

# 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, configuring clock polarity and phase to reliably sample 10-bit potentiometer voltages (0–3.3V) and map them to 50Hz PWM signals for motor speed/servo position control.
- Implementing an I2C driver with register access for barometric sensors, calculating real-time drone altitude.

### Co-Author & Curriculum Developer

Dec. 2025 – Present

University of Waterloo — Department of Electrical and Computer Engineering

Waterloo, ON

- Invited by Course Coordinator to co-author the official ECE 105 (Physics) course text, impacting 400+ students.
- Created 100+ problems with solutions and updated course materials in LaTeX for clarity and maintainability.

### 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 field updates using OpenMP, achieving an 8× speedup on 125K-cell grids over 10,000+ timesteps.
- Enforced numerical stability by Courant (CFL) constraint, validating simulations with 97%+ energy conservation.
- Developed a binary I/O pipeline for large-scale field data, reducing storage and text parsing overhead by 6×.

### 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 evaluations using OpenMP, simulating 1,000+ bodies at 500M+ FLOP/s on multi-core CPUs.
- Utilized 2nd-order Velocity Verlet integration, achieving 99.98% 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, JavaScript, Java, HTML/CSS

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

**Tools:** Linux, Git, VS Code, Arduino, STM32CubeIDE, Altium