

ZHUOWEI XU

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Skills

Programming: C++, Python, MATLAB/Simulink, Julia

Hardware / Fabrication: CAD Design, PCB Design, 3D Printing (Bambu Lab, Raise3D, Formlabs), Arduino

Robotics / ML: Robot Operating System (ROS), MuJoCo, Imitation Learning, Tactile Sensing, Robot Manipulation

Education

Carnegie Mellon University

Sept. 2024 – May 2026

Master of Science in Mechanical Engineering, GPA: 3.9/4.0

Pittsburgh, PA

Coursework: Mechanics of Manipulation, Robot Dynamics, Modern Controls, Computer Vision, Machine Learning

Shanghai Jiao Tong University

Aug. 2020 – Jul. 2024

Bachelor of Mechanical Engineering

Shanghai, China

Professional Experience

Fraunhofer Project Center for Smart Manufacturing at SJTU

Jun. 2023 – Sept. 2023

Research Intern

Shanghai, China

- Developed an air-chamber-actuated underactuated finger that lifted 200 g at 0.1 MPa.
- Improved actuation performance via exoskeleton stiffness enhancement and variable-stiffness joint design.

Shanghai BOCHU Electronic Technology

Nov. 2023 – May 2024

Research Intern

Shanghai, China

- Built a galvo mirror-robot co-work system, extending planar galvo workspace to 3D using a 6-DoF robotic arm.
- Built a kinematic calibration model with error compensation, identifying system parameters from planar images.

Selected Projects

Tactile-Augmented Robot Learning for Contact-Rich Manipulation [🔗](#)

May 2025 – Mar. 2026

Carnegie Mellon University, Robotics Institute

- Built a **real-robot imitation learning pipeline** that fuses vision, and tactile signal (force and vibrotactile) for contact-rich manipulation under partial observability.
- Developed a kinematic-twin-based **teleoperation** and **data-collection system** for coordinated robotic hand and Franka arm control, with a **MuJoCo** virtual twin for state monitoring and deployment debugging.
- Trained and deployed tactile-augmented manipulation policies for fragile and contact-sensitive objects, improving potato chip pinching success by **50 percentage points** over the vision-only baseline.

History-Aware Tactile Decision-Making for Object-Centric Manipulation [🔗](#)

Sept. 2025 – Apr. 2026

Carnegie Mellon University, Robotics Institute

- Developed a **top- k tactile event extraction** module that compresses long-horizon exploration into informative contact events, matching a Transformer-based history compressor with a more compact representation.
- Learned **object-centric tactile representations** from localized vibrotactile exploration, selecting the smooth sponge side for wiping with **100% success** and **100% transfer** to unseen settings.
- Extended tactile event reasoning to **multi-object manipulation**, achieving **100% accuracy** in property-based object selection and outperforming no-tactile policies by **75 percentage points**.

Deployable Multimodal Tactile Fingertip for Dexterous Robotic Hands [🔗](#)

Oct. 2024 – Sept. 2025

Carnegie Mellon University, Robotics Institute

- Developed a low-cost, deployable multimodal **tactile fingertip** integrating **90 Hz force sensing** and **44.1 kHz vibrotactile sensing**, validated over **three months** of continuous real-robot manipulation experiments.
- Built a **tactile feedback pipeline** for adaptive grasping, using slip-triggered force adjustment to maintain stable grasps within **0.3 N** of the minimum required force.
- Reconstructed localized tactile features from physical interaction to guide transparent cup manipulation, achieving a **70 percentage-point higher success rate** than a YOLO-based vision baseline.
- Enabled object-level reasoning under full visual occlusion through multimodal tactile fusion, achieving **99.17% accuracy** in fully occluded object recognition.

Bioinspired Vacuum-Driven Gripper with Elastic Spine [🔗](#)

Sept. 2022 – Nov. 2023

Shanghai Jiao Tong University, School of Mechanical Engineering

- Developed a lightweight, bioinspired **vacuum-driven actuator** based on a snake-like spine-and-rib structure,

achieving a **320 ms response time** and a maximum grasping force of **>50 N**.

- Designed and 3D-modeled the **elastic spine-rib structure** and actuator body, improving structural stiffness while maintaining compliant, underactuated grasping behavior.
- Developed an integrated **PLA-rib and TPU-skin 3D printing process**, reducing single-chamber fabrication time to **<40 minutes** and enabling both three-fingered and wireless handheld gripper prototypes.

Model-Based Trajectory Control and Planning for a Whiteboard Robot  **Feb. 2025 – May 2025**

Course Project, Carnegie Mellon University

- Implemented a **2D simulation environment** and benchmarked PID, MPC, and TVLQR under noise, with MPC achieving the best tracking performance.
- Validated the control pipeline on hardware, integrating visual tracking with real-time trajectory control for autonomous whiteboard erasing.

Publications

- Xinyi Yang, Zilin Si, **Zhuowei Xu**, Oliver Kroemer, Zeynep Temel. “Learning with Object-centric Representations of Tactile Interactive Perception for Robot Manipulation.” Under review.
- **Zhuowei Xu**, Zilin Si, Kevin Lee Zhang, Oliver Kroemer, Zeynep Temel. “A Multi-modal Tactile Fingertip Design for Robotic Hands to Enhance Dexterous Manipulation.” IROS 2026. <https://arxiv.org/pdf/2510.05382>.
- **Zhuowei Xu**, Zilin Si, Kevin Lee Zhang, Moonyoung Lee, Shashwat Singh, Oliver Kroemer, Zeynep Temel. “A Low-Cost Tactile Fingertip Design for Dexterous Robotic Hands.” ICRA 2025 Workshop “Handy Moves: Dexterity in Multi-Fingered Hands.” <https://openreview.net/forum?id=5kj8uif2w>.
- Yongzhou Long, Zhuang Zhang, **Zhuowei Xu**, Enlin Gu, Qiuji Lu, Hao Wang, Genliang Chen. “Lightweight and Powerful Vacuum-Driven Gripper with Bioinspired Elastic Spine.” IEEE Robotics and Automation Letters. <https://ieeexplore.ieee.org/document/10287554>.