# Comau Robotic 3-D Tetris

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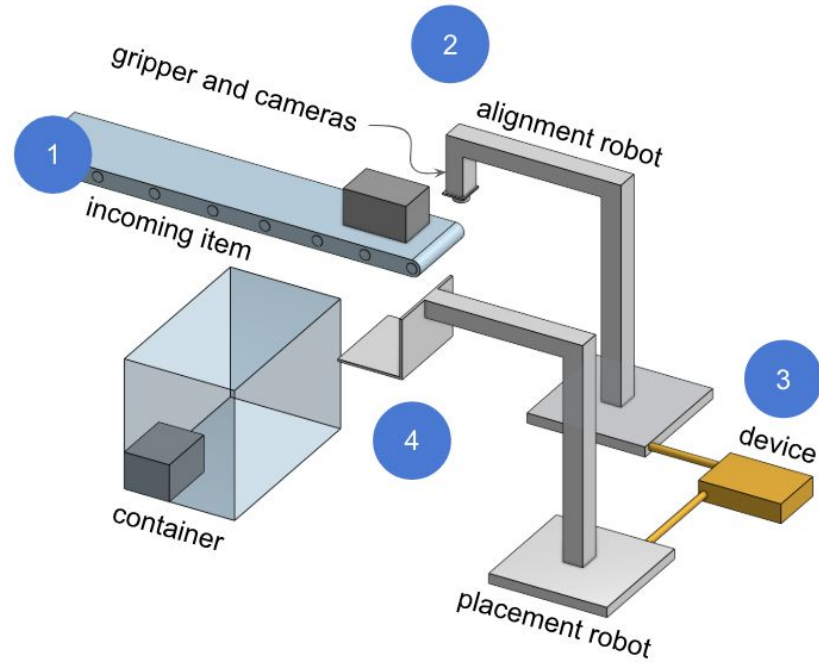
12/21/2020

# About Me

# Problem Overview

# The Potential for Saving Time and Money

# The Two Subproblems

- We were responsible for addressing two primary problems:
  - The online bin packing problem in a three-dimensional space
    - Goals:
      - Fill the bin to at least 85% capacity
      - Place each item within 10 seconds
  - Determining the incoming objects dimensions
    - Goal:
      - Determine the dimensions of every object to within 2.5% margin of error

# Division of Labor

## Camera System

Develop a system that can detect an incoming object

- Integrate camera/hardware into system
- Generate a point cloud from camera

## Segmentation

Segment data from object detection system into usable information

- Segment out the object from the pointcloud
- Identify the dimensions of the object

## Bin Packing Algorithm

Code an algorithm that optimally places objects into a bin

- Devise bin packing heuristic
- Consider edge cases of different objects and scenarios
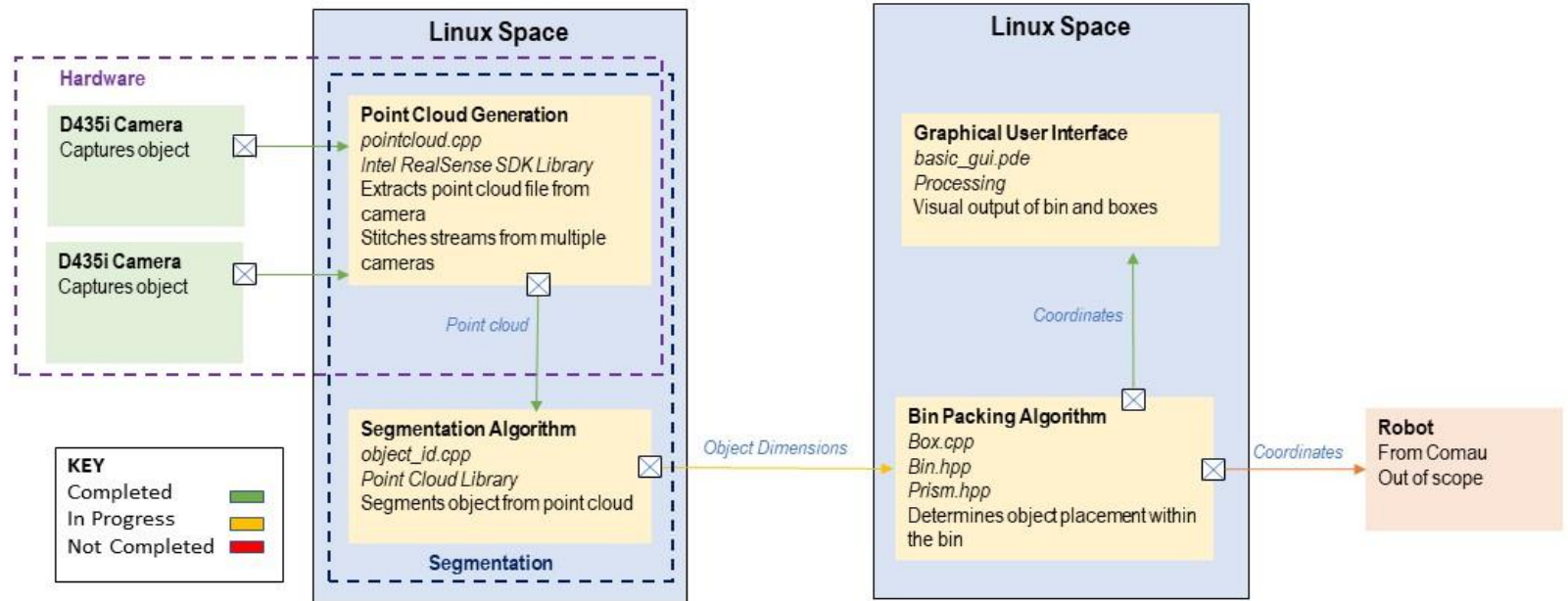- Document system

## Front End Interaction

Create a Graphical User Interface

- Show human user bin placement process
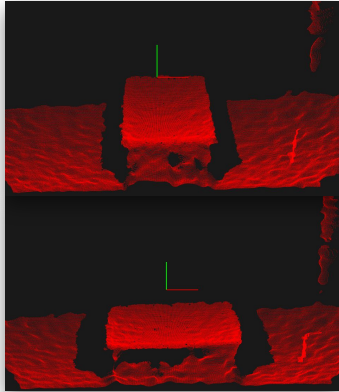- Notify when the system requires human intervention
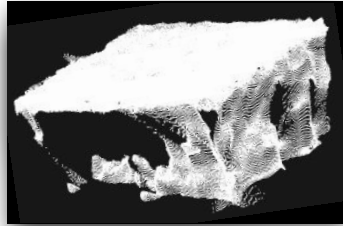
# Our Solution



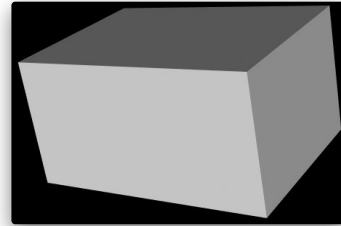Computer Architecture of System

# Results

# Point Cloud & Segmentation Results



Point Clouds from
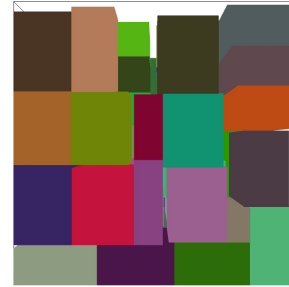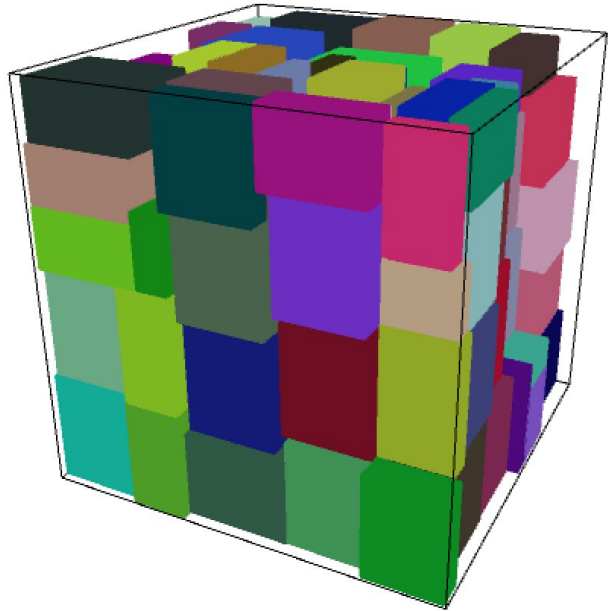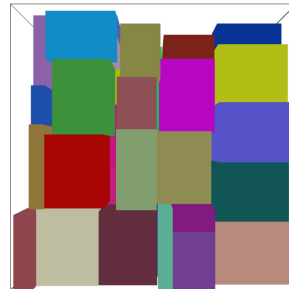Varying Angles

Merged Point
Clouds

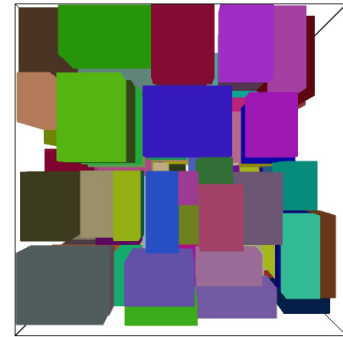Segmented Image
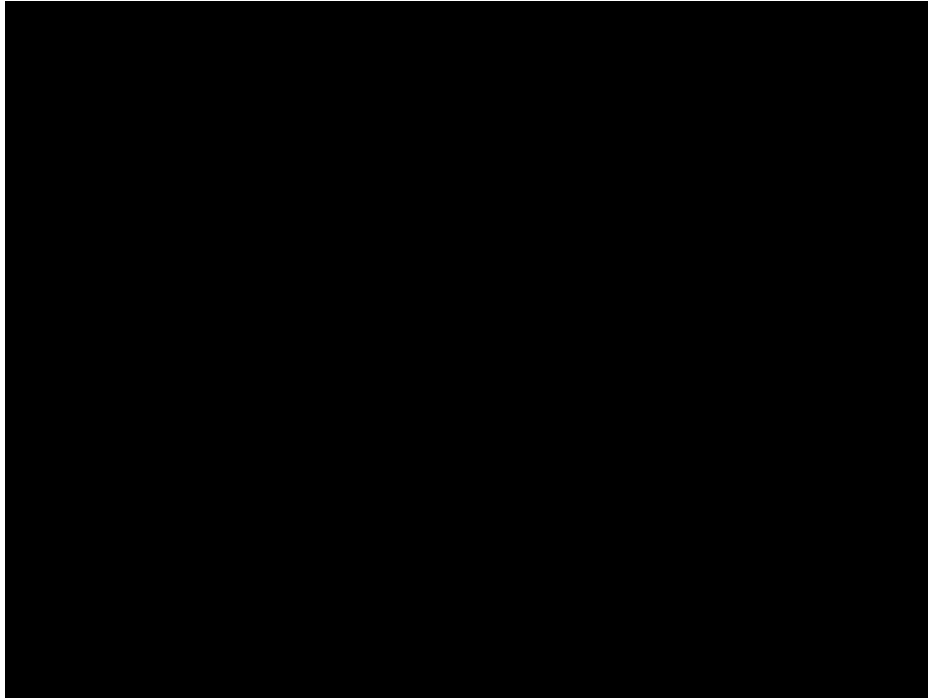with Bounding Box

# Bin Packing Results




Left View


Right View

123 of 140 items placed
Fill Percentage: 75.328%


Top View

# Full System Results

# Implication and Conclusion

| Goal | Status |
|------|--------|
| Fill bin to 85% capacity | Currently at 73% capacity |
| Place each item in under 10 seconds | Technically Complete, unable to test |
| Determine the dimension of every object to within 2.5% margin of error | Complete |
| Display results on graphical user interface | Complete |

# Thanks for Listening!
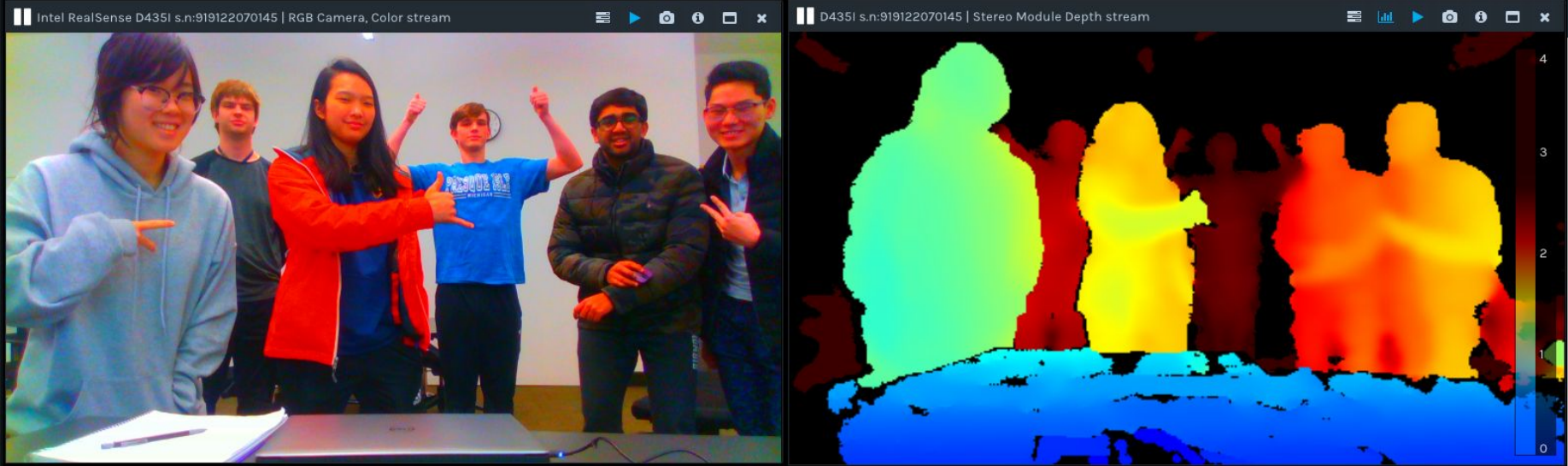
# Q&A

1) How did you get involved in this project?
2) How did you connect with your capstone advisor, lab, team?
3) What hurdles were most difficult or least anticipated?
4) How do you hope to use what you learned from this project in your future career?

# Goals and Project Scope

- The specific code for directing the robot where to go
- Only looked at rectangular prisms of varying shapes
- What we did consider (and goals)
  - Varying shaped items
  - Segment item to within 2.5% margin of error
  - 85% fill capacity
  - Whole placing under 10 seconds