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Feasibility study of using the RoboEarth cloud engine for rapid mapping and tracking with small unmanned aerial systems

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Abstract. This paper presents the ongoing development of a small unmanned aerial mapping system (sUAMS) that in the future will track its trajectory and perform 3D mapping in near-real time. As both mapping and tracking algorithms require powerful computational capabilities and large data storage facilities, we propose to use the RoboEarth Cloud Engine (RCE) to offload heavy computation and store data to secure computing environments in the cloud. While the RCE's capabilities have been demonstrated with terrestrial robots in indoor environments, this paper explores the feasibility of using the RCE in mapping and tracking applications in outdoor environments by small UAMS.

The experiments presented in this work assess the data processing strategies and evaluate the attainable tracking and mapping accuracies using the data obtained by the sUAMS. Testing was performed with an Aeryon Scout quadcopter. It flew over York University, up to approximately 40 metres above the ground. The quadcopter was equipped with a single-frequency GPS receiver providing positioning to about 3 meter accuracies, an AHRS (Attitude and Heading Reference System) estimating the attitude to about 3 degrees, and an FPV (First Person Viewing) camera. Video images captured from the onboard camera were processed using VisualSFM and SURE, which are being reformed as an Application-as-a-Service via the RCE. The 3D virtual building model of York University was used as a known environment to georeference the point cloud generated from the sUAMS' sensor data. The estimated position and orientation parameters of the video camera show increases in accuracy when compared to the sUAMS' autopilot solution, derived from the onboard GPS and AHRS. The paper presents the proposed approach and the results, along with their accuracies.

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