Abstract

METHODOLOGY OF DEVELOPMENT OF DATA OBTAINED FROM LOW ALTITUDE FOR THE PURPOSES OF DETECTION AND CLASSIFICATION OF A SELECTED GROUP OF AVIATION OBTACLES

The dissertation focuses on the problem of detection and classification of aviation obstacles in the close vicinity of the airport. Particular attention was paid to the difficulty of correctly detecting small aerial obstacles of slender and elongated shape. Although there are recommendations for aviation obstacle data collection techniques, data processing algorithms are still being developed for the automatic detection of atypical aviation obstacles, which include objects with a slender and elongated shape. To capture such objects, the image scale should be larger than in traditional photogrammetric flights, which is provided by image data from a low altitude (from the altitude of the UAV). The lower flight altitude of the UAV guarantees a much larger image scale than in aerial photography, and thus the possibility of greater data acquisition accuracy. The main research problem presented in this dissertation is: what algorithm for processing data acquired from the low altitude should be used to detect and classify atypical aviation obstacles in accordance with the accuracy requirements of EUROCONTROL and ICAO documents? The development of data processing methods for the collection of aviation obstacle data was adopted as the main objective of the research, including: the development of a method for adjustemnt a single-row block of images acquired from a low altitude for inaccessible areas, the development of a method for increasing the positioning accuracy of unmanned aerial vehicles and, as a result, photogrammetric products, and the development of a method for automatic detection and classification of atypical aviaton obstacles on the basis of dense point clouds and images acquired from a low altitude. As part of the solution to the research problem, a proprietary algorithm was developed for processing data acquired from the low altitude for the collection of aviation obstacle data, in accordance with the accuracy requirements specified by EUROCONTROL and ICAO documents. The research goal was achieved by: the use of tie points in the adjustment process of a single-strip block of images, based on a modified linear regression method; the application of the SPP method algorithm taking into account IGS products for increasing the positioning accuracy of a UAV equipped with a single-frequency GPS receiver; and by introducing algorithms for automatic detection and classification of atypical aviation obstacles using dense point clouds and images acquired from a low altitude. Based on the results obtained, it was found that the developed methodology allowed the detection of aviation obstacles with maximum differences between

the obtained coordinates (X, Y, Z) and the reference coordinates of 0.05 m for elongated-shaped obstacles and 0.7 m for slender-shaped obstacles. The obtained results conform to the accuracy requirements.

Key words: aviation obstacles, aerotriangulation, SPP coded positioning method, detection, classification, point cloud, UAV