D2.4: Simulations System Requirement and Architecture

Work package	WP2: Requirements and Specifications
Task	Task 2.3: System , simulation and user requirements
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Dissemination level	Confidential (CO)
	with Publishable Executive Summary
Status	Final
Due date	31/03/2017
Document date	04/08/2017
Version number	1.0
File Name	optiTruck-D2.4-Simulations System Requirement and Architecture-v1.0-Final-PU

optiTruck is co-funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 713788

Control sheet

Version history			
Version	Date	Main author	Summary of changes
0.1	13/03/2017	Orhan B. Alankus	First Draft
0.2	26/04/2017	Orhan B. Alankus	Second Draft
0.3	09/05/2017	Orhan B. Alankus	Third Draft
0.4	28/05/2017	Orhan B. Alankus	Fourth Draft
0.5	22/06/2017	Orhan B. Alankus	Final version for review
0.6	31/07/2017	Orhan B. Alankus	Final version after review
1.0	04/08/2017	Orhan B. Alankus	Final version

	Name(s)	Organisation(s)	Date
Main author/ editor:	Orhan Alankus	OKAN University	04/08/2017
Peer reviewed by:	Agostino Marcello Mangini Thorsten Stamm von Baumgarten	ICOOR (POLIBA) IAV	20/07/2017 21/07/2017
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Submitted by:	Jean-Charles Pandazis	ERTICO (Project Coordinator)	24/10/2017

Glossary of terms

Term	Description
Transport mission	Defined transport route
Scenario	Definition of specific elements that characterize the test of a transport mission
Innovation Element	Core element of the optiTruck concept that explain how the project results contribute to fuel savings
Use Case	The use case is a set of possible sequences of interactions between systems and users related to a particular goal.
User	Stakeholders and project partners who uses the system for development and training
Cloud Optimizer	One component of the optiTruck Global Optimizer that supervises the optimization on the cloud
On-board Optimizer	One component of the optiTruck Global Optimizer that supervises the optimization on the on-board system
Dashboard	Dashboard used to collect transport mission data from the fleet management company
Mission User Interface	Interface used to communicate with the driver

Acronyms

Acronym	Description
WP	Workpackage
D	Deliverable
UC	Use Case
SoA	State of the Art
MUI	Mission User Interface
HMI	Human Machine Interface
IE	Innovation Elements
ETA	Estimated Time of Arrival
UML	Unified Modelling Language

Publishable Executive Summary

Simulation system is required mainly for verification of the functions developed in OptiTruck project. The partners will need an integrated system to verify the software they develop. All the requirements of the simulation system are defined and listed in Deliverable 2.3. These requirements determine the capabilities of the simulation system. The simulation system architecture will be determined in detail in this deliverable which can give the possibility of realization of the simulation system specifications.

Firstly, overall simulation system requirements are stated in Section 2. On Table 1 and 2, the capabilities necessary for the simulation system are given in relation with the requirements for the MIL/SIL and HIL simulation systems. The architecture of the simulation system will be based on these capabilities. The simulation system to be formed in OptiTruck project will be basically on longitudinal model of a 40 T truck with all the related interfaces to simulate "Global Optimization System" with the capabilities described on Table 1 and 2.

For engine and transmission system simulations and related function estimators, main system is a combination of GT-Suite and Matlab/Simulink because of the stated reasons in Section 3.1. PTV xSERVER or HERE will be selected based on the cost and previous experience of the partners for 3-D Map data, traffic system simulation, weather, wind and other external data simulation, best route and velocity profile calculations as mentioned in Section 3.2. Another important requirement from the simulation system is the transport mission simulation and driver training. Route, number of tolls, load etc. can be simulated wity PTV xSERVER and visual driving, virtual driver and HMI can be simulated with TruckMaker. In Table 4, all related simulation software systems for different components and functions of the Global Optimization System are reviewed and possible selected tools are given. TruckMaker will only be used for driver training and surrounding vehicle simulation. The bus will be based on Matlab and C.

A high-level of representation of the vehicle simulation environment intended for use in control and calibration development and verification is given in Figure 2 in Section 4.1. The simulation system should be able to allow the developers to verify software developed on MIL/SIL and HIL environment. Each developer should have access to the relevant module and should be able to verify their software on the global optimization system. Modules and simulation architecture are shown in Figure 3 and 4.

HIL system requirements are specified in Section 4.2.1 and simplified HIL simulation environment layout for on-board control system can be found in Figure 5. The real HW units of the on-board control system that should be included in the HIL system are RCP, ECU, TCU and PCCM. The HIL simulation system should include HIL simulator unit with processing unit and I/O interface and GNSS simulator. The HIL simulation system should also include models of driver, engine, EAT, Cooling System, Auxiliaries, Transmission and Environment. The cloud system and Radar&Camera modules are to be simulated with generated signal inputs in the HIL simulation environment.

HIL system layout selected as dSpace Simulator to be used for the OptiTruck project is shown in Figure 6 and its specifications are given in Section 4.2.2.

The optiTruck MIL and SIL verification environment will consist of a number of subsystem models (e.g. engine, aftertreatment, transmission) developed and independently validated on different modelling platforms Matlab/Simulink® will be used as an integration platform for all of the resulting subsystem models. A common model structure that combines the vehicle subsystems will be used for MIL/SIL/HIL simulations, requiring the complete parametric vehicle model. A modular architecture will be developed where each subsystem model may involve different levels of complexity for use in different simulation scenarios and a hierarchical decomposition of the vehicle simulation environment as given in detail in Section 5.1.1.

The overall Global Optimization System components and the embedded software developed on the optiTruck project will be connected to the dSpace HIL system and the overall functioning of the system will be tested in line with the relevant use cases as investigated in Section 5.2.

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