

Improved Mapping Solution Using Terrestrial Laser Scanners and Low-Cost UAV Images

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SUMMARY

This paper provides an improved mapping solution through the fusion of terrestrial laser scanner point cloud data and low-cost unmanned aerial vehicles (UAV) images. The terrestrial laser scanner (TLS) data are collected with the FARO Focus S scanner in different setups and resolutions, while the UAV images are captured with low-cost DJI phantom 4 pro UAV. A number of ground control points and object targets, whose precise coordinates are determined using virtual reference stations (VRS) GPS, are used to enhance the image acquisition and registration. In addition, a number of targets are established throughout the scanned structure, which are precisely positioned using both of GPS and traditional surveying techniques. Such targets are used to enhance the accuracy of point cloud registration. Photoscan (Agisoft Inc.) and Autodesk ReCap Pro software packages are used to verify the image registration, along with MATLAB and CloudCompare software. Both of the laser scanner's point cloud and the UAV images are used to create a 3D model of the scanned structure and surroundings. It is shown that combining different sensor data enables detailed information about the area/objects of interest. In addition, multi-sensor data fusion produced a complete 3D mapping solution, which has no gaps or missing objects.