

Human Robotic Partnerships for Exploration (04)
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ASTRONAUT-ROBOT COOPERATION DEVELOPMENT USING TERRESTRIAL ROBOTS - THE
CASE OF SPACEPARTNER

Abstract

The robotic astronaut assistants envisioned for future manned missions to the surfaces of Moon and Mars are still in early development phase, meaning that only small number of expected subsystems have been properly developed and evaluated. Especially full demonstrations of astronaut-robot cooperation are still very rare because developing a fully functional and versatile assistant robot is very expensive task that takes numerous man-years to complete.

This paper presents an overview of SpacePartner project in which a existing terrestrial centaur-type janitor robot is adopted and further developed to serve as an fully autonomous astronaut assistant robot. The project starts from the analysis of most typical astronaut-robot cooperation missions in order to identify the respective robotic astronaut assistant capabilities required to implement these missions. This analysis directs the project focus on astronaut-robot task communication development to better support situations where the astronaut and robot are operating face-to-face in a shared physical workspace. The core approach in the project is to utilise human-human communication as a model that can be applied also to human-robot communication. Especially the idea of utilising object-action associations in the task communication is examined in depth.

A complete astronaut-robot cooperation system demonstration is presented using the fully autonomous centaur-type robot. The experiment demonstrates the cooperation system's capability to perform useful tasks, such as transferring objects and documenting events, in a planetary analog environment. This indicates that one feasible and cost-effective way to examine astronaut-robot operation concepts is to utilise robots developed originally for terrestrial applications.