Bangan Wang

+1 (437)3411381   wangban2@seas.upenn.edu   **Portfolio:** https://banganwang.nicepage.io/

EDUCATION

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

University of Toronto (St. George Campus)   **Sep. 2020 – Jun. 2025**
Bachelor of Applied Science in Mechanical Engineering (Mechatronics & Solid Mechanics)
- **Cumulative GPA**: 3.85/4.00.
- **Related Course**s: Robotics (4.0/4.0), Microcontroller & Embedded System (4.0/4.0), Mechatronics System: Design and Integration (ROS) (3.7/4.0), Machine Design (4.0/4.0), Analog & Digital Circuit (4.0/4.0).

PUBLICATIONS

- 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*.

PROJECT EXPERIENCE

TurtleBot Autonomous System Development — *MIE443 Course Project, Toronto*   **Jan. 2025 – Apr. 2025**
Aim: Design and implement an autonomous TurtleBot2 capable of path planning, map reconstruction, image classification, and human-machine interaction.
- Designed a path-planning controller using LiDAR, odometry, and bumper sensors that combine Artificial Potential Fields (APF) with a memory-weighted occupancy grid and reactive collision-recovery modules, enabling fast, low-redundancy mapping of a 5m x 5m unknown arena in Gazebo and real-world tests with a 95% success rate.
- Integrated AMCL localization and a brute-force traveling-salesman solver for optimal multi-target routing. Developed a vision pipeline in OpenCV (grayscale, SURF key-point extraction, FLANN k-NN matching), accurately identify and classify images at each target location.
- Designed a finite-state machine to convey six multi-modal emotions through spins, shakes, and voice prompts, etc.

Chamber Temperature Control Unit Design (with ARL-MLS) — *ARL-MLS Laboratory, University of Toronto*   **Sep. 2024 – Apr. 2025**
Aim: Design, optimize, and prototype a temperature control unit to regulate the chamber temperature for the CFC 3D printer at the ARL-MLS lab.
- Produced CAD models (internal compartments, airflow ducts, etc.), electronics schematic, laid out the PCB and assembled the design.
- Ran Full Factorial Design of Experiments (DOE) and used response surface method to optimize the internal airflow duct, outlet-shutter geometry. Improved in-chamber temperature uniformity by 62.9%, achieved in-chamber uniformity of 2°C.
- Developed a customized PD-like controller with a self-adaptive proportional gain. Fine tune the terms using a combined method of DOE and enumeration. Cut steady-state error by 98.6%, boosted control stability by 58.6%, and achieved control accuracy of $\pm 0.5°C$.
- Designed a self-adaptive compensation model that can predict the in-chamber average temperature based on a single-point sensor reading, then feeds the corrected value into the controller.
- Awarded "*1st Place Capstone, Mechanical Engineering ($1000)*" out of more than 80 entries in the 2024-2025 capstone showcase.

Hexapod Robot (named as "eclipse") — *Personal Solo Project, Toronto*   **May. 2024 – Sep. 2024**
Aim: Design, simulate, and prototype a multi-legged robot platform inspired by insects.
- Conducted kinematic and dynamic simulations in MATLAB Simscape Multibody to ensure proper gait timing, balance, and collision-free movement of joints. Measured the workspace of each leg.
- Modeled linkages in SOLIDWORKS, fabricated using FDM 3D printing.
- Designed and programmed the locomotion controller in C. Implemented dynamic gait adjustments (for different terrains) and responsive control based on the remote receiver module and the gyroscope sensors.
- Independently designed and fabricated a 4-layer motor driver PCB to streamline wiring, integrate dual power systems. The board supports up to 24 servo motors and multiple peripherals with a maximum input of 7.5V/15A.

RESEARCH EXPERIENCE

Autonomous Driving Research — *University of Toronto, Toronto*   **Jan. 2024 – May. 2024**
Aim: To design and develop an autonomous driving framework that integrates world models with safe reinforcement learning to enhance training efficiency and mitigate the sim-to-real gap.
- Collaborated on the development of the "Safedrive Dreamer" framework. Reduced real-world interactions and reliance on large datasets, while domain randomization and PAC-Bayes methods were used to improve generalization.
- Conducted literature reviews on current autonomous driving frameworks, focusing on safety-critical scenarios, model-based reinforcement learning (MBRL), and sim-to-real transfer methods.
- Designed the reward mechanism, sim-to-real transfer, and assisted in simulation experiments. Evaluated the proposed framework using customized safety and performance metrics, achieving a 91.3% success rate in simple scenarios and 71.8% in complex scenarios.

Ultrathin Collagen Sheets (via microfluidics fabrication) Research — *Guenther Laboratory, University of Toronto, Toronto*

Aim: Design and develop a control system (with software) for a tensile tester and perform formal data analysis to assess the loading properties and surface characteristics of ultrathin collagen sheets.

- Programmed the control system for a uni-axial tensile tester using LabVIEW under the supervision of Prof. Axel Günther. Conducted static and dynamic loading tests to assess sheets' static and fatigue material properties.
- Operated Transmission Electron Microscopy (TEM). Conducted imaging and data organization of collagen sheet microscopy.
- Developed an image segmentation system using YOLO pre-trained computer vision model, prepared the dataset, fine tuned the model to identify and segment the "droplet-like" surface pattern of the sheet, followed by formal analysis.
- Awarded the *"2023 University of Toronto Mechanical & Industrial Department Undergraduate Summer Research Award"* ($7500).

WORK EXPERIENCES

Mechanical Engineer Intern — *AGS Automotive Systems, Toronto*   **May. 2023 – May. 2024**

- Led the CAD team, created 3D models of production lines and automotive components to support facility reconfiguration and maintenance.
- Conducted Finite Element Analysis (FEA) and simulations to validate mechanical systems functionality.
- Conducted process management to streamline workflows across the plant, facilitated smoother operations.
- Performed ergonomic and motion studies. Utilized MOST methodology to standardize manual tasks, delivering 10% efficiency improvements in multiple assembly stations.

CERTIFICATIONS & AWARDS

• 2024-2025 Capstone Design Course, 1st Place Capstone, Mechanical Engineering ($1000)	**Jun. 2025**
• University of Toronto Engineering Department Dean's Honor List	**Sep. 2020 – Jun. 2025**
• 2023 University of Toronto Mechanical & Industrial Department Undergraduate Summer Research Award ($7500)	**May. 2023**
• Dassault Systèmes Certified SOLIDWORKS Professional - Advanced Surfacing (CSWPA-SU)	**Sep. 2022**
• Dassault Systèmes Certified SOLIDWORKS Professional - Mechanical Design (CSWP)	**Aug. 2022**
• Dassault Systèmes Certified SOLIDWORKS Associate - Mechanical Design (CSWA)	**Dec. 2021**

SKILLS

- **Engineering Technical**: Proficient in SOLIDWORKS, AutoCAD, Autodesk EAGLE (PCB design), ANSYS, PSpice, ROS (Robot Operating System).
- **Programming**: Proficient in MATLAB, C/C++, Python, x86/ARM Assembly, LabVIEW.
- **Supplementary Skills**: PCB Design & Fabrication, 3D Printing & Rapid Prototyping, TEM Microscopy, ImageJ, Adobe Photoshop, Adobe Illustrator.

HOBBIES

- **Electronic Music Production**: Self-taught music production since high school, has produced music for more than 8 years. My music has been signed and published by renowned record labels (Sirup Music GmBh, 325K YouTube subscription) and supported by top artists worldwide (Don Diablo (Ranked No.6 in DJ MAG – Top 100 DJs in the world)).
- **DIY Microcontroller Projects**: Work on various Arduino, ESP32, and Raspberry Pi projects in my spare time. Visit my portfolio to see my latest projects.