

Kyle Mackenzie

1mackenziekyle@gmail.com | 1mackenziekyle.github.io | github.com/1mackenziekyle | linkedin.com/in/kyle-mackenzie-url

TECHNICAL SKILLS

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

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.
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RELEVANT EXPERIENCE

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

University of British Columbia

Sept. 2020 - May 2026

Engineering Physics