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HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
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# TIME-OF-FLIGHT CAMERAS FOR ACTIVE SUSPENSION CONTROL AND AUTONOMOUS NAVIGATION ON A SMALL LUNAR ROVER

**Abstract**

Stereo vision systems are the most common solution for acquiring depth information that can be used for navigation in unmanned vehicles or for mapping unknown terrains. This is the method that was employed by Curiosity, and will also be used by ExoMars in its upcoming mission. However, recent developments in 3D sensor technology allow to acquire higher quality depth data by using Time-of-Flight (ToF) cameras. These new cameras can provide an alternative to stereo vision systems for the tasks of exploration and mapping. For this reason and as the sensors' accuracy improves, their use in space robotics is being investigated as an alternative to stereo vision. In this paper the authors evaluate the effectiveness of one such ToF camera on a small lunar/martian rover developed for semi-autonomous and autonomous exploration. The vehicle has an active suspension system, with four swing-arms controlled by a feedback loop based on data provided by the gyroscopes and the ToF camera. This solution allows to detect and overcome relatively small obstacles while maintaining the attitude and the balance of the rover. The system here developed can be further enhanced, for example, to improve comfort on a human-carrying vehicle moving on uneven terrain. The same ToF data is also used for simultaneous localization and mapping (SLAM), and the performance in both tasks is compared to the one yielded by the use of a standard stereo camera system, highlighting the relative advantages and drawbacks of each sensor technology.