

[Volume XL-5](#)

Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-5, 237-242, 2014
www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XL-5/237/2014/
doi: 10.5194/isprsarchives-XL-5-237-2014

Development of a self-localization method using sensors on mobile devices

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Keywords: Sensor Fusion, Self-Localization, Mobile Devices, Augmented Reality, Visualization, Navigation

Abstract. Recently, development of high performance CPU, cameras and other sensors on mobile devices have been used for wide variety of applications. Most of the applications require self-localization of the mobile device. Since the self-localization is based on GPS, gyro sensor, acceleration meter and magnetic field sensor (called as POS) of low accuracy, the applications are limited. On the other hand, self-localization method using images have been developed, and the accuracy of the method is increasing. This paper develops the self-localization method using sensors, such as POS and cameras, on mobile devices simultaneously. The proposed method mainly consists of two parts: one is the accuracy improvement of POS data in itself by POS sensor fusion based on filtering theory, and another is development of self-localization method by integrating POS and camera. The proposed method combines all POS data by using Kalman filter in order to improve the accuracy of exterior orientation factors. The exterior orientation factors based on POS sensor fusion are used as initial value of ones in image-based self-localization method. The image-based self-localization method consists of feature points extraction/tracking, coordinates estimation of the feature points, and orientation factors updates of the mobile device. The proposed method is applied to POS data and images taken in urban area. Through experiments with real data, the accuracy improvement by POS sensor fusion is confirmed. The proposed self-localization method with POS and camera make the accuracy more sophisticated by comparing with only POS sensor fusion.

[Conference Paper](#) (PDF, 1202 KB)

Citation: Fuse, T. and Matsumoto, K.: Development of a self-localization method using sensors on mobile devices, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-5, 237-242, doi:10.5194/isprsarchives-XL-5-237-2014, 2014.

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