

Justin Francis

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EXPERIENCE

Software Engineering, Sarcos Robotics

February 2020 – Present

- Create [robot control software](#) including async distributed computing in C++ (NXP iMX), algorithms and operator control interfaces on Linux-based soft real time computer (Nvidia Xavier)
 - Implemented pathfinding algorithms while minimizing jerk to reduce sway of payload
 - (WIP) Neural net pipeline for tracking drones with vis spectrum camera in Python 3
 - Computer vision algorithms for rapid object detection and interception in Python 3
- Sensor fusion for a radar and camera using extended Kalman filtering
- High level autonomous drone operations implementation and simulation using ROS and C++
 - Used Singleton design pattern for sensor manager class
 - Used Factory design pattern for algorithm deployment
 - Created library of coordinate transforms using quaternions for drone and gimbal alignment
 - Implemented finite state machine for payload actions
 - Spec'd and implemented navigational sensors such as lidar and pulse-doppler radar
- Designed and implemented Python 3 library to initiate and health check hardware
- Built simulation using Gazebo and ROS for multiple drones and sensors inside of Docker
- QT Ground Control Station GUI using QML
 - Multithreaded sensor manager
 - Created ui for drone updates and calibration using Bash scripts and Debian packages
- Performed data analysis with Python 3 to determine efficacy of algorithms and controls

Embedded Systems Engineer, Bionics Engineering Lab

December 2018 – Present

- Designer of embedded systems using PIC32MX (MIPS), STM32, and NXP iMX (ARM) MCU's
 - Coded DMA SPI, I2C, USART non-blocking with ISR's in C flashed with Makefiles
- Personally led and completed the active cooling project on a DOD rehabilitation hip exoskeleton
 - Reduced weight by about 40 [g] and a total weight reduction by ~8%
- Project lead on functional open source bionic prosthetic with GPL3 licensing
 - Hackster Link: <http://bit.ly/2RLhh2j>
 - Design of inertial navigation system (INS) using sensor fusion and extended Kalman filtering
 - Created a cheap, reliable, and easy to manufacture ground force reaction (GRF) sensor

Control Systems Team Lead, Formula U Racing (FSAE)

January 2016 – June 2020

- Planned systems architecture including expansion plans for wireless telemetry, torque vectoring and autonomous operation with FreeRTOS and distributed computing
- Worked on control hardware such as the shutdown circuit and brake sensor plausibility device
- Team Link: <https://formulau.racing/>

EDUCATION

University of Utah, *Magna Cum Laude*

August 2016 - May 2020

Major BS in Mechanical Engineering with Mechatronics emphasis GPA 3.9

Relevant Coursework: Embedded Systems Design, Advanced Mechatronics, State-Space Controls, System Dynamics, Dynamic Systems and Controls

Minor in Computer Science GPA 4.0

Relevant Coursework: Machine Learning, Data Mining, Data Structures and Algos

TECHNICAL SKILLS

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|-------------------|---------------------------|------------------------|
| • C++ 17 | • Python 3 | • ROS |
| • CMake | • GitLab CI/CD | • SOLIDWORKS |
| • QT/QML | • Docker | • Doxygen |
| • RTOS (FreeRTOS) | • TensorFlow 1/2 | • Gazebo Simulations |
| • Sensor Fusion | • OpenCV | • MATLAB and SimuLink |
| • Eagle/KiCAD | • Linux and GNU Toolchain | • LabVIEW (myRIO/Linx) |