

ABSTRACT

This work analyzes network based positioning methods, in particular the fingerprinting or database correlation methods. Network based methods do not require mobile station upgrading or replacement, thereby being capable of locating legacy mobile stations, i.e., without any specific positioning related features. This characteristic, coupled with the high availability and precision of fingerprinting methods, make them viable candidates for several location based applications, especially for the positioning of cellular mobile phones originating emergency calls - for police, fire brigade, etc. Two techniques to reduce the average positioning fix time are proposed: deterministic filtering and genetic algorithms optimized search. A modification is proposed in database correlation methods evaluation functions, by inserting a factor representing the inherent inaccuracy in the signal strength measurement made by the mobile station. The proposed improvements are experimentally evaluated in second and third generation cellular networks in urban and suburban environments, as well as in indoor wireless local area networks. The viability of using correlation databases built from propagation modeling is evaluated, as well as the effect of empirical propagation models calibration in the fingerprinting location precision. One of the proposed fingerprinting techniques, using a calibrated correlation database, achieved a performance superior to several other published fingerprinting methods, reaching in an urban area the precision requirements set by the Federal Communications Commission for network based methods providing the Enhanced 911 emergency location service.

Keywords: Network based location methods. Radio-frequency fingerprints. Correlation database. Deterministic filtering. Correlation space. Mobile station.