FIELD CAMPAIGN TO TEST A NANO-ROVER IN A MOON-ANALOGUE ENVIRONMENT AND 3D MAPPING USING LIDAR AND STEREOSCOPIC CAMERA

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Introduction: Among various methods for testing and verifying scientific instruments and equipment, field tests on earth are of high relevance. For this, NEUROSPACE conducted a field campaign for its commercial rover platform 'HiveR' [1,2] in cooperation with the TU Berlin which took place during the International Summer School 2023 [3]. It was held on Vulcano Island (Sicily, Italy), offering access to a broad variety of sites suitable to be used as moon-analogue as well as mars-analogue environments due to extreme arid conditions.

Landscapes and Methodology:
The campaign covered the robotic exploration of different terrains around the volcano's caldera, La Fossa Cone. Multiple areas were investigated ranging from dry, rocky areas up to vegetational rich sites.

Figure 1: left: 'Moon Lake' at La Fossa, middle: Channel at La Fossa, right: 'Grillo' plateau opposing La Fossa

The tests of the rover's driving performance in regard of its locomotion and suspension system included its ability to steer, turning on point and overcoming obstacles. The maneuvers were executed via remote control with one operator and two safety assistants. While driving, the built-in stereoscopic camera recorded 3D images of the driven path. TU Berlin provided a sensor rig as a payload for the rover that gathers data for later comparison of Light imaging, Detection And Ranging (LiDAR) and stereo camera data. A map shall be created for future navigation algorithm development.

System and Payload: The rover is a prototype of the HiveR platform that follows the concept to support a 3U CubeSat form factor as a payload. It is designed to carry payloads of approx. 10 cm × 10 cm × 30 cm. The passive suspension system consists of four wheels and the majority of the locomotion is 3D printed. A secondary suspension from aluminum profiles was also tested. On top of the CubeSat payload, the LiDAR system is mounted. An opening in the side of the chassis provides access to the electronic interfaces.

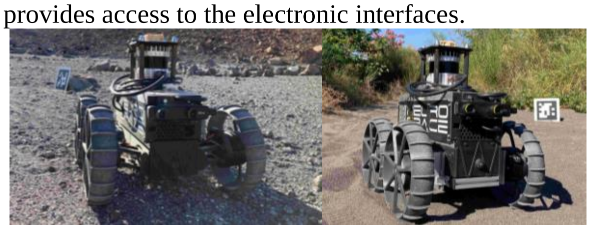

Figure 2: HiveR locomotion system with suspension (left) and with aluminum profiles (right)

Data collection: ArUco makers were placed in the areas for fix reference features in randomized patterns. The driving tracks varied from open paths to closed loops. The driving speed varied from circa 0.1 m/s to 0.6 m/s. The data was saved locally and exported later.

Results: The campaign has shown that this prototype is capable of travelling through various planetary analogues. The team was able to successfully identify weaknesses in both hardware and software for future improvement. The system also turned out to be predominantly dust-proof and temperature-resistant for the duration of the experiments. Initial examinations of the recorded data show successful capturing of 3D images. With Rviz (ROS2), maps from the investigated areas could be visualized. Future data processing will merge the stereoscopic images and extracted depth information with the LiDAR data. Also, cross checking with drone images for better localization is planned.

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