7.0.1 Do You Know That ? Standardized Levels of Autonomous Vehicles

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The SAE classified autonomous vehicles into 5 levels that define their level of autonomy.

To determine the level of a vehicle, four precise questions must be answered.
- First, between human and machine, who controls the vehicle in the longitudinal and/or lateral direction ?
- Who is monitoring the environment ?
- Who ensures safety in case of a failure ?
- Finally, what is the driving mode ?

The table of Figure 7.1 presents the 5 levels of the of driving automation according to the vehicle's answers to these questions.

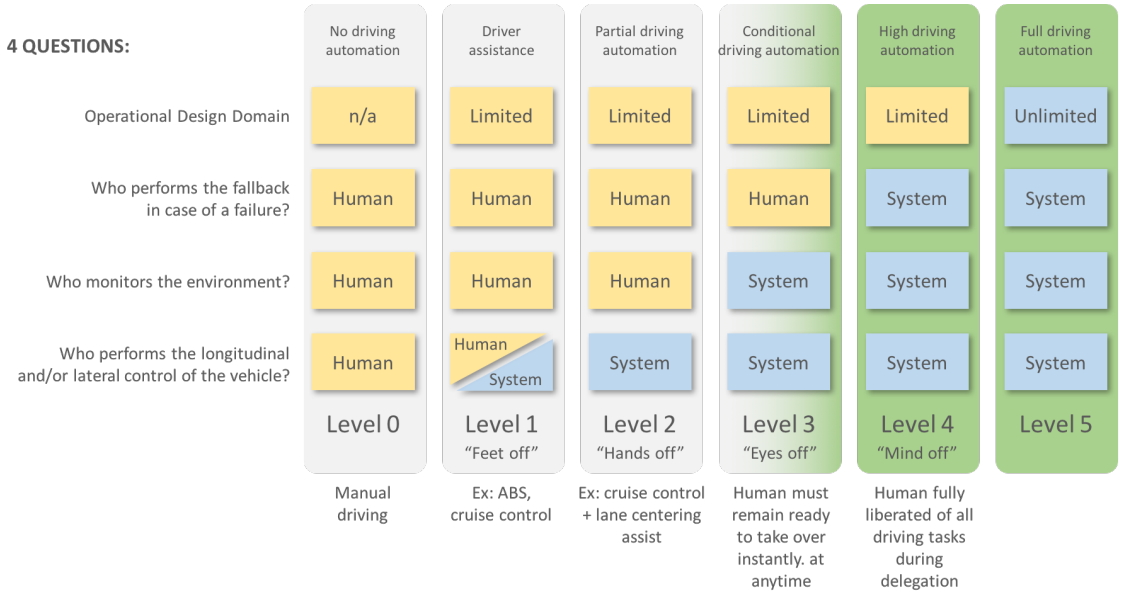

FIGURE 7.1 – Standardized levels of driving automation (SAE classification)

In the case of a fully manual vehicle, called level-0 vehicle, all these tasks are performed by the human driver.
A level-1 vehicle controls the vehicle in a longitudinal or lateral direction but not both at the same time. For instance, cruise control is a level-1 device since the user does not need to accelerate or brake when it is activated. This is the reason why level-1 systems are often called "foot off".
A level-2 vehicle controls the vehicle's longitudinal and lateral motions. The driver can temporarily let go of the steering wheel as long as they remain vigilant to their driving environment. Such systems are often called "hands off".
In addition to all this, a level-3 vehicle monitors the driving environment and can alert the driver if a situation requires the driver to immediately and absolutely take

over. In certain situations, the driver can temporarily take their eyes off the road for a few seconds. This kind of system is often called "eyes off".
A level-4 vehicle can do all this. It can also secure the car in case of unexpected situation if the human driver does not take over, typically by stopping on the roadside. Since this must be exceptional, these unexpected situations must have been almost eliminated compared to level 3. This requires foreseeing any possible situation which is extremely difficult to guarantee. This is the reason why level-4 systems are restricted to certain roads where traffic conditions can simplify this guarantee. The driver does not need to be vigilant anymore and can perform other tasks than driving even if it requires their full focus such as watching a movie or working on a screen. These systems are often called "mind off".
Finally, level-5 vehicles can perform all this without any limitations of the driving mode. "SAE International is a global association which groups over 128 000 associated engineers and technical experts from the space, automotive and commercial vehicle industries."