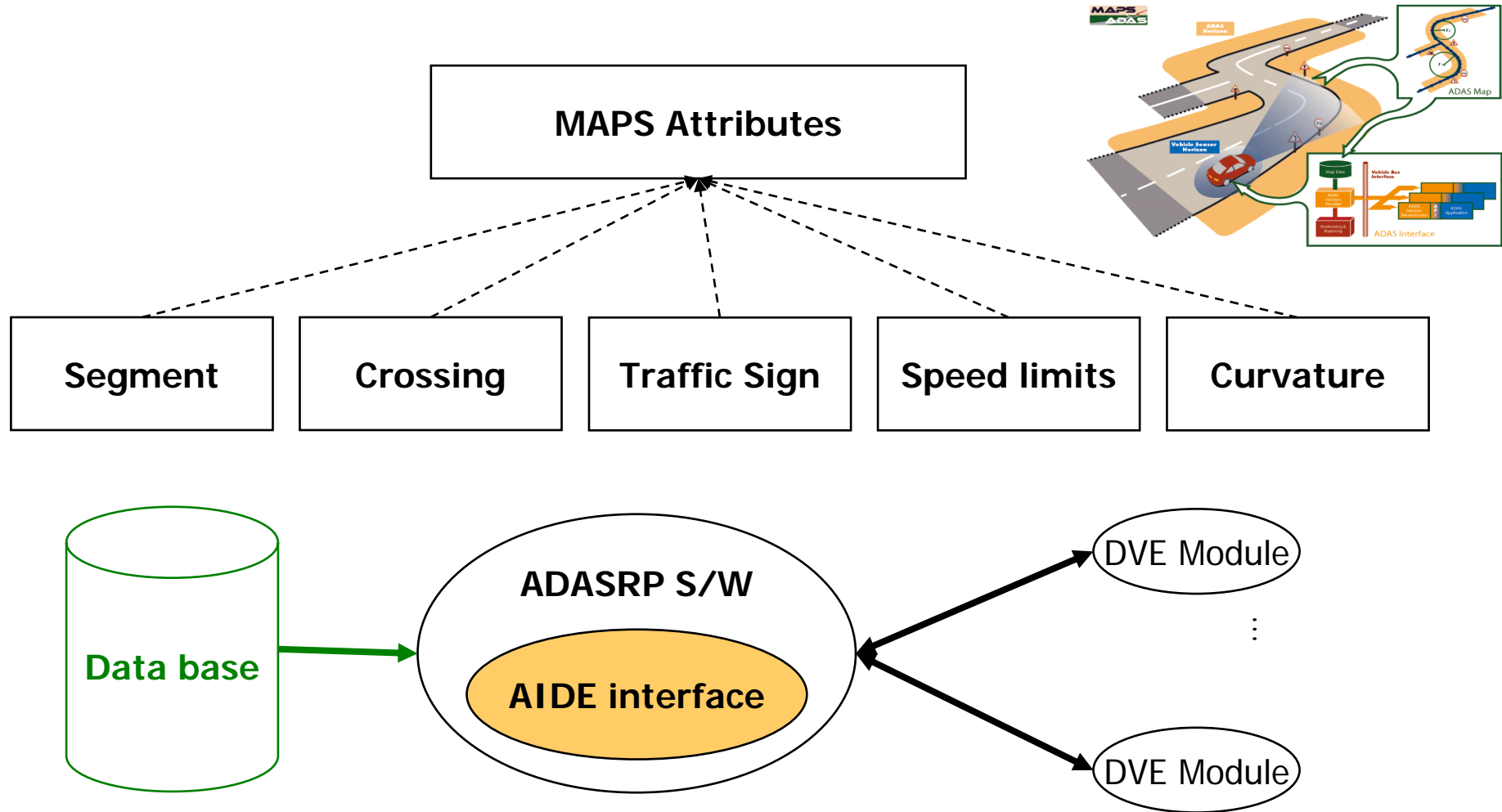
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# Map data extraction



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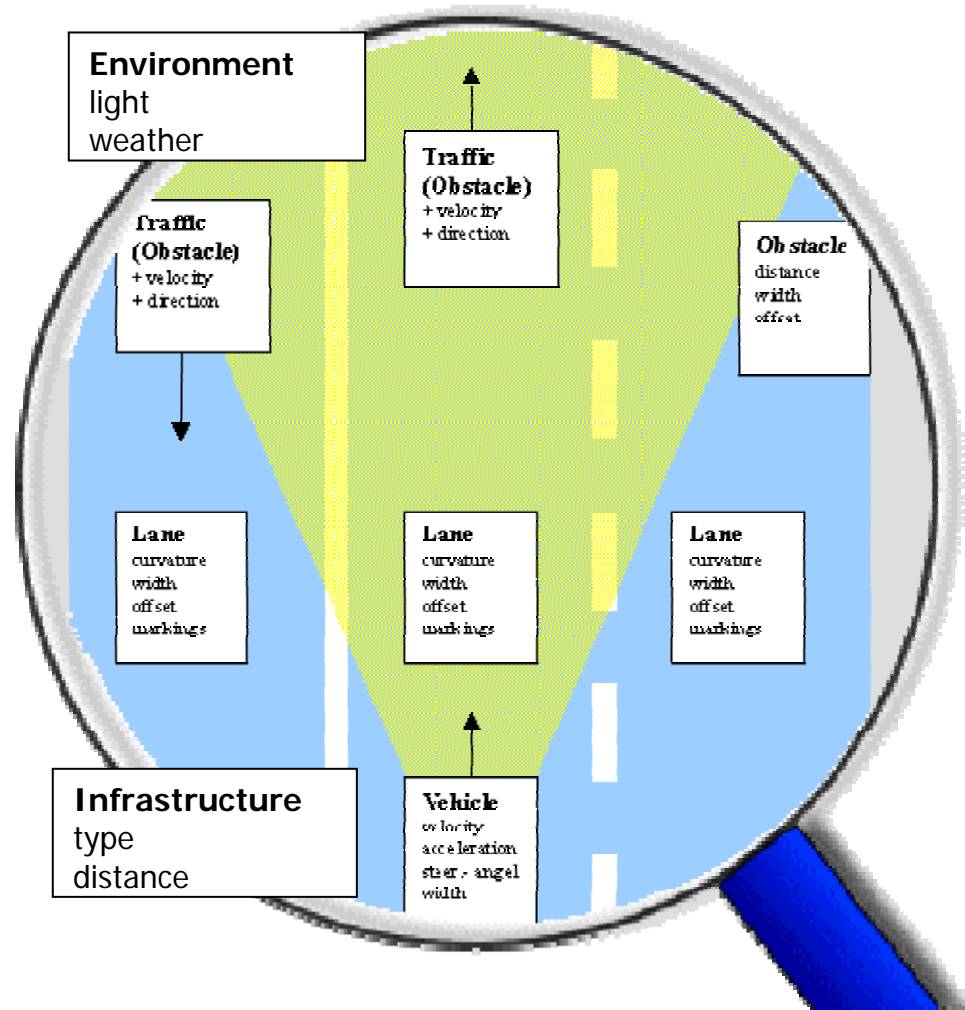
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# Traffic Environment Risk Assessment (TERA) module



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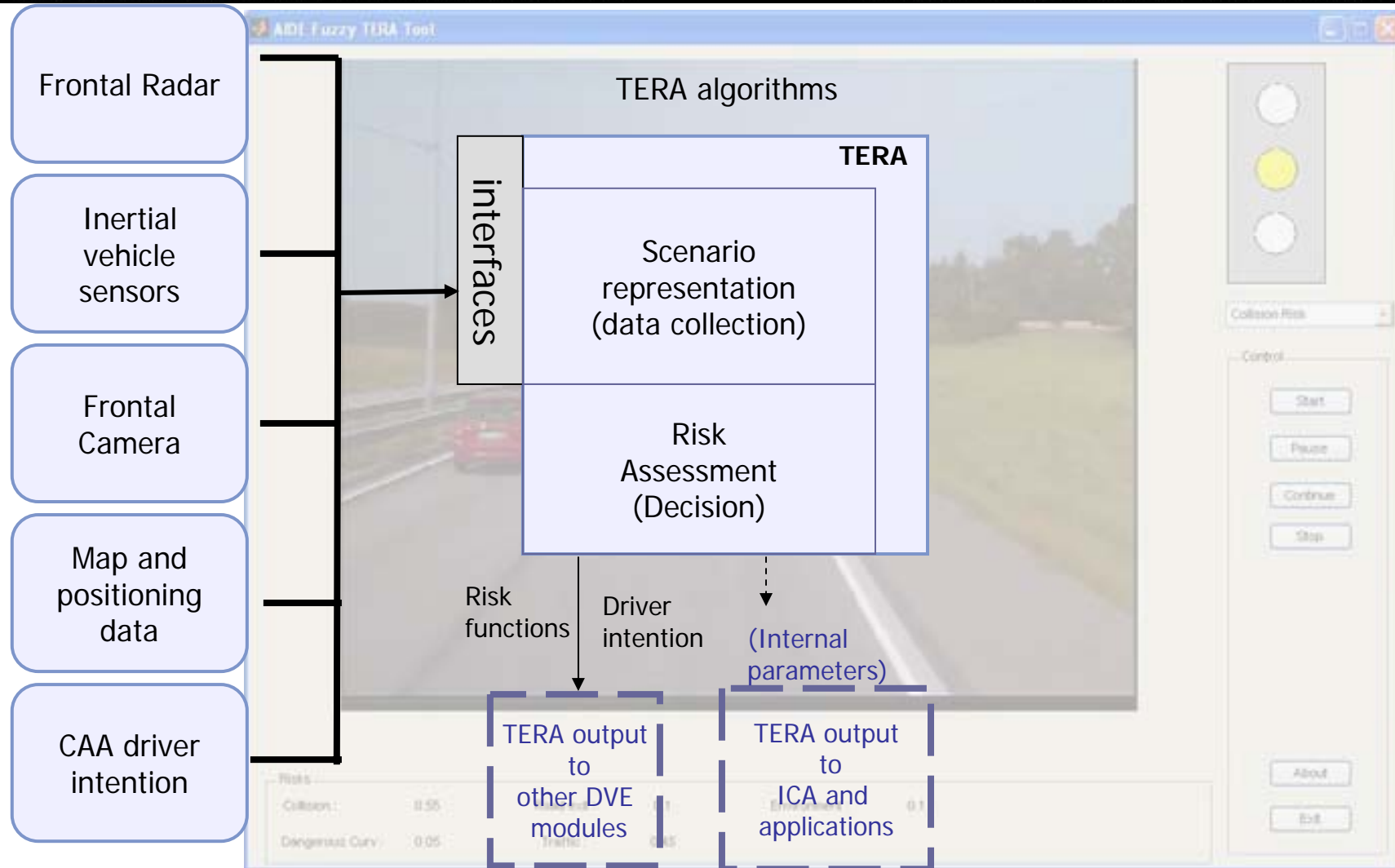
## TERA role:

- To calculate in real time a total level of risk related to traffic and environmental parameters.
- To calculate environmental and traffic parameters according to the requirements of the other DVE modules.
- To estimate the drivers' intention (e.g. for maneuver of a possible lane change).

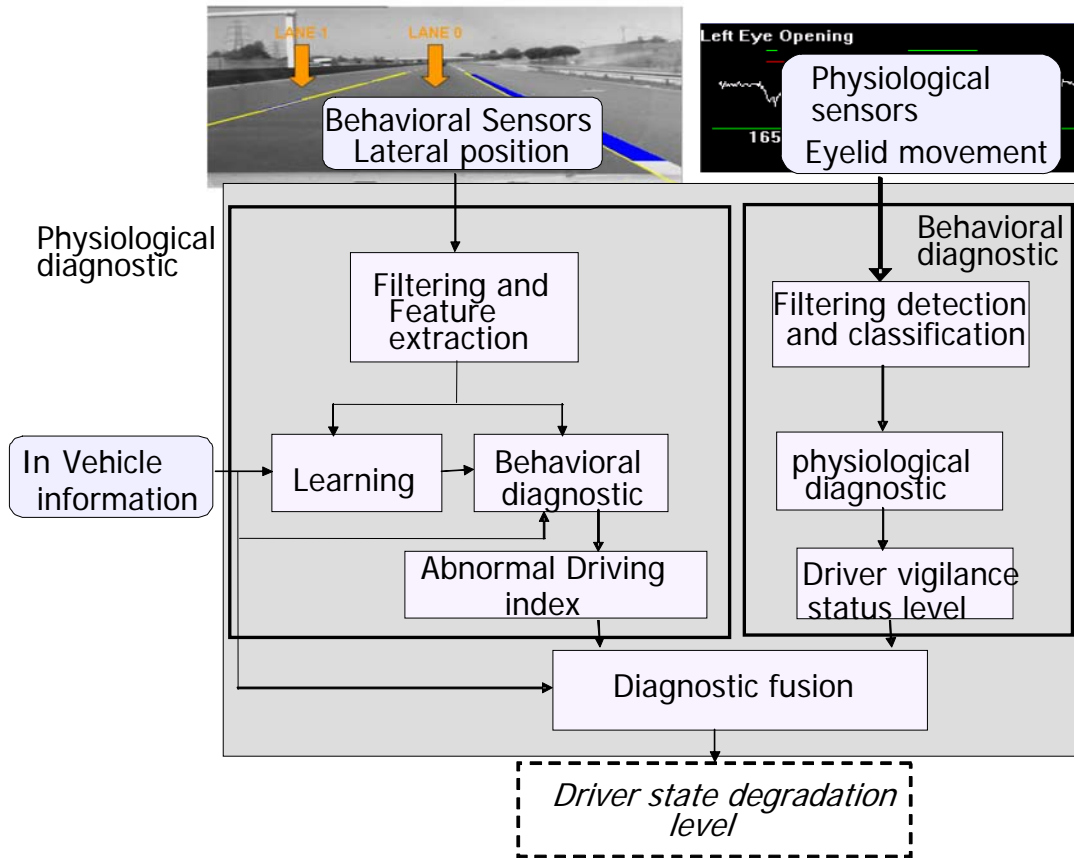
For example, existing sensors used by collision-warning systems and Global Positioning System (GPS) measurements of localization combined with a table of corresponding roadway characteristics could be used to help understand the environment outside the vehicle and adapt the HMI accordingly.



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# Driver State Degradation (DSD) module



**Goal:** Assess the evolution of the driver state degradation (physical ability).

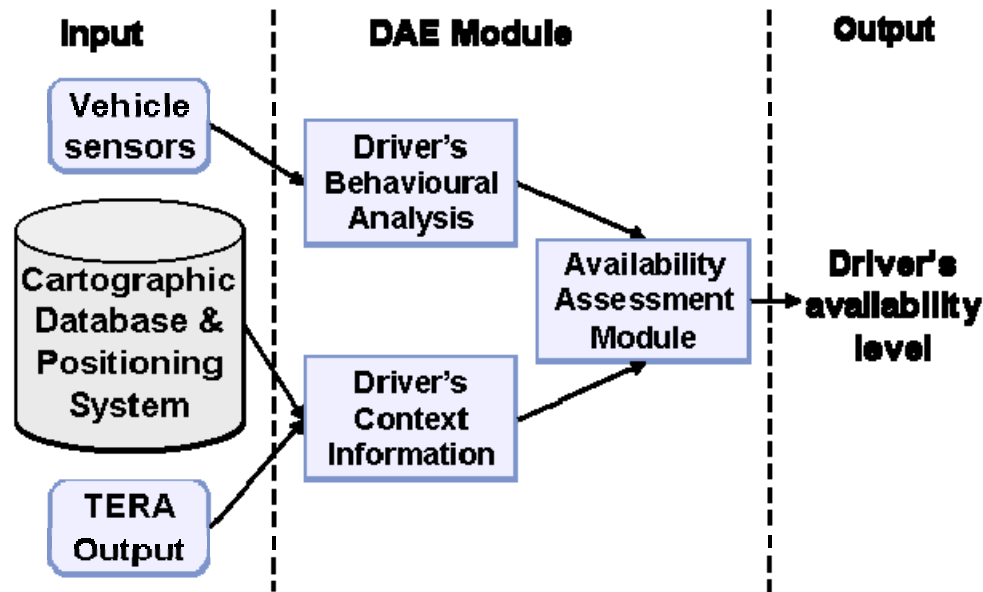
- The DSD is based on the fusion of information provided by physiological and mechanical sensors.
- Several diagnostics are calculated: physiological diagnostic, and behavioural diagnostics; then fused with additional in-vehicle information.

# Driver Availability Estimation (DAE) module



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**Goal:** Assess the availability of the driver to receive and process an information at a given time



- Three levels of Availability / Unavailability:
- Available (Green): “I can receive and process information”
- Unavailable (Red): “I drive my car! Please don't disturb me”
- Intermediary level (Amber): “You can send information to me, if needed. But I'm not sure that I will be able to detect or to process it correctly at this time”



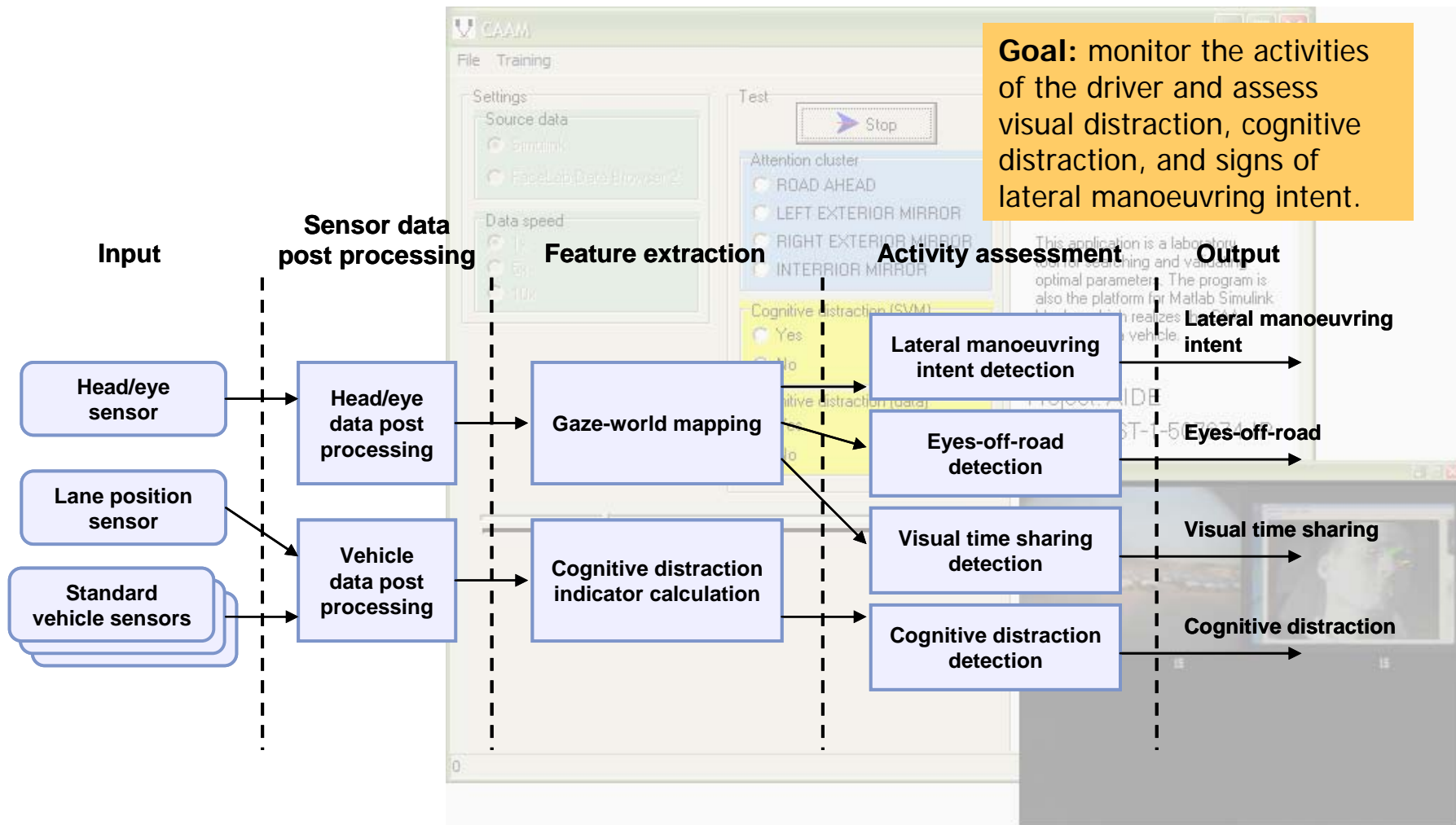
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# Cockpit Activity Assessment (CAA) module



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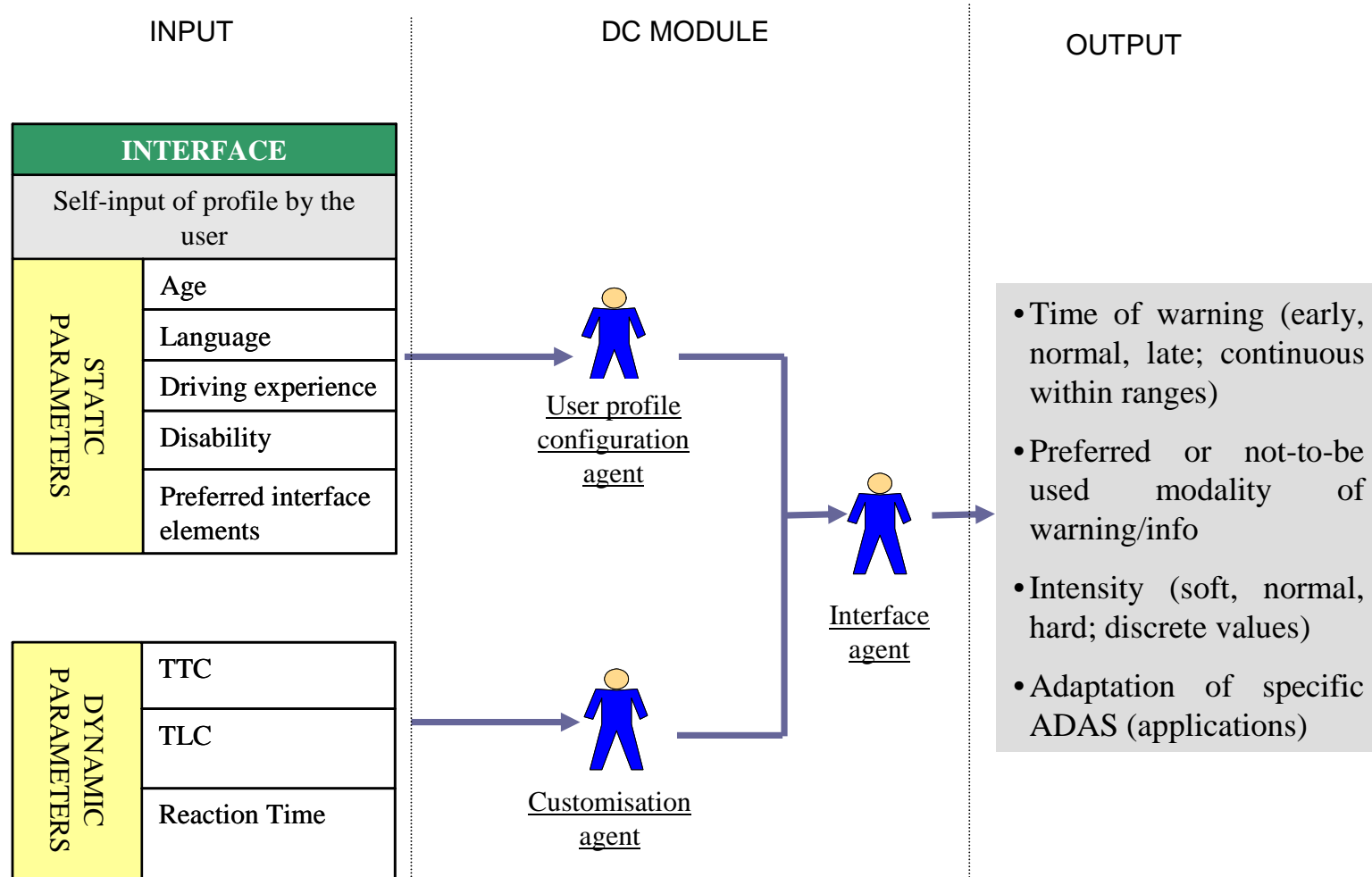
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# Driver Characteristics (DC) module



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# Thank you for the attention!

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