Automatic georeferencing of a UAV carried small format camera

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A fundamental task in any Earth remote sensing application is the georeferencing of the imagery. In this presentation, we establish a georeferencing approach developed for the Finnish Geodetic Institute's (FGI) UAV-imaging system consisting of a quadrocopter type Microdrone md4-200 UAV and a Ricoh GR Digital II low-cost RGB compact camera. The use of different types of unmanned airborne vehicle (UAV) based airborne imaging systems are rapidly increasing in various applications. The characteristics to the FGI's system is high flexibility; it can be operated from different flying heights (1-100 m), with various flying speeds (also in stop-and-go mode), in different orientations (nadir and oblique imagery), in different temperatures (summer to winter), and in different conditions. Because of the flexibility, the system is usable in a wide variety of applications, e.g. snow monitoring, building modelling, forestry, agriculture and bidirectional reflectance factor measurement.

The georeferencing process has been realized in the FGI's photogrammetric software environment. The backbone of the environment is the BAE Systems Socet Set software, which has been extended with various commercial and in-house developed components. The steps of the georeferencing process are: 1) determination of approximate orientations, 2) refinement of the approximate orientations using automatic tie point measurement and self-calibrating bundle block adjustment, 3) measurement of an object surface model and 4) production of georeferenced image products, such as orthophotos, photorealistic surface models, and stereo models (Figure 1).

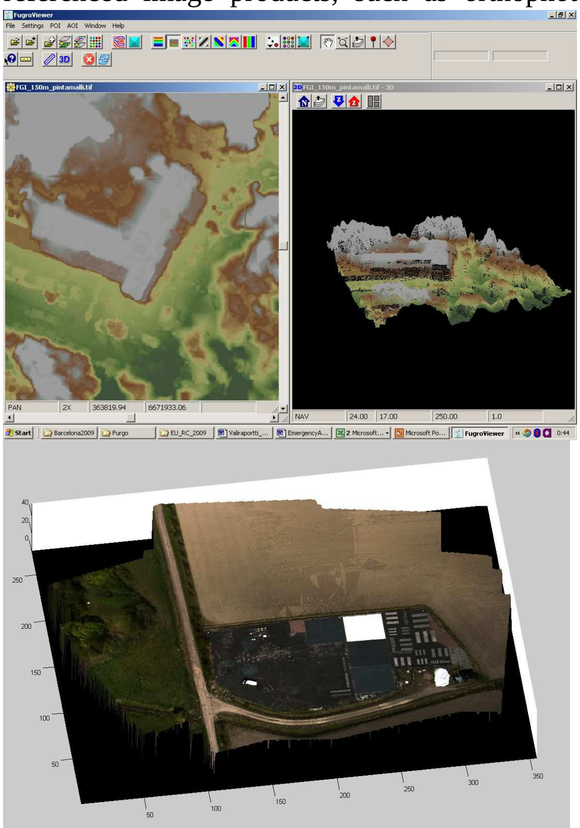

Figure 1. a) A 3D surface model of the FGI main building produced from Microdrone/Ricoh imagery using photogrammetric techniques. b) A photorealistic surface model from the Sjökulla test field.

There are system, object and condition dependent challenges in the georeferencing process, which required tailoring of standard commercial software environment. The system dependent challenges include the poor quality of the approximate orientation information and the large geometric distortions of the images. Examples of the object dependent challenges are the perspective problems with 3D objects and the poor texture in snow monitoring applications. The rapid orientation changes caused by gusts of wind and poor illumination are significant condition dependent challenges. The level of automation of the georeferencing process varies from completely automated to different levels of semi-automated, depending on the complexity of the task. High georeferencing accuracy can be obtained from the imagery.

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