

YIFAN XU

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EDUCATION

Ph.D. in Civil Engineering, August 2023 – Expected May 2026

University of Michigan, Ann Arbor, MI, U.S.

Dissertation: Scaling Assistive Intelligence: A Multimodal Framework for Assistive Robotics in Constructed Environments

Advisors: Prof. Vineet R. Kamat and Prof. Carol C. Menassa

M.S. in Robotics, August 2021 – December 2022

University of Michigan, Ann Arbor, MI, U.S.

Research Focus: Mobile and Socially-Aware Robotics

Advisor: Prof. Maani Ghaffari

Selected Courses: Robotics System Laboratory, Mobile Robotics, Advanced Topic in Computer Vision, Nonlinear Programming, Machine Learning (GPA: 3.94/4.0)

Visiting Student, August 2019 - December 2019

University of California, Berkeley, USA

Advisor: Prof. Ronald Fearing

Selected Courses: Structure and Interpretation of Computer Programs, Introduction to Embedded System, Introduction to Control System (GPA: 3.94/4.0)

B.S.E. in Robotics, September 2017 – June 2021

Northeastern University, Shenyang, Liaoning, China

Thesis: Design of a video-based crowd density detection robotics system

Advisor: Prof. Jianning Chi

Selected Courses: Robotics Operating System, Mobile Robot Control Experiment, Robot Motion Control Experiment, Human-Machine Interaction and Interfaces (GPA: 92.1/100; Rank 2)

High School

PROFESSIONAL APPOINTMENTS

Graduate Student Research Assistant, University of Michigan, August 2023 – Present

LIVE and SICIS Laboratories, Department of Civil and Environmental Engineering

Graduate Student Instructor, University of Michigan, January 2026 – April 2026

CEE 331 Construction Management, Department of Civil and Environmental Engineering

Research Assistant, University of Michigan, September 2021 – December 2022

Department of Robotics

Undergraduate Student Research Assistant, University of California, Berkeley, August 2019 - December 2019. Department of Electrical Engineering and Computer Science.

HONORS AND AWARDS

International Conference on Computing in Civil Engineering (i3CE) Best Paper Award (1/239), American Society of Civil Engineers, 2025

- Best Paper Award at a top Civil Engineering conference.

1st place of International Conference on Robotics and Automation (ICRA) Bimanual Control Competition (1/6), IEEE, 2025

- First place award with over 6 teams in the finalist round at top robotics conference.

Rackham Conference Travel Grant, University of Michigan, 2025

- This grant is awarded to first-author graduate students for conference travel.

Rackham International Students Fellowship (25 awards campuswide), University of Michigan, 2024

- This fellowship is awarded to outstanding students with demonstrated research potential.

Rackham Graduate Student Research Grant, University of Michigan, 2024

- This grant is awarded to graduate students who present a compelling need for equipment.

Rackham Conference Travel Grant, University of Michigan, 2024

- This grant is awarded to first-author graduate students for conference travel.

John L. Tishman Ph.D. Fellowship, University of Michigan, 2023

- First year Ph.D. fellowship for outstanding incoming Ph.D. students.

Excellent Undergraduate Student, Northeastern University, 2021

- Award for top students with an excellent undergraduate dissertation.

First class Excellent student Scholarship, Northeastern University, 2018 - 2021

- Top academic performance and leadership of students in the department.

National Scholarship, Northeastern University, 2018

- Top 1% academic performance and leadership in “985” project at Chinese universities.

PUBLICATIONS

Single-underlined names are Graduate Student advisees.

Double-underlined names are Undergraduate Student advisees.

Published Journal Articles:

Xu, Y., Kamat, V. and Menassa, C. (2025) Open-Vocabulary Semantic Segmentation with Uncertainty Alignment for Scene Understanding in Indoor Building Environments. Journal of Computing in Civil Engineering (Invited Paper), arXiv preprint arXiv:2503.23105.

Xu, Y., Wang, Q., Kamat, V., and Menassa, C. (2024) Socially-Aware Shared Control Navigation for Assistive Mobile Robots in the Built Environment. *Journal of Computing in Civil Engineering*. (In Press)

Journal and Conference Papers In Review (Preprints Available on ArXiv):

Xu, Y., Wang, Q., Lillie, J., Kamat, V., and Menassa, C. (2025) CoNav Chair: Development and Evaluation of a Shared Control-based Wheelchair for the Built Environment. Submitted to *IEEE Transactions on Human-Machine Systems*, arXiv preprint arXiv:2507.11716.

Xu, Y., Wang, Q., Kamat, V., and Menassa, C. (2025) OpenGuide: Assistive Object Retrieval in Indoor Spaces for Individuals with Visual Impairments. Submitted to *Springer Nature Intelligent Service Robotics*, arXiv preprint arXiv:2509.02425.

Journal Manuscripts in Progress:

Xu, Y., Shen, Q., Kamat, V. and Menassa, C., KUKAloha: A General, Low-Cost, and Intuitive Teleoperation Framework for Construction Robot Arm

Xu, Y., Xie, J., Shen, Q., Kamat, V. and Menassa, C., TacRDT: A Visual Tactile Diffusion Transformer for Robotics Bimanual Control

Published Conference Articles:

Xu, Y., Kamat, V. and Menassa, C. (2025). Seeing with Partial Certainty: Conformal Prediction for Robotic Scene Recognition in Built Environments. *Proceedings of the 2025 ASCE International Conference on Computing in Civil Engineering (i3CE)*, New Orleans, LA. **Best Paper Award (1st Place)**.

Xu, Y., Wang, Q., Lillie, J., Kamat, V., and Menassa, C. (2025). CoNav Chair: Design of a ROS-based Smart Wheelchair for Shared Control Navigation in the Built Environment. *Proceedings of the 42nd International Symposium on Automation and Robotics in Construction (ISARC 2025)*, Montreal, Canada, 342-349. doi:10.22260/ISARC2025/0046

Wang, Q.*, **Xu, Y.*,** Kamat, V., and Menassa, C. (2025). A Robust Framework for Open-Vocabulary Multi-Object Search with Visual-Language Understanding. *ICRA 2025 Workshop on Foundation Models and Neuro-Symbolic AI for Robotics*. Atlanta, GA. *Equal Contribution

Xu, Y., Luo, Z*, Wang, Q.*, Kamat, V., and Menassa, C. (2024) Point2Graph: An End-to-end Point Cloud-based 3D Open-Vocabulary Scene Graph for Robot Navigation. *2025 IEEE International Conference on Robotics and Automation (ICRA)*, 2853-2860. Atlanta, GA, doi: 10.1109/ICRA55743.2025.11127471. **(34% Acceptance Rate)**,

Xu, Y., Kamat, V. and Menassa, C. (2024) A Shared Autonomy based Wheelchair Navigation Stack considering User Preference and Control. *Proceedings of the 2024 ASCE International Conference on Computing in Civil Engineering (i3CE)*, Pittsburgh, PA.

Xu, Y., Chakhachiro, T., Kathuria, T., Ghaffari, M. (2023). SoLo T-DIRL: Socially-Aware Dynamic Local Planner based on Trajectory-Ranked Deep Inverse Reinforcement Learning. *2023 IEEE International Conference on Robotics and Automation (ICRA)*, 12045–12051. London, UK. doi:10.1109/ICRA48891.2023.10160536 **(43% Acceptance Rate)**

Kathuria, T., **Xu, Y., Chakhachiro, T.,** Ghaffari, M. (2022). Providers-Clients-Robots: Framework for spatial-semantic planning for shared understanding in human-robot interaction. *2022 31st IEEE*

International Conference on Robot and Human Interactive Communication (RO-MAN), 1099–1106. Naples, Italy. doi:10.1109/RO-MAN53752.2022.9900525

MEDIA COVERAGE

Merging autonomy with manual control for wheelchair users. Michigan Engineering News

- Website: <https://news.engin.umich.edu/2025/04/merging-autonomy-with-manual-control-for-wheelchair-users/>

Smart robotic wheelchair offers enhanced autonomy and control. Tech Xplore

- Website: <https://techxplore.com/news/2025-02-smart-robotic-wheelchair-autonomy.html>

GRANT WRITING EXPERIENCE

Scene-Aware Mobility Assistance for the Blind: From Language to Action, University of Michigan, 2025 (Proposal Budget: \$900,000)

- National Science Foundation Human-Centered Computing (HCC)
- Role: Assisted PI with framework design, technical details, and proposal writing
- PIs: Dr. Vineet R. Kamat and Dr. Carol C. Menassa

HERA: A Home Environment Reasoning Agentic Framework for Smart Home Autonomy, University of Michigan, 2025 (Proposal Budget: \$120,000)

- AWS AI: Agentic AI call for proposals — Spring 2025
- Role: Assisted PI with framework design, technical details, and proposal writing
- PIs: Dr. Vineet R. Kamat and Dr. Carol C. Menassa

Point2Graph: An End-to-end Point Cloud-based 3D Open-Vocabulary Scene Graph for Robot Navigation, University of Michigan, 2025 (Funded: \$1,500)

- Rackham Graduate Student Travel Grant, University of Michigan
- Role: Led proposal writing and budgeting
- Project Lead: Yifan Xu

Assistive Mobile Robotics System for Vision Impaired People, University of Michigan, 2024 (Funded: \$3,000)

- Rackham Graduate Student Research Grant, University of Michigan
- Role: Led proposal writing and budgeting
- Project Lead: Yifan Xu

Shared Autonomy based Wheelchair Navigation Stack considering User Preference and Control, University of Michigan, 2024 (Funded: \$1,500)

- Rackham Graduate Student Travel Grant, University of Michigan
- Role: Led proposal writing and budgeting
- Project Lead: Yifan Xu

RESEARCH EXPERIENCE

KUKAloha: A General, Low-Cost, and Shared-Control based Teleoperation Framework for Construction Robot Arm, University of Michigan, December 2025 - Present

- Propose KUKAloha, a unified leader–follower teleoperation framework that generalizes across different robot arms, end-effectors, and construction tasks.
- Introduce a shared-control strategy that combines intuitive human teleoperation for coarse motion with autonomous perception-driven alignment for fine manipulation.
- We conduct a comprehensive usability study of KUKAloha in representative construction manipulation tasks, evaluating system usability, intuitiveness, and task completion efficiency.

TacRDT: A Visual Tactile Diffusion Transformer for Robotics Bimanual Control, University of Michigan, May 2025 - Present

- Develop an Aloha based dual manipulator data collection plan for robotics training data collection.
- Develop a novel bimanual robot system integrated with a Vision-Language-Action (VLA) foundation model, enhanced by tactile sensing.
- Create a comprehensive tactile-augmented VLA dataset using the bimanual robot across a diverse set of manipulation tasks.
- Train and evaluate the proposed model on the dataset and benchmark its performance against state-of-the-art algorithms.

OpenGuide: Assistive Object Retrieval in Indoor Spaces for Individuals with Visual Impairments, University of Michigan, March 2025 - August 2025

- Developed the OpenGuide framework for open-vocabulary multi-object search to enable assistive robots to retrieve multiple objects in complex indoor environments.
- Designed and implemented multi-stage exploration strategies (frontier-based search, semantic graph reasoning, and language-guided retrieval) that allow robots to efficiently navigate unfamiliar spaces and localize target objects described in natural language.
- Conducted real-world experimental validation in home and office-like settings, demonstrating the framework’s effectiveness in multi-object retrieval tasks and its potential impact on assistive robotics for people with disabilities.

Usability Study of a Shared Control-based Smart Wheelchair, University of Michigan, September 2024 – March 2025

- Design the usability study experiment to test our proposed navigation system developed for disabled individuals with the help of non-disabled individuals based on our hardware smart wheelchair platform.
- Design and assemble a smart ROS-based wheelchair platform implemented from scratch to test our previously proposed shared control navigation system.

Open-Vocabulary 3D Scene Graph Construction Project, University of Michigan, March 2024 - September 2024

- Proposed an end-to-end point cloud-based open vocabulary 3D scene graph pipeline for robot navigation without the need for well-aligned posed images.
- Presented a point cloud-based room segmentation and classification pipeline that possesses the SOTA ability to comprehend highly complex and real-world scenes.

- Presented a point cloud-based open vocabulary 3D object detection and classification pipeline that can reach better performance compared with the previous SOTA algorithm.

Shared Control based Mobile Robot Navigation Project, University of Michigan, September 2023 - March 2024

- Proposed a novel shared control-based navigation framework on an assistive mobile robot integrating a desirable user's control and preference.
- Developed a user preference-based global planner and incorporated it into the global planning pipeline, allowing users to customize their preferred global path.
- Developed a Socially-aware Shared control-based Model Predictive Control with Dynamic Control Barrier Function local planner to generate a safe collision-free trajectory in a dynamic environment.

Fetch Robot Tour Guide Project, University of Michigan, August 2021 - March 2022

- Develop a novel framework for socially assistive robots within the context of a robot at an establishment and identify Provider and Client roles to set expectations for interaction between them.
- Applied a topological map algorithm on the robot to build a topological map of Robot Building.
- Built an augmented map of the lab with object position on it.
- Use object position to augment the topological map to get a better motion planning algorithm.

Multi-Robot Cooperation Locomotion Project, University of California, Berkeley, August 2019 - December 2019

- Responsible for robot dynamics simulation modeling and robot dynamics control.
- Improved the existing model by measuring the solid model and modifying the parameters of the simulation model.
- Adopted PID, Model-Free, and Model-Based to control the robot's steering.

TEACHING AND MENTORING EXPERIENCE

Teaching

CEE 331: Construction Management, University of Michigan, Winter 2026 [upcoming]

- Delivery of lectures in weekly lab sessions, instruction on course projects, conduct of office hours, and leading the grading process.
- Development and administration of laboratory projects and weekly quizzes materials

Student Supervision and Mentorship

Graduate Student Research Mentor, University of Michigan, 2021 - Present

- Qizhang Shen, Graduate Student, Robotics, Aug 2023 - Present
- Junzhe Xie, Graduate Student, Robotics, Aug 2023 - Present
- Rajatsurya M, Graduate Student, Robotics, Aug 2023 - Present
- Qianwei Wang, Undergraduate Student, Computer Science, Aug 2023 – Present
 - Next Position: Ph.D. Candidate at University of California, Los Angeles
- Ziming Luo, Graduate Student, Electronic and Computer Engineering, May 2024 - Feb 2025
 - Next Position: Research Assistant at Carnegie Mellon University
- Zahraa Bazzi, Graduate Student, Robotics, May 2024 - Feb 2025
 - Next Position: Research Scientist at May Mobility

- Theodor Chakhachiro, Graduate Student, Robotics, Aug 2021 - Dec, 2022
 - Next Position: Ph.D. Candidate at University of Southern California

SEMINARS AND PRESENTATIONS

Talks:

Robot Systems help People with Disability, CEE 830: Construction Engineering Seminar, University of Michigan, 2024

Conference Presentations:

CoNav Chair: Design of a ROS-based Smart Wheelchair for Shared Control Navigation in the Built Environment, International Symposium on Automation and Robotics in Construction (ISARC), Montreal, Canada (Online), 2025

Point2Graph: An End-to-end Point Cloud-based 3D Open-Vocabulary Scene Graph for Robot Navigation, International Conference on Robotics and Automation (ICRA), Atlanta, GA, 2025

Seeing with Partial Certainty: Conformal Prediction for Robotic Scene Recognition in Built Environments, ASCE International Conference on Computing in Civil Engineering (i3CE), New Orleans, LA, 2025

A Shared Autonomy based Wheelchair Navigation Stack considering User Preference and Control, ASCE International Conference on Computing in Civil Engineering (i3CE), Pittsburgh, GA, 2024

Poster Sessions:

A Robust Framework for Open-Vocabulary Multi-Object Search with Visual-Language Understanding, Foundation Model and Neutral Symbolic AI (FMNS) Workshop at ICRA2025, GA, 2025

Design of a ROS-based Smart Wheelchair for Shared Control Navigation in the Built Environment, Poster Presentation at CEE Visiting Day, University of Michigan, MI, 2025

PROFESSIONAL LEADERSHIP AND SERVICE

Committee Member, CEE Community Engagement and Empowerment Committee (CEE), University of Michigan, September 2024 – Present

Contributing Member, CEE Community Engagement and Empowerment Committee (CEE), University of Michigan, September 2023 - September 2024

Volunteer, CEE Explore Michigan Engineering Research & Graduate Education (EMERGE) Graduate Recruitment Event, October 2024

Volunteer, CEE Visiting Day at University of Michigan, February 2025

Committee Member, CEE Graduate Student Advisory Council (GSAC), University of Michigan, September 2024 – Present

Review Experience

- AAAI Conference on Artificial Intelligence (AAAI)
- ASCE Journal of Computing in Civil Engineering (JCCE)
- ASCE OPEN: Multidisciplinary Journal of Civil Engineering
- Expert Systems with Applications (ESA)
- IAARC International Symposium on Automation and Robotics in Construction (ISARC)
- ASCE International Conference on Computing in Civil Engineering (i3CE)
- IEEE Transactions on Automation Science and Engineering (T-ASE)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE Robotics and Automation Letters (RA-L)
- IEEE International Conference on Robot & Human Interactive Communication (RO-MAN)
- IEEE International Conference on Intelligent Robots and Systems (IROS)

Professional Affiliations

Student Member, IEEE Robotics and Automation Society (RAS)

Student Member, American Society of Civil Engineers (ASCE)

Student Member, ASCE Technical Council on Computing and Information Technology, Visualization, Information Modeling, and Simulation (VIMS) Committee

Student Member, ASCE Technical Council on Computing and Information Technology, Data Sensing and Analysis (DSA) Committee

TECHNICAL SKILLS

Virtual Design and Construction: AutoCAD, Autodesk Revit, Rhino, Grasshopper, Bluebeam Revu, SolidWorks,

Full-Scale Physical Robot Control and Simulation: LeRobot, KUKA KR120R2500, PiPER Robot, Turtlebot. Gazebo, Unity, RViz

Robot Learning and Programming: Vision-Language-Action Model, Imitation Learning, Robot Operating System (ROS), Computer Programming (Python, C++, C#, Java Script, MATLAB, C).