GUANYU XU

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Ann Arbor, MI - 48105, United States

EDUCATION

- **University of Pennsylvania** *Aug 2026 - May 2028*
  M.S.E. in Robotics (Expected) Philadelphia, US
- **University of Michigan - Ann Arbor** *Aug 2024 - May 2026*
  B.S.E. in Computer Engineering **Major GPA**: 4.0/4.0 Ann Arbor, US
- **Shanghai Jiao Tong University** *Sep 2022 - Aug 2026*
  B.E. in Mechanical Engineering (Expected) **Major GPA**: 3.68/4.0 Shanghai, China

RESEARCH INTEREST

My research interest primarily focuses on **embodied intelligence and robotics**, with the long-term goal of enabling robots to perform diverse tasks in unstructured human environments. I am particularly interested in unifying robotic foundation models with simulation-based RL to enable agile, generalizable robotic behaviors in the real world. My prior work is grounded in **full-stack robotic systems**, encompassing expertise in mechanical design and smart manufacturing, embedded and real-time systems, and closed-loop sensorimotor control.

PUBLICATION & PATENTS

[1] **Guanyu Xu**, Jiaqi Wang, Dezhong Tong, and Xiaonan Huang, "Highly Deformable Proprioceptive Membrane for Real-Time 3D Shape Reconstruction", *ArXiv.org. https://arxiv.org/abs/2601.13574*, 2026.

[2] **Guanyu Xu** and Longquan Liu, "A Variable Radius Wheel", *National Intellectual Property Office, Patent No. CN221698395U*, 2024.

RESEARCH EXPERIENCE

- **Proprioceptive Membrane for 3D Shape Reconstruction (Project lead)** *Jun. 2025 - Present*
  Hybrid Dynamic Robotics Lab, University of Michigan Instructor: Prof. Xiaonan Huang
  - **Spearheaded** the design and fabrication of a highly deformable proprioceptive membrane utilizing an **optical waveguide structure** to achieve real-time **3D shape reconstruction**.
  - Architected and trained a **PointNet-based autoencoder model** in **PyTorch** to decode optical signals into 3D point clouds.
  - Developed an automated data collection pipeline with a **depth camera** to capture high-accuracy ground-truth datasets.
  - Programmed **STM32** microcontroller to scan LEDs and sample photodiodes, and designed a custom stretchable PCB for the multilayer optical waveguide structure.
  - Achieved high-accuracy surface shape reconstruction with **an average Chamfer distance of 1.3 mm** while maintaining accuracy for **indentations up to 25 mm** and **up to 75% stretching strain**.
  - **First-authored paper under review at *Advanced Robotics Research*.**
- **Active Steering Control of Soft Growing Robot (Core contributor)** *Oct. 2024 - Mar. 2025*
  Hybrid Dynamic Robotics Lab, University of Michigan Instructor: Prof. Xiaonan Huang

- Integrated the electrostatic clutch-based steering joint into a functional full-scale robot prototype to enable accurate closed-loop omnidirectional steering.
- Formulated a **geometrical model** to characterize the non-linear relationship between the steering angle and the clutch actuation patterns.
- Designed a custom PCB to drive the high-voltage electrostatic clutch control circuits reliably.

- **Lunar Rover with Transformable Wheel (Project lead)** *Jan. 2023 - Oct. 2023*
  School of Aeronautics and Astronautics, Shanghai Jiao Tong University Instructor: Prof. Longquan Liu
  - **Invented and prototyped** a self-adaptive, variable-radius transformable wheel, successfully translating the design into a fully granted **National Patent**.
  - Implemented real-time sensing and transformation actuation algorithms on a Raspberry Pi, interfacing with ultrasonic sensors and LiDAR for obstacle-aware terrain adaptation.
  - Developed and tuned a PID controller utilizing IMU feedback to maintain vehicle path stabilization during dynamic wheel transformations.

PROJECT EXPERIENCE

- **INSIGHT: Smart Assistive Glass for Visually Impaired (Team Lead)** *Aug. 2025 - Dec. 2025*
  Course project for EECS 473: Advanced Embedded System (MDE). Instructor: Prof. Mark Brehob
  - Designed an **ESP32-based smart-glasses system** on a **custom PCB**, integrating microphone arrays, speaker, vibration motors, and OV2640 camera in a compact wearable form factor.
  - Engineered an end-to-end edge AI pipeline leveraging a **Jetson Orin Nano** base station, enabling real-time obstacle-aware assistive navigation and interactive scene description.
  - Deployed **YOLO object detection** on the base station to achieve **up to 30 Hz** obstacle identification with directional vibrotactile feedback for assistive navigation.
  - Deployed a lightweight Vision-Language Model (VLM) for strictly **on-device** scene description, performing real-time inference without relying on cloud APIs.
  - Programmed the ESP32 to handle wake-word detection, real-time audio and video streaming, and low-latency text-to-speech (TTS) playback.

- **Lumen Grid: Multi-Robot Competitive Parking Game (Team Lead)** *Feb. 2025 - Apr. 2025*
  Course project for EECS 373: Introduction to Embedded System Design Instructor: Prof. Junyi Zhu
  - Programmed **robot control logic and inter-system communication protocols** in **C++** on an STM32 microcontroller.
  - Designed an **IMU-based remote controller** for the **Zumo robot** with vibration feedback reflecting Zumo's speed.
  - Interfaced with a camera for real-time position tracking of all robots based on color codes.
  - Developed the **playground control algorithm** that scheduled lighting patterns, tracked robot position, and updated the scoring for the game setting.

TEACHING & COMMUNITY SERVICE EXPERIENCE

- **Grader, EECS 370: Intro to Computer Organization, University of Michigan** *Sep. 2025 – Dec. 2025*
- **Volunteer, IEEE International Conference on Robotics and Automation, Atlanta** *May. 2025*
- **Student Volunteer, Shanghai Sunflower Community Children's Service Center** *Sep. 2023 – Dec. 2023*

HONORS & AWARDS

- **University Honors, University of Michigan** *Dec. 2024 & May 2025*
- **Dean's List, University of Michigan** *Dec. 2024 & May. 2025*
- **Undergraduate Excellent Scholarship, Shanghai Jiao Tong University** *May 2023 & Dec. 2023 & May 2024*

SKILLS

- **Programming:** C/C++, Python, MATLAB, Bash, CUDA C/C++.
- **Embedded Systems:** STM32, ESP32; Raspberry Pi, Jetson Orin Nano; FreeRTOS; I^2C/SPI/UART/CAN.
- **AI/ML:** PyTorch, YOLO, Moondream-VLM, Sentence Transformer.
- **Hardware Design:** Altium Designer, EasyEDA, Solidworks, AutoCAD.
- **Tools:** Git, SSH, CMake, Vim, Markdown, LaTeX.