MICHIGAN STATE
U N I V E R S I T Y

Project Plan
Augmented Reality Mechanic Training

The Capstone Experience

Team Union Pacific

Justin Barber
Jake Cousineau
Colleen Little
Nicholas MacDonald
Luke Sperling

Department of Computer Science and Engineering
Michigan State University

Fall 2018

From Students…
…to Professionals

Functional Specifications

- General
  - HoloLens based immersive training experience
  - Two separate training modules
- *Learn About Machinery*
  - Displays labeled hologram version of a CAD model
  - Can be spatially manipulated using hand gestures
- *Build a Train*
  - Uses object recognition to locate 3D printed train models
 - Instructs users to assemble a train
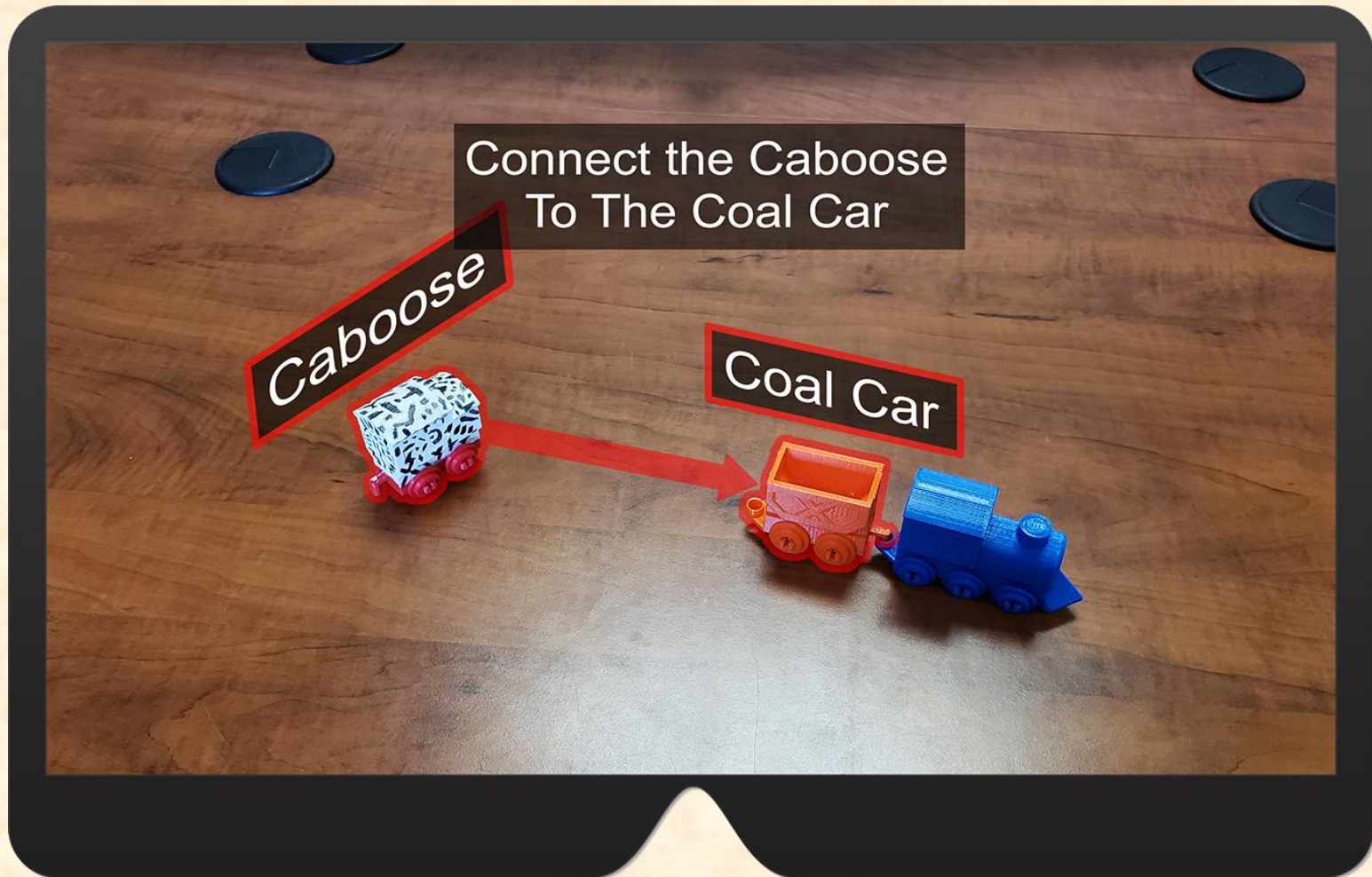
Design Specifications

- General
  - One HoloLens application, two training modules
  - Main menu to select module
- *Learn About Machinery*
  - View holographic machinery projected in space
  - Select from multiple pieces of equipment
  - Look at individual parts to display names
  - Click parts to get detailed information panel
  - Use gesture controls to rotate and interact
- *Build a Train*
  - User instructed to arrange train models in specified order
  - Train cars detected/tracked using object recognition on camera feed
  - Labels appear above train cars when viewed
  - On-screen step-by-step instructions
  - Detection of mistakes, visual cues help the user make corrections
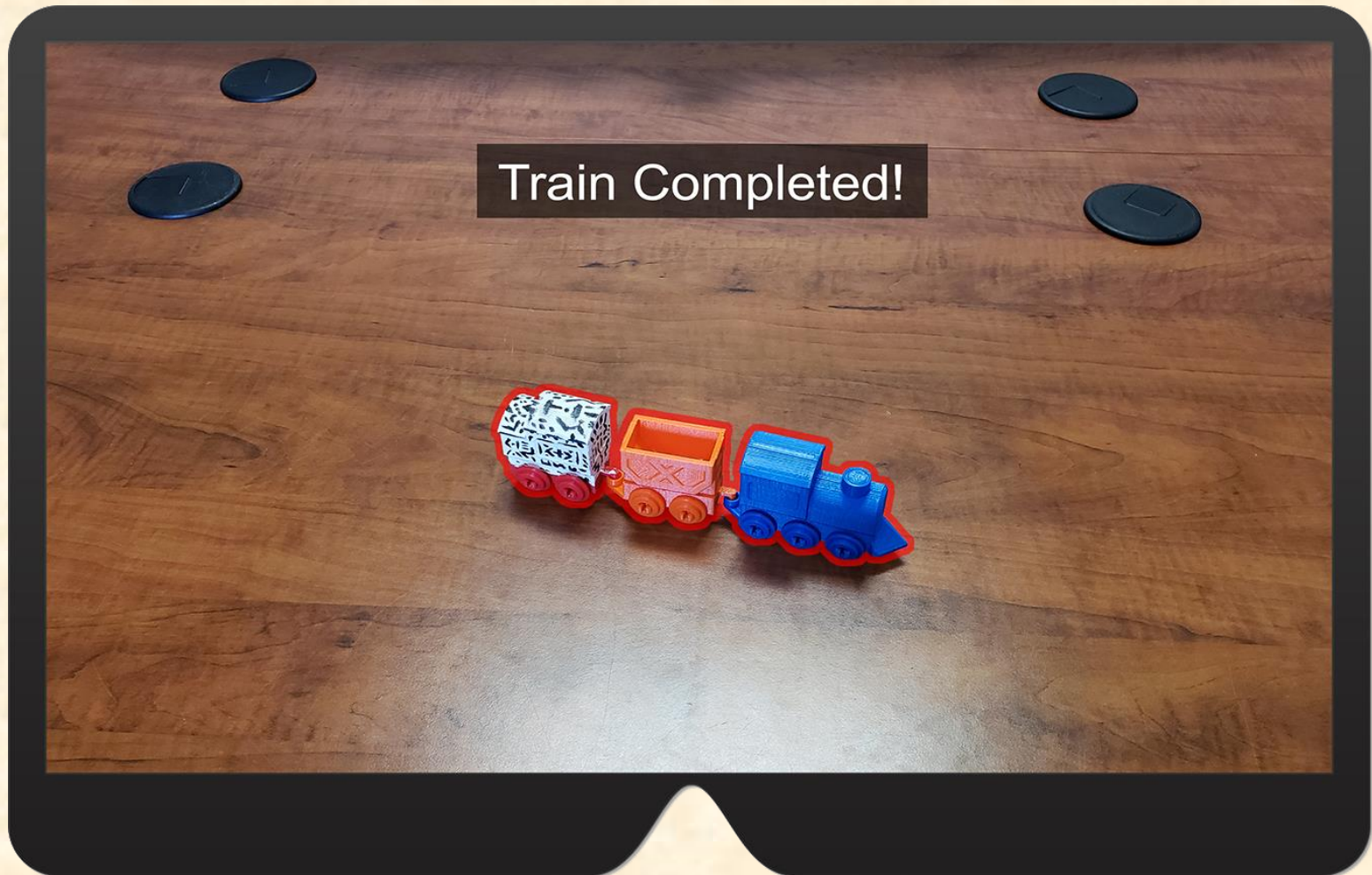 - Final check of the entire train to ensure correct ordering/orientation

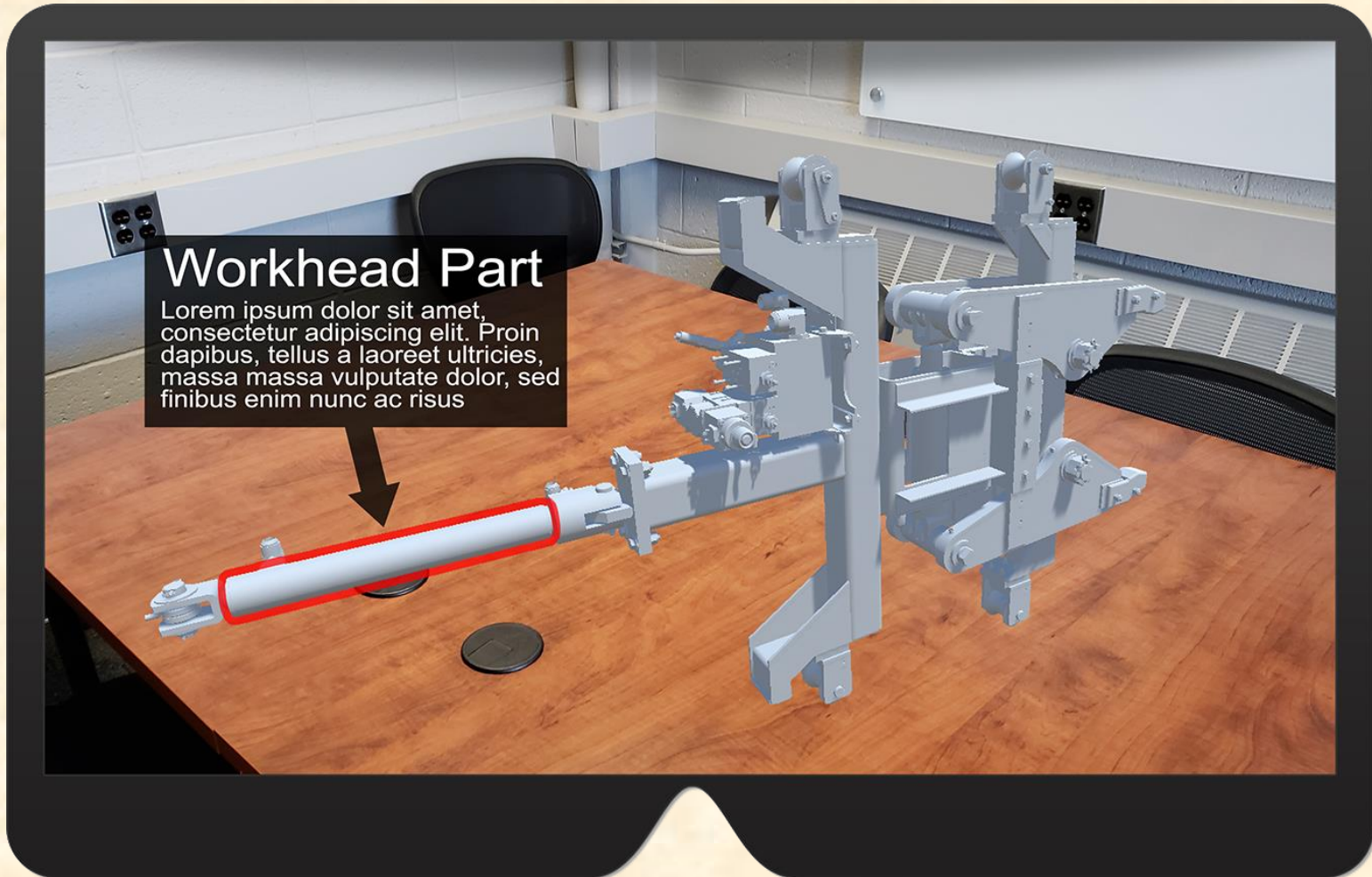# Screen Mockup: Build a Train Step 1
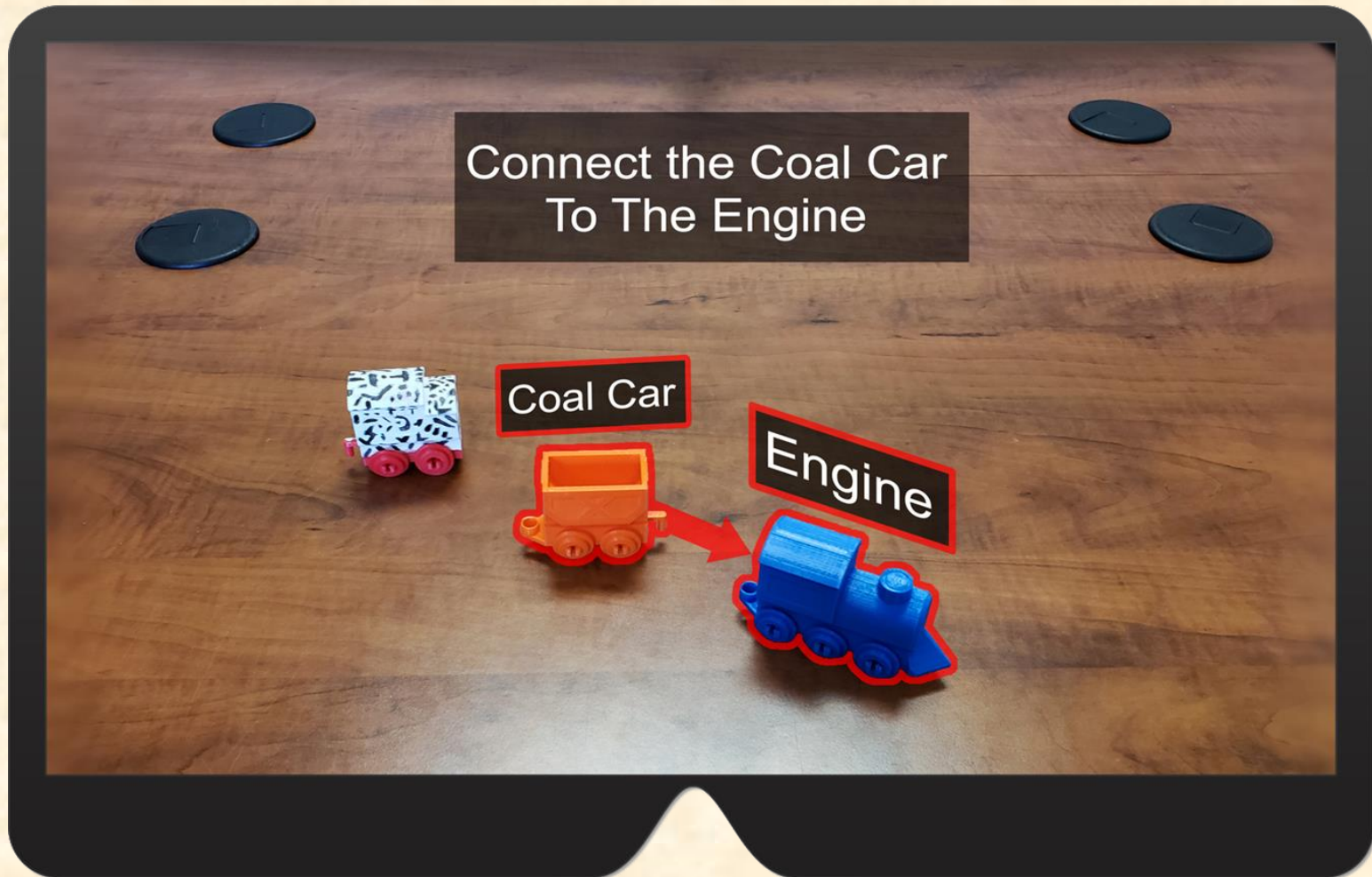
Screen Mockup: Build a Train Step 2

Screen Mockup: Build a Train Complete

# Screen Mockup: Learn About Machinery

Technical Specifications

- General
  - HoloLens Application developed in Unity with C#
  - Uses Windows Mixed Reality Toolkit development utilities
- *Learn About Machinery*
  - PiXYZ is used to convert CAD models to Unity meshes
  - Displays a hologram of the model which can be manipulated using built-in HoloLens gestures
- *Build a Train*
  - Vuforia recognizes objects and gives orientation and position
  - Positions and orientations are compared with desired ranges to check for correctness

System Architecture
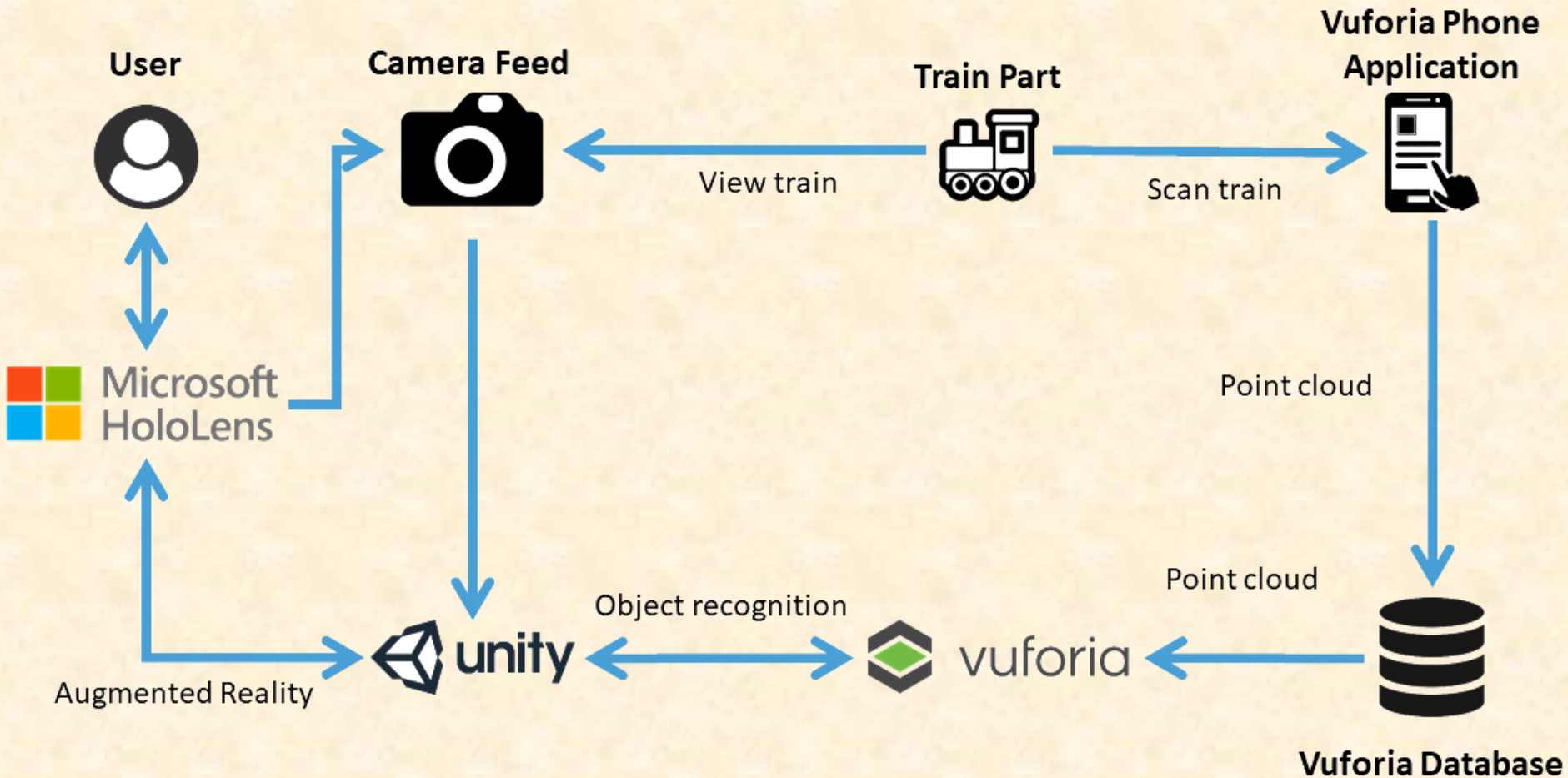
System Architecture
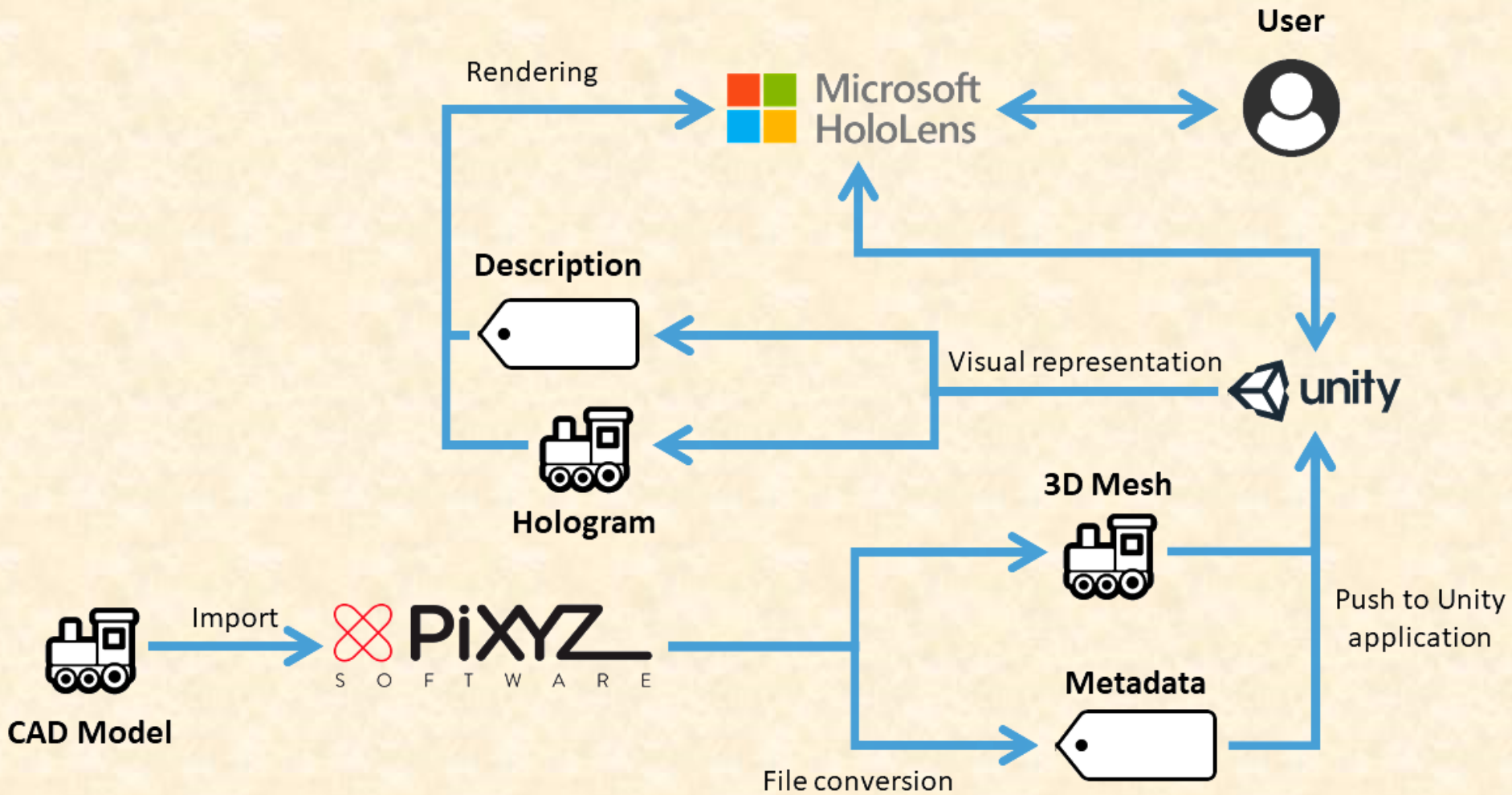
System Components

- Hardware Platforms
  - Microsoft HoloLens
  - Microsoft Windows PC
- Software Platforms / Technologies
  - Unity Game Engine
  - Windows Mixed Reality Toolkit
  - PiXYZ (Unity Plugin)
  - Vuforia (Unity Plugin)
  - Microsoft Visual Studio 2017

Risks

- Vuforia Object Recognition (Moderate)
  - Complications and limitations with various detection methods
  - Test applications built and primary detection method selected
- PiXYZ Build Target Limitations (Moderate)
  - Unity's HoloLens build target is not supported by PiXYZ currently
  - Workaround for current development; exploring moving PiXYZ use into separate process
- Lack of Documentation (Low)
  - New, experimental nature of HoloLens means limited documentation, conflicting/out-of-date info
  - Research to find good information sources has been done and will continue throughout development

Questions?

? ? ? ?

? ?

? ? ?