

Education

Columbia University

Master of Science, Computer Engineering

New York, NY

Expected August 2023

The University of Texas at Dallas

Bachelor of Science, Computer Science

Richardson, TX

December 2019

Languages & Tools: C, C++, Python, Swift, SQL, FreeRTOS, GNU Make, Git, Docker, Xilinx Vivado, Flask

Experience

NASA Langley Research Center

Hampton, VA

Computer Engineer — Flight Software Systems Branch

January 2020 — Present

- Lead development of a high-fidelity simulator for the Navigation Doppler Lidar instrument. The simulator was used in software-in-the-loop testing during the creation and verification of ground / flight software.
- Awarded agency's Superior Accomplishment Award based on feedback from industry partners.
- Developed flight software modules / drivers in C to interface with various peripherals (MMIO, Iridium, actuators, sensors, etc.) over protocols such as SPI, I2C, UART, Ethernet, TCP/IP, and SpaceWire.
- Created tools in Python and C++ for ground system control, test automation, and data visualization.

Pathways Intern — Flight Software Systems Branch

May 2019 — July 2019

- Created a memory access driver in C / FreeRTOS, allowing for thread-safe allocation, wear leveling, etc.
- Developed command and telemetry GUIs for debugging and interfacing instrument subsystems using PyQt.

Pathways Intern — Flight Software Systems Branch

September 2018 — December 2018

- Wrote an equatorial mount control subsystem in C / FreeRTOS. Integrated within SAGE IV flight software.
- Created Ruby scripts to automate test procedures and verify multiple instrument subsystems.

The University of California, San Diego

La Jolla, CA

Undergraduate Researcher — Engineers for Exploration REU

June 2018 — August 2018

- Used C++ High Level Synthesis (HLS) to write FPGA overlays for acquiring I2C sensor data, PID control loop, and PWM signal generation for a Xilinx PYNQ (Zynq) development board. Used for creation of an RC drone flight controller. Used Jupyter Notebooks for debugging and functional demos.
- Developed similar functionality in software for a MicroBlaze soft-processor to compare resource utilization, performance, and complexity against HLS design. Published research paper reporting findings of approach.

NASA Johnson Space Center

Houston, TX

Intern — Integrated Guidance, Navigation, and Control Analysis Branch

August 2017 — December 2017

- Analyzed ascent abort procedures and assisted in creating models to characterize propellant slosh for the SpaceX Crew Dragon landing / orbit tanks. Generated data using NASA's Trick Simulation Environment.
- Created a Python to render propellant slosh for various tank geometries in 3D using simulation data.

Massachusetts Institute of Technology

Cambridge, MA

Undergraduate Researcher — Haystack Observatory REU

June 2017 — August 2017

- Evaluated SoCs, microcontrollers, and software frameworks for an initial avionics system design.
- Wrote software in C and C++ for a remote command / telemetry interface over Iridium, monitoring system resources, sensor data collection, and power reduction optimizations. Developed on FreeRTOS and Linux.

Publications

B. Cain, **Z. Merchant**, I. Avendano, D. Richmond and R. Kastner, "PynqCopter - An Open-source FPGA Overlay for UAVs," in *2018 IEEE International Conference on Big Data (Big Data)*, Dec. 2018, pp. 2491-2498. [Online]. Available: <https://ieeexplore.ieee.org/document/8622102>.