INTERTWINING UAV AND SOFTWARE

Low-speed and Low-altitude UAS

With todayâ€™s operational unmanned aerial systems (UAS), photogrammetry has entered a new era. However, not every unmanned aerial vehicle (UAV) is suited for aerial mapping. The ability to fly at low speed and low altitude while maintaining high wind tolerance is essential. The author presents a UAS in which the favourable flying characteristics of a particular UAV are strongly intertwined with adapted flight planning and processing software to generate high-precision maps including the possibility of stereo restitution.

Vector data extracted from UAS imagery

Can UAS technology compete with standard land surveying? UAS is a valuable addition to satellite and airborne photogrammetry and land surveying since it offers the potential to merge the high precision of land surveying with the ease of photogrammetric capture of geodata. To achieve such a merging of benefits, three features are important: (1) high immunity to weather, light and foliage conditions which limit the operational periods of image capture by high-altitude photogrammetry; (2) supporting both 2D/3D mapping for topographic and cadastral purposes as well as 3D modelling of buildings and other constructions; and (3) high ground resolution or ground sample distance (GSD) and surveying precision, which are limited for high-altitude photogrammetry.

Provisions

The first two conditions are easy to fulfil since the stability and reliability of most UAS are controlled automatically using sensors and sophisticated firmware. Added to this is that a flight can be conducted fully autonomously according to a pre-specified flight plan so that one field operator can operate the system with minimal effort and highly independent of weather conditions. 3D modelling is enabled by manoeuvring the attitude of multicopters such that facades and other vertical elements of 3D structures are captured by oblique imagery. However, the creation of high-resolution and high-precision imagery requires specific provisions concerning speed, altitude and stability of the UAS as well as image configuration. The lower the altitude, the higher the precision will be but also the higher the lay-over of objects, while occlusion will make objects invisible. This problem can only be solved by high overlaps and high-resolution imagery, which requires – taking into account the downsized digital cameras – reduced speed of the UAS. Yet the lower the speed, the more the UAS will be affected by wind and turbulence, and the smaller the area that can be captured in one flight, since the time a UAS can stay in the air is counted in minutes rather than hours. Extending the flight and ensuring stability requires intelligent power distribution.

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