Chassis Systems Control
Driver Drowsiness Detection

Motivation
Fatigue and falling asleep at the wheel are often the cause of serious automobile crashes. The report “The Prevalence and Impact of Drowsy Driving”, published in 2010 by the American Automobile Association (AAA), is just one of many that draws this conclusion. During this investigation, it was found that 17 percent of all fatal crashes in the USA could be attributed to tired drivers.

Monotonous driving is particularly exhausting and can rapidly lead to a loss of concentration. The transition from being fatigued to nodding off is subtle and generally goes unnoticed by the driver. For this reason, Bosch has developed Driver Drowsiness Detection.

Characteristics
Driver Drowsiness Detection is a software function developed by Bosch which constantly analyzes the driver’s steering behavior. It recognizes phases in which the driver briefly ceases steering but then abruptly corrects the vehicle’s direction. These phases are a sign of decreased concentration and increased fatigue. If the software function recognizes signs of drowsiness, an audible, visual and/or haptic signal warns the driver that they are tired and recommends a break.

Driver Drowsiness Detection can be integrated into various control units independent of the manufacturer, such as ESP®/ESC control units, CAN/FlexRay gateways, head units, body computers etc.

Customer benefits
► Cost-effective solution for driver drowsiness detection based on standard hardware
► Highly flexible integration of the software function
► Tiredness data is available to other systems (e.g. navigation system)
► Compliance with driver warnings helps to avoid crashes caused by fatigue
Operating principle
During any journey, drivers provide many steering inputs to guide their vehicle. Decreased concentration and tiredness impair steering behavior and reduce the driver’s reaction time. Fine motor skills deteriorate, steering behavior is less precise and the driver has to correct the steering more frequently. The typical steering patterns which indicate drowsiness begin to occur well before the driver falls asleep at the wheel. Detection of a single occurrence of one of these steering patterns is not, however, a clear sign of fatigue. As studies have shown, it is only when they become more frequent that increasing drowsiness is apparent. As the occurrence of these steering patterns is different from driver to driver, the driver’s steering behavior is analyzed at the start of the journey and individual driving styles are taken into account.

Driver Drowsiness Detection searches for characteristic features in a driver’s steering behavior. The function evaluates data from a high-resolution steering-angle sensor (accuracy <0.1°) or, alternatively, from electric power steering. This information is supplemented by situational parameters such as duration of journey, monotony of journey and time of day. To assess the driver’s level of drowsiness as thoroughly as possible, the function’s algorithm evaluates approximately 70 signals received via the vehicle’s CAN bus.

Driver Drowsiness Detection calculates a drowsiness index from this data. If a defined threshold is exceeded, the function triggers a driver warning. This could be an audible signal or a symbol displayed in the instrument cluster.

As well as warning the driver, data concerning the tiredness of the driver can be used by other systems in the vehicle. In combination with a navigation system, for example, it is possible to display the next available opportunity to stop or take a rest break.