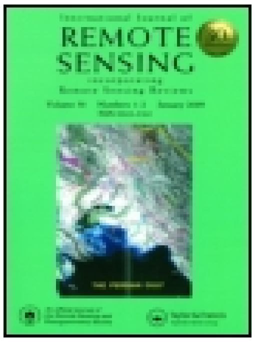

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Generation of accurate digital elevation models from UAV acquired low percentage overlapping images

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Generation of accurate digital elevation models from UAV acquired low percentage overlapping images

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ABSTRACT

Digital elevation models (DEMs) are very useful in solving various environmental problems such as planning and construction, hydrological and meteorological services, mining and oil industry, risk assessment, and hazard predictions, which makes their accurate production very essential. Attempt has been made in this research to investigate the robustness of DEMs produced from unmanned aerial vehicle sourced images with approximately 15–20% overlap. At 50 m altitude (flying height), over 90 overlapping images were acquired using a DJI Phantom quadcopter, and they were processed using Agisoft PhotoScan Digital Photogrammetric Software. The products generated are the three-dimensional model, dense point cloud, mesh surface, wired frame, orthomosaic, and the DEM. In order to ascertain the accuracy of the produced DEM, coordinates of selected points across the imaging area were extracted from the generated DEM. These coordinates were compared with those obtained using Hi-target differential global positioning system receiver. Using the National Standard for Spatial Data Accuracy, the derived horizontal and vertical accuracies are 0.0467 and 0.1151 m, respectively.

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1. Introduction

Digital elevation models (DEMs) contain the elevation of a point on a surface above the mean sea level. DEMs are sometimes referred to as digital terrain model (DTM), or digital surface model (DSM) (Poon *et al.*, 2005). At different scales, various technologies were used in acquiring elevation data for the creation of DEMs. Elevation data was once only gotten through land surveying methods (Gao, 2007), but with remote-sensing technology, elevation data can be acquired at a very quick and rapid pace, thereby saving time and resources at the same time ensuring the sustenance of accuracy integrity. Remote-sensing methods have provided elevation information for difficult, inaccessible and hard to survey areas (d'Ozouville *et al.*, 2008). Present aerial and remote-sensing imagery obtained via digital cameras, radar

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