

# 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

## 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 sampling for motor/servo control at 50 Hz.
- Implementing an I2C driver with register access for barometric sensors, calculating real-time drone altitude.

### Undergraduate Research Assistant

Jan. 2026 – Present

University of Waterloo — Department of Electrical and Computer Engineering

Waterloo, ON

- Researching microwave optomagnetics in Dr. Hamed Majedi's Integrated Quantum Optoelectronics Lab (IQOL).
- Testing and validating novel solar cell designs and optical induction techniques for superconductors.

### Founder & Technical Lead

Apr. 2020 – Nov. 2025

KesTech Systems — Self Employed

Vancouver, BC

- Built and delivered 60+ commissioned custom PC systems, generating \$40,000+ in revenue and \$10,000+ profit.
- Led client consultations to design systems optimized for performance, thermals, reliability, and budget constraints.

## PROJECTS

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

- Implemented 3D Yee-cell FDTD solver for Maxwell's equations with time-domain field evolution and visualization.
- Designed cache-efficient flattened field storage with 3D-to-1D indexing and RAII-based memory management.
- Parallelized computation with OpenMP and implemented binary I/O, achieving 360× speedup on 125K-cell grid.
- Enforced numerical stability by Courant (CFL) constraint, validating simulations with 98%+ energy conservation.

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

- Developed an N-body gravitational simulator modeling long-term celestial dynamics and orbital interactions.
- Parallelized force calculations using OpenMP, simulating 1,000+ bodies 12x faster on multi-core CPUs.
- Utilized 2nd-order Velocity Verlet integration, achieving 99.998% energy conservation over 100+ year simulations.
- 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.
- Implemented firmware safety interlocks, including overcurrent detection to protect coils and electronics.
- 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.
- Integrated and deployed team's XGBoost and CNN models (70% detection accuracy) during NASA SpaceApps.
- 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, SQL, 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

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