

Vaughn Campos

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SUMMARY

Software engineer with 2 years of professional experience and a strong focus on spacecraft simulation and GNC software. Independently developed high-fidelity orbital propagation and attitude dynamics simulators in C++ with Monte Carlo trade study frameworks, physics-based environment models, and real-time 3D visualization. Combining software engineering fundamentals with growing expertise in orbital mechanics, control theory, and statistical simulation methods.

WORK EXPERIENCE

SmallTalk (Jelly Jelly), New York, NY, *Full Stack Software Engineer* December 2023 – October 2025

- Built real-time video streaming pipeline using LiveKit WebRTC with low-latency media transport, multi-client synchronization, and event-driven state management across web and mobile platforms
- Architected cloud infrastructure on AWS (S3, Lambda, EC2) with automated CI/CD deployment; integrated Supabase for real-time data synchronization and PostgreSQL-backed analytics
- Developed Swift-based iOS application end-to-end, shipping to the App Store with concurrent background processing and hardware camera integration

Orenda Inc., New York, NY, *Machine Learning Engineer Intern* June 2022 – August 2022

- Developed and tuned LSTM deep learning models to forecast energy demand across New York City boroughs, improving prediction accuracy by ~10% through hyperparameter optimization and feature engineering
- Deployed containerized data collection services on Kubernetes; built SQL data pipelines and operational dashboards for site selection analytics

PROJECTS

Satellite Constellation Simulation — C++20, OpenGL, Python December 2024 – Present

- Built 6,500-line high-fidelity orbital propagation engine modeling J2 oblateness, atmospheric drag (USSA76 density model), solar radiation pressure (cannonball model), and third-body gravity from Sun/Moon ephemerides
- Developed Monte Carlo trade study framework with parallel execution across CPU cores, sweeping constellation design parameters (altitude, inclination, plane count, phasing) with aggregated statistical output to CSV
- Implemented full GNC flight software simulation: MEKF attitude estimator, reaction wheel momentum allocator, gyroscope/star tracker/accelerometer sensor models, and closed-loop guidance law integration
- Built real-time 3D visualization with custom OpenGL rendering library supporting 1x–1000x time warp, trajectory playback, Earth rotation, and interactive orbit camera
- Developed Jupyter notebook analysis tooling for post-simulation visualization of orbital decay, coverage metrics, revisit times, eclipse fractions, and ground station pass events (AOS/LOS)

Spacecraft Attitude Dynamics Simulator — C++17 October 2024 – Present

- Developed rigid-body attitude dynamics engine with quaternion-based kinematics, inertia tensor propagation, and RK4 numerical integration for coupled orbital-attitude simulation
- Implemented 8-mode ADCS controller (safe, detumble, sun-pointing, attitude hold, target tracking, slew, momentum dump, fine-pointing) with PID auto-tuning and real-time telemetry visualization
- Modeled reaction wheel actuators with angular momentum dynamics, thruster models with gimbal control, and N-body gravitational physics with double-precision orbital state tracking

Bare-Metal IMU Firmware — C, ARM Cortex-M4 (STM32F411) 2025

- Wrote bare-metal C firmware with register-level I2C driver for MPU6050 6-axis IMU, UART telemetry streaming, and hardware verification via WHO_AM_I handshake
- Implemented ARM assembly startup, custom linker script, and multiple flash toolchains (ST-Link, OpenOCD, DFU)

Satellite Ground Station Antenna Tracker — Raspberry Pi, Python 2025 – Present

- Building two-axis tracking mount with NEMA 17 steppers, TMC2209 drivers, and Raspberry Pi for automated satellite pass tracking using TLE-derived pointing commands
- Developing web-based ground control interface with live camera stream, real-time motor control, and media capture/download accessible over local network

EDUCATION

Cornell University, College of Engineering, Ithaca, NY August 2019 – May 2023

B.S. Computer Science, Operations Research and Engineering

CUAir Cubesat Project Team — Developed CNN-based celestial body detection (Earth, Sun, Moon) on Raspberry Pi cameras for spacecraft attitude determination

TECHNICAL SKILLS

Languages: Python, C/C++20, JavaScript/TypeScript, Swift

Simulation & GNC: Orbital mechanics (SGP4, RK4/RK45), attitude dynamics, quaternion kinematics, PID/MEKF control, Monte Carlo methods, reaction wheel modeling, sensor/actuator simulation

Systems & Infrastructure: Multithreading, memory management, CMake, GCC/Clang, Linux, Git, Docker, Kubernetes, CI/CD

Data & Visualization: OpenGL, Jupyter/NumPy/Matplotlib, PostgreSQL, DuckDB, statistical analysis, CSV/telemetry pipelines

Web & Cloud: Next.js, React, Flask, AWS (S3, Lambda, EC2), Supabase, Vercel

AI & ML: Claude Code (agentic development workflows), CNNs, LSTMs, PyTorch