

# Richard Matthews

UNIVERSITY OF WATERLOO 3A MECHATRONICS ENGINEERING, CLASS OF 2020

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## Skills

### Software

- C, C++, Python, Matlab, Assembler, TCL, Perl
- Embedded Development: device drivers and firmware
- Real Time Operating Systems
- Control Algorithms

### Hardware

- ARM-Cortex M, AVR Microcontrollers
- Schematic capture, PCB Layout, Assembly and Rework
- Power Electronics including inverters, regulators, and rectifiers
- I<sup>2</sup>C, SPI, SD SPI, UART, CAN protocols

### Tools

- Altium, Eagle, LTSPICE
- Oscilloscopes, Function Generators, DMMs, Logic Analyzer
- Git, SVN, CVS
- GNU Make
- Linux

## Work Experience

### Embedded Software Developer

September 2017 - December 2017

NOKIA

- Implemented communication API for product simulator using interprocess shared memory between Linux daemon and QEMU VM
- Shared memory communication decreased message transfer time by 75% vs old communication API
- Developed unified API for communication between main processor and FPGAs
- New API replaced numerous redundant functions with one interface to access all FPGA memory regions

### Hardware Design Engineer, Intern

January 2017 - April 2017

LUMOTUNE

- Implemented automatic firmware tests to verify hardware integrity on system startup
- Designed a PI control algorithm to maintain output voltage of DC-AC inverter with varying output loads
- Developed automatic capacitor bleed circuit and voltage quadrupler circuit to generate high voltage DC from AC input
- Performed circuit simulation in LTSPICE to model the new circuitry described above
- Debugged switching voltage regulator with high output ripple by reworking board to test out multiple types of output filters

### Software Developer

May 2016 - August 2016

SOLACE SYSTEMS

- Developed multiple features in Python for new REST API used to configure messaging router product
- Improved reliability and ease of development by automating the classification of new configuration attributes added to the API

### Embedded Software Developer

September 2015 - December 2015

ALCATEL-LUCENT

- Implemented interrupt driven processing of DSL lines to reduce task CPU usage by 50%
- Modified a CPU usage monitoring/profiling tool to handle multi-core systems using VxWorks RTOS
- Created numerous tools to aid with debugging low-level code

## Personal Projects

### Quadcopter Flight Controller

July 2017 - December 2017

- Designed, assembled, and developed software for board to stabilize the flight of a quadcopter
- Used Altium Designer to create schematics and PCB layout of board which included an ARM-Cortex M4 processor and multiple MEMS IMU sensors
- Developed control software, using FreeRTOS, to stabilize quadcopter flight by controlling motor speeds based on sensor input
- Implemented sensor fusion algorithm to combine sensor inputs and cascaded PID control to perform quadcopter auto levelling
- Implemented asynchronous reading of sensors over I2C using DMA with the resultant performance increase allowing faster control loop frequency

### Firmware Subteam Lead, Waterloo Formula Electric

January 2017 - April 2017

DATA ACQUISITION UNIT

- Developed firmware for onboard Data Acquisition Unit (DAU) running FreeRTOS
- Programmed DAU to log data from multiple analog sensors and GPS location to SD card
- Developed SD card driver to initialize, read and write data over the SD card SPI interface
- Synchronized multiple tasks to read from sensors at varying frequencies and log output to SD card