Karl Keshavarzi

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EDUCATION

University of Waterloo — Waterloo, ON
Bachelor of Applied Science, Computer Engineering — *Sep. 2025 – Present*

- **GPA: 3.9/4.0** — Term Distinction | Academic Class Representative
- **Co-authoring** official ECE 105 (Physics) course textbook with Dr. Jamie Forrest.

EXPERIENCE

Embedded Software Developer — Sep. 2025 – Present
Waterloo Aerial Robotics Group — Design Team Member — *Waterloo, ON*

- Developed SPI driver for ADC, enabling reliable 10-bit sensor 50Hz sampling for real-time control loops.
- Implemented low-latency I2C driver for barometric sensors, enabling real-time altitude computation.

Undergraduate Research Assistant — Jan. 2026 – Present
University of Waterloo — Integrated Quantum Optoelectronics Lab (IQOL) — *Waterloo, ON*

- Accelerated validation cycles by designing automated tests and data collection for novel solar cell prototypes.
- Contributing to peer-reviewed research on microwave optomagnetics through optical induction of superconductors.

Founder & Technical Lead — Apr. 2020 – Nov. 2025
KesTech Systems — Self Employed — *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.

PROJECTS

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

- Achieved 60x speedup on a 125K-cell grid by developing a 3D Yee-cell FDTD solver with OpenMP parallelization.
- Reduced RAM access latency by 35% with cache-efficient flattened storage and RAII-based memory management.
- Validated numerical accuracy via 98%+ energy conservation by enforcing stability constraints and analytical tests.
- Implemented binary I/O and decreased overhead by 80% for field snapshots, enabling simulation visualizations.

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

- Achieved 12× speedup on 1,000+ body simulations using OpenMP parallel force calculations across 8 threads.
- Maintained 99.998% energy conservation over 100+ simulated years with 2nd-order Velocity Verlet integration.
- Validated simulation accuracy against NASA JPL Horizons data, achieving sub-5% deviation for celestial bodies.
- 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 manage 180 A+ inrush currents.
- Prototyping custom Altium PCB design to optimize multi-stage timing and achieve 100+ km/h terminal velocity.

ExoDiscover | *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.

TECHNICAL SKILLS

Languages: C/C++, Python, Java, JavaScript, HTML/CSS, LaTeX, Verilog
Frameworks/Libraries: OpenMP, NumPy, Pandas, Plotly, VPython, React, Flask, Three.js
Tools: Linux, Git, VS Code, Bash, Altium, Oscilloscopes, Logic Analyzers, COMSOL, Multimeters
Embedded: SPI, I2C, CAN, UART, Arduino, STM32CubeIDE