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MEASUREMENT OF LARGE-SCALE SOLAR POWER PLANT BY USING IMAGES ACQUIRED BY NON-METRIC DIGITAL CAMERA ON BOARD UAV

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Abstract. This paper reports an experiment conducted in order to investigate the feasibility of the deformation measurement of a large-scale solar power plant on reclaimed land by using images acquired by a non-metric digital camera on board a micro unmanned aerial vehicle (UAV). It is required that a root mean squares of errors (RMSE) in height measurement should be less than 26 mm that is 1/3 of the critical limit of deformation of 78 mm off the plane of a solar panel. Images utilized in the experiment have been obtained by an Olympus PEN E-P2 digital camera on board a Microdrones md4-1000 quadrocopter. The planned forward and side overlap ratios of vertical image acquisition have been 60 % and 60 % respectively. The planned flying height of the UAV has been 20 m above the ground level and the ground resolution of an image is approximately 5.0 mm by 5.0 mm. 8 control points around the experiment area are utilized for orientation. Measurement results are evaluated by the space coordinates of 220 check points which are corner points of 55 solar panels selected from 1768 solar panels in the experiment area. Two teams engage in the experiment. One carries out orientation and measurement by using 171 images following the procedure of conventional aerial photogrammetry, and the other executes those by using 126 images in the manner of close range photogrammetry. The former fails to satisfy the required accuracy, while the RMSE in height measurement by the latter is 8.7 mm that satisfies the required accuracy. From the experiment results, we conclude that the deformation measurement of a large-scale solar power plant on reclaimed land by using images acquired by a nonmetric digital camera on board a micro UAV would be feasible if points utilized in orientation and measurement have a sufficient number of bundles in good geometry and self-calibration in orientation is carried out.

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