EduServ 14
Distance e-Learning Courses
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RPAS in land survey – theory and practice

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Target audience: PhD and Master students involved in geomatics and photogrammetry, staff from national mapping agencies, public authorities and third parties who are planning to or actually working with an unmanned aerial system.

Course objective: UAS photogrammetry can fill a major gap in the spatial data collection and open up new markets for additional image-based spatial data. The course will give an insight of the potential of unmanned aerial systems for geomatics applications and the theory behind it. In aerial photogrammetry, the first question is always about camera used. For a photogrammetric UAS project however, the question of the appropriate carrier platform is first to answer. Independently from the carrier platform photogrammetric UAS projects follow a processing chain and the achievable accuracy is related to several issues, which are important to know. The course will also illustrate the topic of flight regulations and getting permission to fly.

Course outline: The kick-off seminar will give an overview of workflows for photogrammetric UAS projects as well as activate course participants to realize possibilities of UAS for geomatics applications and beyond. The course is divided into four different parts. Special focus will be laid on the processing of image data from RPAS. Highlight of the course is the hands-on practical work with Pix4D software to explore the photogrammetric potential of UAS surveys with real data. UAS are using airspace and may influence privacy of other people. Therefore legal issues, the topic of flight regulations have to be discussed. The e-learning part of the course will include lecture materials, reference literature and assignments, including practical work using real life data and up-to-date photogrammetric software for UAS, self-evaluation questionnaires and tutoring.

Module 1. Introduction and basic principles of UAS
In the introduction several definitions and classifications of UAS types will be given. Common UAS imaging sensors (digital cameras, LiDAR) as well as navigation sensors will be discussed. Due to weight restrictions commonly low-cost camera are used for UAS, which have special characteristics in terms of image quality etc. A comparison to classical photogrammetric cameras will be provided. GPS and recently RTK-GPS are very important UAS navigation sensors.

Module 2. UAS project design and flight planning
Flight planning of photogrammetric UAS projects is different from conventional airborne projects, thus offering a large degree of flexibility, e.g. combing nadir and oblique imagery. However the achievable accuracy of the final product is defined be design of the aerial survey. Important accuracy factors, such as the image scale and overlap, properties of a digital camera, the layout of ground control points and much more are considered here.

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Module 3. UAS data processing - from images to 3D-information

The processing of UAS data follows a common workflow using several up to date photogrammetric techniques, which will be described in detail. Starting from successful flight sensor orientation information is available, but how valuable is this information? Camera calibration is a standard procedure in close range photogrammetry but also very important in UAS photogrammetry. Processing of RPAS image blocks relies on the concepts of computer vision. Structure from motion (SfM) is applied for the image block orientation and will be introduced in this course. As results 3D-point clouds are generated by means of dense image matching algorithms. Beside the point cloud orthophotos and true orthophotos are also common information products.

Module 4. Legal aspects and general remarks

Regulations for UAS vary quite significantly within Europe. Examples from different member states will be given with its pros and cons. Nevertheless there is a common road map for the integration of UAS into the common airspace, which will be discussed. High resolution imagery of objects and persons raises questions about privacy and other legal issues. At the end of the course the focus will be widened and several other applications and current developments of UAS, e.g. sense and avoid technologies using imaging and ranging sensors or UAS as a cargo platform in an unknown environment will be provided.

This course will kindly be supported by Pix4D, Lausanne – Switzerland. Each participant will receive a free month of Pix4Dmapper Pro UAS processing software (valued at EUR 260).

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