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AN IMPROVED ROVER NAVIGATION SYSTEM FOR LONG RANGE TRAVERSES: SURPASSING 1KM PER SOL IN PLANETARY EXPLORATION

Abstract

The Autonomous Decision Making in Very Long Traverses (ADE) - part of Operational Grants - is one of five Space Robotic research projects in the frame of the PERASPERA Strategic Research Cluster (SRC), funded by the European Commission's H2020 Programme. This SRC aims to develop building blocks for future autonomous space robotics missions to provide the capabilities to meet demanding future mission goals. The challenge of ADE is to demonstrate, in a planetary analogue environment, a highly autonomous rover-based system capable of achieving very long traverses (kilometres per sol) with high reliability.

The Rover Guidance (RG) system is responsible for autonomous navigation and is developed by Airbus Defence and Space Ltd. by building on expertise acquired from development of the ExoMars 2020 Rover Vehicle GNC system. The ability to sense, identify, fuse local and orbital information and execute obstacle-free traverse is a critical function of any rover GNC system and is core to RG. RG implements a novel navigation architecture using global maps alongside dynamically reconfigurable multi-mode autonomy. Hazard prevention functionality is also present to ensure rover safety whilst traversing. The multi-mode autonomy architecture allows different navigation algorithms, with differing levels of safety, to be used depending on the traversal risk in the currently perceived environment.

The RG system was tested and validated during field trials in the scope of ERGO project (OG2) in Morocco in late 2018. By demonstrating the capability to traverse more than 1 km in a single sol, the state-of-the-art functionality of the system was proven. The RG system developed in ERGO will be expanded upon by including additional autonomy modes and optimised algorithms for improved traverse performance and robustness.

The main focus of this paper is to summarize the high level design updates since ERGO. The paper will include ADE simulation test results and analysis regarding the proposed system. Finally it will conclude with an outlook towards the field testing due to take place on the Spanish island of Fuerteventura in late 2020.

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