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TASK ORIENTED ONBOARD PLANNING APPROACH FOR MARS ROVERS

Abstract

Operations of conventional spacecraft used to be planned on ground and are uploaded as telecommands and executed onboard at due time. However, because of difficulties in communicating with devices on remote planets, direct human control for rovers is infeasible, and rovers must be able to act autonomously for substantial periods of time. Also, on planetary surfaces such as Mars, there are uncertainties about the terrain, meteorological conditions, and the state of the rover itself (solar panels, battery charge, etc.). In order to support Mars exploration missions in China, automated planning offers great promise in enabling autonomous deep space operations, and is required to enhance security and robustness of Mars rovers. Typically, daily plans of rovers involve on several tasks, which should be significantly ordered to maximize the amount of science return. And we then present our task oriented planning approach for Mars Rovers. To cope with uncertainties during execution, a new modeling method that takes state transitions into consideration is proposed. And we arrange the early detection techniques of task dependencies into our planning approach, and accomplish tasks in the correct order to avoid the overhead of unnecessary backtracking. The key technique we build on is the designed task-achievement graph in a look-ahead search under the task orders. Finally, we run comprehensive experiments on Rover domain and experimental results demonstrate the effectiveness of our techniques.