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 Representative

Experience

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

- Designed SPI driver for ADC and configured clock polarity and phase to reliably sample 10-bit sensor data.
- Developed timer-based PWM control at 50 Hz (1–2 ms pulse), mapping ADC input to servo duty cycle (5–10%).
- Engineering an I2C driver with register access for barometric pressure sensors, calculates real-time altitude.

Co-Author & Curriculum Developer — Dec. 2025 – Present
University of Waterloo — Department of Electrical and Computer Engineering — *Waterloo, ON*

- Selected by Course Coordinator to co-author the official ECE 105 (Mechanics) Course Text for 400+ students.
- Modernized curriculum infrastructure using LaTeX; developed 100+ problems and a solutions manual.

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

- Generated $40,000+ revenue and $10,000+ profit by consulting, building and optimizing 60+ custom systems.
- Managed client consultations and requirements, specializing in performance optimization and thermal solutions.

Projects

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

- Developed gravitational simulator using OOP, achieving sub-0.0002% energy drift over 31.5M second simulations.
- Simulated 1000+ bodies in parallel using OpenMP, optimized and achieved 500,000,000+ FLOP/s.
- Implemented symplectic 2nd-order Velocity Verlet integration for accurate and stable orbital mechanics.
- Developed CSV parsing and simulation outputs using VPython for 60+ FPS 3D rendering of body trajectories.

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

- Designed 3-stage accelerator with 200+ turn wound 16AWG coils and 10x 25V/4700μF capacitor bank.
- Scaled power delivery to 200J, implementing switching system, handling 180A+ inrush from 200V/9,400μF production bank with Arduino-controlled gate timing.
- Optimizing multi-stage timing and power delivery to accelerate 9mm/60g ferromagnetic projectiles to 100+ km/h.
- Prototyping Arduino-based timing controller on breadboard, iterating toward custom Altium PCB design.

3D FDTD Electromagnetic Wave Solver | *C/C++, OpenMP*

- Developing a 3D FDTD electromagnetic wave solver in C++ with dynamic memory allocation and flattened arrays for six EM field components, enabling scalable and cache-efficient simulations.
- Implementing Courant-stable time-stepping and 2D/3D Yee-cell field updates to propagate electromagnetic pulses across arbitrary grid sizes.
- Visualizing wave propagation via heatmaps/animations to validate numerical stability and physical correctness.

ExoDiscover | *Python, Flask, React, Three.js, HTML/CSS*

- Integrated and deployed team's XGBoost/CNN AI models (70% detection accuracy) for NASA SpaceApps.
- Delivered dynamic React/Three.js interface rendering 3D data visuals of 20,000+ exoplanets at 60FPS.
- Presented full-stack final product in React to judges; placed top 4 of all teams (150 participants) in 48 hours.

Technical Skills

Languages: C/C++, Python, JavaScript, Java (Processing), HTML/CSS
Frameworks: OpenMP, VPython, NumPy, Pandas, Flask, React
Tools: Linux, Git, VS Code, Altium, Arduino, STMCubeIDE