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Title : Three Dimensional Building Reconstruction Based on Airborne LiDAR, Aerial Photogrammetry and Topographic Datasets

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3D building model of man-made objects supports a diversity of applications such as urban planning, flood mapping and telecommunication. At present, a total automation towards the construction of a detailed and accurate 3D city model is not possible. In order to reduce the time of constructing the 3D building models, an integration of reliable dataset is explored. In mapping technologies, sophisticated sensor has been developed to serve the mapping community. Airborne LiDAR (Light Detection and Ranging) technology has changed the conventional method of topographic mapping, and the increasing interest of these valued datasets for the construction of 3D building models is an active research agenda. Airborne LiDAR provides three dimensional (3D) information of the earth surface with high accuracy point clouds. In this study, the capability of remotely sensed data for the reconstruction of 3D building models is explored, namely; LiDAR dataset, aerial images, digital topographic information and terrestrial photographic images. The study area comprised of residential buildings situated in Putrajaya within the Klang Valley region, Malaysia, covering an area of two square kilometers. The process of the reconstruction 3D building model includes integration of LiDAR dataset, aerial photo, digital topographic information and low cost terrestrial images couple with processing software namely the ArcGIS and SketchUp. Valuable building parameters are extracted based on automated retrieval from the normalized Digital Surface Model (nDSM) as a result from LiDAR DSM and LiDAR Digital Terrain Model (DTM) separation. Orthophotos are used as backdrop

and generated using digital aerial photographs based on photogrammetric technique and height information from the derived digital models. The Root Mean Square Error (*RMSE*) of the vertical component (*RMSE_z*) for the derived (DSM and DTM) for LiDAR dataset are $\pm 0.15\text{m}$ and $\pm 0.14\text{m}$ respectively. As for the digital photogrammetric models, the *RMSE_z* for the photogrammetric DSM and DTM are $\pm 0.68\text{m}$ and $\pm 0.52\text{m}$ respectively. Accuracy of the topographic DTM is assessed and found to be $\pm 2.49\text{m}$. It should be pointed out that, the nobility of the study include, assessment of LiDAR dataset and the determination of building footprint. The best accuracy utilizing various digital models for the constructed orthophotos to act as the backdrop for the 3D urban model was found to be $\pm 0.37\text{m}$ using DTM LiDAR. The final 3D building models constructed were assessed having an accuracy of $\pm 0.94\text{m}$ and $\pm 0.61\text{m}$ for the vertical and horizontal component (*RMSE_z* and *RMSE_{x,y}*) respectively. Based on the qualitative assessment, the constructed 3D building models were found to be adequate in supporting the LOD3 (Level of Detail of Level 3) applications. In this study, an automatic evaluation of LiDAR dataset is highlight and automated determination of building footprint is proposed. Evaluation of all dataset in used as well as the accuracy of the 3D building models were critically assessed and found that the integration of remotely sensed dataset and terrestrial images were of high value for 3D building model reconstruction.