AŽD

AUTONOMOUS AND DIGITAL RAILWAYS

We develop and test systems for autonomous train operation for GoA4 grade of automation. The goal is to create a complex system of autonomous and digital railways, a set of completely new or innovated current systems for the vehicle and for the infrastructure, which are mutually connected.

AŽD AND AUTONOMOUS TRAIN OPERATION (GoA4)

The level of automation is defined by GoA - Grade of Automation.
We currently operate ATO over ETCS DriveSWing DRS-10 system at GoA2 level. We continue to develop and supplement the system to be able to operate trains completely without a driver and without any attendants – GoA4.

The development of AŽD systems for unattended train operation follows the ATO over ETCS project activities and other research activities within the European Shift2Rail programs.

GoA	Grade of Automation	Train supervision	Train control	Supervision of area in front of train	Closing the door	Permission to depart from station
	GoA0	Train driver	Train driver	Train driver	Train driver	Train driver
	GoA1	System	Train driver	Train driver	Train driver	Train driver
	GoA2	System	System	Train driver	Train driver	Train driver
	GoA3	System	System	System	responsible operators	responsible operators
	GoA4	System	System	System	System	System

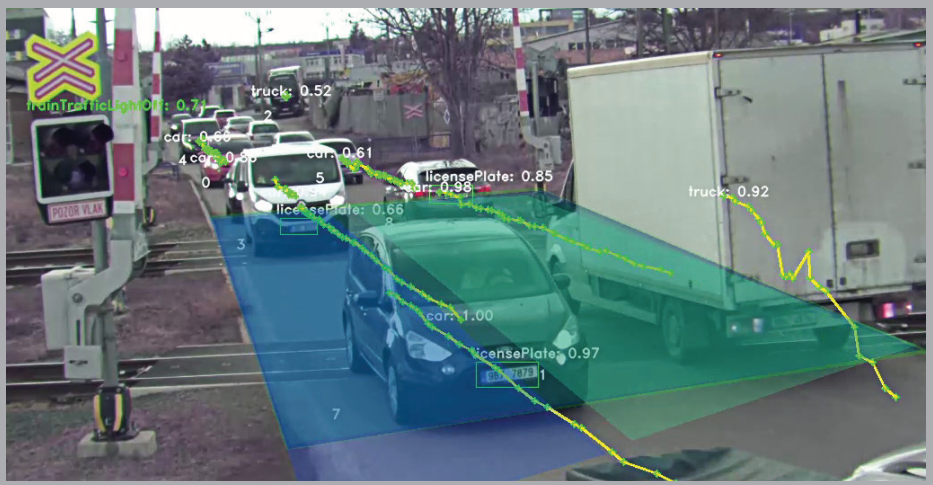
Responsibility: System | Train driver/responsible operators

- In GoA2 (semi-automated operation), a driver is present in the train supervising its driving.
- In GoA4 (unattended operation), all activities are controlled by an automation system.

TRACKSIDE SYSTEMS FOR AUTONOMOUS OPERATION

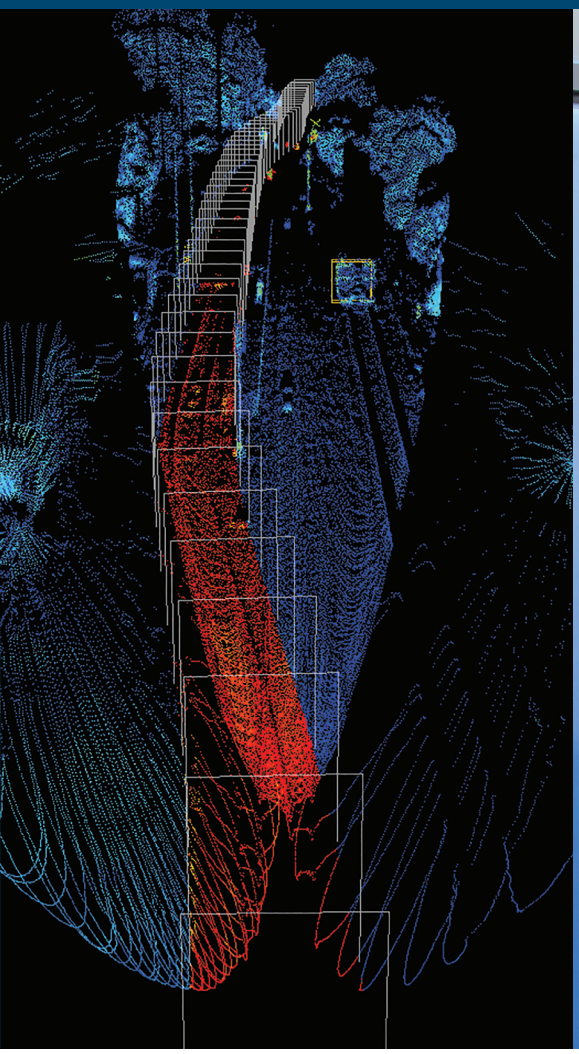
An autonomous train uses supporting information from trackside systems and infrastructure elements to ensure its fail-safe operation. This information is processed and used appropriately in the autonomous vehicle. The trackside systems are as follows:

- detector of obstacles and risk situations, supervisory terminal of unattended operation,
- supporting traffic systems (management of digital maps and unattended train missions, etc.),
- diagnostic systems (information about the physical health of the infrastructure).



The trackside obstacle and risky incidents detector system can warn the autonomous train of impending danger at busy traffic locations and at places that are not covered by train sensors.

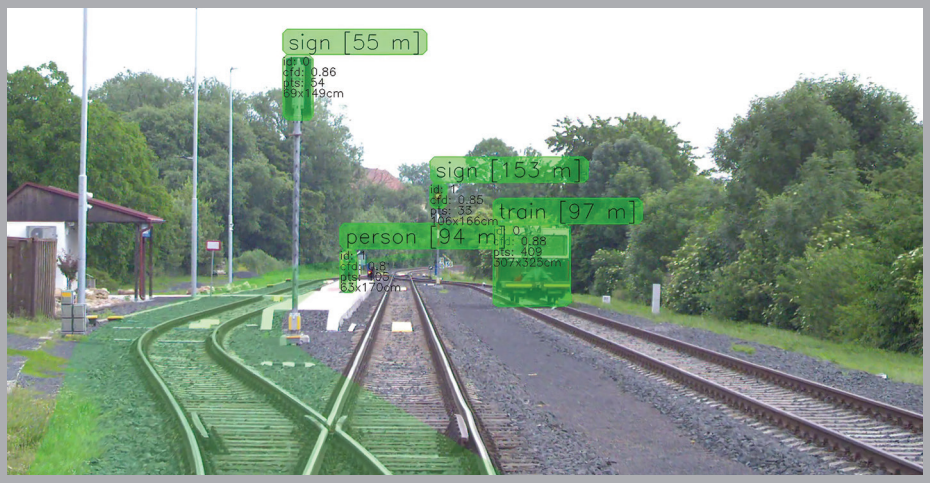
ON-BOARD SYSTEMS FOR AUTONOMOUS OPERATION



The autonomous train is equipped with automation systems enabling to handle the activities that are normally performed by the train driver or responsible operators. New train borne systems include:

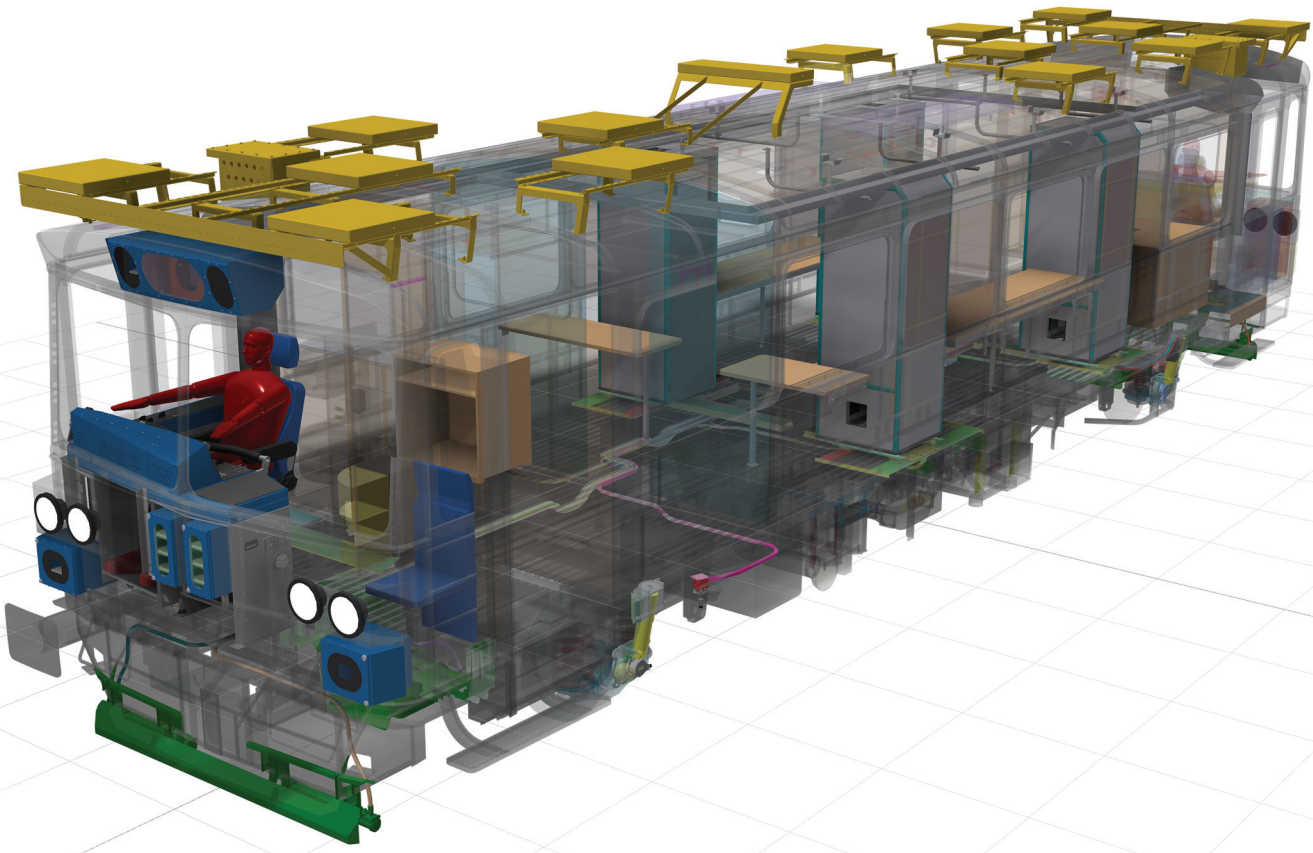
- train expert control system,
- object (obstacle) detector,
- environmental detectors (weather, noise, smoke, impact, train integrity, etc.).

The train expert control system replaces the driver‘s decision-making. The system is set up to handle all possible situations.



The object (obstacle) detector „replaces“ the driver‘s sight and consists of many different sensors (cameras, lidars, etc.). The system is able to detect and recognize objects in front of the train. For this purpose, elements of machine learning and artificial intelligence are used.

OWN EXPERIMENTAL VEHICLE AND TEST TRACK



AŽD is preparing its own experimental vehicle for testing purposes, which will be equipped with all the necessary innovative technologies enabling its unattended operation. It is a motor vehicle of the 810 series, which will bear the name EDITA - Experimental Railway Vehicle for Innovative Technologies AŽD.

At the same time as this project, we are building a test polygon for technology development activities and autonomous train operation systems on its own regional line Dolní Bousov – Kopidlno.

The following most modern signalling, traffic control, automation and telecommunication systems will be installed and operated here:

- Station interlocking system StationSWing ESA,
- Systems TrainSWing for ETCS L1, L2, L3,
- Telecommunication networks GSM-R, GPRS, LTE, 5G and WLAN,
- Electronic security of the entire infrastructure, including track sensors,
- Traffic management systems TrafficSWing (GTN + ASVC).

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