Zain Merchant

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Education

B.S in Computer Science *August 2014 — Present*

The University of Texas at Dallas

Programming Experience: Python, C / C++, R, Ruby, MATLAB, FreeRTOS, OpenCV, and Xilinx Vivado

Relevant Coursework: Adv. Algorithm Analysis and Design, Cluster Computing, Machine Learning, Artificial Intelligence, Operating Systems Concepts, and Digital Logic & Computer Design

Experience

NASA Langley Research Center *September 2018 — December 2018*

Pathways Co-Op — Flight Software Systems Branch *Hampton, VA*

- Developed an equatorial telescope mount API in C++ / FreeRTOS to be used by the SAGE IV Pathfinder ground test instrument.
- Created Ruby scripts to automate test procedures and verify the functionality of multiple interfaces to the instrument. Utilized Ball Aerospace's Cosmos software for system command and telemetry.

The University of California, San Diego *June 2018 — August 2018*

Research Affiliate — Engineers for Exploration *La Jolla, CA*

- Developed an FPGA based flight controller for a remote control hexacopter. Created FPGA fabric overlays for sensor communication, a closed loop PID controller, and PWM signal generation.
- Wrote fabric code in C / C++ utilizing the High Level Synthesis (HLS) tools in the Xilinx Vivado Design Suite.
- Created similar control loop for a MicroBlaze soft processor to compare resource utilization and performance to our HLS design.

NASA Johnson Space Center *August 2017 — December 2017*

Internship — Integrated Guidance, Navigation, and Control Analysis Branch *Houston, TX*

- Used the Trick Simulation Environment to analyze ascent abort procedures and assisted in creating models to characterize propellant slosh in the SpaceX Crew Dragon landing and orbit tanks.
- Created a Python 3D animation tool to visualize propellant slosh movement within various tank geometries.

Massachusetts Institute of Technology *June 2017 — August 2017*

Research Affiliate — Haystack Observatory *Cambridge, MA*

- Designed an avionics system for an air-dropped monitoring device to be used for autonomous antarctic research.
- Wrote software in C / C++ for autonomous system health monitoring, process management, data collection, and power reduction optimizations. Developed on FreeRTOS and Linux.

NASA Johnson Space Center *January 2017 — May 2017*

Internship — International Space Station On-Orbit Engineering Office *Houston, TX*

- Developed an Android and iOS mobile application in C# (using Xamarin) to interface with the ISS Mission Evaluation Room Web System and various NASA / ISS resources.
- Created a user login and verification system, SQLite database, and search function for the console log.

Projects

Blade Runner Voight-Kampff (Visual Polygraph) Machine in Python

- Using Python OpenCV, I developed a program to estimate heart rate visually (via a webcam) from changes in skin pigmentation.
- The project also utilized an Arduino to measure body temperature and perspiration to calculate a user's stress.

iOS Road Conditions Detection and Reporting Application in Swift

- Created an application to autonomously detect and report potholes using an iPhone's internal GPS, gyroscope, and accelerometer.
- The city of Richardson received a $25,000 grant from State Farm for continued development on the project.

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