Kunal Kaushik

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Education

University of Illinois Urbana-Champaign Aug 2026 – May 2029
B.S. Electrical Engineering, Minor in Computer Science *GPA: 4.00/4.00*

Work Experience

Electrical Engineer, BMS Aug 2026 – Present
Illini Electric Motorsports

- Proposed isoADC precharge sensing at design review for differential accumulator-to-inverter ΔV monitoring; calculated voltage-divider ratios and filtering to detect inverter voltage within 5% of accumulator voltage
- Designed schematic and PCB layout for 600V contactor weld detection for post-discharge diagnostics, using shared resistor networks to distinguish all 5 contactor/fuse states; validated sense voltages in LTspice and by hand calculation
- Designed and fabricated an STM32 USB-C-to-CAN development board integrating 3 TCAN1044 transceivers, 5V/3.3V power rails, and isolation circuitry; resolved pin conflicts between the microcontroller's USB and CAN interfaces.
- Assembled and brought up devboard, verifying power/signal integrity through bench testing and debugging.

Undergraduate Researcher, NASA CANVAS Aug 2026 – Present
Novel Mobile Robotics Laboratory under Professor Justin Yim

- Developed a propeller-driven Venus traversal robot that rolls between rounded tetrahedron faces using distributed thrust
- Derived a generalized motor-activation algorithm using a four-color triangular orientation lattice; validated 2-/4-beat rolling sequences along both lattice axes in simulation, reducing motor count from 12 to 8 with two motors per vertex
- Bench-tested motor–propeller pairs for thrust, current draw, and mass; calculated expected force and torque from measured thrust and selected a pair delivering 19 g thrust at 1.58 A to balance rolling actuation and electrical load
- Integrated ESP32-C3, BNO085 IMU over I2C, four dual-channel Pololu Motoron drivers, and a 1S 550 mAh battery; developed motor-control firmware, calibrated the IMU, and soldered a custom wiring harness for closed-loop rolling
- Designed a thin-skinned wireframe chassis and lightweight motor mounts with extended lever arms; cut structural mass from about 540 g to 160 g (70%), enabling rolling at 15% thrust-to-weight across flat ground, gravel, and sand

Hardware Engineering Intern, Self-Balancing Wheeled Humanoid Jan 2025 – Jul 2025
Nova Robotics LLC

- Selected ODrive S1 motor controllers and 16-bit quadrature encoders; wired and brought up Raspberry Pi, IMU, and dual reaction-wheel electronics; built a 6:1 gearbox and a custom quadrature-encoder mount for mechanical alignment
- Configured 1 Mbps CAN between Raspberry Pi and ODrive S1 controllers at 250 Hz; demonstrated repeatable balancing on a single-wheel inverted-pendulum prototype, with sustained balance duration limited by reaction-wheel saturation
- Diagnosed an incorrectly adjusted 24V buck converter with a multimeter; identified unsafe Raspberry Pi supply voltage
- Built modular electronics with hand-soldered perfboard, WAGO connectors, screw terminals, and crimps; designed torso harness to route power, sensor, and CAN/I2C wiring through constrained electromechanical packaging in the humanoid

Projects

Designer, Open Source BLDC Motor Controller Apr 2026 – Present

- Architected an ESP32-C5 BLDC controller schematic with DRV8323SRTAR gate driving and high-resolution quadrature feedback; planned field-oriented control, CAN/power over RJ45, conventional CAN/power connectors, and USB-C
- Designed a CSD MOSFET three-phase power stage for a target 10V–36V input; specified buck-converter/LDO logic supplies, bulk bus capacitance, ESD protection, and reverse-polarity protection for the controller's power input
- Created custom PCB footprints for components missing from EDA libraries to prepare the controller for PCB layout

Project Lead, Competition Robot Jun 2024 – Nov 2025

- Led FTC robot hardware design, integrating 7 motors, 12 servos, color sensing, and vision for game-element alignment
- Built custom wiring harnesses and soldered motor connectors; integrated a servo power module to address voltage droop during simultaneous subsystem operation, using voltage and current measurements for electrical troubleshooting
- Restored failed control hub by isolating a poorly soldered battery connector with a multimeter and resoldering the joint

Spatial Snakes | *Intern w/ RoMeLa at UCLA* Jun 2026 – Present

- Built Spatial Snakes prototype under Professor Dennis Hong using MIT CSAIL's y-zipper as the extrusion mechanism
- Designed ESP32-actuated slider and fabricated custom breakout PCB for static actuation and peripheral control; programmed concurrent actuator monitoring with error detection logic to prevent fabric sheath snags and tears
- Created everting fabric sheath spooled by stepper motor to grow from the extension tip and reduce footprint by 30%

Skills

EDA/CAD & Simulation: Altium, KiCad, LTspice, EasyEDA, Fusion 360, Onshape
Embedded & Programming: C/C++, Python, MATLAB, STM32, ESP32, Raspberry Pi
Protocols & Hardware: Schematic Design, PCB Layout, CAN, I2C, SPI, UART, PWM, ADC, Bring-Up, Debugging
Test & Build: Oscilloscope, Multimeter, Bench Supply, Soldering, SMT/Reflow, Crimping, FDM Printing, CNC, DFM/DFA