Passive Localization Through Channel Estimation of On-the-Air LTE Signals

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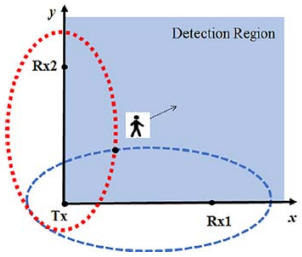

The passive localization model. The delay difference between the direct path and the dynamic reflection path will determine an ellipse, and the crossover point of two ell... View more

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Abstract:
Wireless communication signal is a kind of coherent illuminator, and it can shed light on surrounding environments. The mobile terminal receives the signal and estimate the propagation channel, and can sense the moving objects passively. The localization module and communication module share the RF front-end and baseband processing, and thus greatly reduce the implementation cost in mobile terminals. Passive localization is based on the delay estimation of the dynamic reflection path. However, several practical factors prohibit the accurate estimation of the propagation delays. The multipath reflection and scattering are abundant in urban and indoor environments, and the signal bandwidth is usually not large enough to reach a fine delay resolution. The synchronization error, sampling clock drift, frequency offset and phase noise will severely impact the estimation performance. In this article, we propose a set of methods to make the practical application of this method possible. We also derive the Cramer-Rao lower bound of the delay estimation, and analyze the estimation error related with various impact factors. A prototype system is built to test the performance in real environments, and various experiments have been done to verify its feasibility. We believe that the fusion of wireless communication and sensing is a