

Assessment of a Road Roughness Crowd-Sensing with Smartphone Apps Solution

Maxime Jean, Alexandre Chasse and William Beng

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Safety has a major impact on the adoption rate of bicycle as a daily means of transportation. Among other features, road roughness is a key factor characterizing road hazardousness. Maintaining an attractive infrastructure for the cyclists with a given budget dedicated by local authorities requires a suitable roadwork prioritization. An efficient scheduling of the roadwork needs an accurate monitoring of the degradation of the infrastructure. In order to assist road authorities in their decision making, an integrated road roughness monitoring system has been designed by IFPEN (M. Jean, A. Chasse and W. Beng, "Road Roughness Crowd-Sensing with Smartphone Apps" 2019 IEEE Intelligent Transportation Systems Conference (ITSC), Auckland, New Zealand, 2019, pp. 1079-1084.).

It relies on low-quality data collected from the smartphones of a community of cyclists. It includes the preprocessing during each bicycle ride of the accelerometer measurements on the different smartphones belonging to the users of the community, the data communication through the cloud, and the post-processing on a central server ensuring the data reconciliation. The global system extracts information from diverse and uncalibrated smartphones, unknown measurement protocols and limited data transfers. The output of the system is a map representation of the road roughness. A first proof of concept has been tested through the App of our partner Geovelo, in the city of Paris, between September 2018 and March 2019. Early estimates of the road roughness were consistent with the subjective knowledge of a few road users. However, the amount of data collected has greatly increased since, offering more rigorous assessments of the proposed estimates.

Three different metrics are proposed. Firstly, the comparison between the road roughness estimates computed from disjoint sets of cyclists, over the same period of time, will give an insight on the repeatability of the output. Secondly, the evolution over time of the road roughness estimates of single roads will be analyzed. Thirdly, the comparison with exogenous databases will be discussed, such as voluntary statements made by cyclists on dedicated web platforms.

This paper will point out with those three metrics the strength and limitations of the Road Roughness Crowd-Sensing with Smartphone Apps solution.