

Vincent Zhou

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EDUCATION

University of Waterloo

Sept 2025 – June 2030

Bachelor of Applied Science, Computer Engineering Honors Co-op

EXPERIENCE

Waterloo Aerial Robotics Group

Software Engineering Intern

(May 2026-Sept 2026)

- **Architected a full-stack, real-time UAV geolocation platform** (React/TypeScript frontend, Flask REST API backend, JSON-based persistence layer) enabling ground operators to remotely capture, annotate, and geolocate targets spotted mid-flight for the 2026 AEAC Firefighting Competition, applying linear algebra and ray-plane intersections to localize targets in 3D space with <0.5 m precision.
- Designed a **RESTful API surface** (capture, annotate, generate-output, history, export) and a React frontend with a custom drag-to-pan/scroll-to-zoom image-annotation workflow and live telemetry readouts, giving operators a real-time, human-in-the-loop review pipeline.
- Designed a **ROS 2** precision-landing pipeline that detects AprilTag fiducial markers in real time and feeds live pose estimates into ArduPilot's onboard precision-landing controller via **MAVROS**, enabling the drone to autonomously correct its position and land on a target marker.

UW Orbital

GroundStation Software Developer

(Jan 2026-May 2026)

- Built a **RESTful** command management **API (FastAPI, SQLAlchemy)** for a satellite ground station system, implementing CRUD endpoints with request validation and **Loguru**-based logging middleware for real-time performance monitoring.

PROJECTS

UAV Software-In-The-Loop Simulation Environment — WARG

- Built a from-scratch software-in-the-loop simulator using **PyBullet** rigid-body physics to model a quadcopter's flight dynamics, bridged to ArduPilot's SITL binary over a UDP JSON protocol for high-rate physics/flight-controller state exchange.
- Simulated onboard sensors, downward- and forward-facing RGB/depth cameras (PyBullet's OpenGL renderer) and a ray-casting rangefinder/LiDAR — streamed over GRPC to visualize the 3D environment, enabling integration testing of the vision and precision-landing pipelines without physical hardware.
- Containerized the full simulation stack (physics engine + ArduPilot SITL/MAVProxy) with **Docker**.

Full-Stack Classroom Management Platform

- Built a full-stack school management platform (**React 19, Node.js/Express 5, TypeScript**) with a **Postgres/Drizzle ORM** schema, role-based access control (admin/teacher/student), and **Better-Auth** session authentication (email/password, Google/GitHub OAuth).
- Hardened the API with **Arcjet** bot detection & rate limiting, SQL-injection-safe query patterns, and row-level locking with transactional rollbacks to prevent race conditions during concurrent enrollment.
- Built an invite-based onboarding system using cryptographically secure tokens, transactional email delivery (**Resend**) with role-specific content, and **Cloudinary**-backed image uploads for class banners and user avatars.

Neural Network From Scratch (C++)

- Implemented a multilayer perceptron from scratch in **C++ (Eigen for linear algebra, no ML framework)** with manually-derived forward/backpropagation, mini-batch SGD, and early stopping, achieving **95.4% test accuracy** on MNIST.
- Built an interactive **raylib** GUI for real-time handwritten-digit drawing with MNIST-style preprocessing (centering, normalization) and live multithreaded model inference.
- Wrote a custom binary **MNIST IDX** file parser (big-endian conversion) and a Fisher–Yates dataset shuffle, and implemented best-weight checkpointing with early stopping on validation-accuracy plateaus to prevent overfitting.

SKILLS & AWARDS

- **Programming Languages:** Python, C++, Java, JavaScript/TypeScript, Lua, Verilog, SQL
- **Frameworks & Libraries:** FastAPI, React, Node.js/Express, OpenCV, NumPy, MAVLink, Eigen, Drizzle ORM, Pydantic, Zod
- **Tools & Platforms:** Docker, Git/Github, Github Actions, Cloudinary, Resend, COMSOL, Notion, Quartus, Linux
- **Embedded & Robotics:** Arduino, Raspberry Pi, NVIDIA Jetson, ROS 2, ArduPilot/MAVROS, PyBullet, FPGA