Optical Imaging, Object Tracking, and Motion Control Using a Snapdragon Single Board Computer on a CubeSat

Brandon Munguia†, Kainoa Solidum, Daniel Valdes, and Ke-Xun Sun*

Department of Electrical and Computer Engineering

University of Nevada, Las Vegas

†munguiat@unlv.nevada.edu, *Ke-Xun.Sun@unlv.edu

CubeSat constellation flight can facilitate space quantum link experiment and multi-view space observations. Optical imaging, object tracking, and motion control are critical in CubeSat constellation formation and operation as well as Rendezvous Proximity Operations (RPO) and release / reassembly among CubeSats. These complex optical sensing and operations require substantial computing power onboard the CubeSat.

We have adopted a NASA-suggested Snapdragon Single Board Computer (SBC). We have identified and matched the camera modules. The system is running under Android operating system, allowing use of a variety of available software and hardware. In addition, an LED-based LiDAR was selected to measure the distance between CubeSats for more accurate RPO and release / reassembly operations. We have used a 3D printer to build a new prototype CubeSat to accommodate the SBC and all sensors.

For experimental demonstration, we mounted the CubeSat on our motorized 6-degree-of-freedom CubeSat test platform developed earlier in our lab. Another CubeSat is suspended on our microgravity test platform and set into swing motions. We successfully demonstrated high resolution optical imaging using the Snapdragon SBC and the onboard camera. We further demonstrated both angular and linear motion tracking of the swing object.

We have made important progress in developing CubeSat constellation flight, space quantum links, and multi-view space observations.

This work is supported by NASA/Nevada Space Grant.