Next Generation Flight Displays Using HTML5

Avionic Systems Division | Human Interfaces Branch - EV3
The HIVE (Human Integrated Vehicles & Environments) Lab
Brian Greenwood | Johnson Space Center Summer Intern 2016
Computer Engineering Undergraduate

The Human Integrated Vehicles and Environments (HIVE) lab at Johnson Space Center (JSC) is focused on bringing together inter-disciplinary talent to design and integrate innovative human interface technologies for next generation manned spacecraft. As part of this objective, my summer internship project centered on an ongoing investigation in to building flight displays using the HTML5 standard.

Specifically, the goals of my project were to build and demo “flight-like” crew and wearable displays as well as create a webserver for live systems being developed by the Advanced Exploration Systems (AES) program. In parallel to my project, a LabVIEW application, called a display server, was created by the HIVE that uses an XTCE (XML (Extensible Markup Language) Telemetry and Command Exchange) parser and CCSDS (Consultative Committee for Space Data System) space packet decoder to translate telemetry items sent by the CFS (Core Flight Software) over User Datagram Protocol (UDP). It was the webserver’s job to receive these UDP messages and send them to the displays. To accomplish this functionality, I utilized Node.js and the accompanying Express framework. On the display side, I was responsible for creating the power system (AMPS) displays. I did this by using HTML5, CSS and JavaScript to create web pages that could update and change dynamically based on the data they received from the webserver. At this point, I have not started on the commanding, being able to send back to the CFS, portion of the displays but hope to have this functionality working by the completion of my internship. I also created a way to test the webserver’s functionality without the display server by making a JavaScript application that read in a comma-separate values (CSV) file and converted it to XML which was then sent over UDP. One of the major requirements of my project was to build everything using as little preexisting code as possible, which I accomplished by only using a handful of JavaScript libraries.

As a side project, I created a model of the HIVE lab and Building 29 using SketchUp. I obtained the floorplans of the building from the JSC Geographic Information Systems (GIS), which were computer-aided design (CAD) files, and imported them into SketchUp. I then took those floorplans and created a 3D model of the building from them. Working in conjunction with the Hybrid Reality lab in Building 32, the SketchUp model was imported into Unreal Engine for use with the HTC Vive. Using the Vive, I was able to interact with the model I created in virtual reality (VR). The purpose of this side project was to be able to visualize potential lab layouts and mockup designs as they are in development in order to finalize design decisions. Pending approval, the model that I created will be used in the Build-As-You-Test: Can Hybrid Reality Improve the SE/HSI Design Process project in the fall.

Getting the opportunity to work at NASA has been one of the most memorable experiences of my life. Over the course of my internship, I improved my programming and web development abilities substantially. I will take all the skills and experiences I have had while at NASA back to school with me in the fall and hope to pursue a career in the aerospace industry after graduating in the spring.