ESCAPE: the preliminary design of the positioning engine is completed.

At the end of the first year of activities, the ESCAPE project team has consolidated the preliminary design of the "ESCAPE GNSS Engine", or "EGE". It is an innovative positioning engine intended for use as a critical positioning component in autonomous vehicles. Beyond the current state-of-the-art, the EGE will enable vehicles to navigate in high automation modes (SAE level 4) in various operational environments.

The design of the EGE prototype addresses several major components: the novel multi-frequency multi-constellation GNSS receiver chipset for automotive use, the hardware and software architectures, the algorithms for data fusion, positioning and integrity, as well as the safety analysis of all the elements of the positioning engine.

The project enters now in its second year, which foresees the release of the first EGE hardware samples and a sequence of three integration steps and tests distributed along the year. The second and final HW release is expected during the third year.

Robust and safe positioning

To navigate autonomously and safely, vehicles require perception systems that recognize, identify, classify and locate objects surrounding them. The more complex the navigation functions are, the more sensors will be needed to achieve the degree of robustness required to drive safely in complex traffic conditions. Thus, the need for GNSS-based absolute location estimates is a major requirement.

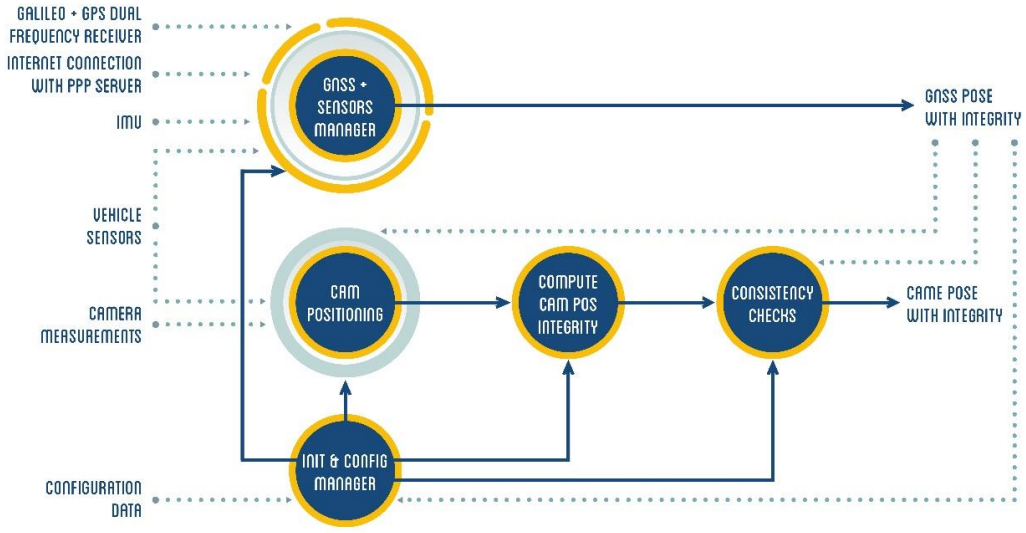
The positioning capability of the EGE is the result of a complex algorithm suite, whose foundation is the GNSS sensor. Its measurements are integrated with those of an inertial unit (IMU) to provide the baseline *Standard point positioning* function; a second level of positioning service is represented by the *Precise point positioning*, which exploits an Internet connection to a remote server to get sets of precise corrections for the GNSS measurements. Furthermore, *a camera-based positioning* function, enabled by the processing of High Definition maps with lane markings and merged with other vehicle sensors, offers a third level of positioning service, which complements and enhances the previous ones to reach the maximum possible accuracy.

Each position estimate, whatever service is used to compute it, is provided with a *protection level*, which is the measure of the incertitude (integrity) associable to the current estimate. In this way, different Autonomous Driving capabilities can be dynamically enabled, depending on their integrity and protection level requirements.

The EGE architecture

The whole architecture of the EGE hardware has been conceived following the most recent practices in the design of automotive electronic control units, so that all the interfaces, configurations and form factors will result compliant with widely recognized sector trends.

The software suite is hosted in a multi-processor System-On-Chip, chosen to guarantee the availability of the necessary computational resources at a competitive cost.



The GNSS receiver

The main distinguish feature of the automotive-grade GNSS receiver designed within ESCAPE is its capability of processing at the same time signals from two different GNSS bands and from different satellite constellations. Although this capability is common in high-end professional receivers, it represents a cutting-edge industrial development in the automotive Tier-2 panorama, where it conjugates highly demanding safety requirements to high-volumes and comparatively limited costs and sizes.

Furthermore, the receiver is the first-of-a-kind device on its segment that supports the new Navigation Message Authentication (NMA) service of Galileo, the additional anti-spoofing service offered by Galileo on the open E1 signal starting from 2018.

Finally, the new GNSS receiver comes with several core signal-processing enhancements: better receiver sensitivity and tracking capability, multipath mitigation, more IF channels and flexibility in routing IF samples, jamming detection and mitigation, optimization of the GNSS data flow.

The result is an ESCAPE GNSS sensor capable of integrating in a unique device a high-end GNSS technology traditionally reserved for professional applications, the innovation represented by the dual-band Galileo processing, as well as all the hardware and software safety aspects that are needed to certify the component for the automotive market.

For further information, please visit: www.gnss-escape.eu or contact the Project Coordinator:

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