

# Kyle Mackenzie

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## TECHNICAL SKILLS

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**Software:** FreeRTOS, STM32 Firmware, Operating Systems, Python (numpy, pandas, scipy, tensorflow)

**Modelling & Controls:** Laplace-domain physical system modelling, Simulink, Vehicle Dynamics, BLDC motor controls

**Tools/Environments:** Git, Docker, Linux, Bash scripting, Data wrangling & automation

## TECHNICAL PROJECTS

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**OS161 Operating Systems Kernel Development ([link](#))** | *C* Sept. 2024 – Dec. 2024

- Implemented high-level synchronization primitives such as locks, condition variables, and semaphores, which were later used to implement thread-safe system calls, a file system, and virtual memory.
- Designed and implemented a thread-safe file system architecture to support file-related syscalls such as open, close, dup2, and more. (more details in personal website)
- Implemented a virtual memory system that manages a page table to keep track of the state of RAM pages, and a TLB to cache page table entries. Additionally implemented swap-space support.

**Uni-wheeled Robot Drive Controls ([link](#))** | *Python* Sept. 2023 – Present

- Derived non-linear equations of motion for 3-axis wheeled unicycle robot using Lagrangian Mechanics.
- Brought up the software system on a Jetson Nano to facilitate the development of LQR, MPC, and reinforcement-learning controllers.
- Developed the cost function for an LQR controller, and subsequently obtained the linearized motor controller to balance the robot upright.

**Machine Learning Self-Driving & Character Recognition ([link](#))** | *Python* Jan. 2023 – Apr. 2023

- Derived non-linear equations of motion for 3-axis wheeled unicycle robot using Lagrangian Mechanics.
- Brought up the software system on a Jetson Nano to facilitate the development of LQR, MPC, and reinforcement-learning controllers.
- Developed the cost function for an LQR controller, and subsequently obtained the linearized motor controller to balance the robot upright.

## RELEVANT EXPERIENCE

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**Vehicle Dynamics & Controls Developer & Team Lead** Sept. 2022 – Dec. 2024

*UBC Formula Electric FSAE Design Team*

- Led the research & design of quad-motor torque vectoring drive algorithm, utilizing state-of-the-art sensor fusion, cornering response design, and four-wheel slip control.
- Built a physics-based dynamics model of the car in MATLAB Simulink, to evaluate stability and performance of the controller, and allow year-wide testing, instead of simply during Summer months, improving prototype cycle.

**Reliability Test Engineer Co-op** May 2024 – Aug. 2024

*Corvus Energy*

- Developed a certification-level test plan to isolate a single failure mode for power-path connectors.
- Crimped, bolted, and torqued bolted voltage pickup connections.
- Performed an analysis on test data to numerically characterize the reliability of busbar components, providing the company with concrete data supporting the lifespan reliability of our product.

**Battery Controls Systems Co-op** Sept. 2023 – Dec. 2023

*Corvus Energy*

- Developed a thermal model in Simulink of the precharge circuit of a 1MWh energy storage system.
- Developed coulomb-counting algorithm and automated test scripts to validate SOC algorithm and track cell health.
- Developed a PCB to emulate temperature sensors to extend test coverage for a battery cell test bench.

**Research Assistant** May 2023 – Aug. 2023

*Cognitive Neuroscience of Schizophrenia Lab, BC Children's Hospital*

- Streamlined a MATLAB implementation of CPCA, a regressive dimension-reduction algorithm to handle 10s of GB of brain fMRI data, and refactored into python while removing over 300 lines of code and providing data visualization.

## EDUCATION

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**University of British Columbia**

Sept. 2020 - May 2026

*Engineering Physics*