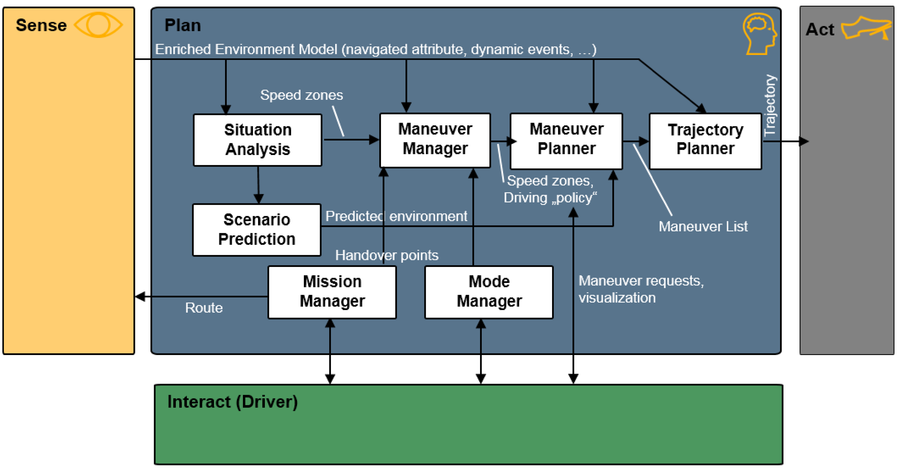
FUNCTION DEVELOPMENT

Ko-HAF
KOOPERATIVES HOCHAUTOMATISIERTES FAHREN

Continental‘s Spectrum of Driving Functions

OVERVIEW AND FUNCTIONAL ARCHITECTURE

Within AP4 and its subprojects Continental focused on the development of **safe driving functions in and between highway nodes and -intersections.** To enable the automated system to reason about the safe and situational correct vehicle behavior, a hierarchically structured architecture was utilized **that sequentially refines the future vehicle behavior from mission- to trajectory level** and also enables situation analysis and -prediction.



AUTOMATED HIGHWAY ENTRY

The Continental system allows the driver to activate the automated system already on the highway entrance ramp to relieve him from the challenging task to merge into the flowing traffic. The main challenge of the highway entry function is to maintain a safe vehicle state (safe distances and relative velocities) whilst enforcing the own driving mission with an upcoming lane ending. Key part of the solution is the **Maneuver Planner** that determines the **optimal maneuver sequence**, including speed adaption and lane changes for merging, utilizing a **graph-based search algorithm**. In it, a set of cost functions is used that also take the predicted positions of other vehicles **(Scenario Predicition)** into account. **As a result, the Ko-HAF vehicle is able to automatically chose a gap, adapt the vehicle speed to it and to finally merge into it.**

AUTOMATED HIGHWAY EXIT AND HIGHWAY INTERCHANGE

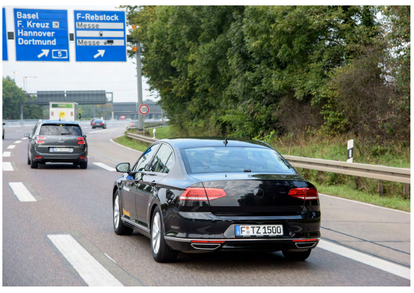
In addition to the short-term maneuver planning, the automated highway exit function – and especially the handling of a complete highway interchange – require a **longer-term maneuver planning** to make sure the Ko-HAF vehicle is in the correct lane in time. This **routing capability** is enabled in the Maneuver Manager by a probabilistic approach, formulated as a **Markov Decision Process** (MDP). The MDP determines the **optimal driving policy** by considering which lane sequence has the highest chance to follow a desired route. By utilizing this functional chain, **the Ko-HAF vehicle is able to automatically follow a desired route by selecting and changing to the target lane that leads to the highway exit or to another highway.**

STRATEGIC REACTION ON HAZARDOUS EVENTS BY SAFETY SERVER

The benefit of the above mentioned MDP approach is that it also takes **dynamic events from the Ko-HAF Safety Server** into an account, indicating which lane should be taken to avoid unnecessary risk. In addition, the **Situation Analysis** module provides artificial speed limitations in close proximity to hazardous events. Therefore, **the Ko-HAF vehicle is able to avoid driving directly next to hazardous events or – if this is not possible – to reduce its speed to lower the risk.**

MINIMAL RISK MANEUVER

In case the driver does not react on a system’s **request to intervene** that results from reaching either expected (e.g. ending highway) or unexpected (e.g. component failure) system limitations, the Mode Manager automatically issues a **Minimal Risk Maneuver** (MRM). When this happens, **the Ko-HAF vehicle automatically tries to change to the shoulder lane and comes to a full stop.**



Continental

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