

# Karl Keshavarzi

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## EDUCATION

### University of Waterloo

*Bachelor of Applied Science, Computer Engineering*

Waterloo, ON

Sep. 2025 – Present

- **GPA: 3.9/4.0** — Term Distinction | Academic Class Representative

## PROJECTS

### Computational Electromagnetics Solver | C/C++, Python, OpenMP, Plotly, NumPy, Pandas

- Engineered parallelized 3D FDTD Maxwell Solver, achieving 60× speedup on 8M-cell grids using OpenMP.
- Reduced RAM access latency by 35% with cache-efficient flattened storage and RAII-based memory management.
- Implemented binary I/O and decreased overhead by 80% for field snapshots, enabling simulation visualizations.
- Validated numerical accuracy via 98%+ energy conservation by enforcing stability constraints and analytical tests.

### N-Body Gravitational Simulator | C/C++, Python, OpenMP, NumPy, Pandas, VPython

- Developed parallelized orbital mechanics physics engine, achieving 6× speedup on 6 cores for 10,000+ bodies.
- Achieved energy conservation ( $\Delta E/E \leq 10^{-14}$ ) over 100+ simulated years using 4th-order Yoshida integrator.
- Validated accuracy against NASA JPL Horizons data, achieving sub-2% deviation for solar system simulation.
- Built a real-time 3D visualization pipeline with VPython, rendering interactive trajectories at 60+ FPS.

### Electromagnetic Propulsion System | C/C++, Python, Arduino

- Designed 3-stage propulsion system with 200+ turn 16AWG coils via 200V/9,400μF (200J) capacitor bank.
- Developing microcontroller-based gate timing to sequence stages and safely manage 180 A+ inrush currents.
- Prototyping custom Altium PCB design to optimize multi-stage timing and achieve 100+ km/h terminal velocity.

### ExoDiscover — NASA Hackathon | Python, Flask, React, Three.js, HTML/CSS

- Built a full-stack web platform to identify and visualize potential exoplanets using machine-learning models.
- Delivered dynamic React/Three.js interface rendering 3D data visuals of 20,000+ exoplanets at 60FPS.
- Presented the final system to judges and placed top 4 overall (150 participants) within a 48-hour competition.

## EXPERIENCE

### Embedded Software Developer

*Waterloo Aerial Robotics Group — Design Team*

Sep. 2025 – Present

Waterloo, ON

- Developed SPI-based servo motor driver with deterministic 50 Hz update timing, ensuring stable actuation.
- Implementing I2C driver for barometric sensors, enabling real-time altitude estimation for control loops.

### Co-Author

*University of Waterloo*

Dec. 2025 – Present

Waterloo, ON

- Selected by Dr. Jamie Forrest to co-author the official ECE 105 (Physics) course text used by 400+ students
- Authored 100+ original problems with full solutions and modernized course material in LaTeX.

### Founder & Technical Lead

*KesTech Systems*

Apr. 2020 – Nov. 2025

Vancouver, BC

- Generated \$40,000+ in revenue with 25% profit margin by building and optimizing 60+ custom PC systems.
- Prevented post-delivery failure through stress-testing protocols including thermal, memory, and storage validation.

## TECHNICAL SKILLS

**Languages:** C/C++, Python, Java, JavaScript, HTML/CSS, LaTeX

**Frameworks/Libraries:** OpenMP, NumPy, Pandas, Plotly, VPython, React, Flask, Three.js

**Tools:** Linux, Git, VS Code, Bash, Altium, Oscilloscopes, Logic Analyzers, Multimeters

**Embedded:** SPI, I2C, CAN, UART, Arduino, Verilog, STM32CubeIDE