

D1 - Virtual and Augmented Reality demonstration towards developing and commercializing a Mixed Reality interface for working with construction robotics

This Virtual Reality (VR) and Augmented Reality (AR) demo is aimed at showcasing three highly immersive modules: (1) An AR prototype, AR-Classroom for learning the concepts of 3D spatial transformations; (2) A gamified Virtual Construction Lab (VCL) for construction task and safety training and a digital twin for simulated construction robot control; and (3) A BIMThermo VR/AR prototype for learning building thermal behavior and energy use. The AR-Classroom prototype will enable students to hold and manipulate a 3D physical model (a LEGO space shuttle as an example) while simultaneously interacting with AR visualization of 3D rotations. AI-generated real-time audio guidance is integrated to enhance the learning experience. The gamified VCL would enable students to put together building assemblies such as a wall using conventional materials and methods. With the increasing levels of difficulty, students will be able to pick materials and install them virtually using tools and support systems such as a ladder to build, for instance, an exterior wall with CMU blocks, and aluminum angles with terracotta rain screen. In addition, the 3D/VR interface can enhance the interaction and collaboration with construction robots. Finally, the BIMThermo VR/AR prototype will immerse students in a virtual experience of a residential or an educational building to explore how the building consumes energy in different design configurations.

The main goal of this demo is to show how different AR and VR prototypes may converge to create an AI-powered Mixed Reality (MR) interface that can help train future construction workforce, particularly for automated robotic construction.