



# Niel Mistry

nielmistry.com | niel-mistry

## Experience

---

### Systems Engineer

Jun 2022 - Aug 2024

TREXO ROBOTICS INC. | [trexorobotics.com](https://trexorobotics.com)

#### General/Management

- Worked across disciplines in medical robotics company: embedded programming, electrical, R&D, validation, and regulatory affairs
- Managed up to four people at a time: provided projects & tasks, mentorship, feedback, and reviewed pull requests
- Analyzed data to effectively troubleshoot and resolve customer and manufacturing issues

#### Embedded Programming

- Implemented BiSS C Protocol from first principles: prototyped hardware, implemented logic in the RP2040 PIO peripheral, wrote C code
- Re-structured firmware to support multiple MCUs by designing and implementing a custom hardware abstraction layer in team of three
- Wrote HAL modules for clock setup, GPIO access, analog conversions using the ADC over DMA, and PWM synchronization from ADC reads

#### Electrical

- Determined root cause of sporadic MOSFET failures in BLDC inverter circuit, preventing premature failure in >100 devices
- Designed PCBs in Altium used for internal tools such as decoding RS485 buses, interfacing a  $\pm 10V$  output sensor with an Arduino
- Mentored student to create his first PCB which allowed testing the capacity of up to three batteries simultaneously

#### Electromagnetic Compatibility (EMC)

- Led EMC compliance efforts by creating & executing test plans, analyzing & visualizing data with Python, and testing changes
- Coordinated with contract electrical engineer to rapidly iterate on updated board designs for EMC performance
- Used spectrum analyzers, near field probes and far-field antennae to characterize system, achieved 25dB reduction
- Oversaw reduction of problematic peaks from 20dB over CISPR 11 Class B Limits to 5dB under limits

### Robotics Software Developer Intern

May 2021 - Aug 2021

TREXO ROBOTICS INC. | [trexorobotics.com](https://trexorobotics.com)

#### Software

- Implemented production firmware (C, FreeRTOS) and software (C++, ROS) to manage different configurations of hardware

#### Controls

- Introduced Simulink use to develop new control systems, demoed by implementing an impedance controller to control exoskeleton leg
- Wrote custom s-function to interface Simulink with hardware allowing for real-time controller evaluation

#### Electrical

- Debugged issues in LED ring board using logic analyzers, oscilloscopes and scripted testing
- Designed custom SD card logger board to help log information from devices with issues

### Drone Systems Engineer Intern

May 2020 - Dec 2020

FORWARD ROBOTICS INC. | [forwardrobotics.com](https://forwardrobotics.com)

#### General/Systems

- Designed and tested the mechanical, electrical and software subsystems for a fixed-wing sprayer drone refill/recharge station
- Specified motor and motor controller, brought up boards, and tested linear travel on the ground station

#### Embedded Programming

- Wrote C driver for I2C interfacing of PCA9956 LED controller chip with STM32 MCU, providing individual control for each LED
- Integrated U-Blox ZED-F9P Modules as base station-rover pair, providing cm-accuracy via RTK to drone

#### Electrical

- Created a Raspberry Pi expansion PCB that added two CAN FD interfaces, an RS422 interface and a fan controller
- Integrated buck converter module, linear voltage regulator and ST laser time-of-flight sensor on custom 23x15mm PCB
- Designed relay PCB to handle switching of 120VAC loads, complying with creepage/clearance requirements
- Soldered complex PCBs with SMT devices down to 0402 size using stencils and solder paste

### Laboratory Development Assistant Intern

Sep 2019 - Dec 2019

INSTITUTE FOR QUANTUM COMPUTING | [research.iqc.uwaterloo.ca/qiti](https://research.iqc.uwaterloo.ca/qiti)

#### General

- Used MATLAB, Autodesk Inventor and Python to design magnetic field coils to generate static fields for a trapped ion quantum computer
- Performed a thorough investigation on the heating profiles of magnetic field coils with various wire gauges, holder materials and currents

## Mechatronics/Systems Design Engineering Co-op

Jan 2019 - Apr 2019

PHILIP BEESLEY ARCHITECT INC. | [philipbeesleystudioinc.com](http://philipbeesleystudioinc.com)

### Electrical

- Investigated long-range I2C communications failures, determined root cause, and implemented fix in production
- Produced >100 actuator assemblies for sculpture by soldering SMT components, motors and LEDs and routing wires aesthetically

### Software/Controls

- Helped to design & implement system to simulate virtual sculpture elements, and control the real hardware without code changes
- Wrote deployment scripts to update firmware of >100 individual devices through a network of Raspberry Pis
- Wrote low-level code in C++ to have microcontrollers control actuators, read from sensors and communicate with control program

## Projects

---

### Rotational Double Pendulum Demonstration

Jan 2022 - Apr 2022

UNIVERSITY OF WATERLOO - PROFESSOR CHRISTOPHER NIELSEN

- Worked on & documented an educational tool for control theory: a rotational double pendulum with switchable control schemes
- Modeled the rotational double pendulum from first principles with the Euler Lagrange equation
- Simulated different control schemes in Simulink including continuous vs. discrete time, observers and integrator augmentation
- Tested control schemes on physical apparatus, compared results with simulation and tweaked model to improve performance

### Opus

Jul 2021 - Mar 2022

UNIVERSITY OF WATERLOO CAPSTONE PROJECT | [uwopus.github.io/blog/](http://uwopus.github.io/blog/)

#### General

- Created a rappelling, wall plotting robot prototype in team of four over six months

#### Systems/Electrical

- Architected high-level system design for control, sensing and actuation; chose motors, specified MCU/SOC and all electrical components
- Designed dynamics based navigation & control system prototype, tested in MATLAB, and implemented in Python
- Designed and captured schematics for two PCBs used for control of the system for power delivery, computation, and motor control
- Mentored team members to use KiCad for PCB layout, resulting in successful PCBAs
- Assembled SMT components on custom PCB, bringing up board and enabling communication with Talon motor controllers

#### Software

- Implemented low-level code to collect quadrature encoder data from motors and provide PWM data out in C on a Raspberry Pi Pico
- Designed control algorithms to move the robot to arbitrary locations, employing Kalman Filtering to fuse IMU and encoder data

## Education

---

### EPFL

Sep 2024 - Present

PURSuing MASTER OF SCIENCE, ROBOTICS

Lausanne, CH

- **Relevant Courses:** Legged Robots, Neural Interfaces, Machine Learning, Model Predictive Control

### University of Waterloo

Sep 2017 - Apr 2022

BACHELOR OF APPLIED SCIENCE, HONOURS MECHATRONICS ENGINEERING - WITH DISTINCTION, DEAN'S HONOUR LIST

Waterloo, ON

- 89.98% Cumulative GPA
- **Awards:** President's Scholarship of Distinction, 2x President's Research Award
- **Relevant Courses:** Automatic Control Systems, Multi-Sensor Data Fusion, Introduction to MEMS Fabrication, Sensors and Instrumentation

## Skills

---

**Programming** C/C++, Python, Java, Git, MATLAB, Simulink, Unix, Regex

**CAD** Altium Designer, Solidworks, KiCAD

**Fabrication** Composite Layup, Carbon Fiber Layup, 3D Printing, Laser Cutting, Milling Machine, Drill Press, Bandsaw

**Electronics** SMT/THT Soldering, Oscilloscopes, Multimeters, Spectrum Analyzers

## Hobbies and Interests

---

- Aviation: Licensed Power Pilot
- Astronomy/Astrophysics
- Computer Security

## Skills

---

- Programming Languages: C/C++, Python, Java, Rust (learning)
- English: Native Proficiency
- French: CEFR A2 Level (Self-Assessed)