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MULTIFUNCTIONAL INTERCONNECT FOR FUTURE MODULAR PLANETARY ROBOTS

Abstract

Current state-of-the-art planetary robotic systems are typically designed as large, heavy, and complex systems capable of performing many tasks. The Mars rovers Perseverance or Zhurong are such examples. These one-of-a-kind, expensive systems offer little opportunity for future maintenance, upgrades, or reuse. A more environmentally friendly and cost-effective solution would be a modular system at the subsystem level, assembled for a specific task, which can be upgraded in the future using multifunctional interfaces. In this case, any future mission would only need to transport individual, self-contained subsystems on an as-needed basis, rather than a single-use system. The MODKOM project aims at realizing such systems through the development of an integrated, multifunctional interface for mechanical, data and electrical connection, the Electro Mechanical Interface - Modular (EMI-MOD). The envisioned application scenario of the modular system is a Lunar environment. The paper describes the design of the third generation of the EMI-MOD and analyzes its suitability considering the need for scalability, reusability and compatibility. A modular 6-DoF manipulator was chosen as the design reference. This is capable of changing its host system and reconfiguring the system based on modular payloads. In addition, the paper describes the intended use of the EMI-MODs, ranging from the combination of different subsystems (once they are equipped with an EMI-MOD) to (re)configurations in so-called multi-robot teams. Finally, the results of the first tests of the breadboard components of the interface are outlined. The results of the analysis and tests indicate that the proposed EMI-MOD represents a feasible concept within the system requirements of the project and outlines a baseline that can be used in future steps of the project as a guideline for the detailed design of its reference implementation. Furthermore, the outcomes shall help to develop an interface for lunar applications and the respective prevailing environmental conditions as part of the envisioned mission scenario.