香港城市大學
City University of Hong Kong

Towards human-robot collaboration in construction: Learn and study collaborative robot knowledge through a virtual reality training game.

Project Number: 6000781

Principal Investigator: Dr. Xiaowei LUO

Grant Type: TDG

Abstract:

Robotic technologies have been strategically introduced into the architecture, engineering, &construction (AEC) fields. While this state-of-the-art technology is attracting students' unprecedented study interest, huge barriers of safety and operation remain in students' learning and collaborating with a real construction robot. Therefore, this project aims to develop an immersive virtual reality (VR) training system, allowing students to work collaboratively with construction robots and strengthening their understanding of robotic technologies. Firstly, a virtual prototype of the construction robot will be developed by Unity 3D. The regular workflow and basic human-computer interaction functions of construction robots will be developed and built into the Unity scene. Next, a BIM-based building prototype will be used as an open-ended proposition for students to explore. Basic interactive tasks in a VR-based training system will be designed for students, such as adjusting the position of wooden slats, checking the quality of robot construction, and assisting wooden rivet slats. To test the developed system, the project team will invite students to trial use the VR-based human-robot collaboration (HRC) training system, and to learn robotics and HRC knowledge from an immersive first-person perspective. In such a system, the students are allowed to optimize and modify the workflow of construction robots and develop a workflow for assisting workers. The project team will assist students in creating and evaluating the customized collaboration workflow after their self-exploring in HRC. Students' open and creative thinking will significantly promote human-oriented collaborative workflow design. If successful, the collaborative VR-based training system will enable students to work with virtual construction robots based on immersive perspective and be deployed in the teaching tasks of CA3188, CA3420, and CA3154. This gamification training system can also be extended to enable students to learn robotic technologies and human-robot collaboration in other subject areas.

Academic Publication:

Ouyang, Y., & Luo, X. (2022). Differences between inexperienced and experienced safety supervisors in identifying construction hazards: Seeking insights for training the inexperienced. Advanced Engineering Informatics, 52, 101602. https://doi.org/10.1016/j.aei.2022.101602

Adhikari, A., & Luo, X. (2021). A multi-level knowledge mastery assessment system for construction safety education in virtual reality. Industry 4.0 Applications for Full Lifecycle Integration of Buildings Proceedings of the 21st International Conference on Construction Applications of Virtual Reality, 43–55.

香港城市大學
City University of Hong Kong

Ouyang, Y., & Luo, X. (2021). Using eye-tracking to compare the experienced safety supervisors and novice in identifying job site hazards under a VR environment. EG-ICE 2021 Workshop on Intelligent Computing in Engineering, 270–280. https://doi.org/10.14279/depositonce-12021

Ouyang, Y., Wong, C. K., & Luo, X. (2020). Assessing students' hazard identification ability in virtual reality using eye tracking devices. EG-ICE 2020 Workshop on Intelligent Computing in Engineering, 12–21. https://doi.org/10.14279/depositonce-9977