



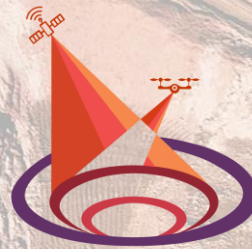
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ReSe
APPLICATIONS



M4 MINING

D3.2

Multi-sensor fusion algorithms for positioning and path planning for autonomous UAS



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Project

Acronym: **m4mining**

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1. Executive Summary

This document elaborates on the technology contributions developed as part of Tasks T3.2 and T3.3 in WP3. The primary goal of the Unmanned Aerial Vehicle (UAV) is to fly alongside the mine face from a distance and collect data using the onboard sensor payload, specifically the hyperspectral camera. This document covers the enabling technologies on the platform deployment towards achieving such advanced missions, including modules for local reactive navigation using visual sensing path planning and control, object detection-localization and obstacle warning systems, as well as positioning on multi-sensor fusion based on available sensors such as either 3D LiDAR, Inertial Measurement Unit (IMU), or visual camera. As such, this deliverable consists of the evaluation and testing of different techniques on perception and navigation under various circumstances (simulation, lab, and outdoors environments). Additionally, it includes all technical details of the deployed modules as part of the technology preparation from WP3.

More specifically, Task 3.2 considers technologies for obstacle awareness to ensure the UAV's collision-free deployment, and the development of different fusion algorithms for UAV positioning information, especially in GNSS-denied environments. Moreover, the path planning module that generates guidance commands (visual-servoing) for the UAV for safe mine face following is part of Task 3.3. All the developed contributions in the two tasks are comprehended under three main modules: (a) Perception system: state estimation schemes for multi-sensor fusion, (b) Obstacle awareness: module to detect and localize object of interest, as well as detecting the proximity of the aerial platform to the surrounding obstacle and alert the Remote Control (RC) operator and (c) Path planning: generates the guidance commands for autonomous UAV navigation in the open-pit mine, while tracking the face surface and maintaining it within the field of view and at safe distance.