Driver Coaching

Challenges and solutions:

Power for vehicle propulsion is need to overcome the drag losses of the vehicle as well the rolling resistance, but also the accelerate the vehicle. If all roads would be flat and if a constant speed could be realized than focus on aero and rolling resistance would be the only factors to reduce fuel consumption, but it is known that highway trucks in their typical cycle will apply the engine and foundation brake and this energy is lost. So avoiding use of the (conventional) braking systems can contribute as well to further fuel reduction in the vehicle, by optimized speed control of the vehicle (including the use of a hybrid system).

Highway trucks do not travel entirely on the highway, but need to go to factories and logical centers for loading and unloading and these typically can be found close to cities and even in the urban areas. Here is the highest potential for reduction of brake events if the driver knowns in advance were the speed need to be reduced, in order to relieve the throttle pedal in time and start Ecoroll events.

At the vehicle velocity optimization level, it is possible, that velocity change requests are made. These velocity change requests can come from other optimizers, which use the velocity profile as basis, (e.g. in a thermal optimization loop a higher velocity could be more convenient) or from adaptive cruise control, for example if another slower vehicle is detected by the radar. The information exchange and coordination is handled by the Powertrain Controller. The velocity change request needs to be combined with an efficiency factor or cost. The velocity optimizer can now estimate what following the velocity change request would cost in terms of fuel consumption, and it can update its velocity profile based on this value as well as on the priority.

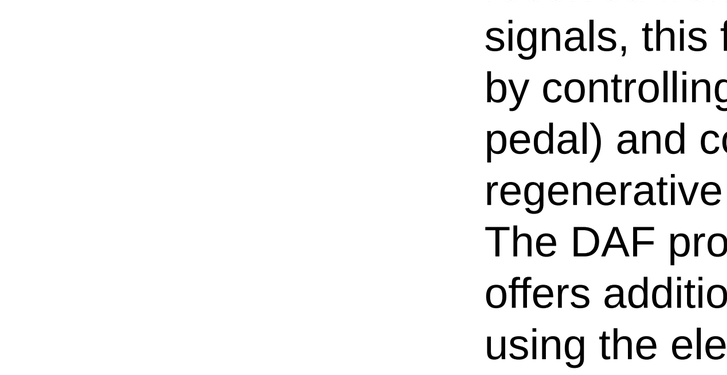
IMPERIUM's contributions:

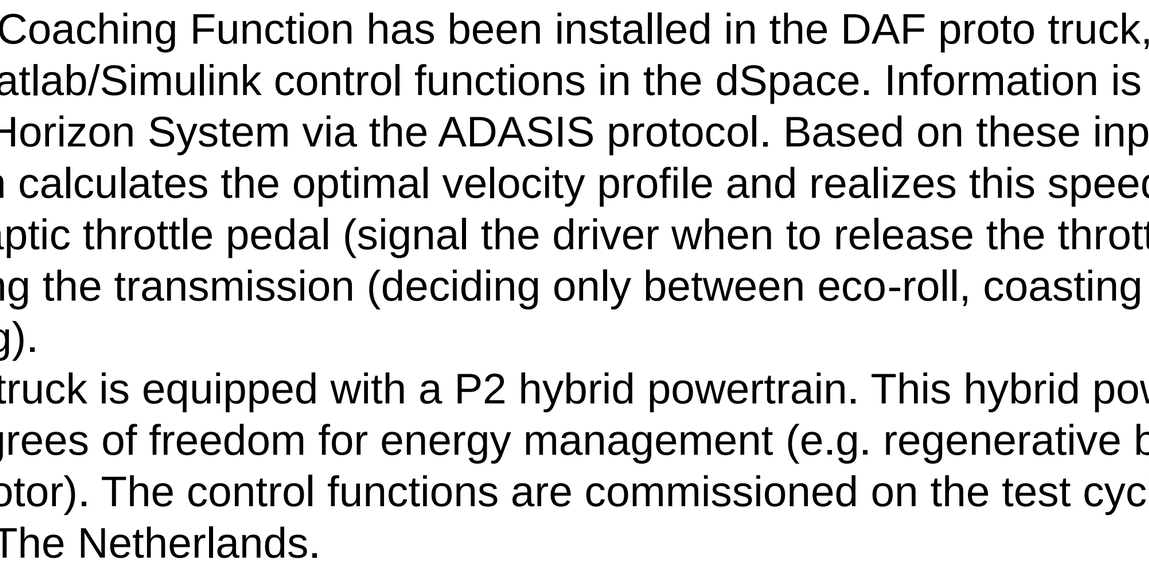
The Preview Driver Coaching Function has been installed in the DAF proto truck, by implementing the Matlab/Simulink control functions in the dSpace. Information is received from the eHorizon System via the ADASIS protocol. Based on these input signals, this function calculates the optimal velocity profile and realizes this speed profile by controlling the haptic throttle pedal (signal the driver when to release the throttle pedal) and controlling the transmission (deciding only between eco-roll, coasting and regenerative braking).

The DAF prototype truck is equipped with a P2 hybrid powertrain. This hybrid powertrain offers additional degrees of freedom for energy management (e.g. regenerative braking using the electric motor). The control functions are commissioned on the test cycle around Eindhoven, The Netherlands.

Impact / what's next:

As announced on the IAA truckshow in 2018 DAF is seriously working on a heavy-duty hybrid vehicles as a solution for further reduction in fuel comsumption as well to drive zero emissions in urban areas. The results of Imperium will be used during the further developments of these vehicles.





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