Title:
Advanced Integrity Concept as one Step Further in GNSS-based Positioning for Autonomous Driving

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GNSS Augmentation and Robustness for Autonomous Navigation - VIRTUAL ONLY

Abstract Text:
The key role of GNSS in autonomous driving applications (ADAS) is incontestable nowadays. Nevertheless, there are a number of factors that are very likely to make this role evolve for the future generations of autonomous cars. First of all, the race to increase the level of autonomy in the relatively short term in comparison with the classical technological cycles in other domains, such as aviation, leads to ever more demanding requirements in terms of accuracy and robustness. In contrast, the availability of more information coming from different sources (sensors, signals, services…) allows the implementation of more advanced solutions. Also, in the automotive sector, many of the new key features are moving from the purely mechanical and HW parts to complex SW systems embedded in powerful ECUs (Electronic Control Units). This fact, together with the objective of optimising the cost per value, makes the “GNSS for ADAS equation” even more exciting to resolve. At the same time, its solution appears quite promising.
This paper will analyse the main challenges that the future positioning solutions for ADAS need to address in the upcoming framework. It will also discuss the role that the different actors may have in these solutions. GNSS positioning techniques such as Precise Point Positioning (PPP), in combination with regional augmentation data, offer high accuracy and fast convergence. There also already exist integrity algorithms that provide the necessary safety layer for PPP. Besides, hybridisation with inertial sensors ensures a fair level of performance during dead-reckoning. Security and safety mechanisms have to be put in place against threats such as jamming or multipath. And all these aspects must be considered while keeping in mind the target environment and the different driving conditions (open-sky versus urban, low versus high speed, etc.).
And what else? New signals such as GPS L5 or BeiDou-3, new planned services like the Galileo HAS (High-Accuracy Service) or the Australian SBAS-PPP, new broadcast channels like the E5b signal of future SBAS systems/evolutions or 5G positioning, hybridisation with more sensors or additional information (HDmaps, road landmarks, visual odometry, etc.), techniques such as machine learning or SLAM (Simultaneous Localization and Mapping).
The key question is how to put all these capabilities together to build the most accurate and reliable positioning solution. The main objective of this paper will be to review all available technologies and their main functionalities and performance in order to achieve this goal. It will also describe the basis of a safety case that combines GNSS with other technologies and that is compatible with the demanding integrity requirements for autonomous driving applications

Description of new and innovative aspects of the presentation:
This paper will present the challenges to be tackled for the next generation of autonomous driving functions and potential solutions for the target systems.