DEM Embedding in GNSS-Based Navigation Using a Statistical Modeling [†]

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Abstract: Given the boom linked to smart mobility, transport systems require increasingly precise and relevant navigation applications to offer optimized journeys in terms of time and energy consumption, such as for HEV. Most of these navigation applications are based on the processing of 2D digital road maps while taking into account the GNSS location of vehicles. These localization systems also integrate sensors such as accelerometers and gyroscopes to overcome the well-known problems of GPS positioning even if the current limited introduction of IoT in the transport industry has made it possible to develop new aided-GPS method such as geofencing. This paper focuses on one important parameter in journey optimization of land vehicles: the road slope. We propose a method to estimate the roads inclination parameters by fusing GNSS, INS, OSM and ASTER GDEM data through a nonlinear filter. The incremental estimate of the slope will complement the 2D modeling of the roads already available in OpenStreetMap and could be used in route planning optimization. The scientific novelty lies more specifically in the statistical map-matching approaches that we develop both for OSM and DEM data. Estimation results of the roads slopes are shown in experimental conditions.

Keywords: intelligent transportation; GNSS-based navigation; digital roadmap and elevation models; nonlinear filtering; multi-sensor fusion