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Lightweight Hyperspectral Mapping System and a Novel Photogrammetric Processing Chain for UAV-based Sensing

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We have developed a lightweight Hyperspectral Mapping System (HYMSY) and a novel processing chain for UAV based mapping. The HYMSY consists of a custom pushbroom spectrometer (range 450–950nm, FWHM 9nm, ∼20 lines/s, 328 pixels/line), a consumer camera (collecting 16MPix raw image every 2 seconds), a GPS-Inertia Navigation System (GPS-INS), and synchronization and data storage units. The weight of the system at take-off is 2.0kg allowing us to mount it on a relatively small octocopter.
The novel processing chain exploits photogrammetry in the georectification process of the hyperspectral data. At first stage the photos are processed in a photogrammetric software producing a high-resolution RGB orthomosaic, a Digital Surface Model (DSM), and photogrammetric UAV/camera position and attitude at the moment of each photo. These photogrammetric camera positions are then used to enhance the internal accuracy of GPS-INS data. These enhanced GPS-INS data are then used to project the hyperspectral data over the photogrammetric DSM, producing a georectified end product. The presented photogrammetric processing chain allows fully automated georectification of hyperspectral data using a compact GPS-INS unit while still producingin UAV use higher georeferencing accuracy than would be possible using the traditional processing method.
During 2013, we have operated HYMSY on 150+ octocopter flights at 60+ sites or days. On typical flight we have produced for a 2–10ha area: a RGB orthoimagemosaic at 1–5cm resolution, a DSM in 5–10cm resolution, and hyperspectral datacube at 10-50cm resolution. The targets have mostly consisted of vegetated targets including potatoes, wheat, sugar beets, onions, tulips, coral reefs, and heathlands,. In this poster we present the Hyperspectral Mapping System and the photogrammetric processing chain with some of our first mapping results.