Enhancing Cooperative Localization by Exploiting Human-Induced Effects on RSS-based Ranging Measurements

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ABSTRACT

In this paper we present experimental evaluations of human-induced perturbations on Received Signal Strength (RSS)-based ranging measurements for cooperative mobile positioning. Cooperative mobile positioning is deeply rooted in the exploitation of the most likely reliable short-range RSS measurements coming from neighbouring devices, estimation of the distances among them (ranging), and processing data-fusion using non-linear filtering, enhancing indeed the final position estimation with respect to conventional non-cooperative schemes. However, a plethora of simplistic approaches, optimistic assumptions and unrealistic reference cases represent a common practice in many studies proposed in literature, showing exceptional but questionable performances. At this purpose, we demonstrate that human-induced errors cannot be ignored when performing experimental activities, showing that hand-grip and body-loss effects highly compromise even the basis of cooperative schemes, corrupting the expected enhanced performances. The recent fervor on the iPhone 4 antenna-gate has contributed to surface in layman terms to the general public how important is the influence of the hand, due to the close proximity, showing an impact greater than the rest of the body. In this paper, the authors experimentally demonstrate that although the effects of hand-grip and body-loss generate systematic errors, if correctly accounted and cognitively exploited, rather than roughly discarded or mitigated, it is possible to enhance the effect of the cooperation among devices in terms of positioning accuracy. To the best of our knowledge this work is the first attempt to gain insight and understand the impact of both body-loss and hand-grip on the RSS for enhancing ranging measurements among neighbouring devices in cooperative scenarios. Our main contribution is represented by experimental investigations on ranging estimations among neighbours, analysis of the errors introduced in the distance estimation using path-loss based methods and exploitation of human-induced perturbations for enhancing the final positioning accuracy of cooperative schemes.

KEYWORDS: Received Signal Strength, WLAN, Cooperative Positioning, Hand-grip.