OverSEA

Synchronous Remote Maintenance Systems

Meet the Team

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NAVSEA
NAVAL SEA SYSTEMS COMMAND

FATHOMWERX

Sponsor: NAVSEA
Mentor: Alan Jaeger

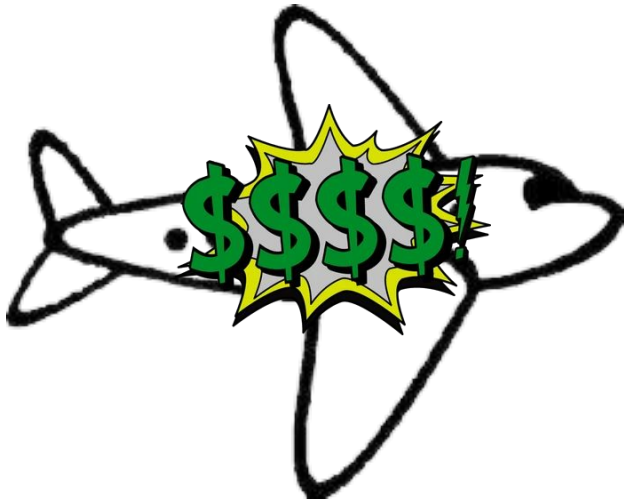
Scenario

Ship Worker: Xavier Gomez (19yo)
Background: He is a young recruit tasked with fixing equipment on the ship.
Problem: The equipment has an issue that Gomez has no expertise on.

How would he get help?

Problem Statement

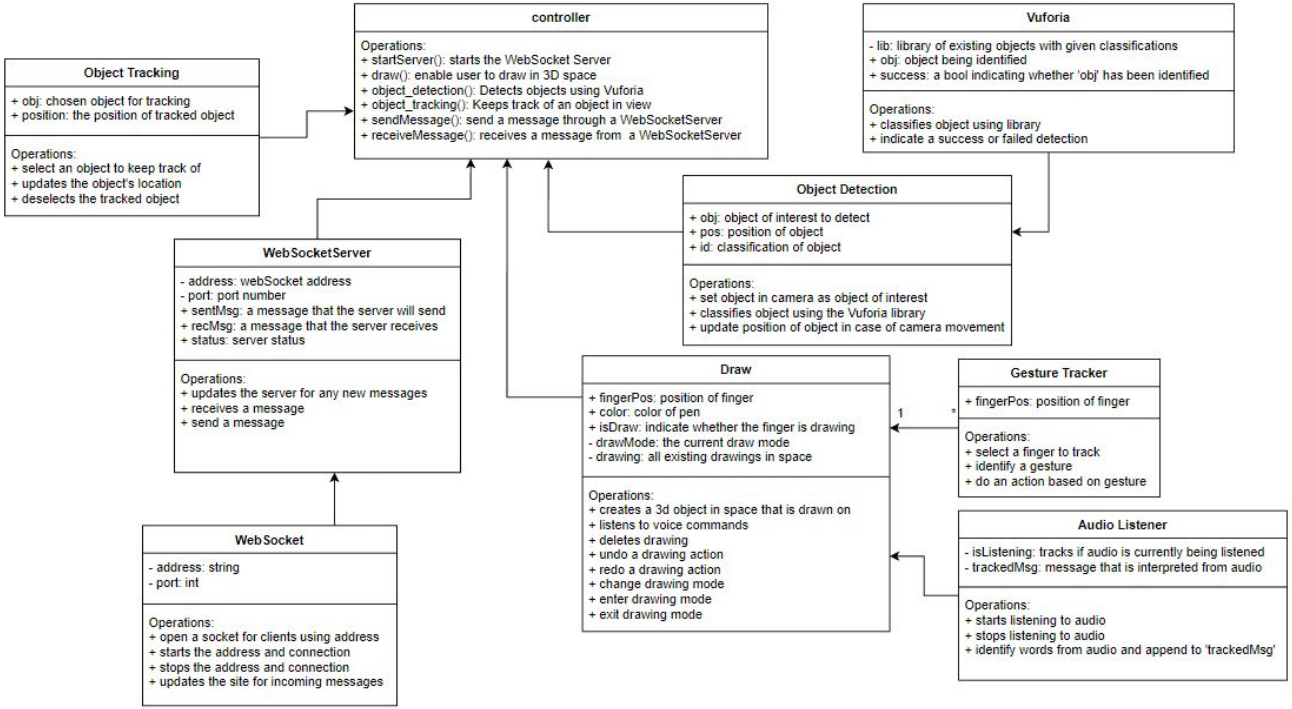
- Maintenance requires flying experts on-site
- Negative impacts on system reliability
  - Costly
  - Resource inefficient
  - Logistically challenging
- Unstable operation in times of war or turmoil
- Specialized personnel are a liability in combat



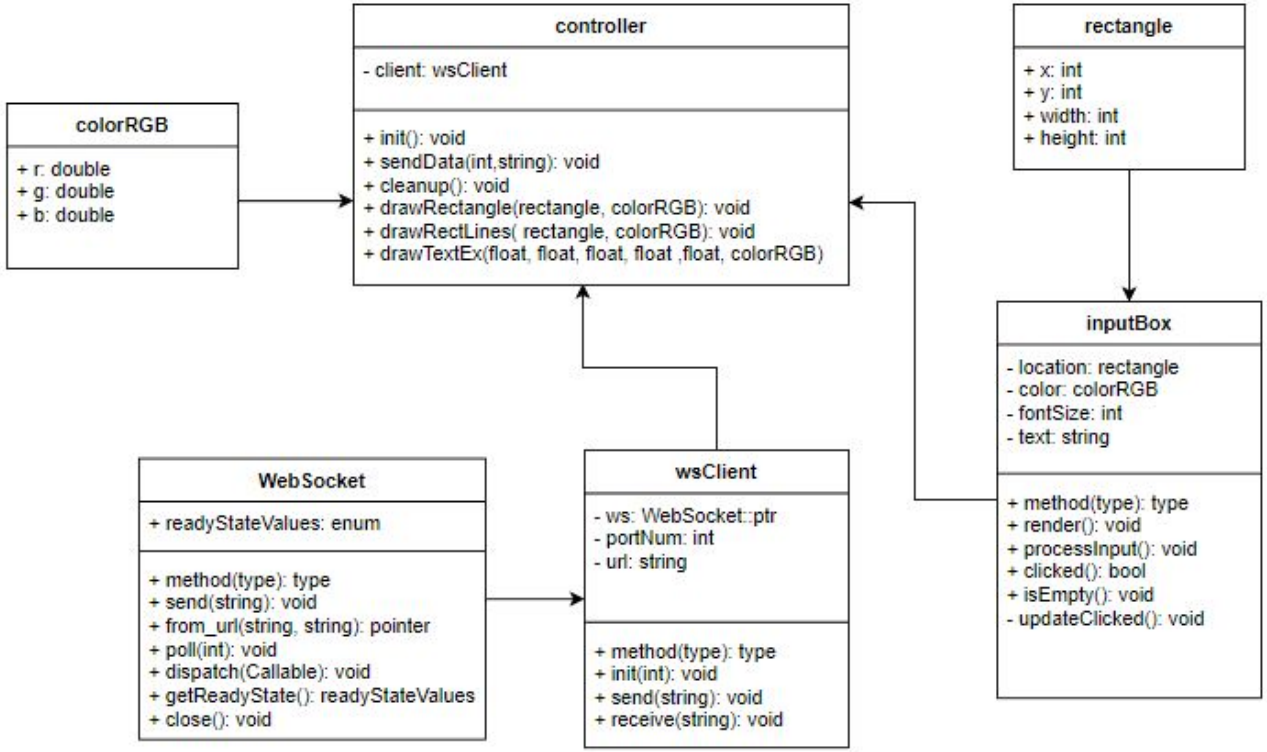
Our Solution

- We use AR headsets, allowing the specialist to communicate with the sailor via a remote computer application
- Development of three components/interfaces
  - HoloLens drawing and object detection,
  - Remote Client application
  - A server-client connection between the HoloLens and the Client
- Seamless experience for remote specialist to help sailors
- Low-cost solution to the remote maintenance problem

System Architecture Overview - Server



System Architecture Overview - Client



Two Separate Applications

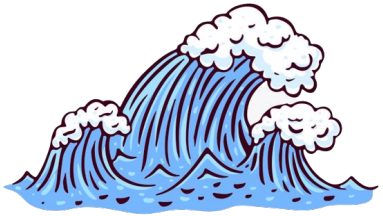
Application Server

- HoloLens user (mechanic)
- Broadcasts video to client
- AR drawing capabilities
- Communication via WebSockets
- Broadcasts video to Client

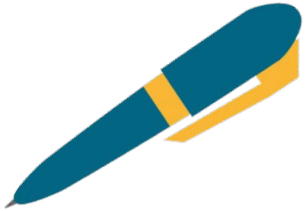
Client

- Remote user (specialist)
- Allows viewing and interaction with the HoloLens user's environment
- Communication via WebSockets
- Receives video from Server

Communication Diagram



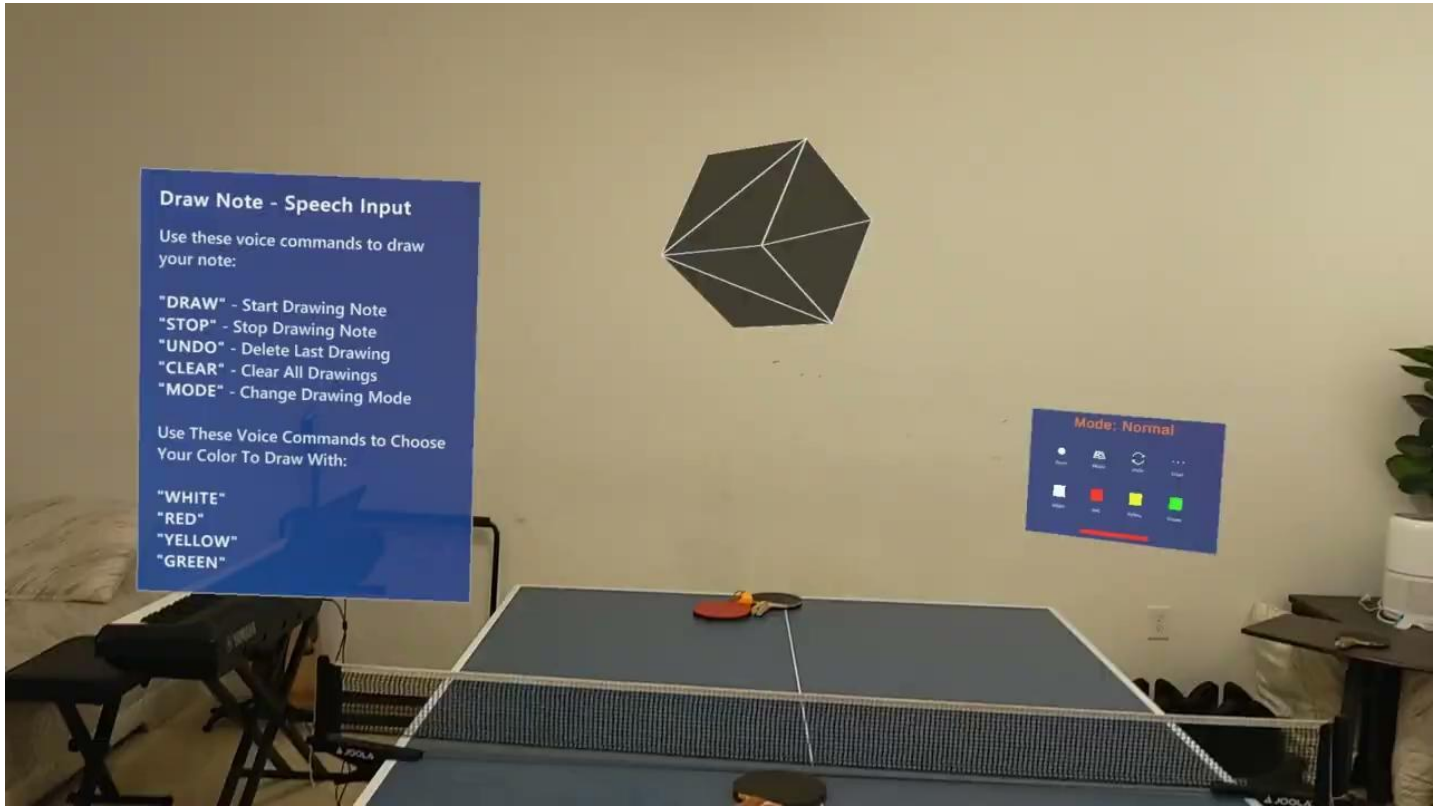
~ 3,500 miles away ~



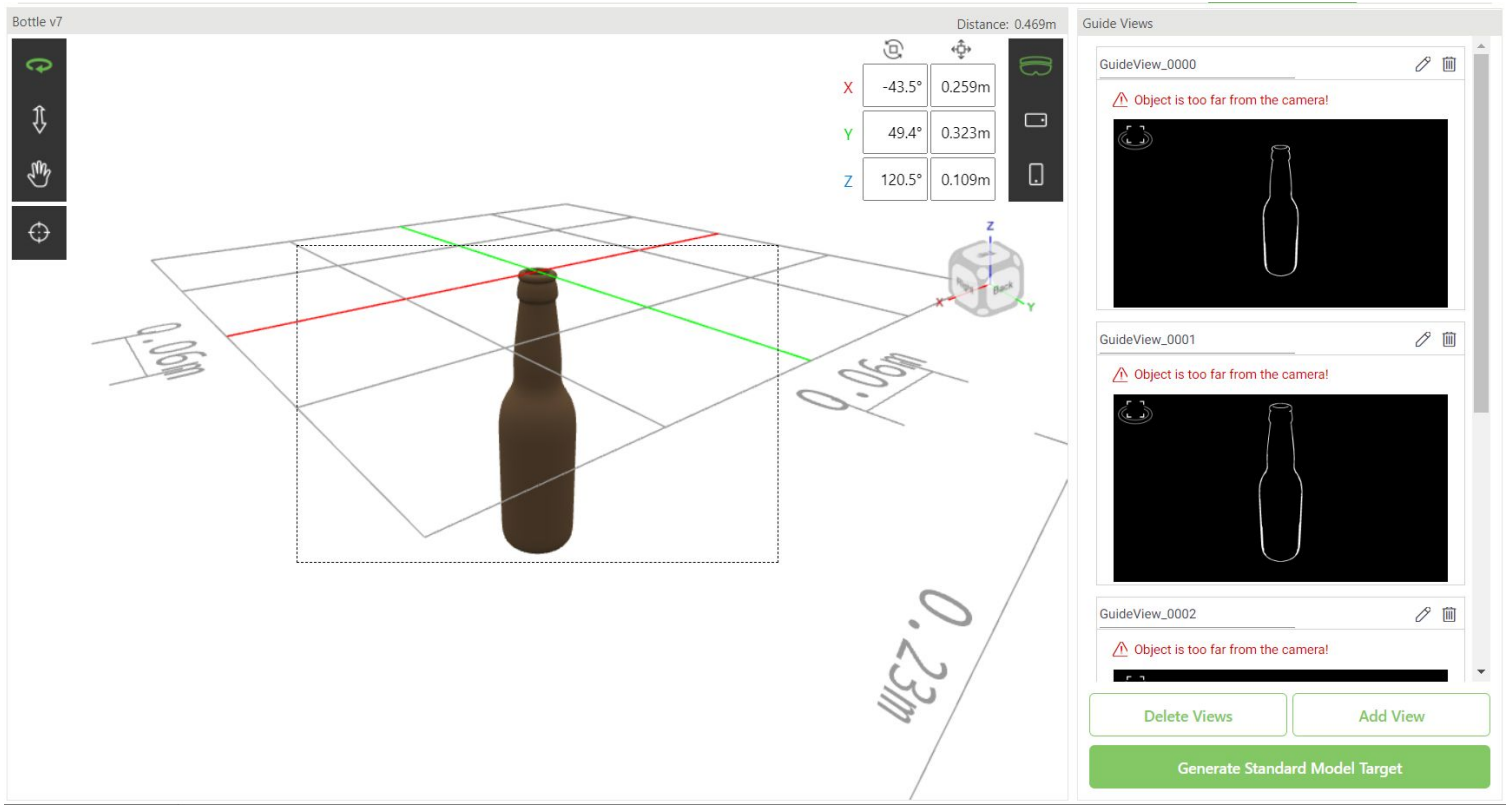
Xavier Gomez
(Application Server)

Specialist
(Client)

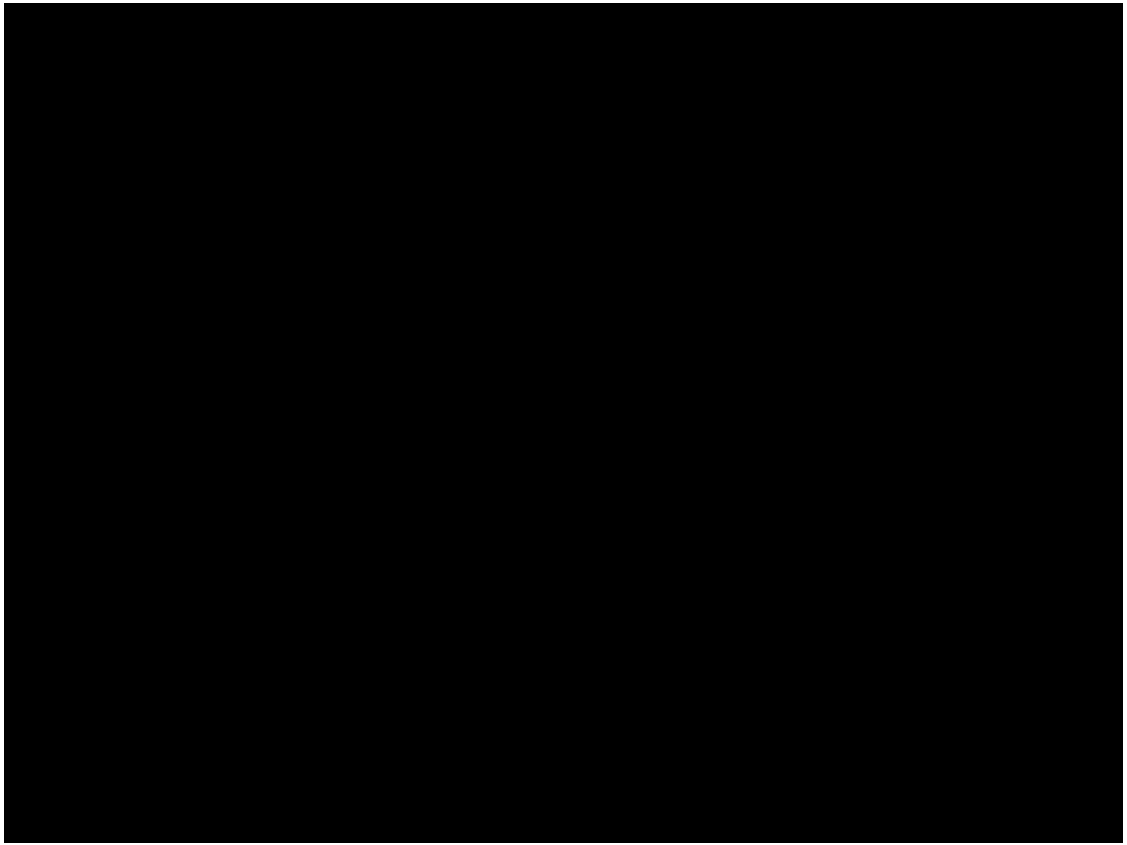
Demonstration - AR Drawing Component



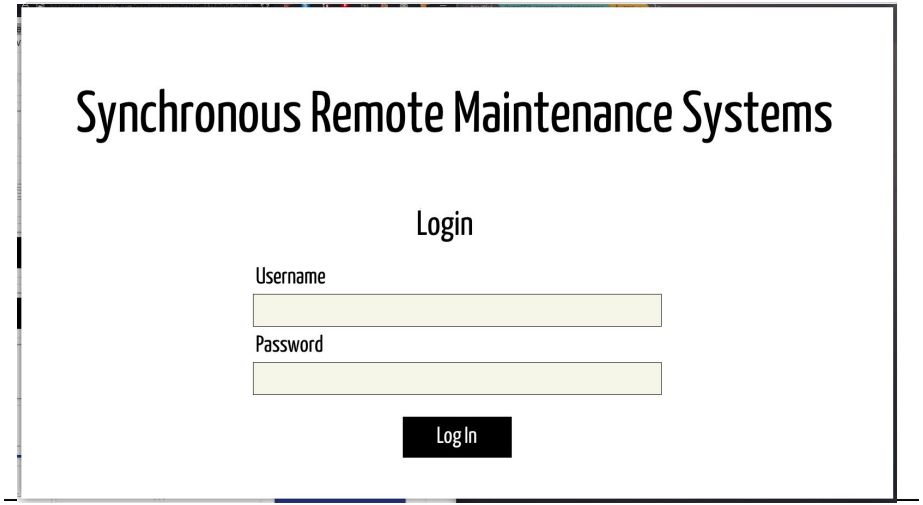
Demonstration - Object Detection Component



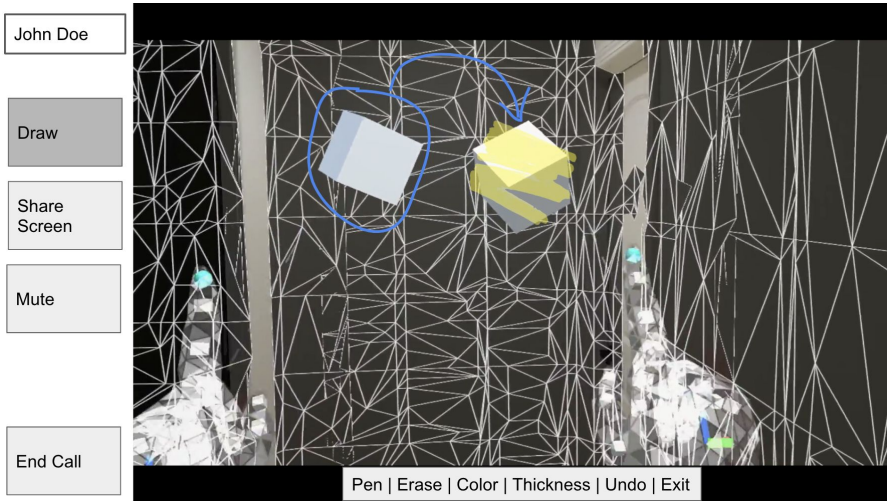
Demonstration - Object Detection Component



Demonstration - Receiver



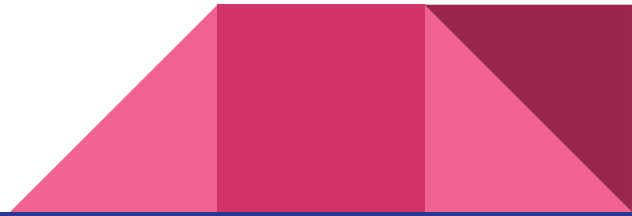
This is the login page on the receiver side. They will have a given username and password in order to ensure security.



This is the main page, in a call, that the receiver will see. They have the ability to draw on the hololens camera stream and talk to the hololens user directly.

Novelties and Challenges

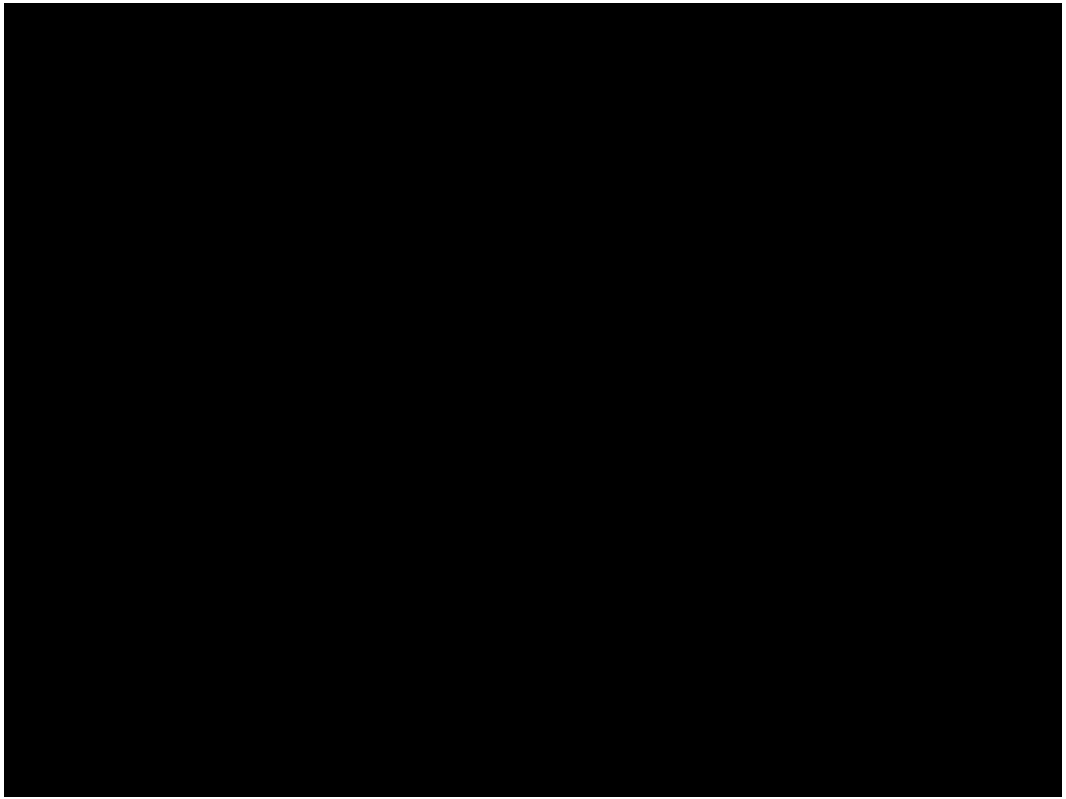
- Delays in obtaining equipment
  - Received second HoloLens in week 5
- Steep HoloLens learning curve
- Integrating cross-app communication
  - Video components are in progress
- WebSocket protocol challenges
  - Header information inconsistent
- HoloLens video export is quite complicated
  - Our existing solution for video export is not feasible
  - Limitation with HoloLens to overcome with external libraries



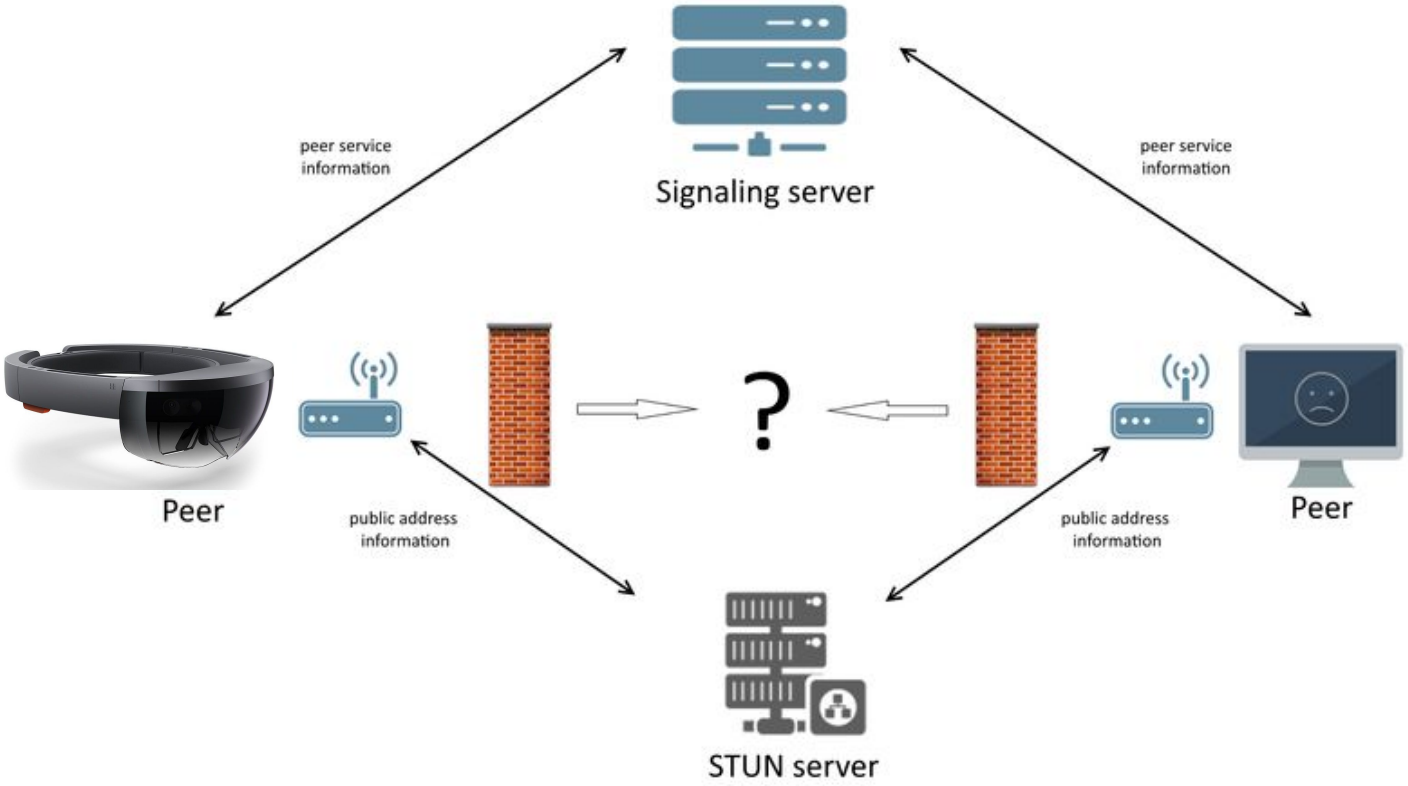
Next Steps

- Further integration with WebSocket technology
- HoloLens broadcasts video to Client
  - Using new technologies to broadcast directly from HoloLens server
- Drawing ability for client-side application
- Further integration of all components
  - Client, Server (Drawing), Server (Object Detection)

Next Steps - Render Streaming



Next Steps - Signalling Server



Thank you!

Questions?