ACHAL PATEL

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SUMMARY OF SKILLS AND QUALIFICATIONS

Platforms: Fusion360 • Visual Studio • VS Code • Platform IO • ESP-IDF • Jira • Jenkins • Docker Compose • SQL • MATLAB • Simulink • KiCad • JetBrains suite.
Programming: C • C++ • Python • Java • VHDL • SystemVerilog • ARM Assembly • YAML
Libraries: PyTorch • TensorFlow • MediaPipe • OpenCV • NumPy • Matplotlib • SciPy • Pandas • Free RTOS
Others: ROS2(Gazebo & Rviz Simulation) • Control Systems • Docker • Git Bash • Hugging Face • Pytest • 3D Printing • MQTT
Currently ongoing: SLAM • Reinforcement Learning • ML • Sensor Fusion • TinyML • MPC
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*

- Worked on **CRAWLR (Concordia Robotic Articulated Wheel-Legged Rover)**, an experimental space-rover platform for push–pull locomotion research in unstructured planetary terrain; full-time (May–Aug) then part-time (Sep–Dec)
- Developed manipulator planning using MoveIt 2 for the rover's inching motion, including simulation setup and integration with the control pipeline to transition from simulation to real motor control via Virtual CAN hardware
- Implemented Xacro conditional plugin loading and launch-time arguments for seamless simulation/hardware switching, removing manual config edits and streamlining development workflow for the entire team
- Built complete Xbox joystick teleoperation package with pipeline: Joy → Twist → diff-drive/skid-steer solver → Float64MultiArray → CAN; validated in Gazebo and on hardware during field trials
- Designed and implemented onboard position feedback system enabling closed-loop control: initially attempted ArUco marker-based tracking with external stationary camera, then migrated to Jetson Xavier with Docker containers running ROS2, mounting camera onboard for real-time inference and high-accuracy position tracking
- Integrated position feedback with ROS2 infrastructure, enabling wired and wireless data collection from the Jetson; researchers previously relied on open-loop control and required this feedback system to implement closed-loop motion algorithms for experimental validation

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.

PROFESSIONAL ASSOCIATIONS & VOLUNTEER WORK

Vice President of Projects
June 2024 – Present

IEEE Concordia student branch · *Concordia University*

- Lead project teams and manage initiatives engaging students from beginner to advanced levels; secured over $11,000 in funding from university, IEEE Montreal, and industry partners
- Project leadership: Autonomous Hovering Drone project and IoT Automation Project, mentoring students in programming, electronics, CAD, and embedded systems

Engineering Workshops Instructor
October 2023 – Present

Concordia University · *Montreal, QC*

- Created Several Interactive workshops on Intro to Robotics, Intro to 3D Modeling & Printing with Fusion360 and Intro to Microcontrollers with ESP32, teaching university & CEGEP students practical skills in design, Programming and embedded systems.

PROJECTS

MIMIC Robotics — Bimanual Mobile Robots for Imitation Learning | *Capstone, Concordia-McGill Collaboration* Sept 2025 – Present

- Co-leading interdisciplinary capstone project with McGill Mobile Robotics Lab (MRL) to develop bimanual mobile robots that learn tasks through imitation, bridging low-cost research platforms and industrial-grade systems
- Building low-cost platform with Mecanum base and dual SO-101 arms for rapid VLA model experimentation, while simultaneously restoring MOVO industrial robot (Kinova Jaco arms) for validation on high-end hardware
- Developing custom teleoperation system for data collection and implementing behavior cloning pipelines using LeRobot framework for Vision-Language-Action (VLA) model training

LeRobot — Intro to Imitation Learning | *Personal* Summer 2025

- Explored imitation learning fundamentals, Vision-Language-Action (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
- Laid foundation for MIMIC capstone project by building intuition in transformer-based robotics and understanding the gap between current capabilities and general-purpose robots

RNA Folding Prediction — Custom Transformer Architecture | *Academic, COEN 432* Fall 2025

- Designed and implemented DeepResUNet-Transformer hybrid from scratch to predict RNA 3D 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 484* 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 and sensor fusion techniques

RoboWars 2025 — Autonomous Sumo Robots | *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 Users | *MakeUofT 2025 Hackathon* Feb 2025

- Built wearable navigation system combining Intel RealSense depth sensing, YOLO v12 World for runtime-configurable object detection, OpenAI Whisper for voice commands, and haptic feedback motors for directional guidance
- Integrated four AI/ML subsystems (vision, depth, speech, detection) on Jetson Nano with Arduino-controlled haptic motors, creating end-to-end prototype in 24-hour hackathon that enables users to locate objects through touch-based navigation

Autonomous Hovering Drone | *Personal, IEEE Concordia* July 2024 – Nov 2024

- Built custom drone with autonomous hover capability using optical flow sensor for altitude hold, ArduPilot firmware, and custom PID tuning for stable flight

- Integrated sensor filtering and flight control systems, implementing GPS-based mission planning and FPV head-tracking gimbal for enhanced flight stability and autonomous operation

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 optimized automations through Node-RED

EDUCATION

Concordia University   Montreal, QC
Bachelor of Engineering – Computer Engineering Co-op   *2022 – 2026 (Expected)*
- Relevant courses: C++ OOP • Data structures and algorithms • Computer architecture and Software • Continuous & Discrete Time Signals and Systems • Controls System • Digital Electronics • Probability & Statistics

AWARDS & COMPETITIONS

Innovation Fund, Concordia University — $10,000 (Dec 2025)

Winner, Canadian Engineering Competition (CEC) — National Champions (Mar 2025)

2nd Place, CQI 2025 — Quebec Engineering Competition (Jan 2025)

Winner, Englympics 2024 — Quebec Engineering Competition Qualifiers (Oct 2024)

RoboWars (2024, 2025)
MakeUofT (2024, 2025)
ENGR 290 Hovercraft
ConUHacks VIII
IEEExtreme

INTERESTS

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