World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:12, No:05, 2018

Accuracy of Autonomy Navigation of Unmanned Aircraft Systems through Imagery

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Abstract : The Unmanned Aircraft Systems (UAS) usually navigate through the Global Navigation Satellite System (GNSS) associated with an Inertial Navigation System (INS). However, GNSS can have its accuracy degraded at any time or even turn off the signal of GNSS. In addition, there is the possibility of malicious interferences, known as jamming. Therefore, the image navigation system can solve the autonomy problem, because if the GNSS is disabled or degraded, the image navigation system would continue to provide coordinate information for the INS, allowing the autonomy of the system. This work aims to evaluate the accuracy of the positioning though photogrammetry concepts. The methodology uses orthophotos and Digital Surface Models (DSM) as a reference to represent the object space and photograph obtained during the flight to represent the image space. For the calculation of the coordinates of the perspective center and camera attitudes, it is necessary to know the coordinates of homologous points in the object space (orthophoto coordinates and DSM altitude) and image space (column and line of the photograph). So if it is possible to automatically identify in real time the homologous points the coordinates and attitudes can be calculated whit their respective accuracies. With the methodology applied in this work, it is possible to verify maximum errors in the order of 0.5 m in the positioning and 0.6º in the attitude of the camera, so the navigation through the image can reach values equal to or higher than the GNSS receivers without differential correction. Therefore, navigating through the image is a good alternative to enable autonomous navigation.

Keywords : autonomy, navigation, security, photogrammetry, remote sensing, spatial resection, UAS
Conference Title : ICUAS 2018 : International Conference on Unmanned Aircraft Systems
Conference Location : Amsterdam, Netherlands
Conference Dates : May 10-11, 2018