Ziyi Liu

HCI Researcher | AR/VR/XR Developer

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Education

Purdue University *West Lafayette, IN*

PH.D. STUDENT *Aug. 2021 - Present*

- Lead researcher in developing **Intelligent Authoring/Tutoring, Visual Programming AR/VR/XR systems**. Advisor: Dr. Karthik Ramani.
- Published **3** lead-author research papers in CHI and UIST. Co-authored **6** papers in top-tier HCI venues. Got **1** Patent Applications.

Purdue University *West Lafayette, IN*

MASTER'S DEGREE OF MECHANICAL ENGINEERING *Jan. 2019 - Aug. 2021*

Purdue University *West Lafayette, IN*

BACHELOR'S DEGREE OF MECHANICAL ENGINEERING *Aug. 2014 - May. 2018*

Research Experience

InstruMentAR: Auto-Generation of Augmented Reality Tutorials for Operating Digital Instruments Through Recording Embodied Demonstration [C.1] *West Lafayette, IN*

CO-LEAD AUTHOR *Published in CHI 2023*

- Developed a system that automatically generates digital instrument AR tutorials by recording users' operations.
- Prototyped a hand wearable with pressure sensors to detect the precise frames of each operation.
- Built a decision-tree algorithm that differentiates operations based on the pressure and gestural data.
- Conducted multiple comparative studies to evaluate respective features of the system.

LearnIoTVR: An End-to-End Virtual Reality Environment Providing Authentic Learning Experiences for Internet of Things [C.2] *[Honorable Mention Award (Top 5%)]* *West Lafayette, IN*

CO-LEAD AUTHOR *Published in CHI 2023*

- Built a VR environment that enables students to install, program, and test IoT applications.
- Designed the 3D block-based programming system based on the affordance of VR.
- Implemented the virtual IoT programming mechanism through the event system in Unity3D.
- Evaluated the effectiveness of the system by conducting quantitative and qualitative usability studies.

MechARspace: An Authoring System Enabling Bidirectional Binding of Augmented Reality with Toys in Real-time [C.3] *West Lafayette, IN*

CO-LEAD AUTHOR *Published in UIST 2022*

- Summarized an input-output model of the bidirectional physical-virtual interaction for AR-empowered toys.
- Prototyped a collection of IoT modules and their communication protocol with the AR headset.
- Created an immersive authoring interface to link the behaviors of AR content and objects.
- Conducted multiple comparative studies to evaluate respective features of the system.

ColabAR: A Toolkit for Remote Collaboration in Tangible Augmented Reality Laboratories [C.4] *West Lafayette, IN*

CO-AUTHOR *Published in CSCW 2022*

- Designed an AR-compatible toolkit to improve social presence through vibration feedback.
- Prototype the hardware of the toolkit with PTC Creo and SLA printer.
- Came up with a list of haptic behaviors, and programmed the behaviors within Unity3D and Arduino.
- Established the connection between the toolkit and the phone by utilizing BLE.

RobotAR: An Augmented Reality Compatible Teleconsulting Robotics Toolkit for Augmented Makerspace Experiences [C.5]

West Lafayette, IN

Co-Author

Published in CHI 2021

- Designed and built a desktop-based robot that can be remotely controlled for navigation.
- Implement ARCore into the system that enabled the robot to autonomously navigate the makerspace.
- Created the interface of the system that allows the remote user to control the movement of the robot and annotate in the local makerspace

Meta-AR-App: An Authoring Platform for Collaborative Augmented Reality in STEM Classrooms [C.6]

West Lafayette, IN

Co-Author

Published in CHI 2020

- Built a system for easy-creation of AR learning material for Assembly tasks.
- Designed a collaborative workflow for AR tutorial iteration.
- Implemented the interface of the system that allows the users to import, manipulate, and assemble their own 3D models to create AR tutorials

Blindness Visualizer: A Simulated Navigation Experience [C.9]

West Lafayette, IN

Co-Author

Published in IEEE VRW 2020

- Created a VR game that simulates the whole story of a blind drummer attending a concert with his cane.
- Simulated the cane by the Oculus joystick and regenerated the physical feedback with haptic feedback.
- Rephrased the drummer's memory about the surrounding environment with customized VFX.

Technical Skills

AR/VR/XR Development	Unity3D; HoloLens 2, Oculus Quest, ARCore, Vuforia
Programming Languages	C#, C++, Python, R
Design and Prototyping	PTC Creo, Arduino, Blender, Matlab, AutoCAD, 3D Printing, Laser Cutting, CNC Machining
Deep Learning	PyTorch

Design and Prototyping Projects

Cargo Distributing Robot   *West Lafayette, IN*

ME MECHATRONICS PROJECT   *Jan. 2022 - May. 2022*

- Developed a robot that can distribute cargo(cubic foam) to designated colored regions .
- Designed the FSM, and the structure of the robot.
- Designed, manufactured, and assembled the distributing mechanism of the robot.
- Programmed the FSM of the robot by Arduino.

Teaching Experience

Toy Design (Computer-Aided Design and Prototyping)   *West Lafayette, IN*

TEACHING ASSISTANT   *Spring 2019 - Present*

- Delivered lectures about CAD using PTC Creo to over 200 students.
- Tutored struggling students individually and in small groups to reinforce learning concepts.
- Designed mid-term competition projects aiming to reinforce students' innovative thinking and the capability of CAD prototyping.
- Organized events for the students to present their projects to the public.

Honors and Awards

Apr. 2023 **Honorable Mention,** ACM Conference on Human Factors in Computing Systems [CHI 2023]   *West Lafayette, IN*

Publications and Patents

[C.1] **Ziyi Liu***, Zhengzhe Zhu*, Enze Jiang, Feichi Huang, Ana M Villanueva, Xun Qian, Tianyi Wang, and Karthik Ramani. 2023. InstruMentAR: Auto-Generation of Augmented Reality Tutorials for Operating Digital Instruments Through Recording Embodied Demonstration. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems **(CHI 2023)**. DOI: https://doi/10.1145/3544548.3581442

[C.2] Zhengzhe Zhu*, **Ziyi Liu***, Youyou Zhang, Lijun Zhu, Joey Huang, Ana M Villanueva, Xun Qian, Kylie Peppler, and Karthik Ramani. 2023. LearnIoTVR: An End-to-End Virtual Reality Environment Providing Authentic Learning Experiences for Internet of Things. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems **(CHI 2023)**. DOI: https://doi.org/10.1145/3544548.3581396

[C.3] Zhengzhe Zhu*, **Ziyi Liu***, Tianyi Wang, Youyou Zhang, Xun Qian, Pashin Farsak Raja, Ana M Villanueva, and Karthik Ramani. 2022. MechARspace: An Authoring System Enabling Bidirectional Binding of AR with Toys in Real-time. In Proceedings of the 35th Annual ACM Symposium on User Interface Software and Technology **(UIST 2022)**. DOI: https://doi.org/10.1145/3526113.3545668

[C.4] Ana M Villanueva*, Zhengzhe Zhu*, **Ziyi Liu**, Feiyang Wang, Subramanian Chidambaram, and Karthik Ramani. 2022. ColabAR: A Toolkit for Remote Collaboration in Tangible Augmented Reality Laboratories. In Proceedings of the ACM on Human-Computer Interaction **(CSCW 2022)**. DOI: https://doi.org/10.1145/3512928

[C.5] Ana M Villanueva, **Ziyi Liu***, Zhengzhe Zhu, Xin Du, Joey Huang, Kylie Peppler, and Karthik Ramani. 2021. RobotAR: An Augmented Reality Compatible Teleconsulting Robotics Toolkit for Augmented Makerspace Experiences. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems **(CHI 2021)**. DOI: https://doi.org/10.1145/3411764.3445726

[C.6] Ana M Villanueva, Zhengzhe Zhu, **Ziyi Liu***, Kylie Peppler, Thomas Redick, and Karthik Ramani. 2020. Meta-AR-App: An Authoring Platform for Collaborative Augmented Reality in STEM Classrooms. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems **(CHI 2020)**. DOI: https://doi.org/10.1145/3313831.3376146

[C.7] Ana Villanueva, Hritik Kotak, **Ziyi Liu**, Rutvik Mehta, Kaiwen Li, Zhengzhe Zhu, Yeliana Torres, Karthik Ramani. 2020. ARbits: Towards a DIY, AR-compatible electrical circuitry toolkit for children. In Proceedings of the 2020 ACM Interaction Design and Children Conference: Extended Abstracts **(IDC EA 2020)**. DOI: https://doi.org/10.1145/3397617.3397849

[C.8] Ana Villanueva, **Ziyi Liu**, Yoshimasa Kitaguchi, Zhengzhe Zhu, Kylie Peppler, Thomas Redick, and Karthik Ramani. 2021. Towards modeling of human skilling for electrical circuitry using augmented reality applications. In International Journal of Educational Technology in Higher Education 2021. DOI: https://doi.org/10.1186/s41239-021-00268-9

[C.9] Claudia Krogmeier, Justin Heffron; Justin Legare, Michael Nelson, **Ziyi Liu**, Christos Mousas. 2020. Blindness Visualizer: A Simulated Navigation Experience. In 2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops **2020 IEEE VRW**. DOI: https://doi.org/10.1109/VRW50115.2020.00107