Zain Merchant

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Experience

NASA Langley Research Center — *Hampton, VA*

Computer Engineer — Flight Software Systems Branch — *January 2020 — Current*

- Currently support the design, development, and testing of embedded software for satellites and science instruments.
- Lead the development of a high fidelity simulator for the Navigation Doppler Lidar instrument. The simulator aided in the creation and verification of ground / flight software and was shipped to external partners for use in hardware-in-the-loop testing. Awarded agency's *Superior Accomplishment Award* based on feedback from industry partners.
- Developed flight software modules / drivers to interface with various peripherals (MMIO, Iridium, actuators, sensors, etc.) over protocols such as SPI, I2C, UART, Ethernet, TCP/IP, and SpaceWire for ARM and RISC-V microcontrollers.
- Created tools in Python / C++ for ground system control, test procedure automation, and data logging / visualization.

Pathways Intern — Flight Software Systems Branch — *May 2019 — July 2019*

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

Pathways Intern — Flight Software Systems Branch — *September 2018 — December 2018*

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

The University of California, San Diego — *La Jolla, CA*

Undergraduate Researcher (REU) — Engineers for Exploration — *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.
- Developed similar functionality in software for a MicroBlaze soft-processor to compare resource utilization, performance, and complexity against HLS design. Used Jupyter Notebooks for debugging and functional demos.

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 and orbit tanks. Generated sample data using NASA's Trick Simulation Environment.
- Wrote a 3D animation tool in Python to render propellant slosh for various tank geometries using simulation data.

Massachusetts Institute of Technology — *Cambridge, MA*

Undergraduate Researcher (REU) — Haystack Observatory — *June 2017 — August 2017*

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

Education

The University of Texas at Dallas

Bachelor of Science, Computer Science — *December 2019*

Languages: C, C++, Python, SQL, MATLAB, Rust (novice), JavaScript (novice)

Software & Tools: RTOS, Linux, Xilinx Vivado, Flask, Docker, Git, GNU Make, Bash, GDB

Awards: 1st place Fall 2019 Senior Design Capstone Project, 1st place at HackNAU 2017, 1st place at Richardson Community Hack Week 2016 (incl. a $25,000 grant for continued project development)

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