Bangan Wang

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EDUCATION

University of Pennsylvania • Master of Science in Mechanical Engineering (Mechatronics & Robotics System)

- Cumulative GPA: 4.0 / 4.0 *Sep. 2025 – Present*

University of Toronto (St. George Campus) • Bachelor of Applied Science in Mechanical Engineering

- Cumulative GPA: 3.9 / 4.0, graduate with High Honor *Sep. 2020 – Jun. 2025*

PUBLICATIONS & PATENT

- Zhang, Y., Malladi, S., Wang, B., Son D.O., Hinz B, Chaikof, E.L., & Günther, A. (2025). Microfluidic Formation of Ultrathin, Handleable Collagen Sheets Exhibiting Toe-heel Tensile Behavior. *(Advanced Materials Technologies)*
- Li, H.*, Peng, T.*, Wang, B.*, Zhang, R., Gao, B., Qiao, N., Guan, Z., Li, J., & Shi, T. (2025). Safedrive Dreamer: Navigating Safety-Critical Scenarios in Autonomous Driving with World Models. *(Alexandria Engineering Journal)*
- Patent pending (USPTO & CNIPA) — Method and System for Automated Single-Cell and Spatial Multi-omics Profiling (Co-inventor). Dual filings in the United States and China (2025).

RESEARCH EXPERIENCE

Tidybot Army, A Mobile Manipulator Platform • Figueroa lab, University of Pennsylvania *Sep. 2025 – Jan. 2026*

Built an end-to-end mobile manipulation platform (holonomic base + 7-DoF arm) for household/object-tidying tasks, integrating onboard compute, ROS2 stack, whole-body control, teleoperation, and safety recovery.

- **Hardware & bring-up:** Built the full robot system with dual power rails (arm/base), onboard NUC compute, and holonomic powered-caster base; implemented base low-level controllers and system bring-up/testing.
- **Software integration (ROS2):** Integrated gamepad teleoperation, arm/base interfaces, and runtime nodes into a unified ROS2 pipeline for closed-loop command and state feedback.
- **Whole-body control:** Designed and deployed a velocity-level QP whole-body controller to coordinate base + arm (Franka panda and Kuka iiwa 7) to reach target poses; achieved robust trajectory tracking and disturbance recovery.
- **Safety & autonomy:** Implemented a safety-boundary and collision recovery mechanism that logs execution history and automatically rewinds to a safe state when exceeding user-defined boundaries or detecting arm–base collisions.

SafeDrive Dreamer (World-Model + Safe RL for Autonomous Driving) • University of Toronto *Jan. 2024 – May. 2024*

Designed an autonomous driving framework that combines world models with safety-aware reinforcement learning to improve sample efficiency and reduce sim-to-real performance drop.

- **Reward design:** Designed and implemented the reward function to encode safety-critical objectives (e.g., constraint satisfaction, stable progress, and penalty shaping), and integrated it into the training loop to guide policy learning under risk-aware constraints.
- **PAC-Bayes sim-to-real module:** Built a PAC-Bayes sim-to-real transfer module using KL-regularized policy adaptation from sim prior to bridge posterior. Reduced the sim-to-real gap.
- **Hardware validation:** Defined customized safety + performance metrics and validated the framework on hardware mobile platform.

Uni-axial Tensile Tester for Ultrathin Collagen Sheets • Guenther Laboratory, University of Toronto *May. 2023 – Sep. 2023*

Designed and integrated a tensile-testing workflow for ultrathin collagen sheets, spanning actuator control, microscopy characterization, and vision-based surface feature extraction.

- **Low-level control:** Implemented a low-level controller for a custom uni-axial tensile tester and executed static and cyclic (fatigue) loading tests to characterize collagen sheet's mechanical response and durability under Prof. Axel Günther's supervision.
- **TEM microscopy:** Performed TEM imaging and organized microscopy data collection to assess sheet microstructure and surface characteristics.
- **Computer vision analysis:** Built a YOLO-based segmentation pipeline (dataset curation + fine-tuning + evaluation) to detect and segment droplet-like surface patterns, enabling scalable, repeatable surface metric extraction.
- Awarded the "2023 University of Toronto Mechanical & Industrial Department Undergraduate Summer Research Award" ($7500).

PROJECTS

CFC 3D Printer Chamber Temperature Controller • ARL-MLS Laboratory, University of Toronto *Sep. 2024 – Apr. 2025*

Designed and prototyped a chamber temperature control unit for a CFC 3D printer, integrating airduct design, PCB/electronics, control, and data-driven optimization to improve thermal uniformity and regulation accuracy.

- **System integration:** Produced CAD models, electronics schematic, laid out the PCB and assembled the design.

- **Data-driven optimization:** Ran full-factorial DOE and response-surface optimization on duct and outlet-shutter geometry, achieved 2°C chamber temperature uniformity.
- **Low-level control:** Developed a PD-like controller with self-adaptive parameters; tuned parameters via data-driven experiments, achieved ±0.5°C regulation accuracy.
- **Sensor calibration:** Designed an adaptive compensation model to estimate chamber-average temperature from one single-point sensor and feed corrected measurements to the controller for consistent regulation.
- Awarded 1st Place Senior Design (Mechanical Engineering, $1000) among 80+ design projects.

Hexapod (named as "eclipse") • Solo Project, Toronto *May. 2024 – June. 2024*

Designed, simulated, and prototyped a bio-inspired multi-legged robot, leveraging kinematic simulation, mechatronics integration, locomotion control.

- **Hardware:** Designed and built the full robot system. Fabricated a 4-layer servo driver PCB to support dual power rails, and drive up to 24 servos with peripherals (7.5V / 15A max input).
- **Simulation:** Built kinematic/dynamic models in MATLAB Simscape Multibody to validate gait timing, balance, and collision-free joint motion.
- **Locomotion control:** Implemented an IMU-feedback gait controller with terrain-aware scheduling, dynamically adjusting step timing and regenerating leg trajectories in real time.

WORK & INTERNSHIP EXPERIENCES

AGS Automotive Systems • Toronto, Canada

Mechanical Design Engineer, Mechanism Design and Process Engineering *Sep. 2023 – May. 2024*

- **Mechanical design:** led the CAD team to deliver 3D models for production-line equipment and automotive components (e.g., bumper paint fixtures and chrome-plating process layouts) to support facility reconfiguration and maintenance planning.
- **FEA:** Performed FEA and kinematic simulations to validate structural integrity and functional requirements of mechanical systems.
- **Ergonomics & process management:** Performed ergonomic and motion studies. Utilized MOST methodology to standardize manual tasks, delivering 10% efficiency improvements in multiple assembly stations.

CERTIFICATION & AWARDS

- 1st Place Senior Design, Mechanical Engineering ($1000), University of Toronto *Jun. 2025*
- MIE Undergraduate Summer Research Award ($7500), University of Toronto *May. 2023*
- Dassault Systèmes Certified SOLIDWORKS Professional - Advanced Surfacing (CSWPA-SU) *Sep. 2022*
- Dassault Systèmes Certified SOLIDWORKS Professional - Mechanical Design (CSWP) *Aug. 2023*

SKILLS

- **Mechatronics Design & Integration:** Proficient in SOLIDWORKS, AutoCAD, Autodesk EAGLE (PCB), ANSYS.
- **Programming:** Proficient in Python, C/C++, MATLAB, LabVIEW.
- **Robotics (Hardware):** Kuka iiwa 7 manipulator, Franka Emika Panda manipulator.

HOBBIES

- **Electronic Music Production:** My music has been signed and published by renowned record labels (Sirup Music GmBh, 325K YouTube subscription) and supported by top artists worldwide.
- **DIY Microcontroller Projects**: Work on various ESP32 and Raspberry Pi projects. Visit my portfolio to see my latest projects.