ERASMO

OBU technical specifications for advanced driving success

GSA/GRANT/03/2018

The main objective of ERASMO is to develop an **innovative positioning On-Board-Unit (OBU)** that will enable fully automated driving. This OBU will integrate multi-constellation and multi-frequency GNSS signals, including the ones transmitted by the Galileo constellation, and combine information from the vehicle sensors and exteroceptive sensors, to provide an hybridised **high-accuracy solution** with Integrity estimations that will enable intelligent vehicle applications. The developed OBU will be integrated onto the test vehicles and validated. ERASMO project includes a demonstration and several dissemination activities.

The purpose of the OBU is to **provide accurate and reliable positioning information** that can be used for autonomous driving tasks and enhanced vehicle pose estimations (position and orientations) of a vehicle when operating in real-time. The system combines state-of-the-art technologies, on-time, continuous and precise information to the various functions within the AV software stack with which a localisation function interfaces. The approach also considers safety critical applications related to actuating Advanced Driving Assistance Systems (ADAS) that rely very much on position information.

This brochure aims at presenting operational, functional and performance requirements from the user perspective that will provide the framework for the design, implementation and testing of the GNSS hybridised localisation and integrity solution that is at the centre of the ERASMO project.

1 Operational design domain (ODD) where the localisation system is intended to be deployed

ODD defines when, where, and under what conditions an automated vehicle is designed to operate.

For the project ERASMO, the ODD classification used is an interpretation of the referred standards and different discussions as part of the ASV Project between Renault S.A., System-X and CETRAN-NTU.

The classification of the ODD components applied to the development of a localisation system for autonomous vehicle with ERASMO includes:

- Road Network Infrastructure
- Road Network Traffic Entities
- Environmental Factors
- Environment Connectivity

The ODD for ERASMO is centred on two sites: Saclay (in Essonne, France) close to the Renault's Technocentre and Compiègne (in Oise, France) close to the University of Technology of Compiègne (UTC).

2 Main functional and external interface requirements

The system shall meet the functional requirements (conditions) classified as:

- **Hardware Requirements;** for example the system shall run on an engine close to commercialization, with enough HW resources to meet the latency and logging requirements.
- **Software Requirements;** for example the EAPE (ERASMO Advanced Positioning Engin) shall operate in Real Time.
- **Stored Data Requirements;** for example the EAPE shall be able to store the input data from the different used sensors and GNSS receiver for debugging purposes.
- **Integration Requirement;** for example during integration tests the EAPE shall make it possible to visualize the operating state, and the availability of its sensors, as well as the estimates produced.

3 Summary of the defined operating conditions (Nominal, Coarse, Challenging and GNSS-denied) along with the target performance requirements

The list of target performance requirements applicable to the ERASMO Advanced Positioning Engine (EAPE) has been defined for the different operating conditions (Nominal, Coarse, Challenging and GNSS-denied), taking into account the available inputs, the user needs, the required safety and the areas where the system is to be used. The EAPE target performance requirements were mainly defined based on Renault's autonomous vehicle performances and also the employed Target Integrity Risk (TIR) values were set so the PL target performance requirements could be validated with the amount of data collected during the project.

4 How the performance requirements are tested and validated

The performance validation of the ERASMO Localisation System (ELS) will be executed thanks to an extensive data acquisition campaign. The dataset will cover all the use cases within all the driving conditions of interests. Data will be recorded on both sites at Compiègne and Saclay to demonstrate the robustness of the solution w.r.t. different locations. Two experimental Renault ZOE vehicles will be used to integrate the ELS, along with a ground truth solution, and will record data week for a period of at least one year.

To demonstrate the usability of the ELS in a real AD scenario, several demonstrations are planned at the end of the project: autonomous driving in a private test track, manual driving on open road, partial autonomy on open road.