

# ACHAL PATEL

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## SUMMARY OF SKILLS AND QUALIFICATIONS

**Platforms:** Fusion360 • MATLAB • Simulink • Hugging Face • LeRobot • Kaggle • Docker • Docker Compose • VS Code • Platform IO • ESP-IDF • KiCad • Jira • Jenkins • Linux  
**Programming:** C • C++ • Python • Java • VHDL • SystemVerilog • ARM Assembly • ReactJS • Bash  
**Libraries:** PyTorch • TensorFlow • MediaPipe • OpenCV • YOLO • NumPy • Matplotlib • SciPy • Pandas • Free RTOS  
**Others:** ROS2 • MoveIt2 • Nav2 • ros2\_canopen • ros2\_localization • ros2\_control • SQL • Git Bash • Pytest • ArUco  
**Currently ongoing:** VLA (Visual Language Action models) • Bimanual Dexterity • MPC (Model Predictive Control) • SLAM  
**Languages:** English, (Spoken & Written) • French (Beginner A1 certified)

## WORK EXPERIENCE

### Robotics Research Intern (CUARL — CRAWLR Rover)

May 2025 – Dec 2025

Concordia University Aerospace Robotics Lab (CUARL)

Montreal, QC

- Learned MoveIt2 for trajectory solving and planning for articulated wheel legged rover. Created simulator environment in ROS2 Gazebo with virtual motor controllers using ros2\_canopen's virtual CAN to pass real CAN messages simulating real motors. Set up virtual CAN hardware and implemented inching motion solver using MoveIt2 for the massive codebase
- Created Xbox joystick teleoperation package that sends twist commands to the solver, enabling realtime user control of the robot. Validated in Gazebo simulation then hardware field tests
- Designed and implemented onboard position feedback system enabling closed-loop control for researchers: Initially attempted ArUco marker-based tracking with external camera off board stationary;
- migrated to onboard mounting ZED camera onboard for real-time inference on Jetson Xavier with Docker setup to run ros2 on old deprecated hardware. Implemented perception-based position estimation package using ZED SDK. This feedback system was key input for closed-loop controller algorithms used by researchers to collect experiment data

### Validation Engineering and Semiconductor design Intern

Sept 2024 – Dec 2024

Microchip Technology Inc.

Montreal, QC

- Validated hardware for **800G Ethernet PHYs** with **112G PAM4 SerDes** for high-speed data centers, designing test scenarios using Pytest to ensure **IEEE standards** compliance
- Gained deep knowledge in Error Detection, Ethernet Frames, and OSI model with focus on MAC & PHY layers, particularly PCS (Physical Coding Sublayer) for encoding/decoding
- Received training on **NASA's HPSC** (High-Performance Spaceflight Computing) project, using SystemVerilog for hardware verification and fault-tolerant systems to mitigate **SEUs** (Single-Event Upsets)
- Gained expertise in large-scale project management, hardware design, fault injection, regression testing, Git with Bitbucket, CI/CD on Jenkins, and extensive Linux experience for deployment, testing, and system management

### Undergraduate Teaching Assistant

May 2024 – Present

Concordia University

Montreal, QC

- **SOEN/COMP 228** (System Hardware): Taught tutorial classes and project-oriented lab sessions, guiding students in building a 4-bit RISC CPU on a breadboard with logic gates, flip flops, timers, shift registers and a microcontroller.
- **COEN 313** (Digital Systems Design II [FPGA]): Conducted lab sessions, teaching VHDL programming, from basic constructs to RT-level design, covering combinational and sequential circuits, FSMs, and FPGA basics.
- **MIAE 215** (Programming for Mechanical and Industrial Engineers): Tutored student C++ and embedded programming for microcontrollers in tutorials and guided with an robotics project with in the lab sessions
- Developed websites to educate with curated videos, resources, notes, and exam tips to help students succeed.

## PROJECTS

### MIMIC Capstone — Bimanual Mobile Robotics for Imitation Learning | Concordia-McGill Collab.

Sept 2025 – Present

- Co-leading interdisciplinary capstone project in partnership with McGill Mobile Robotics Lab to work on imitation learning research on bimanual mobile robots and create low-cost industry-grade teleoperation arm systems
- Built low-cost platform with Mecanum base and dual SO-101 arms for rapid VLA model experimentation, while simultaneously restoring Kinova MOVO industrial robot with Jaco arms for validation on high-end hardware
- Developing custom teleoperation systems for data collection using LeRobot framework and Vision-Language-Action models such as Pi0, X-VLA, and NVIDIA Groot and other behavior cloning policies from ACT to diffusion
- Secured \$20,000 in funding from various sources and sponsors

## LeRobot — Intro to Imitation Learning | *Personal*

May 2025 – Aug 2025

- Explored imitation learning fundamentals, VLA models, and the Hugging Face robotics ecosystem to understand how robots learn from human demonstrations
- Set up and experimented with the LeRobot framework, learning data collection pipelines, behavior cloning, and Action Chunking Transformers (ACT) architecture for policy training, laying foundation for MIMIC capstone project

## RNA Folding Prediction — Custom Transformer Architecture | *Academic, COEN 432*

Fall 2025

- Designed and implemented DeepResUNet-Transformer hybrid model architecture for the class project from scratch to predict 2D RNA folding patterns, achieving highest F1 score in class of PhD and Master's students
- Built custom transformer attention mechanism and ResNet-U-Net encoder-decoder architecture in PyTorch, conducting extensive hyperparameter sweeps and training dynamics analysis to optimize for imbalanced base-pair prediction task

## Extended Kalman Filter — IMU/GNSS Sensor Fusion | *Academic, ELEC 473*

Fall 2025

- Implemented Extended Kalman Filter from scratch in MATLAB for real-time vehicle position estimation, fusing IMU and GNSS measurements to handle sensor noise and uncertainty propagation. Extracted vehicle trajectory from raw IMU/INS data and computed motion parameters, achieving accurate position estimation through proper state-space modeling

## RoboWars 2025 — Autonomous Sumo Robots | *Personal, Competition*

Feb – Mar 2025

- **Back with Vengeance:** Built sumo robot with brushless motors controlled by VESCs, Time-of-Flight sensors for opponent detection, Teensy 4.0 microcontroller, and finite state machine architecture for autonomous operation
- **Definitely Overkill:** Developed advanced sumo robot with Jetson Orin Nano, Intel RealSense depth camera, YOLO-based opponent detection, and point cloud processing for enhanced situational awareness and strategic positioning

## Haptic Navigation Wearable for Visually Impaired | *MakeUofT 2025 Hackathon*

Feb 2025

- Built 24-hour hackathon wearable navigation system prototype integrating **Intel RealSense** depth, **YOLO World** for runtime-configurable object detection, **OpenAI Whisper** for voice commands, and haptic feedback motors for directional guidance, inferencing on Jetson Nano, enabling users to locate objects through vision-based navigation

## The IoT Automation Project | *Personal, IEEE Concordia*

Sep 2024 – Dec 2024

- **Led team of 6 in transforming club workshop into smart lab** with self-hosted IoT network using WiFi, Zigbee, MQTT, and Home Assistant, eliminating cloud dependencies. Developed custom IoT devices and sensors with ML object detection on CORAL TPU for automated lab routines, integrating voice control via Alexa and Node-RED automations

## Autonomous Hovering Drone | *Personal, IEEE Concordia*

July 2024 – Nov 2024

- Built custom drone with optical flow altitude hold, ArduPilot firmware, custom PID tuning, GPS mission planning for enhanced flight stability, and FPV support.

## PROFESSIONAL ASSOCIATIONS & VOLUNTEER WORK

### Vice President of Projects

June 2024 – Present

*IEEE Concordia student branch*

*Concordia University*

- Lead multiple project teams from ideation to execution, mentoring students in programming, electronics, CAD, and embedded systems while managing recruitment, onboarding, and secured over \$11,000 in funding from all projects

### Engineering Workshops Instructor

October 2023 – Present

*Concordia University*

*Montreal, QC*

- Created Several Interactive workshops on **Intro to Robotics**, **Intro to 3D Modeling & Printing** with Fusion and **Intro to Microcontrollers** with ESP32, teaching beginners practical skills in design, programming and embedded systems.

## EDUCATION

### Concordia University

Montreal, QC

*Bachelor of Engineering – Computer Engineering Co-op*

*2022 – 2026 (Expected)*

- Relevant courses: Autonomy for Mobile Robots • Applied Machine Learning • Modern Control Theory • C++ OOP • Data structures and algorithms • Computer architecture and Software • Continuous & Discrete Time Signals and Systems

## AWARDS & COMPETITIONS

**Innovation Fund**, Concordia University – \$10,000 (Dec 2025)

**National Champions**, Canadian Engineering Competition (CEC) (Mar 2025)

2nd Place, Quebec Engineering Competition (Jan 2025)

Winner, Englympics 2024 — QEC Qualifiers (Oct 2024)

**RoboWars** (2024, 2025)

**MakeUofT** (2024, 2025)

ConUHacks VIII (Jan 2023)

**IEEEExtreme** (Oct 2023)

## INTERESTS

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Autonomous Robotics • Rocket Avionics • Embedded Programming • Drones (UAVs) • Cybersecurity • IoT Systems  
Movies • Photography and filmmaking • Personal Finance • Investing • Traveling • Gardening • Eng. Competitions