

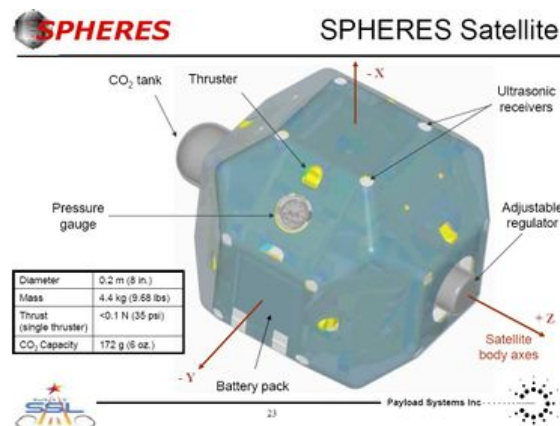
Navigation of the SPHERES aboard ISS using head-mounted 3D display

Topic description

The Synchronized Position Hold, Engage, Reorient Experimental Satellites (SPHERES) experiment is a testbed consisting of three miniaturized robots sent to the ISS in 2006 [1]. Initially designed for testing of formation flying algorithms, the SPHERES have since been used in several scientific experiments requiring micro-gravity conditions.

Future use-cases of a SPHERES like system include the inspection of the outside of the ISS, but also the observation of science experiments within the ISS from ground. To use the SPHERES as mobile eyes for scientists on Earth it is crucial to be able to safely and efficiently control and navigate the probe around the space station.

The aim of the project is to implement the dynamics of a SPHERE aboard the ISS in a simulator and control it with a head-mounted 3D display (HMD); such as the Oculus Rift [2]. This simulator will then be used to assess the performances of an immersive stereoscopic teleoperation system with respect to conventional 2D camera system on a series of navigation and control tasks.



Candidate's tasks

- Build on [3] to implement the dynamics of the SPHERES.
- Extract the signal from the tracking hardware of the Oculus Rift in order to control the sphere from user head movements.
- Modelling (part of) the ISS in the simulator.
- Design and implement a number of basic control (tracking of an object) and navigation tasks (moving to a specific module of the ISS).

The ideal candidate

Mandatory:

- Excellent programming skills (C++ required)

Desirable:

- Experience with 3D modeling and rendering

References

- [1] MIT SPHERES: <http://ssl.mit.edu/spheres/>
[2] Oculus Rift: <http://www.oculus.com/>
[3] SPHERES Simulator Libraries: <http://www.nasa.gov/spheres/gsp.html#.VEZWxvmUd8E>