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A multisensor LBS using SIFT-based 3D models

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ABSTRACT

This paper introduces an LBS multisensor system that acquires data from different sensors available in commodity smartphones to build accurate location-based services. We provide several solutions to reduce the deployment cost, in terms of time, and to minimise the interference degree within the environment, but also pursuing a good balance between accuracy and performance. Our approach is based on the use of visual structure from motion techniques to run off-line 3D reconstructions of the environment, based on 3D points obtained from the correspondences among SIFT descriptors extracted from images used at the reconstruction process. To determine the position of the smartphones, we first obtain a coarse-grained estimation based on RSSIs and built-in accelerometers, making use of fingerprinting methods, probabilistic techniques, and motion estimators. Then, using images captured by the camera, we perform a matching process to determine correspondences between 2D pixels and model 3D points, but only analysing a subset of the 3D model delimited by the coarse-grained estimation. We implement a resection process providing high localisation accuracy when the camera has been previously calibrated, that is, we know intrinsic parameters like focal length, but it is also accurate if an auto-calibration process is required. Our multisensor approach facilitates the deployment, increasing the scalability and extensibility of LBSs. Furthermore, our experimental tests show promising results, since we are able to provide high accuracy with an average error down to 30 centimetres, making this proposal suitable for those applications combining location-services and augmented reality.

KEYWORDS: Image processing, multisensor, SIFT, training, smartphones.