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SENSORPOD: A COMPACT AND LIGHTWEIGHT AUTONOMOUS SENSOR SUITE MODULE FOR LUNAR SURFACE EXPLORATION

Abstract

The availability of low-cost Components Off the Shelf (COTS) has become an enabler for innovative missions to deep space including cis-lunar space. The interest in lunar exploration missions has increased dramatically, fueled by government incentives such as NASA's Commercial Lunar Payload Services (CLPS). The prospect of regular commercial services to the lunar surface with a reduced cost promises opportunities for new actors such as small and medium enterprises as well as universities to test and deploy scientific and technology demonstration missions in lunar orbit and on the lunar surface.

In this paper, we present a lightweight and compact design solution based on a combination of automotive grade and flight-proven COTS. The SensorPod platform accommodates four cameras, an Inertial Measurement Unit, temperature sensors and microphones. It is designed to enhance the capabilities of a lunar surface mobile asset such as a rover or a surface hopper. The small and compact volume ($< 120\ cm^3$), low mass ($\approx 150\ g$) design can be easily integrated into various upcoming missions. The SensorPod bus consists of a microcontroller, wireless transceiver and non-rechargeable battery that have wide operating temperature ranges and minimal power requirements. For instance, it can be carried by a rover and can also be deployed and communicate wirelessly. A key mission objective is to provide 3rd person views of a rover or other landed hardware. When deployed, SensorPod operates autonomously on the lunar surface for a period of several hours taking images and measurements to characterize the surrounding area. The camera parameters and sensor suite onboard the SensorPod are customizable to adapt to a broad range of scientific and engineering objectives.

The immense value of these small independent devices was recently demonstrated by the Sora-Q micro rover deployed by JAXA's SLIM lander. It provided vital visual information concerning the orientation of the lander that landed in a non-optimal configuration and thus significantly contributed to the mission's real time operations, scientific contextualization and public outreach.