

Safety challenges for a steering adjustment system in a highly autonomous drive

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Steering adjustment systems are required to move the steering column in an axial or radial direction to suit the drivers comfort. This system is predominantly mechanical in nature in most of the cars, now we have the same system electrically driven as well. The steering adjustment typically consists of two DC motors with hall sensors to move the column and measure the revolution of the motor. One motor adjusts the radial movement of the steering wheel and the other adjusts the telescopic movement.

In a conventional electric steering adjustment system safety challenges are not quite high because of the movement of the steering wheel is quite limited to 30 mm in the telescopic movement and the adjustment speed is low(12 mm/s). In autonomous driving the telescopic movement of the steering wheel can be as high as 300 mm or it can also even be stow able with a speed up to 40 mm/s. We have to keep in mind that, the steering wheel is no longer required by the driver when the vehicle is in autonomous mode.

This paper aims to describe the steering adjustment system and its dependency on the motors and sensors used and the safety challenges that the system needs to be address in case of autonomous driving. The system predominantly handles three safety critical operations,

- Moving from regular driving mode to autonomous driving mode
- Moving from autonomous driving mode to regular driving mode
- Report the position of the steering wheel to the decision center of autonomous driving

In the first case, the telescopic movement is triggered and the motor moves the steering column down and it's rested. In the second case, the motors are powered to get back the steering wheel in hand. Finally the position of the steering wheel has is passed to the central autonomous unit and the data has to be safe, as the central unit might take decisions based on the position of the steering wheel position.

This paper addresses the safety challenges in the above scenarios, basically the unintended actuation of the system and responsiveness of the system to move from autonomous driving to regular mode. The paper also intends to give the potential solutions to address the safety issues arises out of these challenges.

Keywords: Functional Safety, Highly autonomous drive, Steering Adjustment system, Electric Vehicles, DC Motor control