

Just-In-Time AR-Based Learning in the Advanced Manufacturing Context

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Background

Overview

- Use computer game and augmented reality (AR) technologies to enable smart workers.
- Smart workers utilize AR-game techniques to receive just-in-time training and workflow support.
- Utilize wearable and networked digital devices to sense, affect, or control manufacturing work objects, workflows, and operation processes.

Motivation

- Improve energy efficiency and productivity, reduce wasted resources and mistakes.
- Enable manufacturing workers to continuously improve manufacturing processes and work practices.
- Help make manufacturing work more fun and learning-oriented.

Goal

- To design and develop a prototype for a head-mounted AR application demonstrates just-in-time augmented learning for use in the assembly line manufacturing context.

What is augmented reality?

Augmented reality (AR) refers to the superimposition of virtual objects in the real world.

What are problems in effective training?

Problems in effective training refer to issues that are related to when workers are required to learn new or updated skills.

Why just-in-time learning?

Just-in-time learning integrates the training process into the workflow and reduces diversion.



This research project would not be possible without the help and guidance from the following groups and individuals: the faculty at the Institute for Software Research (ISR); Said M. Shokair and others from the Undergraduate Research Opportunities Program (UROP); the California Institute for Telecommunications and Information Technology (Calit2); Professor Richard Lathrop and Jessica Shanahan of the ICS Honors Program (ICSHP); and fellow undergraduate researcher and close friend Arzang Kasiri.

Design

Manufacturing Game Systems

- Computer games can provide compelling models and simulations of complex systems.
- Few games focus on manufacturing systems or operations as central to gameplay.
- Gameplay mechanics and user experience allow users/workers to learn new/revised manufacturing tasks in playful ways that improve through skill-leveling capabilities.
- Game-based training provides safe, low-cost experiential learning of manufacturing systems, processes, and work practices.

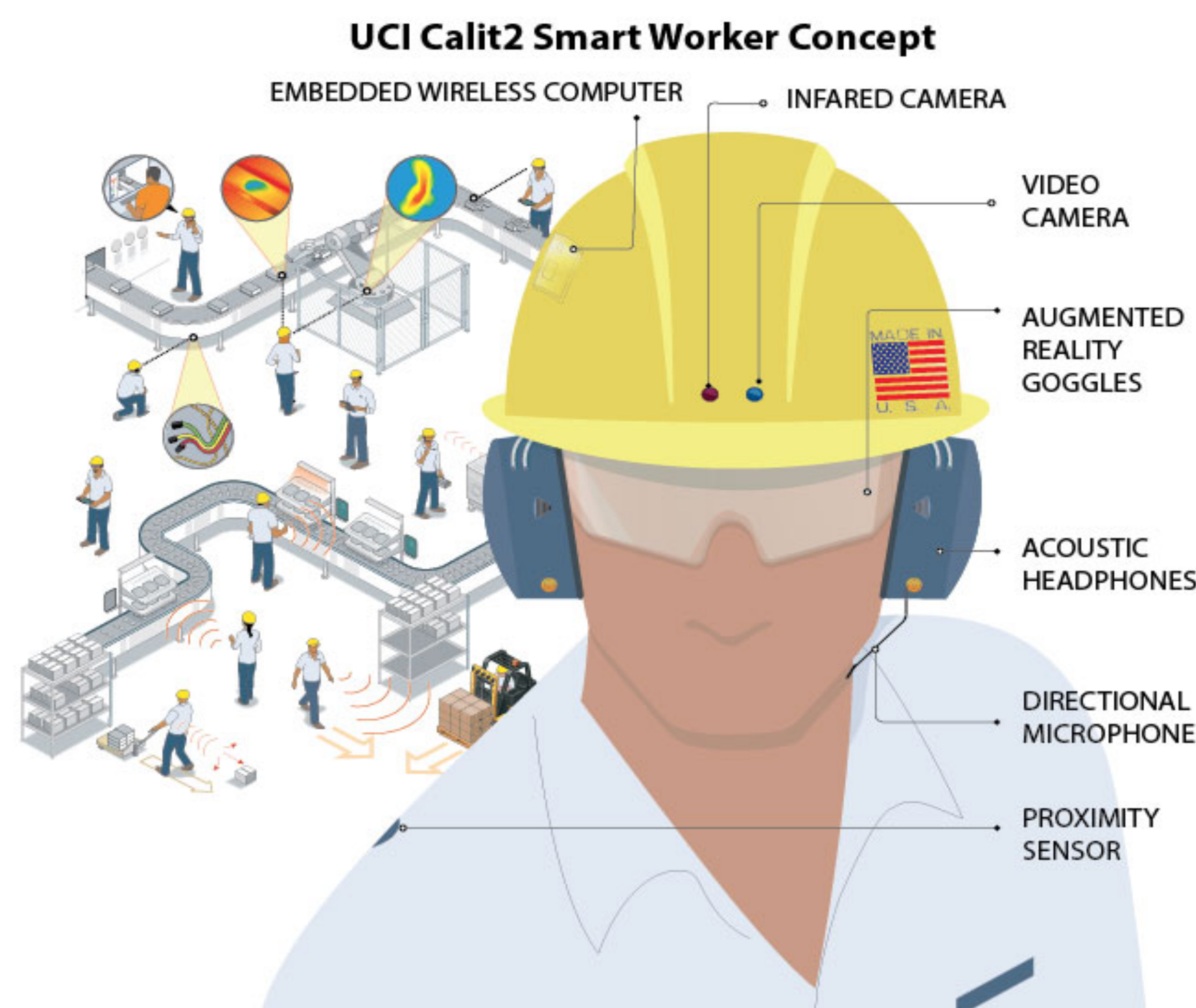
AR Games for Smart Workers

- Iteratively design, develop, demonstrate and refine AR-based user interface devices to sense, effect, or control playful models and simulations of manufacturing processes.
- Utilize low-cost AR compatible devices and techniques to deliver playful training and compelling user experience.
- Demonstrate smart worker headset as user interface to AR-based manufacturing training and operations process support.



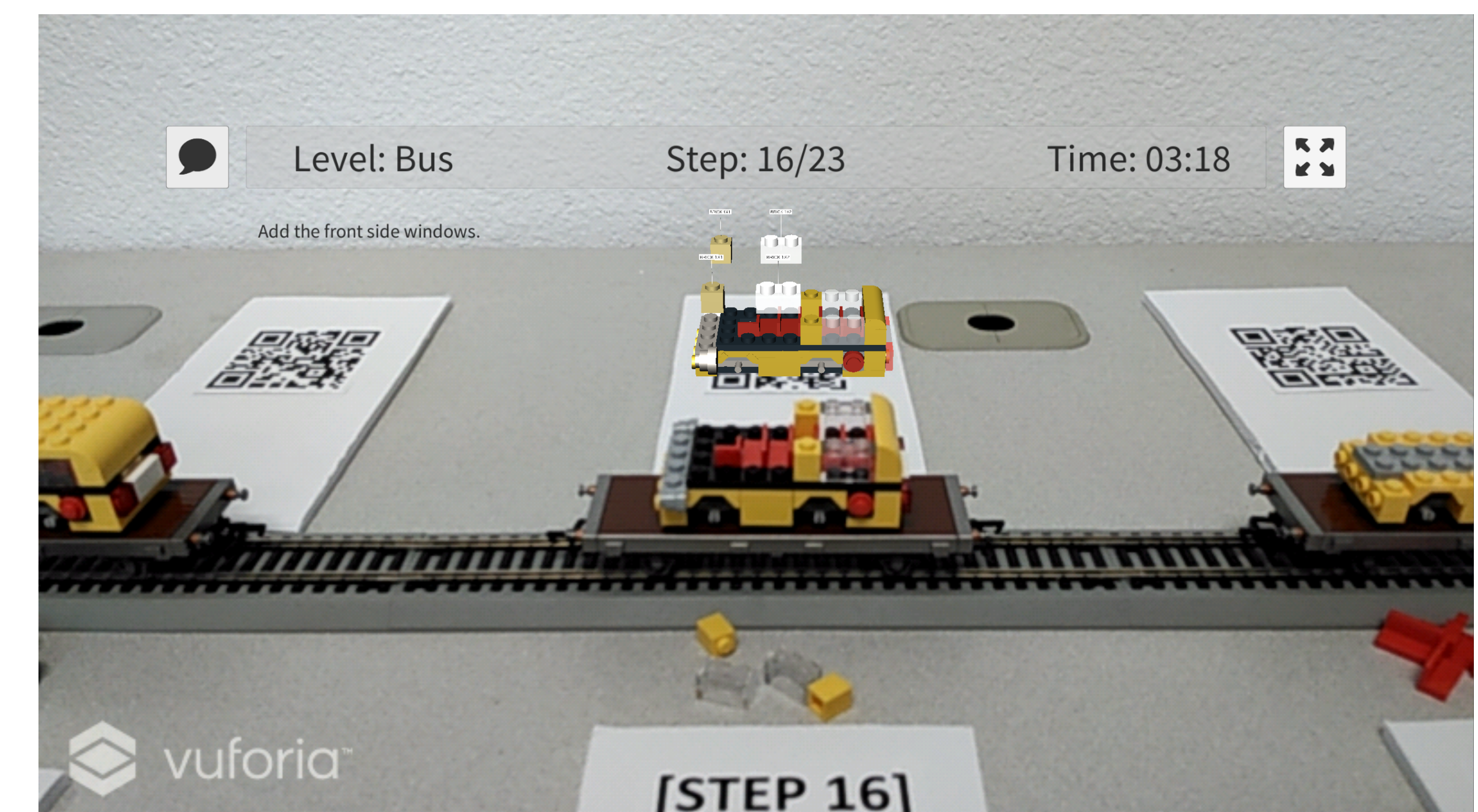
Above: Contraption Maker (top-left), Minecraft (top-right), Infinifactory (bottom-left), and Fallout 4: Contraptions Workshop (bottom-right).

Smart Worker Headset Concept



Researchers from Calit2, The Institute for Virtual Environments and Computer Games (IVECG), and Institute for Software Research (ISR) are combining IoT-supported, game-based learning and VR/AR interfaces to develop technology focused on enabling workers to become the ultimate manufacturing asset.

Final Prototype



2 Systems, 1 Prototype

- Unique dual-systems approach both simulates the manufacturing process and provides a meaningful AR-based training solution.
- Conjunctive use of 2 systems creates a tactile experience further improved by AR.
- Prototype demonstrates a working approach to deliver AR-based training and user experience for a complex product across multiple assembly steps.

System 1 (Assembly Line System)

- A simulated interactive manufacturing line, shown in a miniature, physical form.
- Created using HO scale model railway tracks and LEGO parts.

System 2 (AR System)

- The AR application itself to be used on an AR-enabled headset.
- Developed using Unity and Vuforia Augmented Reality SDK.