

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 • FreeRTOS

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

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).
- Brought up and stabilized a ROS2 control stack for motor control over CAN (EPOS4), including ros2_control/ros2_controllers integration and a **Virtual CAN** workflow with ros2_canopen to enable hardware-identical testing without the rover.
- Improved simulation/hardware switching by implementing **Xacro conditional plugin loading** and launch-time arguments, removing manual config edits when moving between Gazebo and real hardware.
- Built and documented a complete **Xbox joystick teleoperation package**: Joy → Twist → diff-drive/skid-steer solver → Float64MultiArray → CAN; validated in Gazebo and on hardware during field trials.
- Implemented perception-based position tracking for closed-loop experiments using **ZED2/ZED SDK** and **ArUco markers**; achieved **20–30 Hz** tracking and piped outputs into ROS2 message types for integration into a teammate's Simulink control stack.

Validation Engineering and Semiconductor design Intern

Sept 2024 – Dec 2024

Microchip Technology Inc.

Montreal, QC

- Collaborated with engineers in validating hardware for **800G Ethernet PHYs** with **112G PAM4 SerDes** used for high-speed data centers, and designing test scenarios using Pytest to ensure compliance with **IEEE's standards**.
- Gained in-depth knowledge in Error Detection, Ethernet Frames and the OSI model, with a strong focus on the MAC & PHY layers, particularly the PCS (Physical Coding Sublayer) for encoding/decoding of the data.
- Received comprehensive training on **NASA's HPSC** (High-Performance Spaceflight Computing) project, involving SystemVerilog for hardware verification, and fault-tolerant systems to mitigate SEUs (**Single-Event Upsets**)
- During this internship, I gained expertise in large-scale projects, hardware design, fault injection, regression testing, Git, CI/CD pipelines 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 a 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

- Manage multiple project teams as a Project Manager, leading the planning and execution of initiatives created by me to engage students from beginner to advanced levels, ensuring hands-on learning and skill development

- Mentoring less-experienced students in various techniques (programming, electronics, CADing, soldering, circuit design, and IT networking), guiding them through challenges and helping the team achieve tangible results.
- Drive recruitment by creating onboarding materials, conducting interviews, and integrating new recruits efficiently into the team. I also secure critical project funding and ensure all members get the resources needed.

Engineering Workshops Instructor

October 2023 – Present

Montreal, QC

Concordia University

- Created Several Interactive workshops on Ntro 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.

Vice President of Marketing

Sep 2023 – Apr 2024

Concordia University

IEEE Concordia student branch

- Led the marketing team through a successful rebranding of IEEE Concordia's social media, doubling Instagram followers in 8 months through strategic content creation and event promotion for 20+ workshops/events.

PROJECTS

CRAWLR Rover (CUARL) | ROS2, MoveIt2, Gazebo, CAN, ZED2, OpenCV

May 2025 – Dec 2025

- Developed a reusable simulation->hardware workflow for a wheel-legged space-rover testbed using Virtual CAN and ROS2 control, enabling safer iteration on mobility/control logic.
- Implemented launch-time simulation/hardware switching via Xacro conditional plugin loading; reduced integration friction and improved reliability for lab-wide testing.
- Built and validated a joystick teleoperation stack and perception-based position tracking (ZED2 SDK + ArUco) to support closed-loop experiments and data collection.

6-Axis Robotic Arm using ROS | Personal, IEEE Concordia

Sept 2024 – Ongoing

- Leading a multidisciplinary team of 6, MECH, ELEC, and SOEN students in developing a modular, 3D-printed, 6-DOF robotic arm with a custom cycloidal actuator, overseeing task assignments, project decisions, and ROS setup.
- Developing a ROS2 framework for a precise closed-loop controller, inverse kinematic solver for 3D space retracing and end-effector alignment using ML-based object detection & computer vision on Jetson Nano to optimize real-time inference performance.

Autonomous Forest fire prevention Drone | Personal, IEEE Concordia + Competition

July 2024 – Ongoing

- Building a custom drone featuring GPS-based mission planning & pathfinding, altitude hold using optical flow, and FPV head-tracking gimbal. Integrating, PID tuning, and sensor data filtering for enhanced flight stability.
- Competing in the NARC UAV competition with a focus on creating an autonomous drone designed for forest fire prevention and safety missions, utilizing computer vision with Mediapipe for fire detection & obstacle avoidance.
- Implementing gesture control using TinyML on a Microcontroller as a personal challenge, allowing the drone to switch between FPV head-tracking mode and gesture-controlled mode when not using FPV.

The IoT Automation Project | Personal, IEEE Concordia

Sep 2024 – Dec 2024

- Led the transformation of the club's workshop into a smart lab with a team of 6, developing a fully self-hosted IoT network using WIFI, Zigbee, MQTT, InfluxDB, on our own servers, eliminating reliance on cloud services.
- Made our own Wifi and Zigbee based IoT devices and sensors all connected through a unified automation system on Home Assistant, creating optimized automations through Node-Red, and enabled voice control via Alexa.
- Enhanced lab safety and functionality with an ML object detection Object running on camera feeds and running inference on a CORAL TPU, automating lab routines to control devices like lights, soldering irons, and cabinet locks based on real-time data, while ensuring network security all throughout this smart security system.

Autonomous Sumo Robot | Personal + Competition

Feb – Mar 2024

- Engineered a Sumo robot with precision in design using Advanced CADing and 3D printing for rapid prototyping.
- Proficient in embedded C++ programming, state machine, UART, SPI, I2C protocols, and custom PCB design

Autonomous Hovercraft | Academic + Competition

Jan – Apr 2024

- Led a team of six, overseeing all aspects of the project while also handling Design and Component selection.
- Aided the team in learning GitHub to better ensure version control and seamless collaboration, furthermore implemented maze-solving algorithms in C using US sensor and IMU, achieving a 95% success rate.

EDUCATION

Concordia University	Montreal, QC
<i>Bachelor of Engineering – Computer Engineering Co-op</i>	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	

COMPETITIONS

CQI 2025 – Quebec Engineering Competition	January 2025
<i>2nd Place</i>	<i>Montreal, QC</i>
Englymics 2024 – Quebec Engineering Competition Qualifiers	October 2024
<i>Winner</i>	<i>Montreal, QC</i>
ENGR 290 Competition – Autonomous Hovercraft Class Competition	April 2024
<i>3rd Place</i>	<i>Montreal, QC</i>
Robowars 2024 – Autonomous Sumo Robot Competition	March 2024
<i>4th Place</i>	<i>Montreal, QC</i>
MakeUofT 2024 – Hardware-based Hackathon at UofT	February 2024
<i>Winner</i>	<i>Toronto, ON</i>
ConUHacks VIII – Montreal's biggest hackathon	January 2024
<i>Participant</i>	<i>Montreal, QC</i>
IEEEExtreme – Global Programming Competition	October 2023
<i>Participant</i>	<i>Online</i>

INTERESTS

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