Zain Merchant

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Education

B.S. in Computer Science, The University of Texas at Dallas
Junior, Expected Graduation in May 2019

Relevant Coursework: Algorithm Analysis & Data Structures, Linear Algebra, Computer Architecture, Digital Logic & Computer Design, Digital Systems Laboratory, Operating Systems Concepts, and Artificial Intelligence

Extracurricular Activities: SpaceX Hyperloop Pod Competition (Flight Control Team), Robotics and Automation Society (Officer)

Experience

NASA Johnson Space Center; *Houston, TX* *August 2017 — December 2017*
Internship — Integrated Guidance, Navigation, and Control Analysis Branch (EG4)

- Used the Trick Simulation Environment to analyze ascent abort procedures and created mathematical models for estimating propellant slosh in the SpaceX Crew Dragon landing and orbit tanks.
- Created a Python modeling and animation tool to visualize propellent slosh movement within various tank geometries. The software is currently used in the Aeroscience and Flight Mechanics Division of JSC.

Massachusetts Institute of Technology; *Cambridge, MA* *June 2017 — August 2017*
Research Affiliate — Haystack Observatory

- Developed a prototype avionics system for an air-dropped penetrator system to be used for autonomous antarctic research.
- Wrote software for remote communication and command via the Iridium satellite network, autonomous system health monitoring, process management, data collection, and reduced power optimizations. Developed using FreeRTOS and Linux.

NASA Johnson Space Center; *Houston, TX* *January 2017 — May 2017*
Internship — International Space Station On-Orbit Engineering Office (OB2)

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

William B. Hanson Center for Space Sciences; *Richardson, TX* *May 2016 — December 2016*
Undergraduate Researcher — Upper Atmosphere and Remote Sensing Laboratory

- Developed a beacon satellite receiver to calculate total electron content (TEC) in the ionosphere. Investigated different methods of signal acquisition and built a nested Quadrifilar Helicoidal (QFH) antenna system.
- Wrote a satellite tracking and signal recording program in Python to automate the data acquisition process.

Projects

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

- Using the OpenCV Python library, I developed a rudimentary program to calculate heart rate visually (via webcam). The project also utilized an Arduino to measure body temperature, perspiration, and speech patterns to calculate a user's stress.
- The user's heart rate is calculated using changes in skin pigmentation as a subject's heart beats.

Enigma Machine in Verilog

- Developed a digitally encoded processing unit in Verilog to simulate a WWII Enigma Machine with 4 states - On, Reset, Encrypt / Decrypt, and Calibrate.

iOS Road Conditions Detection and Reporting Application in Swift

- Created a mobile application to autonomously detect, verify, and report roads with rough pavement or potholes.
- The application utilizes the iPhone's GPS, gyroscope, and accelerometer to distinguish normal road conditions from those unsafe.
- The city of Richardson received a $25,000 grant from State Farm for continued development on the project.

Programming Languages / Platforms

Python, C, C++, C#, MATLAB, Arduino, Verilog, OpenCV, SQLite, Xamarin, GNU Radio, FreeRTOS, and UNIX

Awards

- 1st Place at HackNAU 2017
- 1st Place at Richardson Community Hack Week 2016
- Best Microsoft Hack + Best Drone Hack at TAMUHack 2015