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ASSISTANCE FUNCTION AS A DRIVING TRAINER

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Technical task:
Ensure safe behaviour of the driver in dangerous situations.

Initial situation:
According to the current state of compulsory driving training, many drivers have no experience in moving their vehicle close to the limit. In emergency situations, this can lead to incorrect and/or inadequate action due to lack of vehicle control and fear of using the vehicle's potential. Safe training is only possible through driving safety or race track training, in which the drivers are taught both theoretical knowledge and practical exercises by a professional instructor. In addition, many vehicles today are equipped with driver assistance functions (e.g. ACC, lane departure warning systems, etc.). These systems support the driver, but do not help him to develop a driving skill in order to act anticipatory correct. The disadvantage of professional driving training lies in the availability of seats and the high costs that deter many drivers from participating. In addition, a human driver trainer can only try to impart the appropriate knowledge to the driver by means of verbal instructions (in theory and while driving) or via an "instructor". A direct transfer of the driving feeling is therefore difficult. Current driver assistance functions are also unable to teach the driver how to react correctly in advance to such situations in the future.

Solution:
By using (highly) automated driving functions, it is possible to convey a driving feeling to the driver according to the desired learning objective. Exemplary learning objectives are: Lap time optimisation on the race track, drifting, driving safety training, gaze guidance training, chauffeur training (gentle steering / braking / acceleration), off-road driving or driving school for obtaining a driving licence. The driving feeling or the correct entries for the vehicle controls can be transmitted via various communication channels between vehicle and driver (e.g. optical, haptic, acoustic, kinesthetic). The specification of the appropriate driving behaviour can be carried out both via driver assistance functions and via (highly) automated driving functions.

Advantages:
By using existing assistance functions as driving trainers, the teaching of driving skills in the dynamic range can be made available to a significantly higher number of drivers. The cost factor for these drivers is significantly lower as a human instructor can be saved. Costs can also be saved from the developer's point of view, as only existing functions can be used and easily extended if necessary. A further advantage is the more direct way of communicating the driving feeling, as the driver now feels the vehicle reaction on the one hand and the movement of the controls on the other. Thus there is no need to transfer the instructions of the driving trainer to a movement of the controls. In addition, the driving function can intervene immediately in the event of danger and prevent damage.

Possible application:
In principle, the idea of an implementation via the use of current driver assistance functions is conceivable. The application possibilities are limited according to the installed function. In a particularly advantageous version, a highly automated/piloted driving function (e.g. environment or route data-based) takes over the vehicle guidance proportionally and adjustably and hands over control to the driver accordingly. This transfer can also take place by means of a detected learning success. This learning success can take place, for example, by monitoring the difference between the specified driving behaviour and the driving behaviour induced by the driver's control input. With increasing learning success, the degree of support or input can be reduced, should this be desired by the driver. It is also conceivable to implement a licence system for the driver based on the successfully completed training sessions.

The information required for the learning objective can be transmitted via various communication channels (corresponding to human sensory perception) and systems. An exemplary listing results as follows:

Optical communication channel:
Display via projection in windshield (driving line, brake point, ghostcar etc.)
(AR)-glasses (driving line, brake point, ghostcar etc.)
Projection onto the road (lane, brake point, ghostcar etc.)

Haptic communication channel:
Hand torque (steering impulses, hardening, vibrations etc.)
Pedals (counterpressure, displacement, vibration)
Seat adjustment (vibration)
belt tensioner

Acoustic communication channel:
Verbal comments
Frequency modulated tones etc.

Kinesthetic communication channel:
Car drives forward and shows maximum lateral/longitudinal/yaw acceleration and driving line
Active influence on suspension travel (eABC)

A combination of the channels is also conceivable. Ideally, the selected sensory impressions for communication are generated via systems already installed in the vehicle.