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CNES ROVER AUTONOMOUS NAVIGATION, APPLICATION TO EXOMARS AND POTENTIAL FOR MSR FETCH ROVER

Abstract

The involvement of the CNES robotics team in rover autonomous navigation dates back from the mid 90s with its participation to the Russia led Marsokhod project. CNES contribution comprised the stereo camera system and the Autonomous Navigation (AN) software package which was thoroughly optimised effort because of the limited computing resources at that time. AN algorithms were subsequently improved and matured through several years of RD development and validation effort including field testing. In the mid-2000s, CNES got involved in the ESA-led Exomars project through an active participation in the requirements phase, and delivered in kind its AN framework to the main actors, along with its technical support. The AN capacity was removed from the rover at the end of 2016 because of budget pressure. CNES subsequently stepped forward to promote the reintroduction of AN in Exomars and is currently working on the accommodation of its own AN flight software along with the AN baseline solution provided by Airbus UK. For instance, this AN technique has been intensively validated on a representative numeric simulator and tested on the field with ARTEMIS rover (Exomars-like rover platform).

This paper will describe the main features of CNES NA solution and how it meets ExoMars 100 m / sol mobility expectations. We will elaborate on the typical structure of this vision based AN package which relies on 3 sequential computational stages performed while the rover is stopped:

- Stereo Correlation DEM Generation,
- Traversability Map Build Update,
- Path Perception Planning.

We will also introduce the recent development of two additional features (Regional map build update, Regional path planning) which rely on a more efficient and complementary representation of the environment. This enhancement aims at increasing the rover long traverse capability. We will show how this could represent a great asset for the fetch rover of the future Mars Sample Return mission, where the traverse capability should be increased by an order of magnitude to optimize samples retrieval.