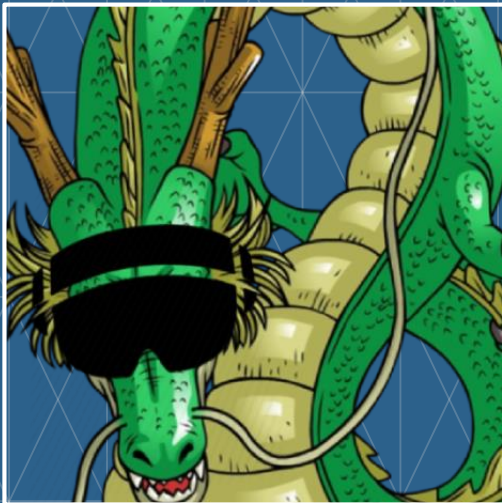


Spatial Reconstruction Using Microsoft HoloLens



GUPTA Aman
ZAFAR Waleed



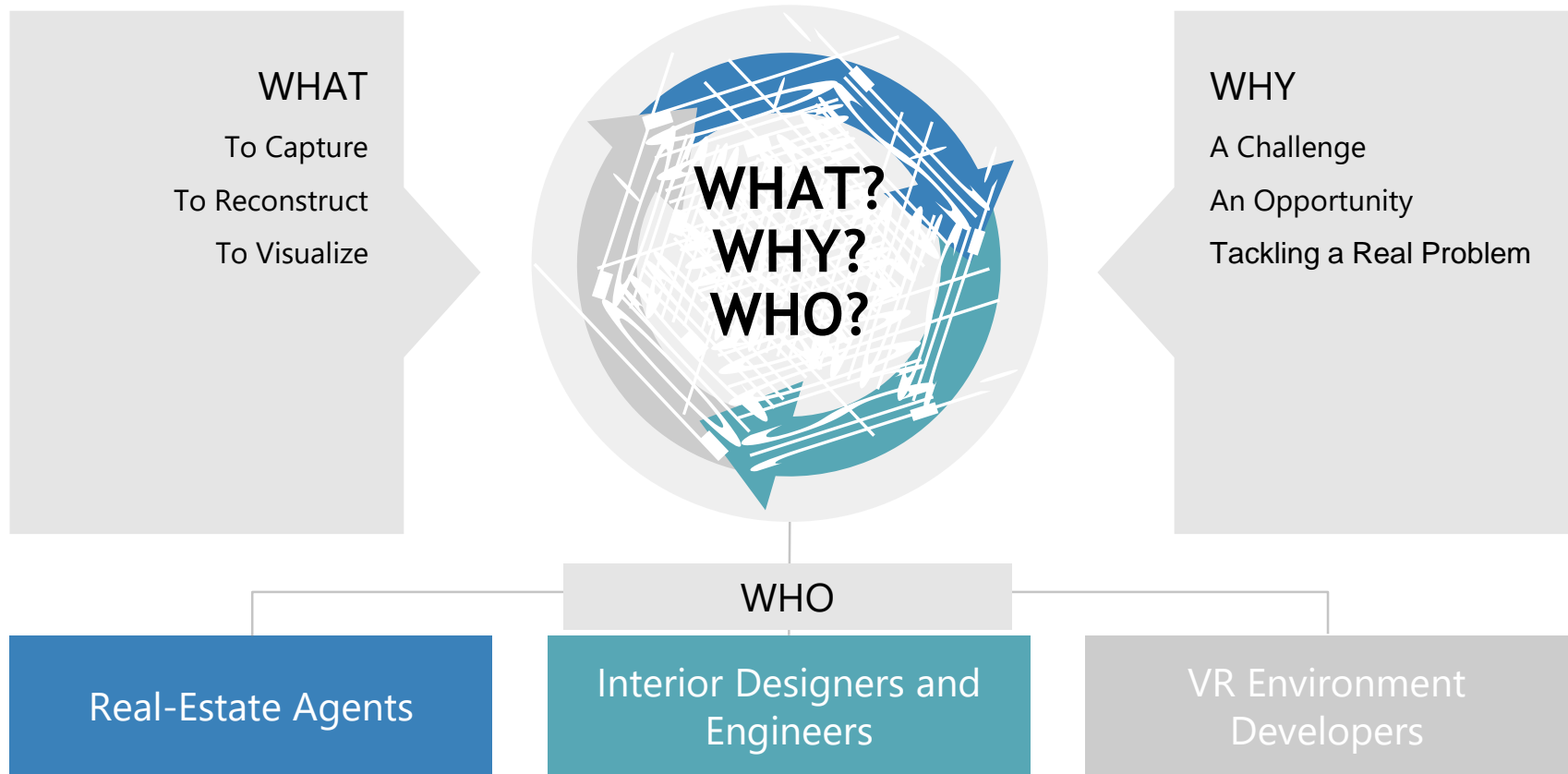
HISS

Holo Indoor Spatial Scanner

2

AGENDA

- Introduction
- Application Design
- Results
- Looking Back
- Moving Forward
- Conclusion
- Feedback & Demo



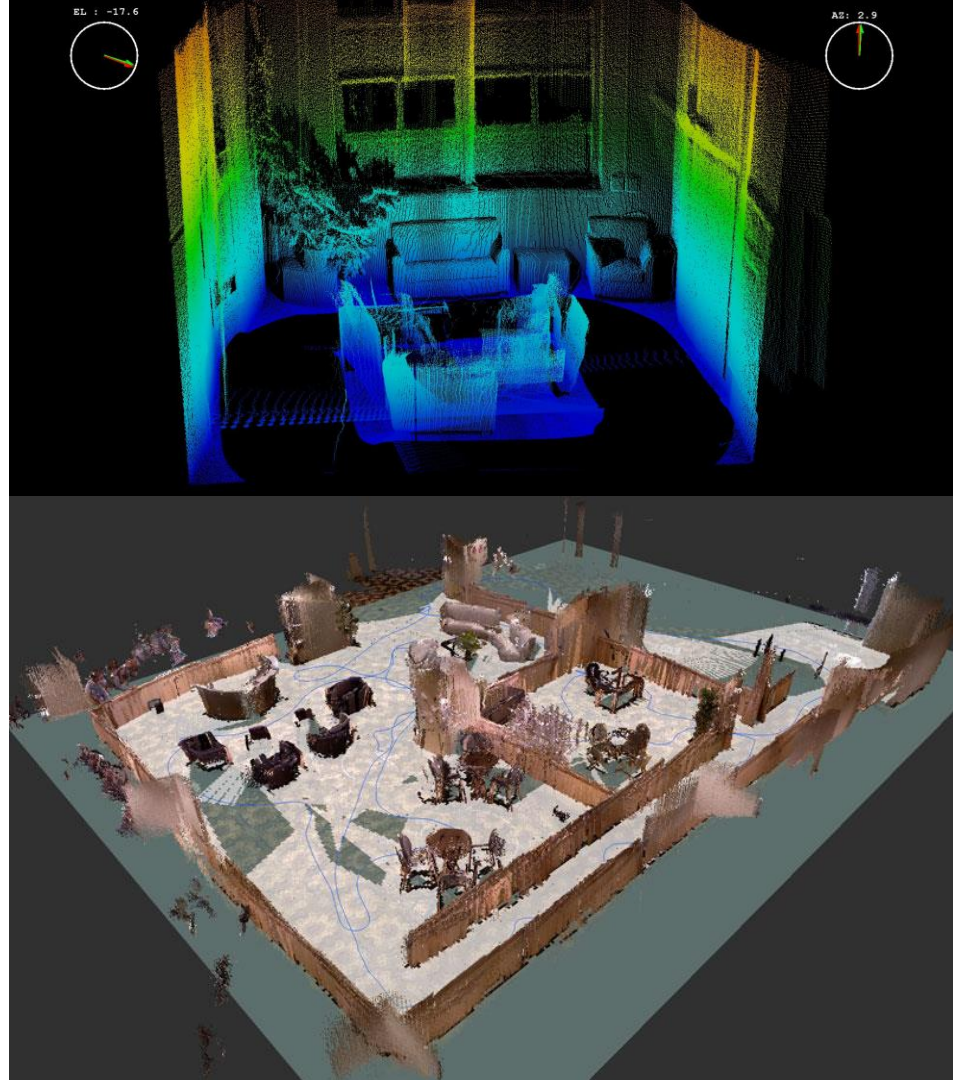
Existing Technologies

LIDAR

Microsoft Kinect Fusion

Google Tango

4





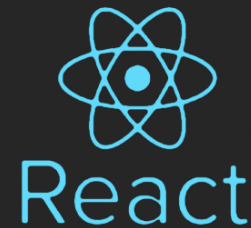
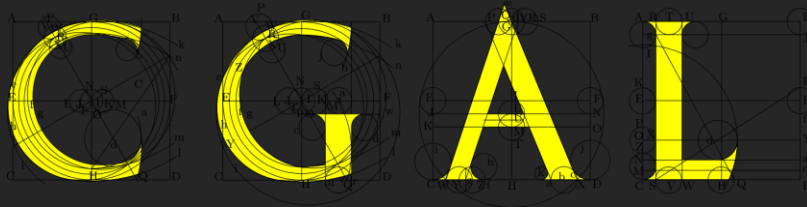
5

The HoloLens

- Spatial Understanding
- Mobility
- Accuracy
- Cost Effectiveness
- 3D Visualization



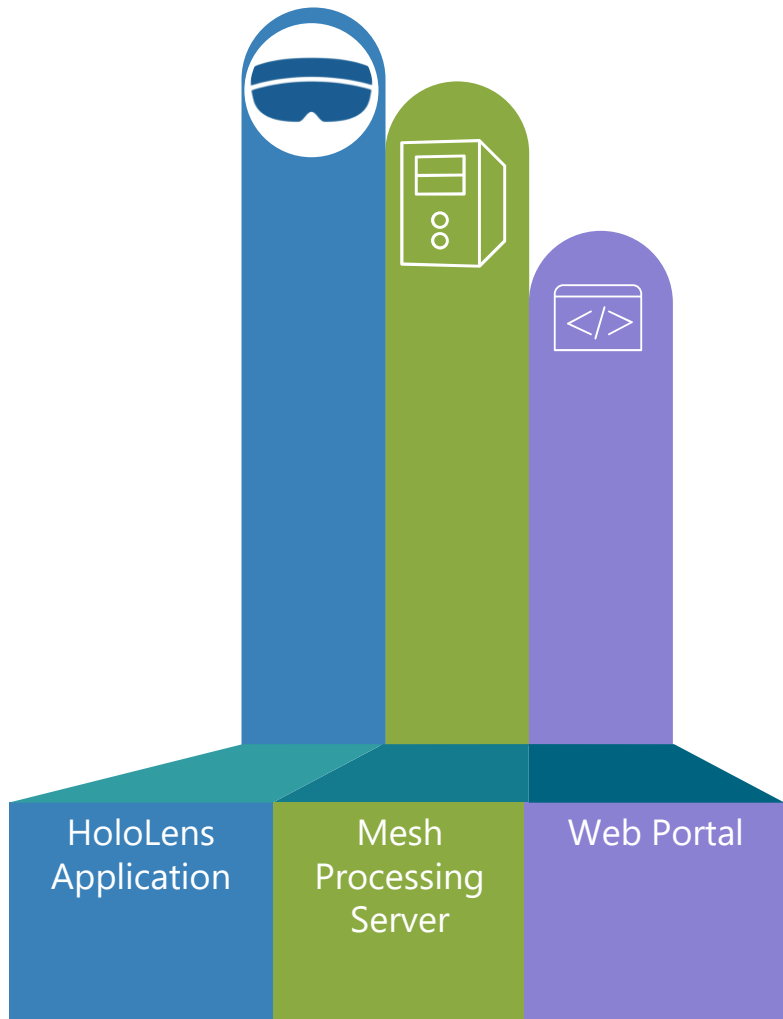
Software and Technologies



A close-up photograph of several interlocking metal gears, likely from a mechanical watch or a precision instrument. The gears are made of dark metal and show signs of wear and lubrication. The lighting is dramatic, with strong highlights and deep shadows, emphasizing the texture and geometry of the teeth. A semi-transparent dark rectangle is overlaid in the center of the image, containing the text.

Application Design

HISS: Holo Indoor Spatial Scanner



The Deliverables

HoloLens

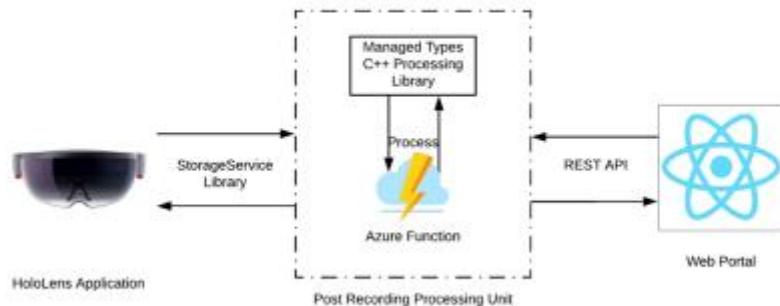
Record & Visualize

Processing Server

Process and Store Meshes
on the Cloud

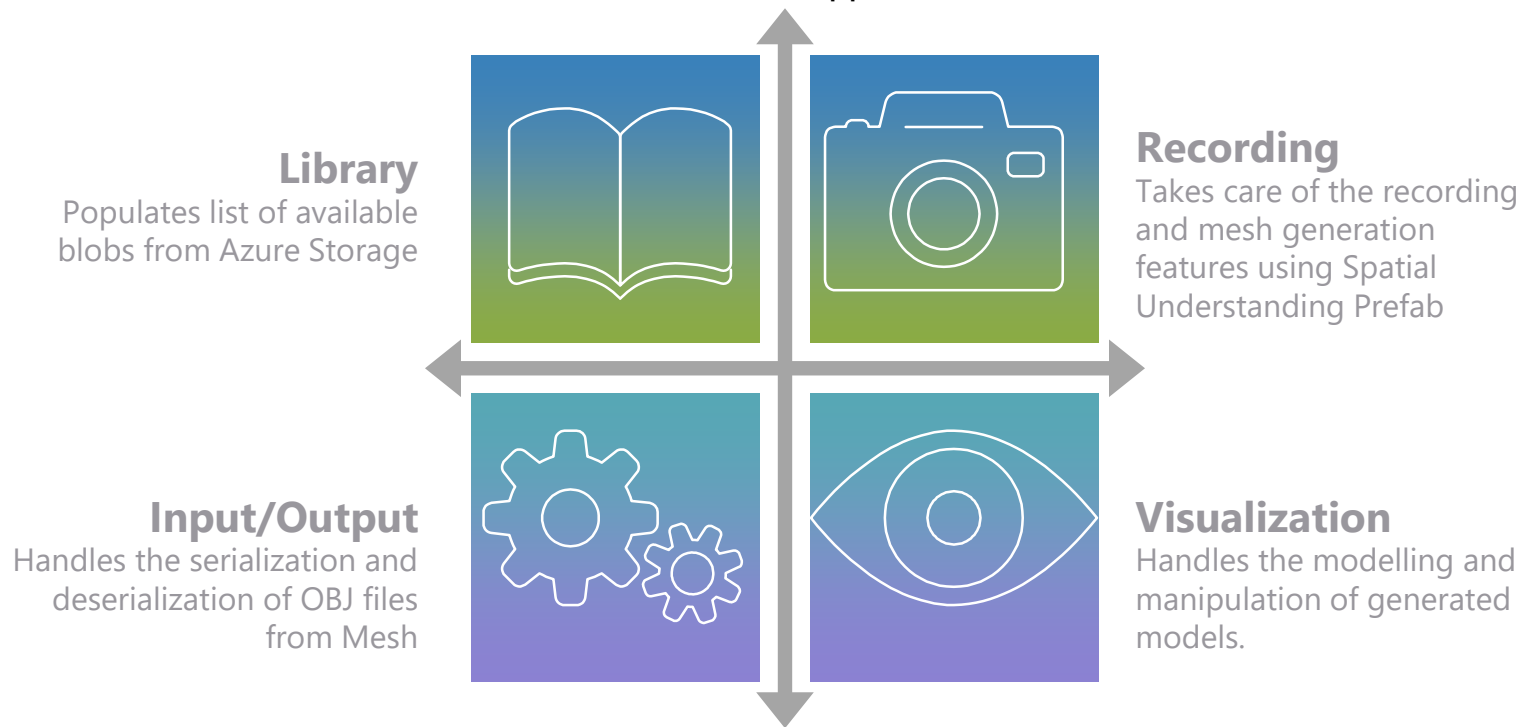
Web Portal

Interact with the Server



HoloLens Application

A modular approach.





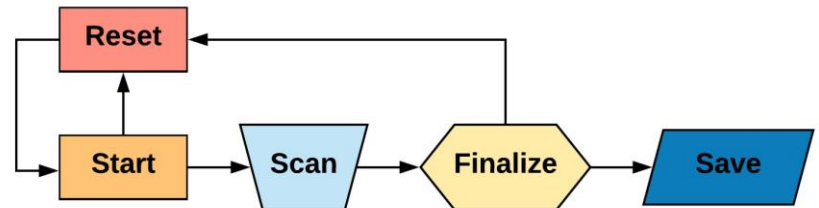
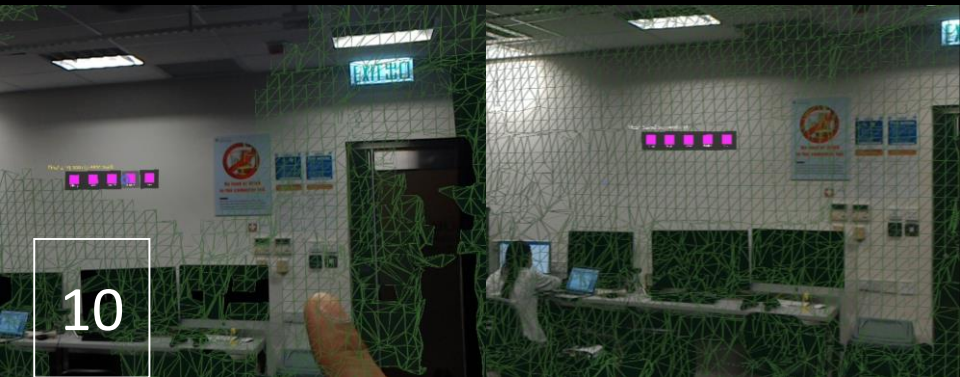
The Recording Module

Uses the Spatial Understanding DLLs
built by Microsoft

Gesture and Speech Input

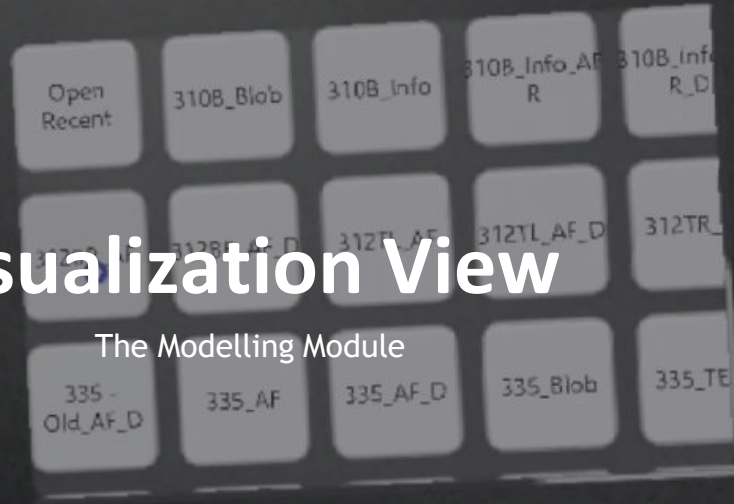
Helpful Mesh Insights

Minimum Criteria for Mesh Quality

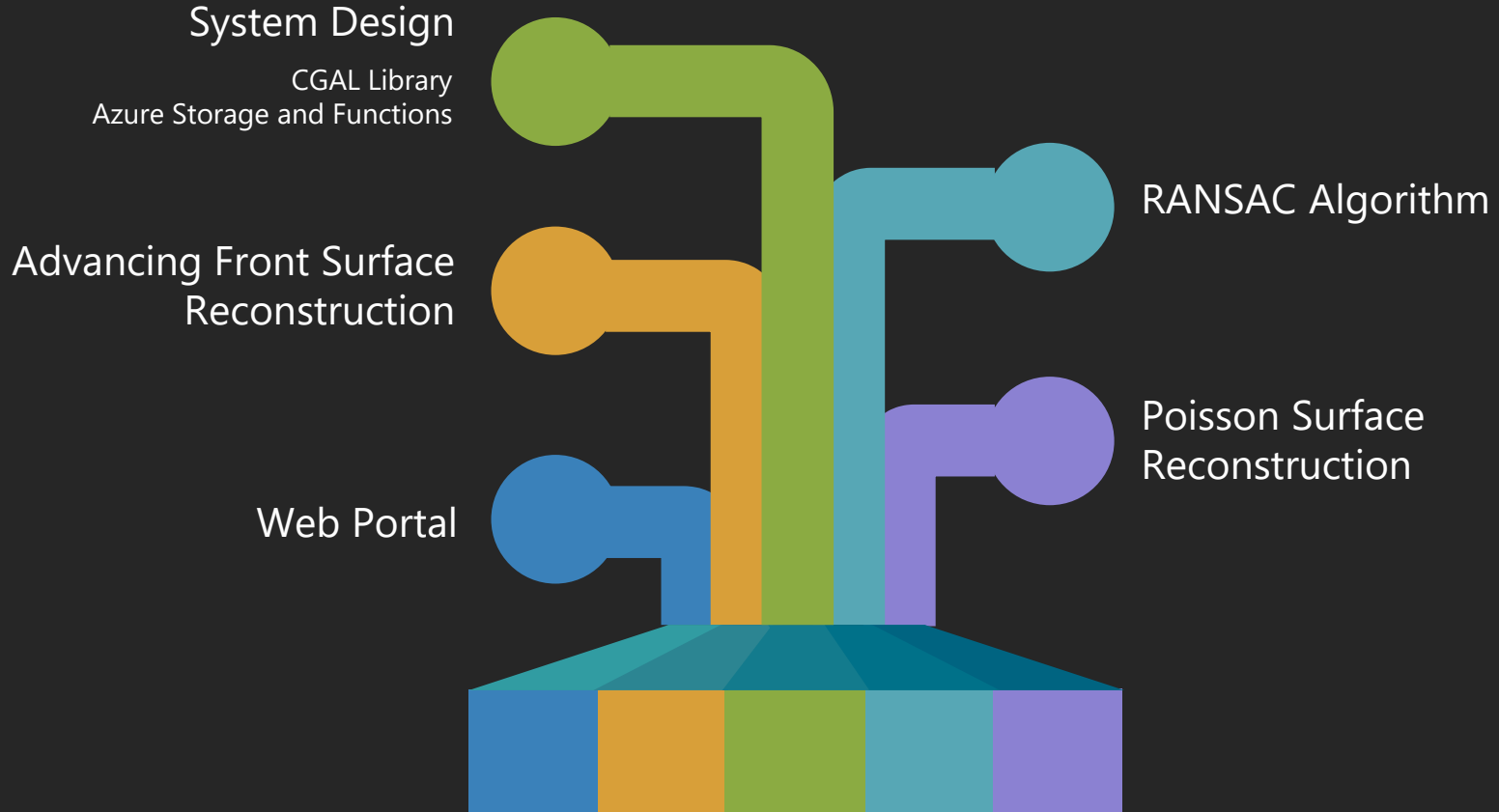


Visualization View

The Modelling Module

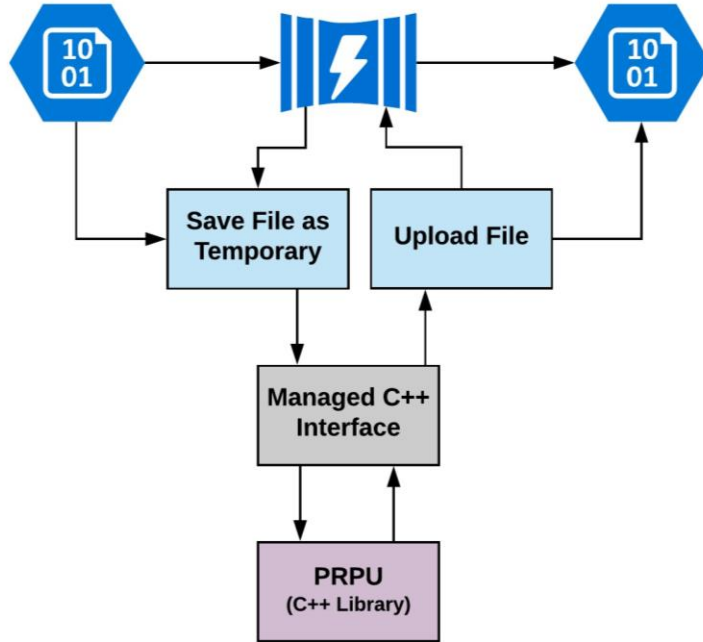


The Processing Server



Input Storage

Output Storage



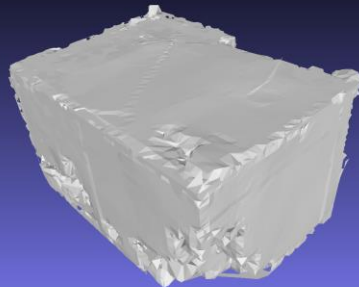
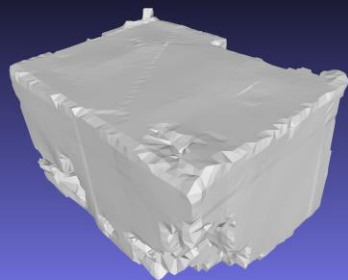
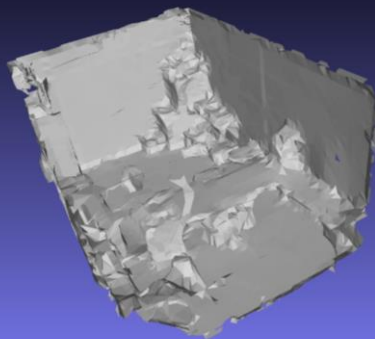
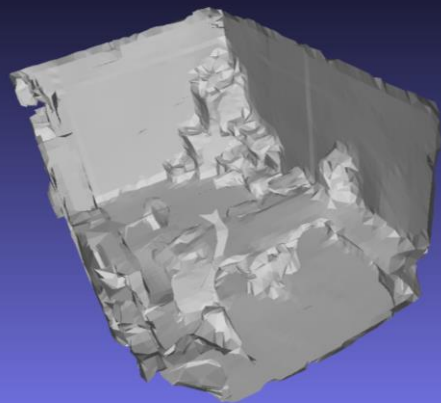
PRPU Design

- Core C++ processing library
- Managed Interface
- Azure Function App

RANSAC Algorithm

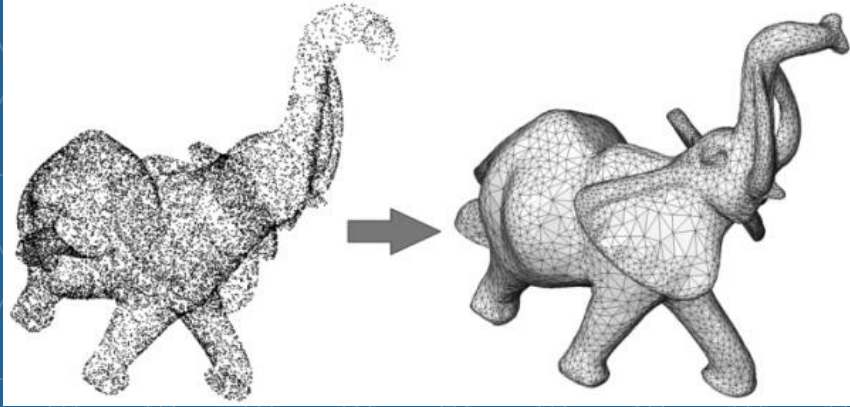
- Point set shape detection
- Plane detection using point and normal set
- Outer hull reconstruction using point set with oriented normal

Advancing Front Surface Reconstruction



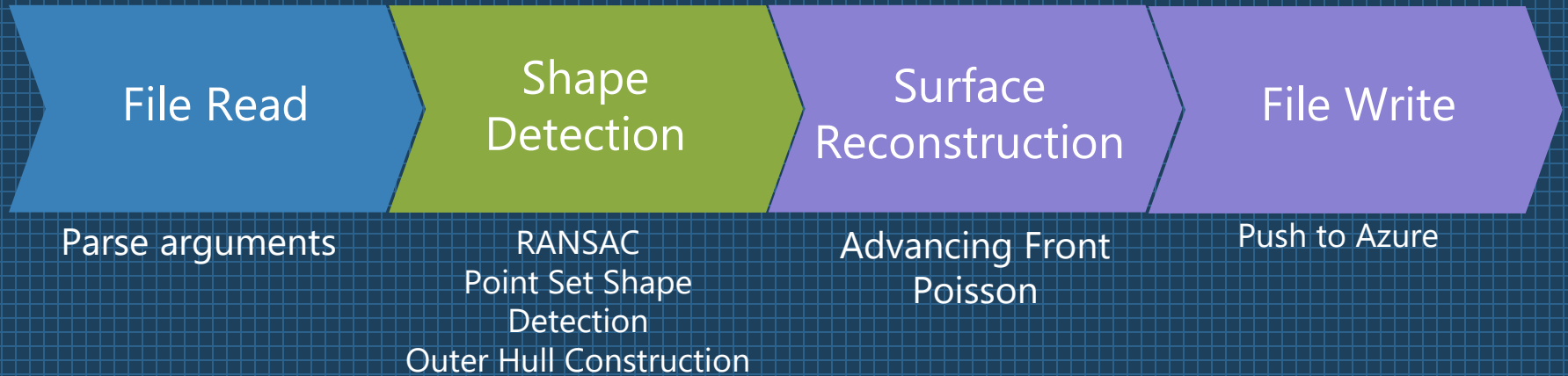
- **RANSAC for Plane Identification**
- **Priority Structure Functor**
- **Advancing Front Reconstruction**

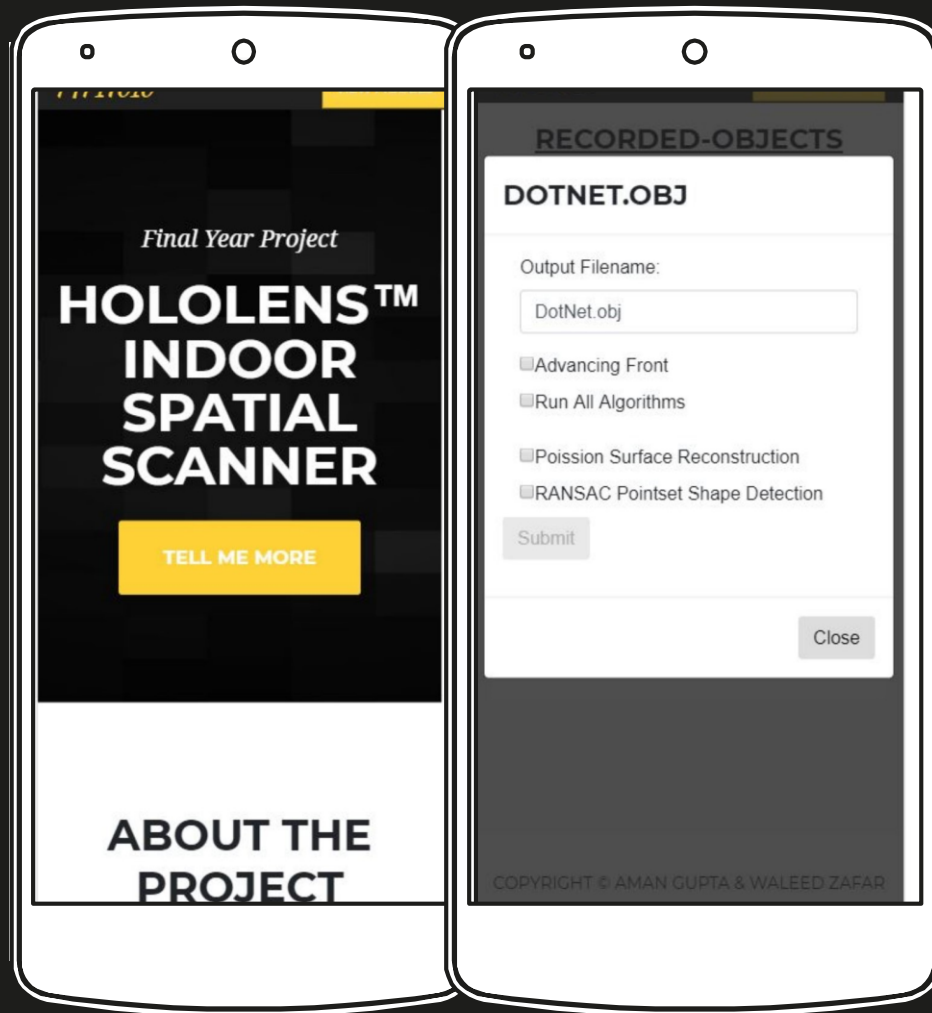
Poisson Surface Reconstruction



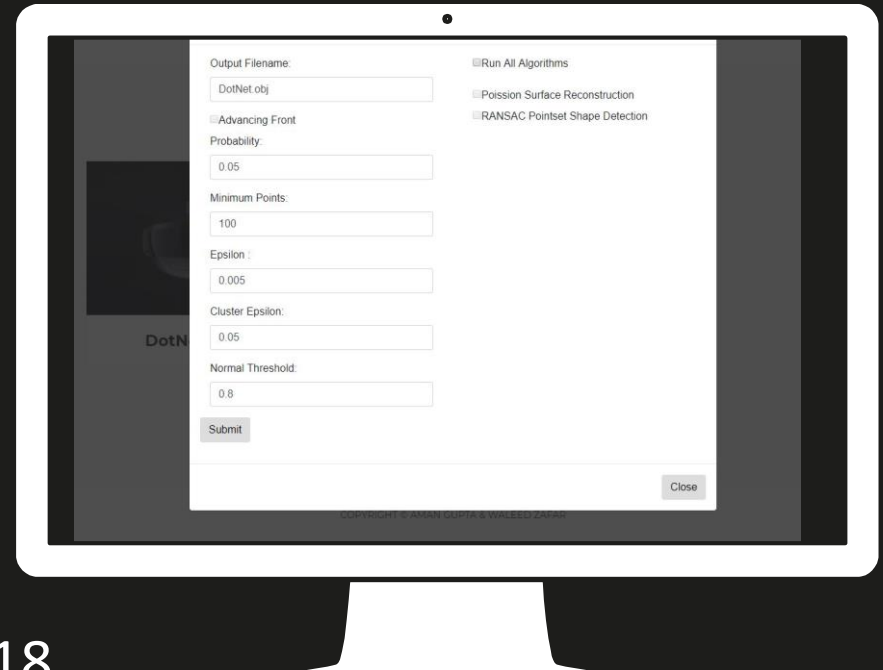
- Operates on 3D point sets with oriented normal
- Computes an implicit Poisson function and extracts an isosurface
- Doesn't handle sharp features, noise or outliers well
 - Use for interior element reconstruction

Processing System Flow

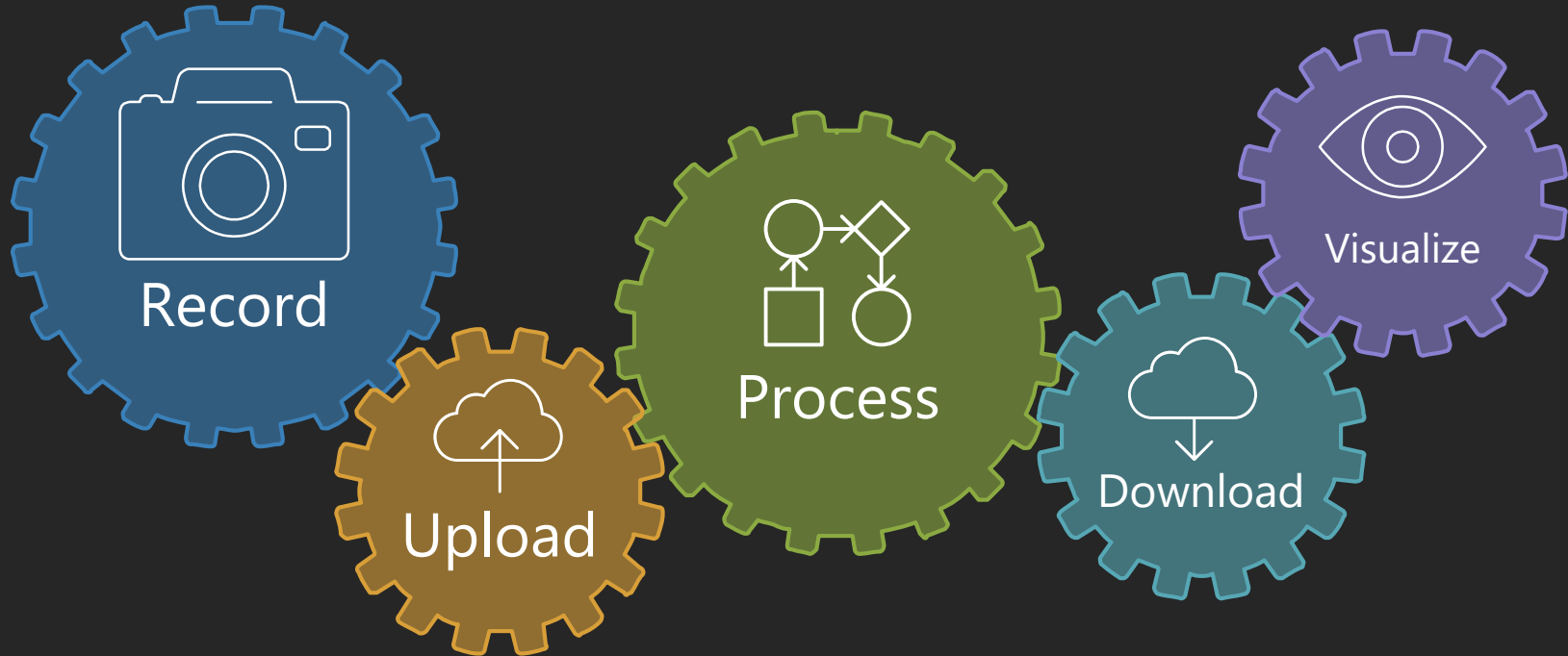




Web Portal



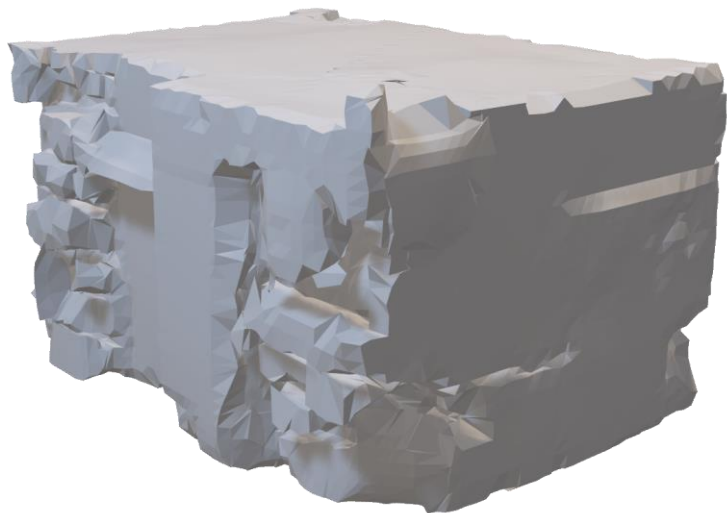
Spatial Reconstruction



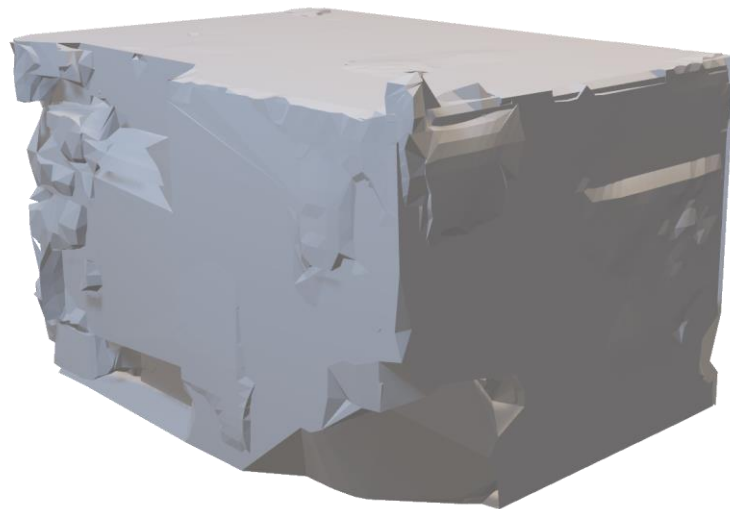
Results



Dirk's Office

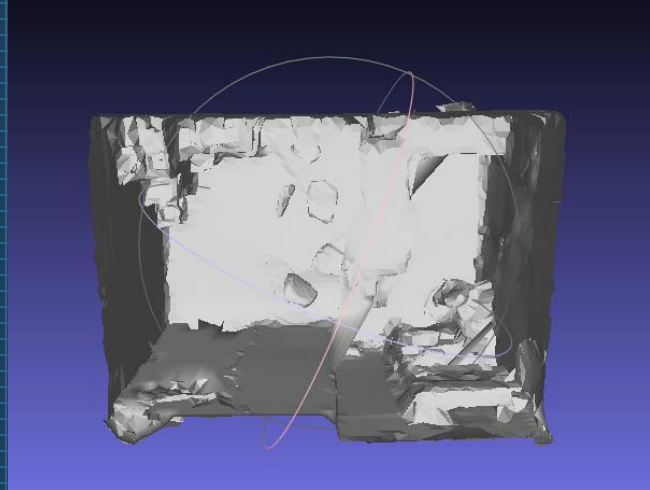


Original Scan

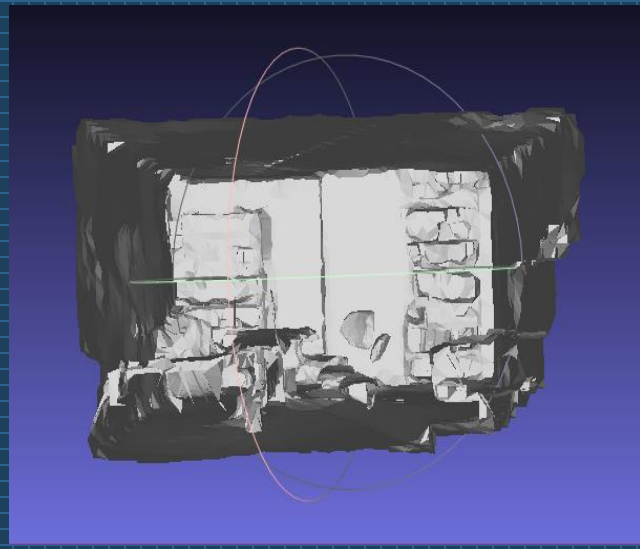
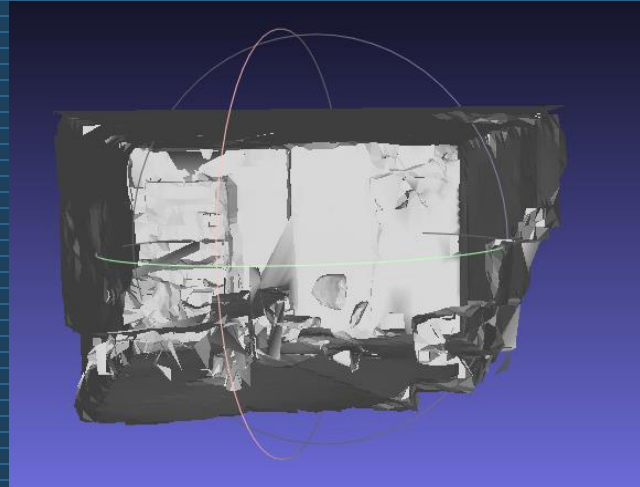
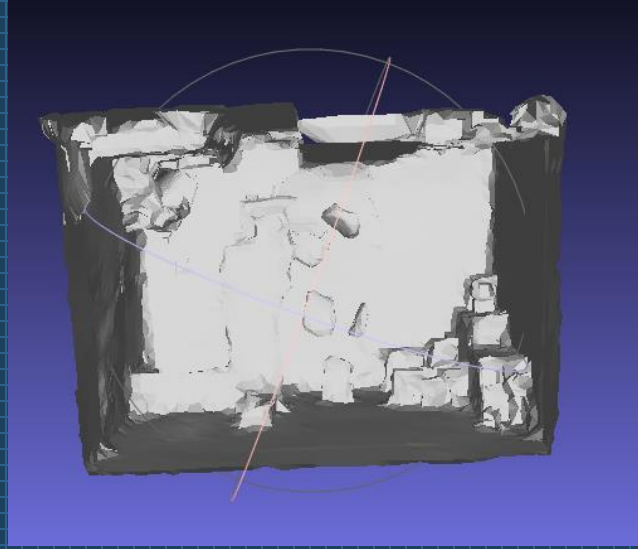


Processed Model

Results



Originals



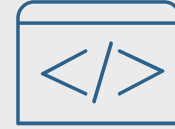
Results



HLA



Processing Server



Web Portal

Mesh Recording

Processing Algorithms

Server Connection

Visualization & Modelling

Server Connection

Front End

IO Module

Throughput

Response

Looking Back

- Enhance Feasibility Study
- Better Integration
- Better User Interface

Moving Forward

- Integration of Classification Algorithms (Machine Learning)
- Incorporate Textures and Coloring of surfaces
- Manual capture of model features

CONCLUSION

Spatial Reconstruction is possible!

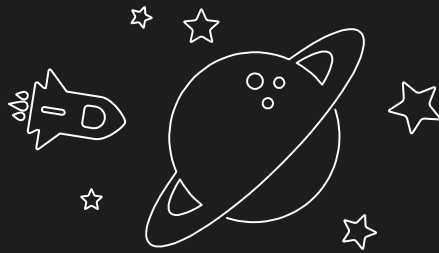
The proof of concept works!

We implemented various modules and interactions with multiple systems!

The system has amazing applications!

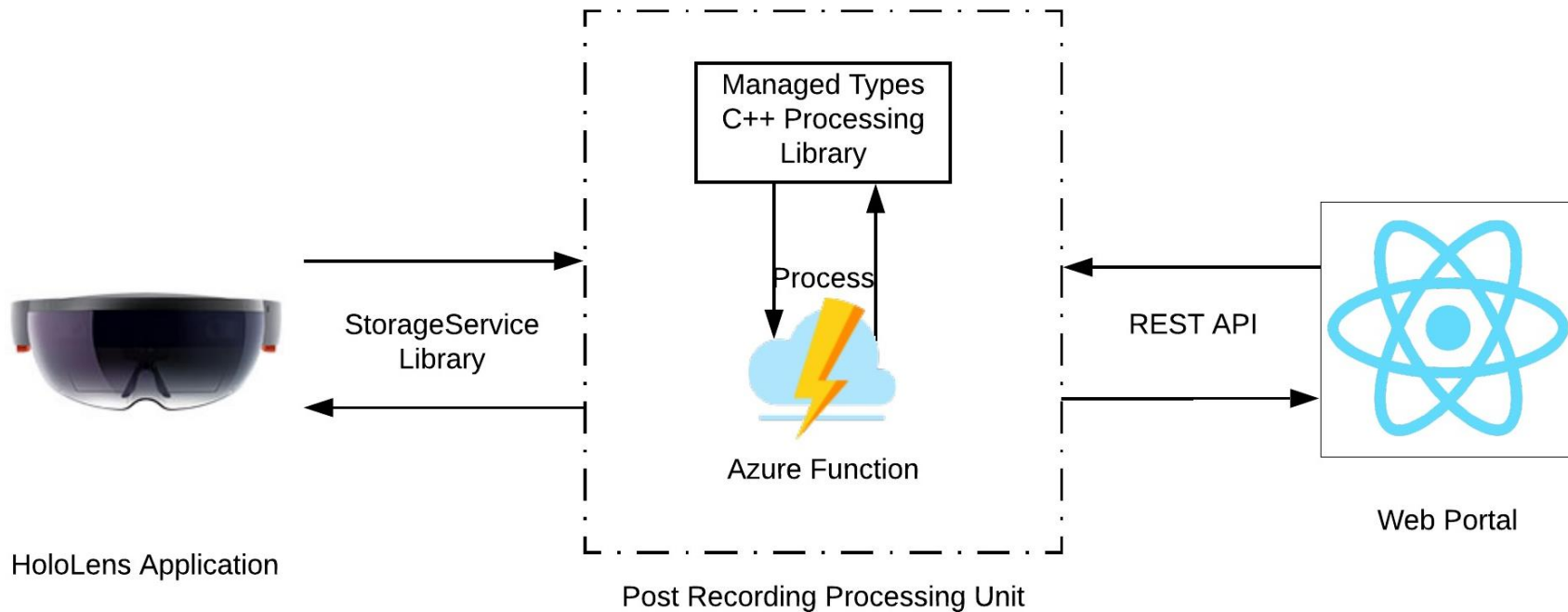
We need to refine the system!

It must be implemented fully to become user acceptable!

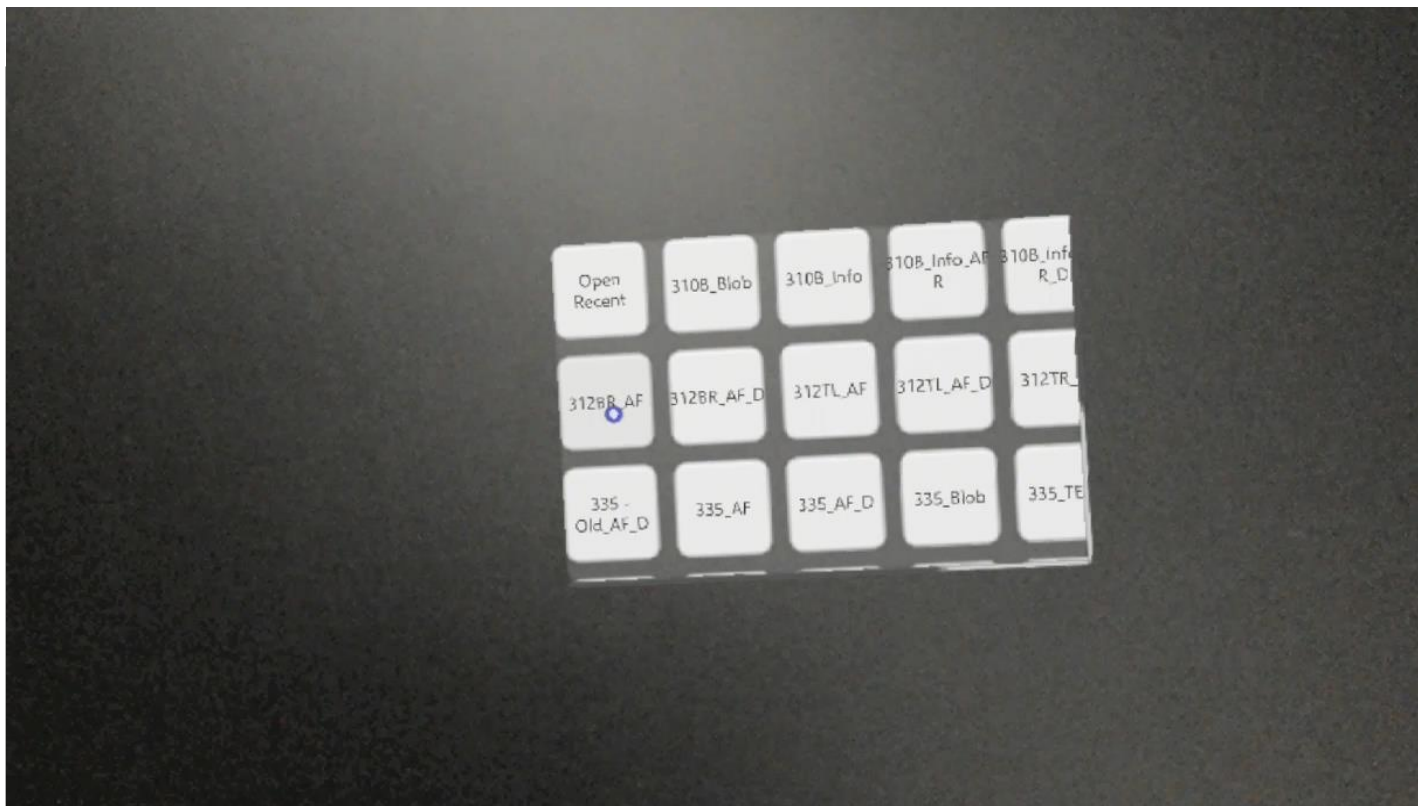


Thank You!

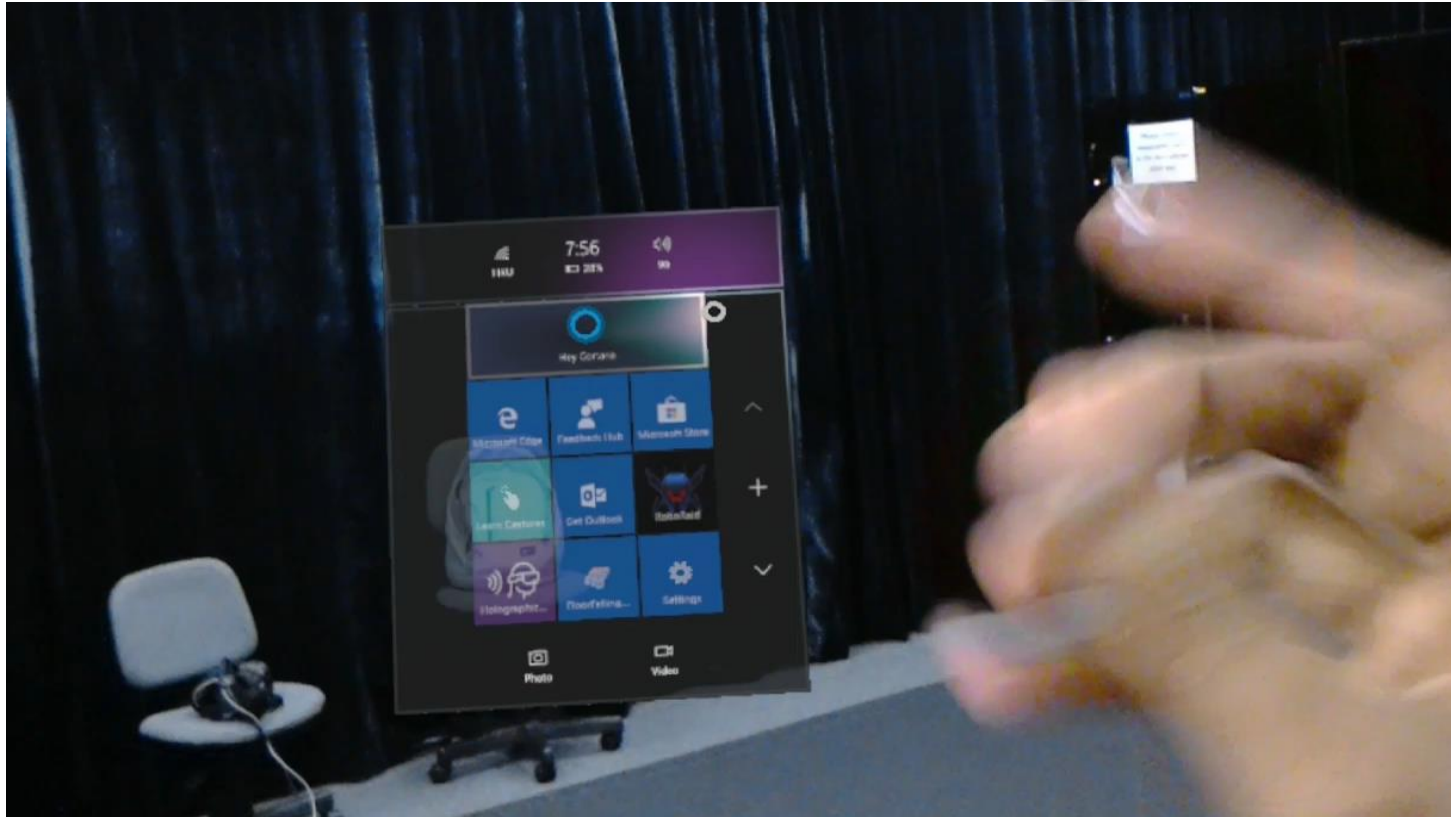
Demo & Questions



Visualization



Recording



Dirk's Office Advancing Front

