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A Prototype Instrumentation System for Rover-Based Planetary Geology

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Abstract

The prototype of an instrumentation suite for rover-based in situ exploration of planetary surfaces is presented. This is part of the ExoGeoLab pilot project of the European Space Agency (ESA), which aims at building a system of scientific instruments for geology, exobiology and meteorology.

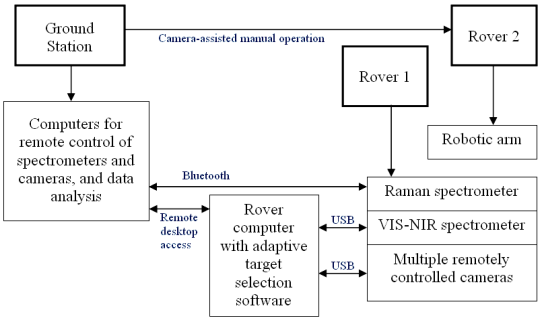

Figure 1: System block diagram

The rover segment consists of consists of two rovers:
Rover 1: Base rover
Rover 2: Rover equipped with robotic arm

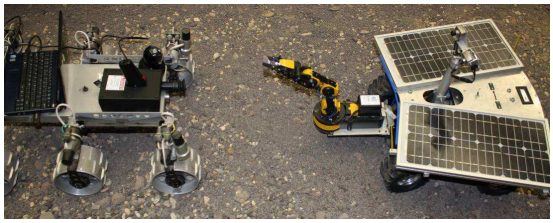

Figure 2: Rover 1 (left) and Rover 2 (right)

Portable Raman and VIS-NIR spectrometers, cameras, and the rover computer are installed on Rover 1. Rover 2 and its robotic arm can be controlled remotely by an operator that relies solely on the video stream obtained from cameras strategically located on the rovers. The arm is used to pick up rock samples of scientific interest, which are brought precisely to the nose of the Raman spectrometer, at the correct focal distance required to measure the Raman spectrum.

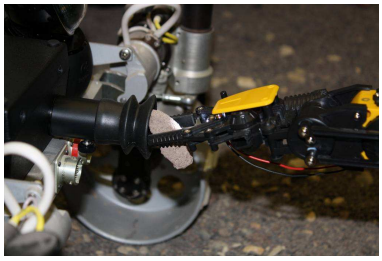

Figure 3: Capture of a Raman spectrum

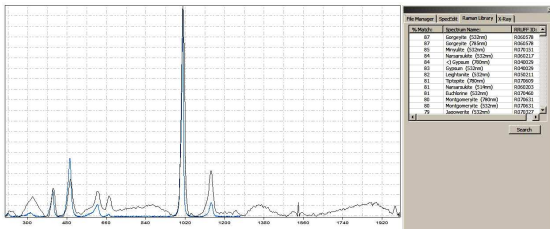

Figure 4: Test Raman spectrum of a gypsum rock

The operator issues a command to the spectrometer remotely using the ground control computer, to start and stop recording the Raman spectra. The spectra are sent to the ground station, where software determines the composition of the rock from a library in real time. Work is in progress to minimise human intervention in determining scientifically interesting rocks, by means of adaptive target selection algorithms that use image data to extract information about the locations and distributions of rocks.

References

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