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Rapid large- and site scale RPAS mission planning for remote sensing of rock falls and landslides in alpine areas

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Since landslides and rock falls are complex phenomena involving a multitude of factors, current and historic surface data play besides geologic conditions and others an important role in analyzing hazard situation and efficient site-specific remediation actions. Especially in displacement acceleration phases which are frequently linked to bad weather conditions, data acquisition remains difficult. Therefore RPAS with their small ground sampling distance and correspondingly high resolution open up possibilities for surveying ground situations not only for visual inspection but also for geodetic data acquisition. Both, visual and geodetic data provide valuable information for geologists and related decision makers. Slides or rock falls in alpine areas pose special challenges due to mostly acute and unforeseen displacements on the one hand and geographic conditions of narrow valleys along with steep slopes on the other hand. Rapid RPAS mission planning and mission adaption for individual requirements according to different project stages (initial investigation, repeat measurements, identification of hazard zones for urgent remediation actions, etc.) is therefore of particular importance.

Here we present a computer-simulation supported approach to RPAS mission planning taking the identified thematic and remote sensing targets, the relevant terrain and obstacle databases, legal restrictions, aircraft performance, sensor characteristics, and communication ranges into account in order to produce a safe and mission-optimized flight route. For the RPAS mission planning, we combine and adapt tools developed at University of Salzburg, namely a flight track generator taking into account a 3D-model of the earth surface with both, focus on large area coverage (e.g. Austria) and the highest available resolution (e.g. sub-meter for specific areas), available obstacle data bases for the mission area (e.g. cable car lines, power lines, buildings, slope stabilization constructions, etc.) and ad-hoc or predefined target lists. Whereas large area data with moderate resolution allows rapid and remote mission planning, high resolution data avoids flights into terrain even in steep and tricky slopes. We utilize a fast-time air traffic simulation to verify that the generated mission plan satisfies the mission requirements through the prediction and near-realtime 3D visualization of the flight path as well as survey camera views. If required for the mission, the survey camera view can be supported by augmented reality features (showing up-to-date or historic or thematic analysis data relevant to the mission). The accurate mission planning and generation of a detailed flight track supports also systematic repetitions of the RPAS survey flight for situation awareness or research purposes. During the execution of the mission the simulated flight track provides a nominal-actual comparison guiding the operation that can be rapidly changed using the same tools with predictable results during the mission.

We present the developed rapid mission planning approach on the basis of selected examples in the Austrian Alps.