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Project Acronym: ARCC

DELIVERABLE D 1.4

Development of the surround sensor module for integration in the demonstrator, following Specification of surround sensor solution under GoA2+:

Public summary

Project acronym:	ARCC
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Public Summary

The ‘Automated Train Operation’ work package faces the challenge of steering freight trains automatically by means of an autopilot, known as the Automatic Train Operation module (ATO module), in a safe, efficient, and reliable way.

The aim of the ATO module is to fulfil the operational timetable in the most energy-efficient way by calculating the ideal speed profile for the train. The ETCS system with the European Vital Computer (EVC) on board ensures safe operating parameters for the ATO which is in turn supervised by the ATO and controls traction and the brakes. If the automated driving mode is supervised by a driver on board, this is called Grade of Automation 2 (GoA2). On a technological spectrum, Work Package 1 (WP1) goes one step further to GoA 2+. This includes sensor solutions to monitor the environment, identify wagons and objective on the track and react accordingly.

To develop a fitting sensor solution the requirements (e.g., 0–200 meter detection range) were specified based on an use case analysis and on first results of simple field tests. Different technologies such as cameras, radars or LIDAR and LEDDAR were taken into account and evaluated.

The developed surround sensors system (called ERACLES-Enhanced Range AntiCollision system for Locomotives –Experimental System) consists of two subsystems:

- The short-range (SR) system (0 to 20 m detection range) is equipped with two cameras in stereo-vision mode and one radar. The dedicated controller implements sensor fusion between the camera and radar system. The system detects any kind of object (volumetric environment sensing) and it detects the track. The SR system is mainly used while driving slowly and shunting.
- The mid-range (MR) system (up to 175 m detection range) is equipped with three cameras (for double stereo-vision) and one radar, also. The resulting information is fused as well. The system detects any kind of object (volumetric environment sensing) and it detects the tracks. The MR system is mainly used while driving faster (up to 100 km/h).

Stereo machine vision consisting of the combination of camera and radar signals is a suitable technology for the SR and MR. Other optical sensors such as LIDAR and LEDDAR showed to be too sensitive to dust or debris in the railway environment. Nevertheless, the need of a very accurate calibration process of the stereo machine vision as well as the impact of geometrical changes due to deformations in the long-term use of this measurement system must be taken into account.

With respect to the safety assessment of this specification, the locomotive equipped with the surround sensor solutions still acts according to GoA2, meaning that the train driver is on board and supervises the journey. This Deliverable summarizes the work done in T1.2.1, 1.2.2 & 1.3.1. Officially a demonstrator, D1.4 comes along as a report, while D1.6 will provide the evidence (movie) of the demonstrations done during the project time frame.