

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

Bryce Joe-Kun Tham | Dr. Walt Scacchi (Faculty Mentor)

Donald Bren School of Information and Computer Sciences, University of California, Irvine

## 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.

## 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.

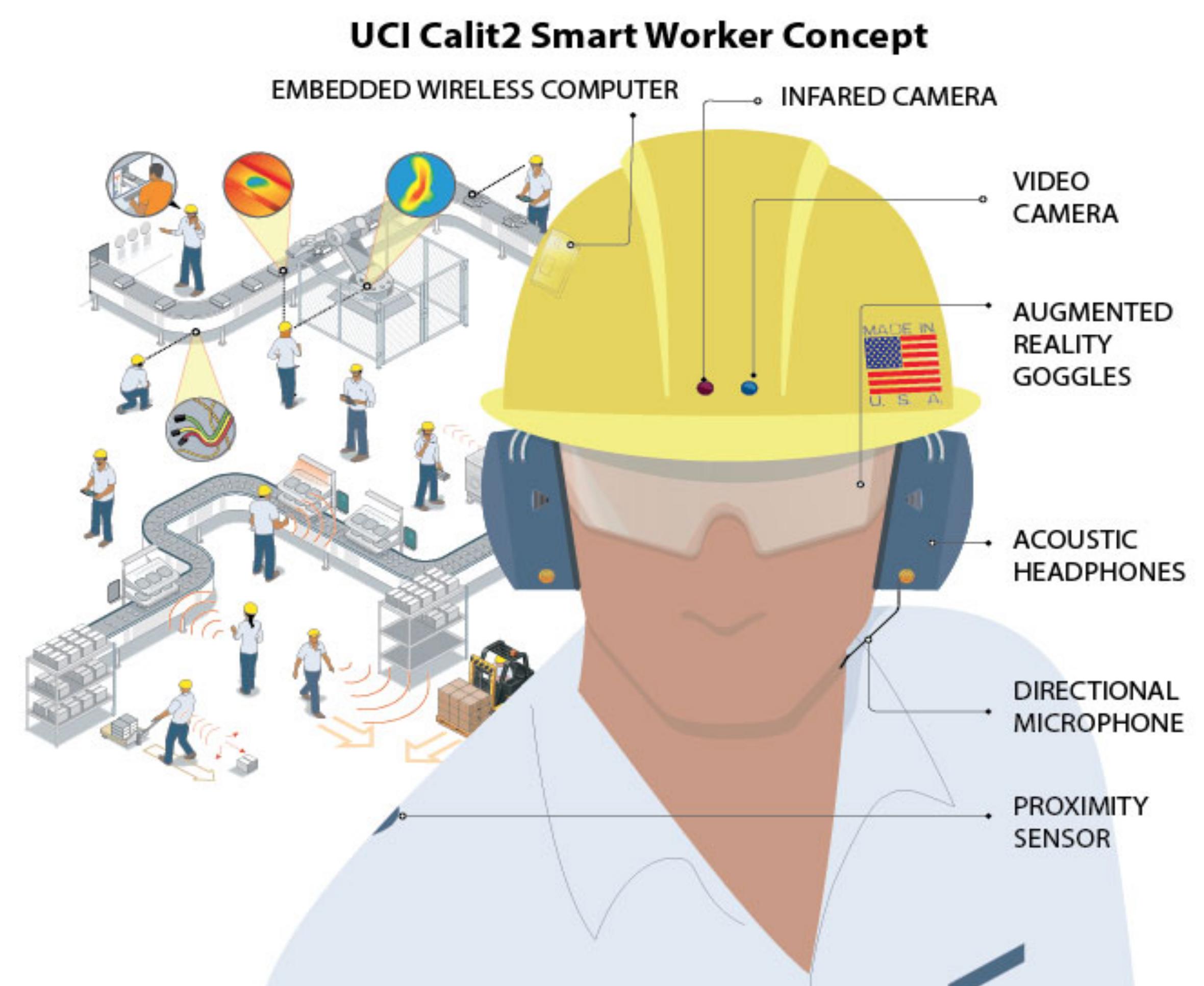
### AR Games for Smart Workers

- 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.



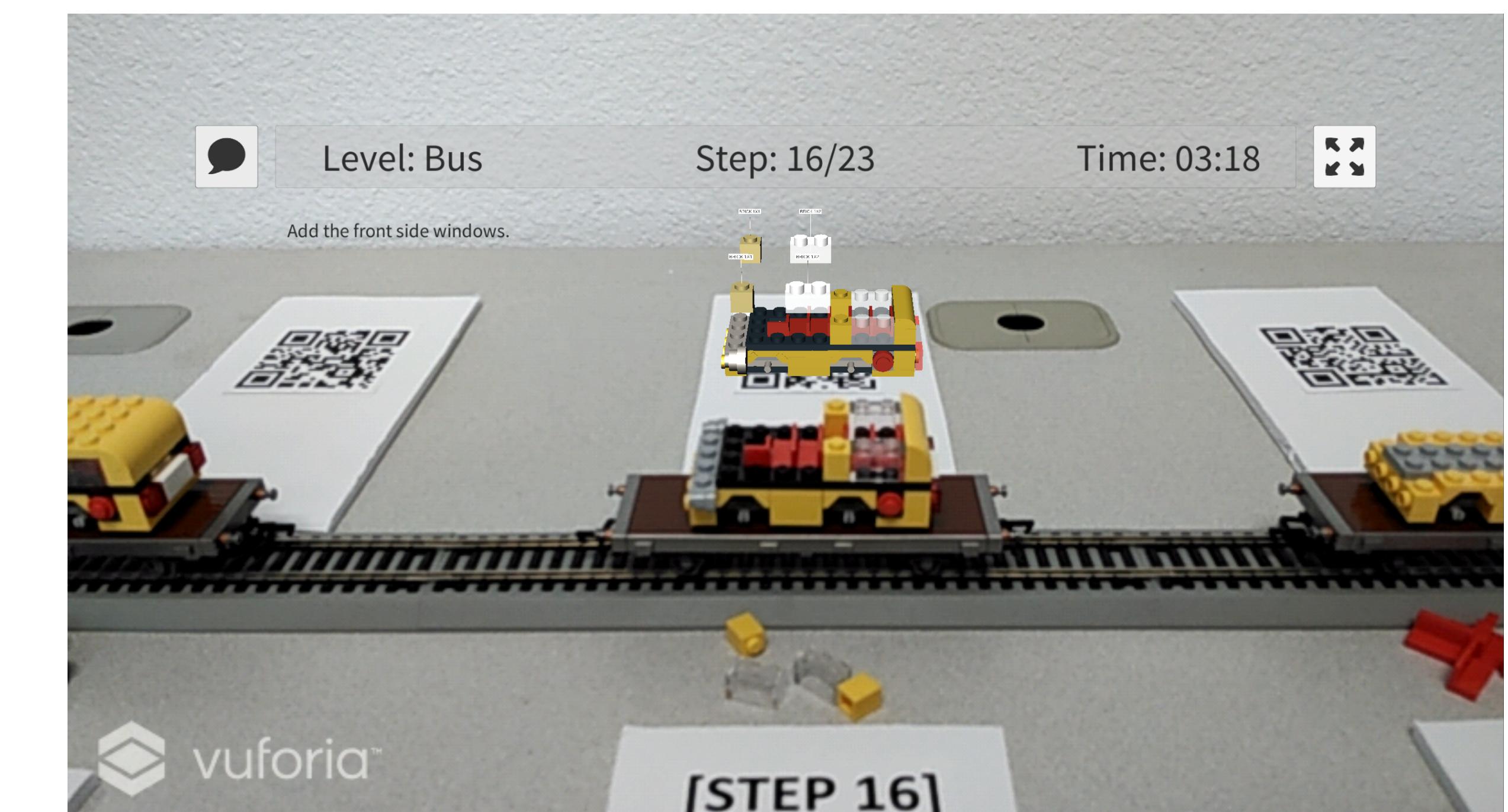
Above: Contraption Maker (top-left), Minecraft (top-right), Infinifactory (bottom-left), and Fallout 4: Contraptions Workshop (bottom-right).

## 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.