A DJI Phantom 4 drone was used in this work. Phantom IV is a system composed of a drone (UAV) and a mobile RTK station and is suitable for aerial photography and aerial filming activities suitable for data processing in order to obtain orthophotoplanes, point clouds or 3D modeling.

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METHODS FOR GENERATING THE DIGITAL TERRAIN MODEL, DIGITAL SURFACE MODEL AND ORTHOMOSAIC USING UAV AND GNSS TECHNOLOGY

Bianca GHERGA, George POPESCU, Mihai Valentin HERBEI

Abstract: *The purpose of this article is to accomplish a Digital Terrain Model, Digital Surface Model and an orthophotoplan - orthomosaic of an area within the Didactic and Experimental Resort of BUASVM Timisoara based on geomatic technologies. The interest for UAVs has been constantly growing, researchers and developers use a lot of resources and efforts to contribute to this topic, especially in applications of geomatics in various fields such as: agricultural and forestry, autonomous surveillance, emergency and disaster management, traffic management and 3D mapping with photogrammetry.*

• Introduction

The purpose of this article is to accomplish a Digital Terrain Model, Digital Surface Model and an orthophotoplan - orthomosaic of an area within the Didactic and Experimental Resort of BUASVM Timisoara based on geomatic technologies. The interest for UAVs has been constantly growing, researchers and developers use a lot of resources and efforts to contribute to this topic, especially in applications of geomatics in various fields such as: agricultural and forestry, autonomous surveillance, emergency and disaster management, traffic management and 3D mapping with photogrammetry.

• Material and method

Drones, also called UAVs (unmanned aerial vehicles) or UASs (unmanned aerial vehicles), are unmanned aircraft on board. The flight path can vary in some degree of autonomy, fully or partially automatically by on-board computers or remotely controlled by a ground pilot. UAVs are programmed to cover a certain area of interest at a set altitude. At a preset time, photos are taken. These photos must overlap (Figure 1) enough to create a perfect image compiled from the image collage. The amount of overlaps can vary from 60-90%.

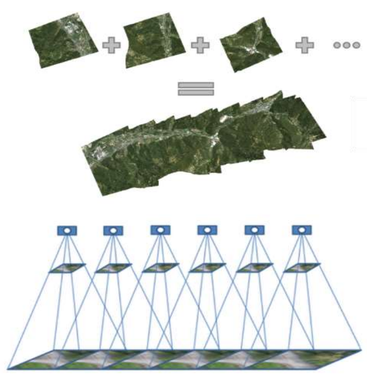

Figure 1. Example of overlapping images taken with a UAV system

GPCs are collected with high-precision GPS. The points are then imported into the image processing software. After the control points are collected and the ariel photo is entered into the system, the points are manually selected from several photos to obtain high-precision results.
The process of using stereophotogrammetry for mosaic images also creates a cloud of 3D dots and a digital surface model (DSM).
If the vegetation is absent, the values in the DSM will be equivalent to the ground elevation and you will actually have a digital terrain model (DTM) (Figure 4).

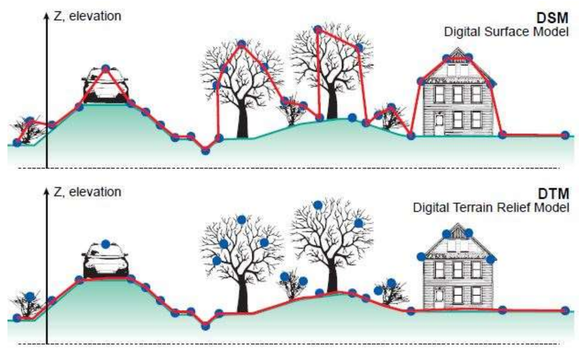

Figure 4. DSM vs DTM (www.charim.net)

• Results and discussions

A DJI Phantom 4 drone was used in this work. Phantom IV is a system composed of a drone (UAV) and a mobile RTK station and is suitable for aerial photography and aerial filming activities suitable for data processing in order to obtain ortophotoplanes, point clouds or 3D modeling.
In order to purchase images from the field with UAV technology, the Pix4D application and a mobile tool Android OS (STULEANEC AND HERBEI, 2018) were used, which allowed the realization of the flight plan to aquire the images from the desired location.
The workflow for data acquisition and processing is shown in Figure 5.

Figure 5.Data acquisition and processing using the Pix4D application.

The point cloud classification is useful for generating the digital DTM terrain model. Each point is automatically classified into one of the following predefined groups: Soil, Road surface, Vegetation, Building, Man-mode object.

Figure 18. The Orthomosaic of Study Area

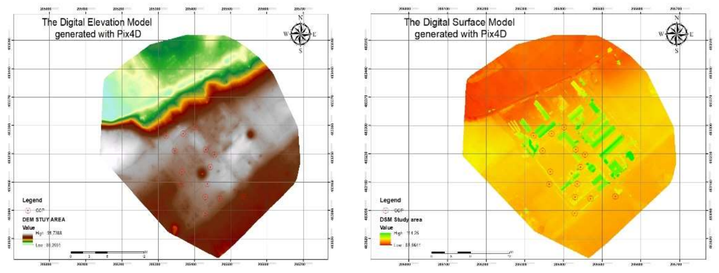

Figure 19. The DTM and DSM of Study Area

• Conclusions

This research wants to analyse the use of images taken by UAV platforms and their processing based on GCP's measured with GNSS technology, in order to make a digital terrain model DTM, a digital surface models DSM and an orthomosaic, with high precision and using specialized software.