Weichen ZHANG

PhD Candidate
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RESEARCH PROFILE

My PhD research aims to establish an integrated framework for intelligent human–multi-robot construction by linking two complementary strands. The first investigates how multimodal large language models can be coupled with embodied interaction and XR interfaces to translate human intent, spatial context, and evolving task conditions into context-aware robotic actions. The second examines the human factors of multi-robot collaboration through controlled studies of interaction modes and collaboration strategies, considering subjective experience, behavioral performance, workload, trust, and coordination. Together, these strands connect interaction intelligence with empirical human-centered evaluation, supporting adaptive and trustworthy robotic construction systems.

EDUCATION

HARBIN INSTITUTE OF TECHNOLOGY
PhD Student in Architecture · School of Architecture and Design — Harbin, China · Sep 2024–Present
Supervisor Prof. Cheng Sun
PhD research Embodied Interaction for Multi-Robot–Human Collaborative Construction

POLITECNICO DI MILANO
MSc in Architecture and Urban Design — Milan, Italy · Aug 2021–Dec 2023
Supervisor Pierpaolo Ruttico
Master's thesis Interactive Fabrication: Exploration of Human–Machine Collaboration Methods for AR-Assisted Robotic Fabrication

HARBIN INSTITUTE OF TECHNOLOGY
Bachelor of Architecture — Harbin, China · Aug 2016–Jun 2021

PUBLICATIONS

1. **Zhang, W.**, Ruttico, P., Zhou, Y., Jia, Y., Dong, Q., & Sun, C. (2026). *Integrated design and fabrication of building components for environmental performance enhancement: A review.* Frontiers of Architectural Research. Advance online publication. DOI
2. **Zhang, W.**, & Ruttico, P. (2025). *Enhanced interactive AR bricklaying: Elevating human–robot collaboration in augmented reality assisted masonry design and construction.* Architectural Intelligence, 4, Article 6. DOI
3. **Zhang, W.**, & Ruttico, P. (2025). *Interactive bricklaying: A comparative experiment on human involvement in masonry structure design and construction through augmented reality.* In Symbiotic Intelligence: CDRF 2024, pp. 106–115. DOI
4. **Zhang, W.** (2024). *Interactive robotic grinding: Interactive building metal surface design and fabrication for robotic grinding.* In HCI International 2024 Posters, pp. 427–437. DOI
5. Zhuang, D., Jia, Y., Leng, Y., Guo, C., Xu, F., **Zhang, W.**, Dong, Q., & Sun, C. (2026). *Artificial intelligence applications in building computational transformation: A systematic review from cradle to use.* EBES Sustainable Building, 1(1), 100012. DOI

SELECTED SOFTWARE AND ROBOTIC SYSTEMS

Embodreal — Cross-Platform XR Interface for Robotic Construction
Grasshopper server plugin · Multi-device XR clients — Independent Developer · Jan 2025–Present

- Conceived and independently developed a cross-platform XR system connecting Rhino and Grasshopper workflows with handheld and head-mounted devices for spatial computing and robotic construction research.
- Developed a server-side Grasshopper .gha plugin for exchanging geometric, spatial, and robotic-environment data between parametric design workflows and multiple XR clients.
- Built client applications for iOS, Android, visionOS, Magic Leap, and Meta Quest 3, enabling deployment across smartphones, tablets, spatial-computing devices, and mixed-reality headsets.
- Implemented real-time 3D visualization, interactive spatial alignment, object positioning, and immersive inspection of robot models, pose configurations, and workspace relationships.
- Completed the first working version in February 2026; released the system through the App Store and Food4Rhino, and deployed it in human–robot interaction studies and CDAC workshop teaching.

Control and Data Integration for a Multi-Robot Construction Testbed
Grasshopper-based supervisory control and hardware integration — Harbin Institute of Technology · 2024–Present

- Contributed to the control and data-integration layer of a heterogeneous robotic construction testbed comprising two gantry robots and a robotic manipulator mounted on an autonomous mobile base.
- Developed custom C# components in Grasshopper to communicate with the Siemens PLC and robot control cabinet, enabling real-time robot-state acquisition and command dispatch through hardware-specific interfaces.
- Implemented a Modbus-based control component for the LiDAR-SLAM mobile base, supporting target-position input and multiple modes of navigation and motion control.
- Developed and packaged an internal-use Grasshopper .gha plugin for accessing real-time pose and tracking data from the laboratory's motion-capture system; the plugin has been deployed in ongoing robotic construction and human–robot interaction studies.

RESEARCH TEACHING AND PROFESSIONAL PRACTICE

INDEXLAB, POLITECNICO DI MILANO
Student Research Assistant — Lecco, Italy · Mar–Nov 2023

- Conducted research on extended-reality-mediated human–robot collaboration and interactive robotic fabrication, contributing to full-scale construction demonstrators, academic publications, and master's thesis research.
- Developed and validated robotic construction workflows and prototypes in collaboration with academic researchers, industry partners, and robotic technology providers.
- Contributed to two international exhibitions on construction automation and emerging building technologies in Bologna (March 2023) and Bari (October 2023); led the on-site demonstration of a mobile robotic bricklaying system at the Bari exhibition.

CDAC CONFERENCE WORKSHOP · BEIJING UNIVERSITY OF TECHNOLOGY
Workshop Coordinator and Teaching Assistant — Beijing, China · Oct 2026

- Co-led the organization, curriculum development, and delivery of an intensive workshop on XR-mediated human–robot collaboration and multi-robot construction.
- Introduced Embodreal and guided participants in developing interactive workflows and multi-robot construction simulations for timber-frame systems.
- Designed and facilitated an XR-based experimental environment for evaluating participants' subjective and objective responses under different modes of human–robot interaction.

CDAC CONFERENCE WORKSHOP · TONGJI UNIVERSITY
Teaching Assistant and Technical Instructor — Shanghai, China · Nov 2024

- Delivered technical instruction, robotic operation, and design guidance for the Mixed-Reality Timber Construction Workshop.
- Coordinated three robotic systems and participant teams in the mixed-reality-assisted assembly of a full-scale timber structure.
- Workshop outcomes received the CDAC 2024 Best Workshop Award and the DigitalFUTURES 2025 Project Award.

CHINA IPPR INTERNATIONAL ENGINEERING CO., LTD.
Architectural Design Intern · Design Innovation Studio — Beijing, China · Oct 2020–Feb 2021

- Contributed to research, programming, and schematic design for commissioned and competition-based educational projects, translating stakeholder requirements into spatial planning and architectural proposals.
- Developed campus-renovation and façade-design schemes and produced architectural drawings, visualizations, analytical diagrams, and tender materials.

SELECTED HONORS AND AWARDS

- **Best Interactive Experience Award,** Wish Link, Digital Heritage 2025 Global Youth Maker Competition (2025)
- **Selected Work and Exhibition,** City Culinary Journey, Ars Electronica Festival, Linz, Austria (2024)
- **DigitalFUTURES Project Award,** Collaborative Robotic Timber Pavilion (2025)
- **CDAC Best Workshop Award,** Mixed-Reality Timber Construction Workshop (2024)
- **National Scholarship,** Ministry of Education of the People's Republic of China (2020)
- **Outstanding Graduate,** Harbin Institute of Technology, ranked 4 of 68 (2021)
- **Gold Medal,** 2021 Asia Design Prize (2021)
- **Inclusive Design Ambassador,** Politecnico di Milano (December 2023)
- **Excellence Prize,** 2020 National College Student Advertising Art Competition (2020)
- **Provincial Second Prize,** 2020 National College Student Advertising Art Competition (2020)
- **Second Prize,** 2019 National Sustainable Architecture Design Competition for College Students (2019)
- **Digital Technology Prize,** 2019 National Sustainable Architecture Design Competition for College Students (2019)
- **People's Scholarship,** Harbin Institute of Technology (2018, 2019, and twice in 2020)
- **Excellent Student Cadre Scholarship,** Harbin Institute of Technology (2019)
- **Second Prize,** Harbin Institute of Technology Architectural Festival (2017)