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THE PERFORMANCE OF A TIGHT INS/GNSS/PHOTOGRAMMETRIC INTEGRATION SCHEME FOR LAND BASED MMS APPLICATIONS IN GNSS DENIED ENVIRONMENTS

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Abstract. Nowadays the most common technologies used for positioning and orientation of a mobile mapping system include using Global Navigation Satellite System (GNSS) as a major positioning sensor and Inertial Navigation System (INS) as the major orientation sensor. The integration strategy of the most commercially system is the loosely coupled (LC) architecture, that has the simplest architecture using the GNSS solutions to aid the INS navigation information with proper optimization estimator. The LC does combine the two sensors ' solutions when the number of tracked satellite is more than four. In recent year, another commonly integration strategy is known as tightly coupled (TC) architecture. Because the TC uses the GNSS measurements to aid INS, it can integrate measurements provided by GNSS receiver and INS unless no GNSS satellite is tracked. Obviously, the TC architecture is a better candidate for land based mobile mapping applications than LC in Taiwan. Unfortunately, there are still many GNSS denied environment in the urban area, therefore the TC architecture is still not robust and stable enough for MMS application. The overall objective of this paper is to provide a scheme that tightly integrates INS/GNSS and Photogrammetric for land based MMS applications with sufficient and stable POS solutions during GNSS outages. In the traditional photogrammetry operation, numerous ground control points are applied to compute those Exterior Orientation Parameters (EOPs) of cameras by bundle adjustment. The key opinion is to derive the INS centre position and attitude and reconstruct 3-D tracking and 3-D object space by cameras EOPs. The proposed algorithm is verified using field test data collected in GNSS denied environments and the preliminary results presented in this study illustrated that the proposed algorithm is able to provide 60% improvement in terms of positioning and orientation accuracy in Taipei and Tainan cities.

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