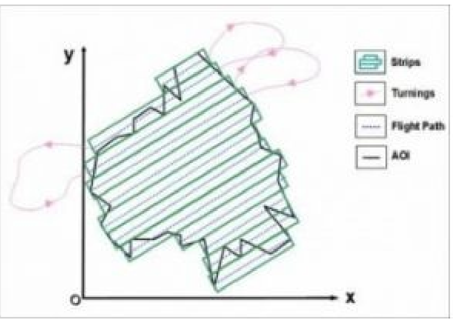
Lidar Flight Planning System with Minimal User Intervention



Airborne Lidar has become a regular technology for acquiring accurate, consistent and dense point clouds. However, the constraints on specifications, available sensors and aerial platforms are still a challenge for Lidar data acquisition. Optimal flight planning is essential. Current practices rely on rules of thumb and trial and error, meaning that optimal solutions are rare. A research group at the Indian Institute of Technology Kanpur has developed a Lidar flight planning system which does provide an optimal solution at a high level of automation and requiring minimal user intervention.

Once acquired, Lidar data should satisfy the specifications on density, overlap, spatial distribution and accuracy. Data clusters and voids should be absent. Further requirements can be found in *U.S. Geological Survey National Geospatial Program Lidar Guidelines and Base Specification Version 13*. The constraints on specifications, available sensors and aerial platforms make Lidar data acquisition a challenging task. The need to simultaneously capture photogrammetric imagery further complicates matters.

Flight Planning

Lidar flight planning starts with dividing an area into rectangular strips (Figure 1). After finalising one flight line, the aircraft has to turn to the next flight line. Flight planning defines flight lines and other flight parameters through a simulation exercise, thus enabling Lidar and/or image data of predefined specifications to be acquired at minimum costs. Flight planning explores the relationships between the Lidar scanner, camera, aircraft, navigation sensors (GNSS and IMU), terrain features and other components. The resulting flight plan is used by the flying crew and sensor operator.

Flight planning should thus take into account the possible operation ranges of sensors including pulse repetition frequency (PRF), field of view (FOV), scan frequency, beam divergence, ground sampling distance (GSD), flying height, trajectory position and attitude. Furthermore, it should account for the accuracy of the resulting 3D coordinates of the points in the point cloud or of the 2D coordinates measurable in the orthoimagery as the consequence of observation errors. Flight planning should also consider preferences in direction of flight, type of turning, maximum banking angle and cushion period (the time needed in addition to the time to fly from the end of one strip to the beginning of the next strip).

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