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Shadow Adaptable Sun-Synchronous Trajectory Planner for Planetary Exploration

Taking advantage of solar power is the key for the survivability of planetary exploration in the inner solar system. Several path planning approaches take advantage of "sailing" with the sun to maximize sun exposure and extend the survivability of the rover [1][2]. For navigating from point A to point B, these algorithms can take the rover safely around a shadow region to its destination. However, these algorithms also elongate the completion of the task and also have the possibility of terminating the mission if the robot solely relies on moving through sunlight paths. We propose to study an approach that allows the rover to navigate through regions of shadows given that the robot can determine if it has enough resources and power to safely cross the region. This would thus reduce the amount of time taken for the rover to complete its task. Figure 1 shows a map of an area where traveling through a shadow region would be beneficial. For this study, we will assume the robot knows the topology and global sun regions of the space by information collected from orbital mapping satellites.

This is an area of interest for the team because Ander and Ben have been involved with space robotics. Both have worked with space robots tasked with planetary exploration and surveying of lunar topology. However, we have yet to study the concepts of path planning algorithms that takes into account resources, solar power, mission time, and design capabilities.

Figure 1. Overview of shadow adaptable trajectory

References
1. R. Whittaker, G. Kantor, D. Wettergreen, "Sun-Synchronous Planetary Exploration", Field Robotics Center, The Robotics Institute, Carnegie Mellon University
2. R. Whittaker, P. Tompkins, T. Stentz, "Automated Surface Mission Planning Considering Terrain, Shadow, Resources and Time", Field Robotics Center, The Robotics Institute, Carnegie Mellon University