Robotized Object Recognition and Pick-and-Place Operations

Students: Zhamilya Saparova, Sayat Oskenov, Ali Dalash
Supervisor: Almas Shintemirov
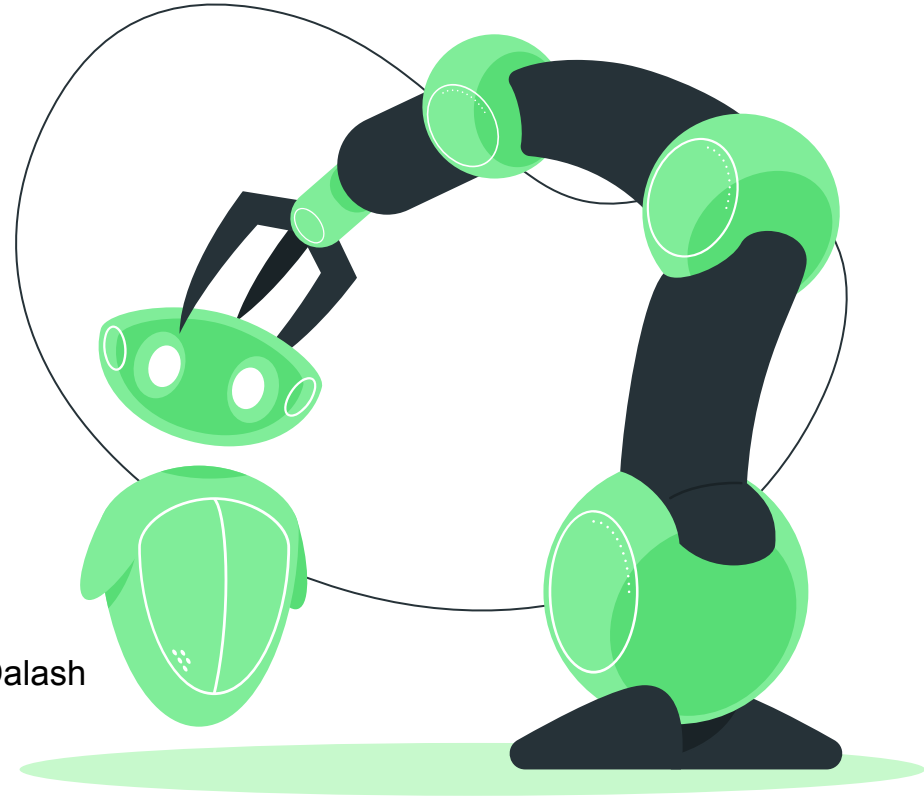
ALARIS
TOWARD INNOVATIONS

Table of Contents

1 **Motivation**
Motivation behind of the project

2 **Related Works**
Related Works

3 **Implementation**
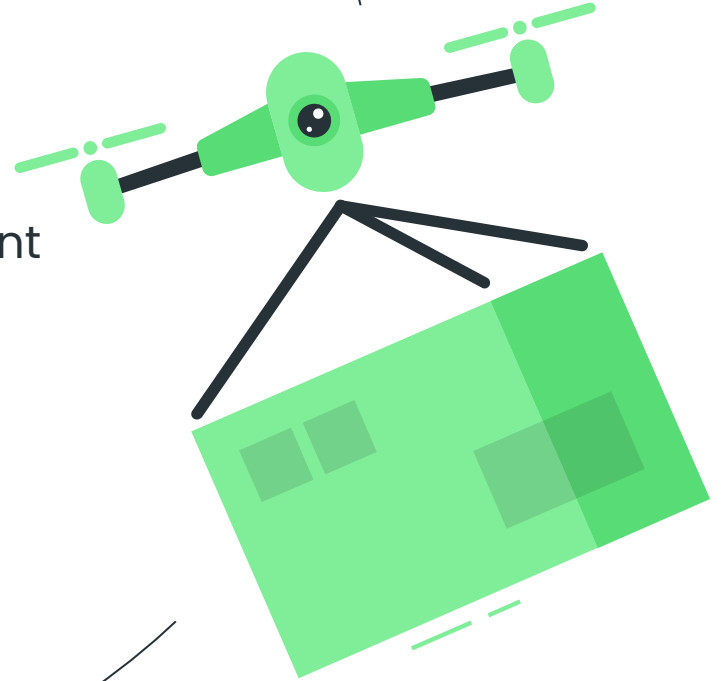Method of the project and results

4 **Conclusion**
Future works

Why?

1. Logistics
   a. Complex network management
   b. Capacity and Labour deficit
   c. Warehouse management

2. Manufacturing
   a. Inventory management
   b. Defect Detection

3. Daily Life
   a. Help aged / disabled people

Related Works

1. "Towards Assistive Robotic Pick and Place in Open World Environment" by Wang et. al.

2. "Autonomous Object Detection and Grasping Using Deep Learning for Design of an Intelligent Assistive Robot Manipulation System" by Rakhimkul S. et. al.

3. "Robotic object recognition and grasping with a natural background" by Wei et. al.
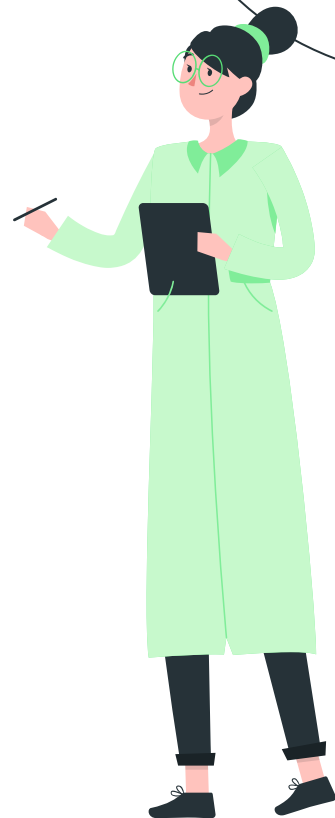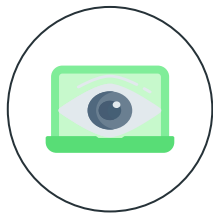
Tools

Kinova Robotic Arm

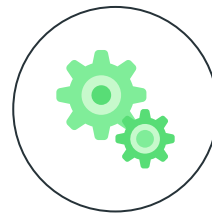Intel RealSense D435

Implementation

Simulation

Gazebo, MoveIt

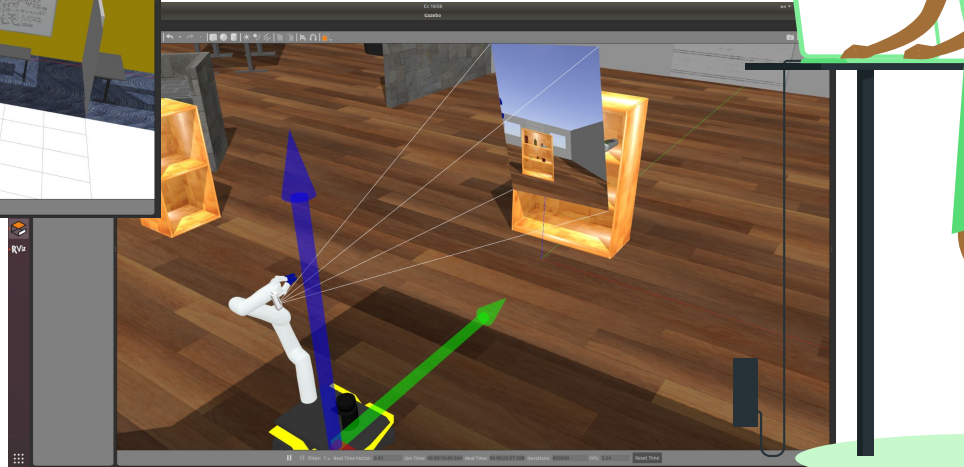### Object Recognition

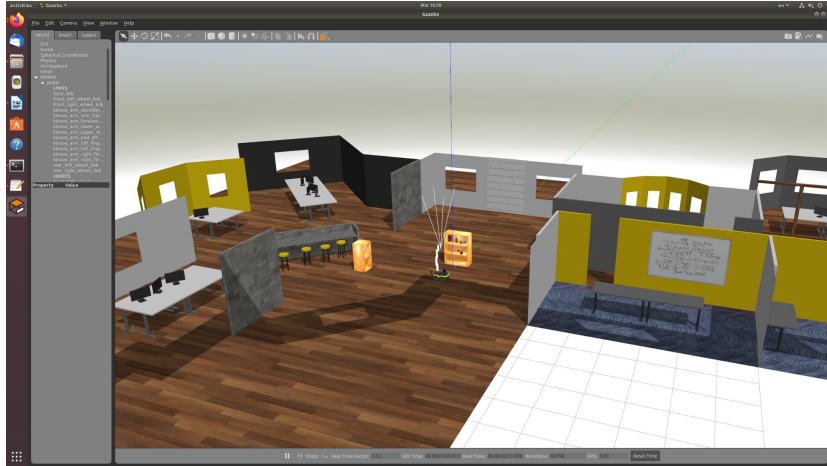Detecting object in 3D coordinates

Pick-and-Place

Motion planning for Kinova manipulator via Moveit on ROS
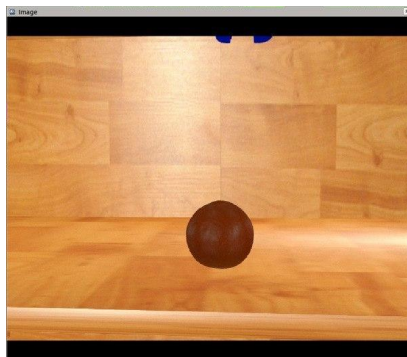
Simulation

- A workplace run in Gazebo
- Two tools are put here
- Camera attached to the last joint
- Easy for the further demonstration
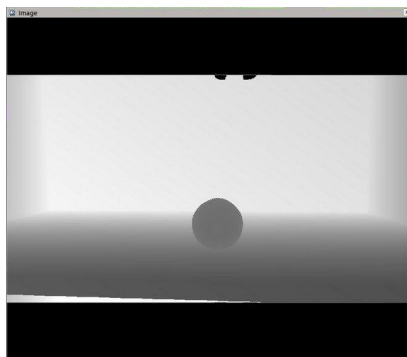- No need for physical experimental setting, everything is virtual
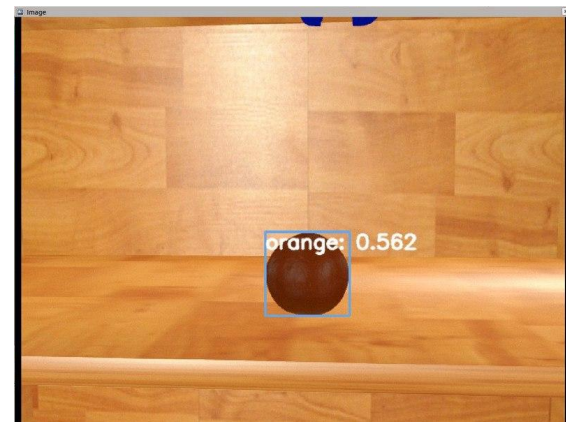
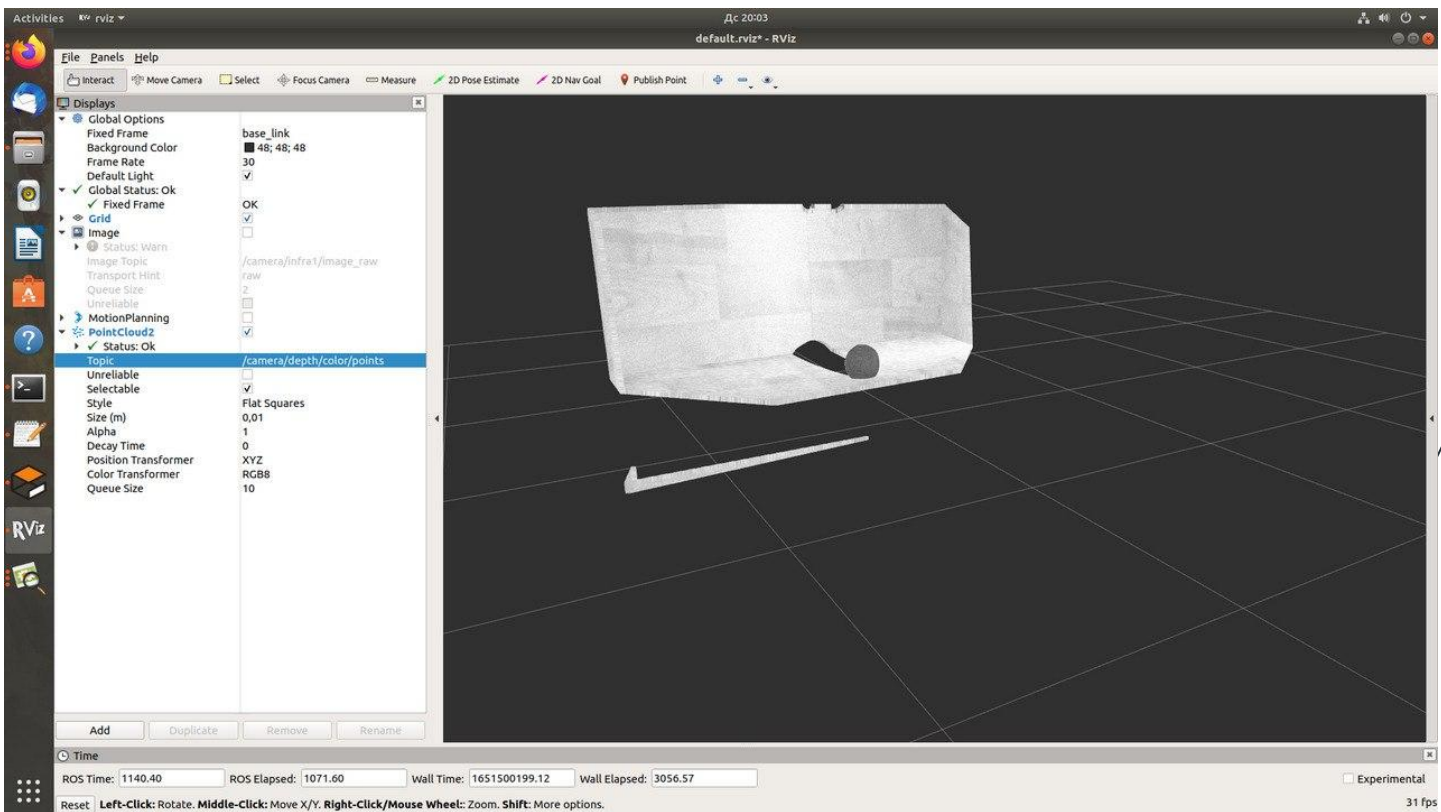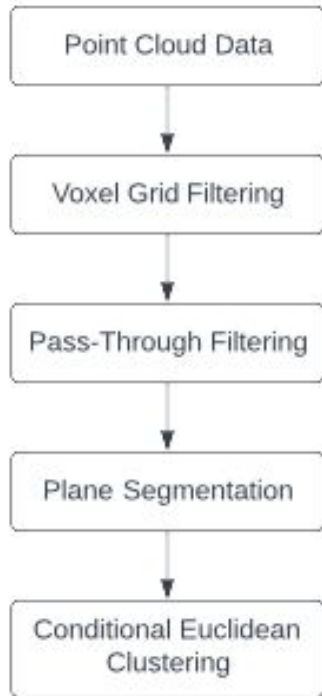# Object Detection

Intel RealSense D435

color

depth

Yolov5

orange: 0.562
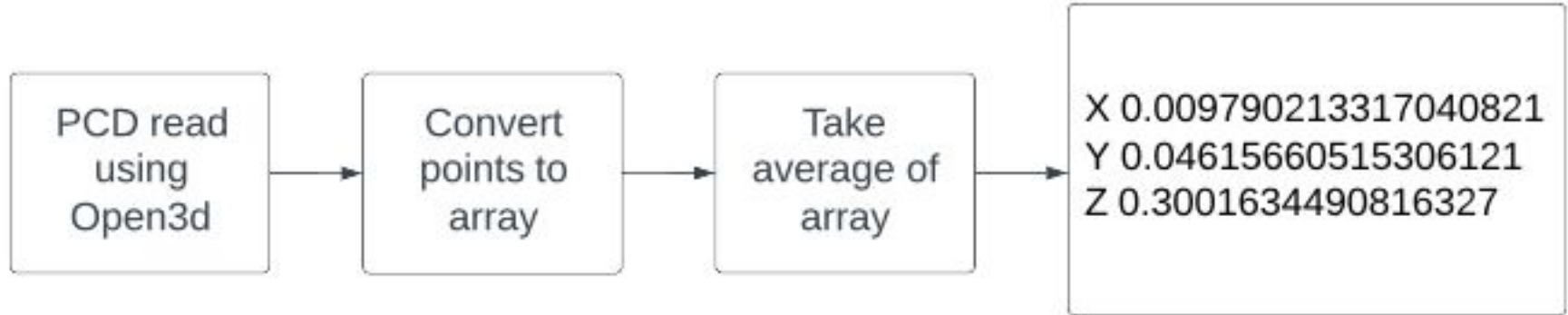
Point Cloud Data (PCD)

PCD processing

Point Cloud Data

↓

Voxel Grid Filtering

↓

Pass-Through Filtering

↓

Plane Segmentation

↓

Conditional Euclidean Clustering

→

PCD viewer

XYZ extraction

PCD read using Open3d → Convert points to array → Take average of array →

X 0.0097902133317040821
Y 0.04615660515306121
Z 0.30016344490816327

Multiple Objects Detection

RGB Image → Yolov5 →
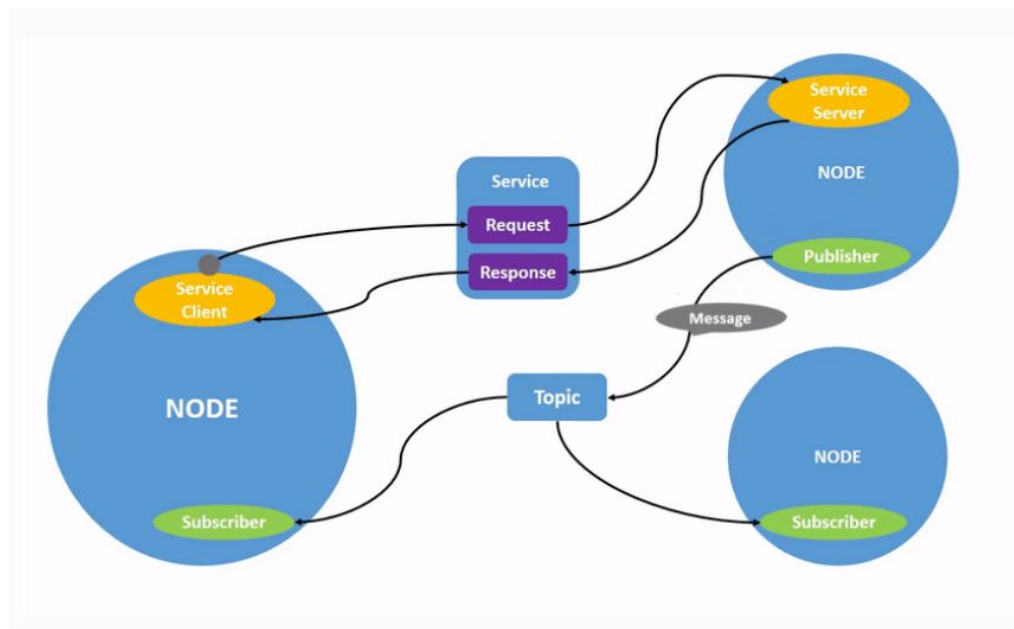
PCD → PCD Processing →

→ Mapping → Detecting Centroids XYZ
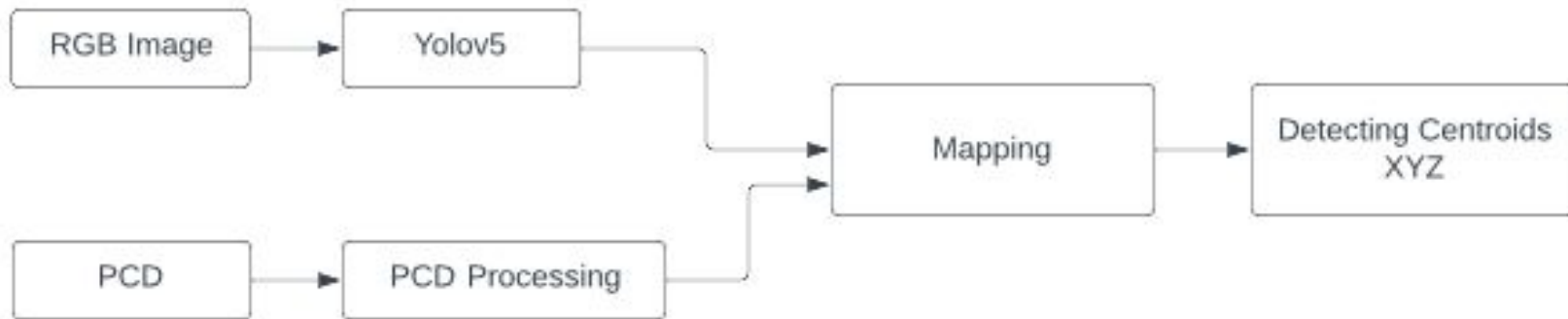
Motion Planning

- Melodic version
  - Node
  - Message
  - Topic
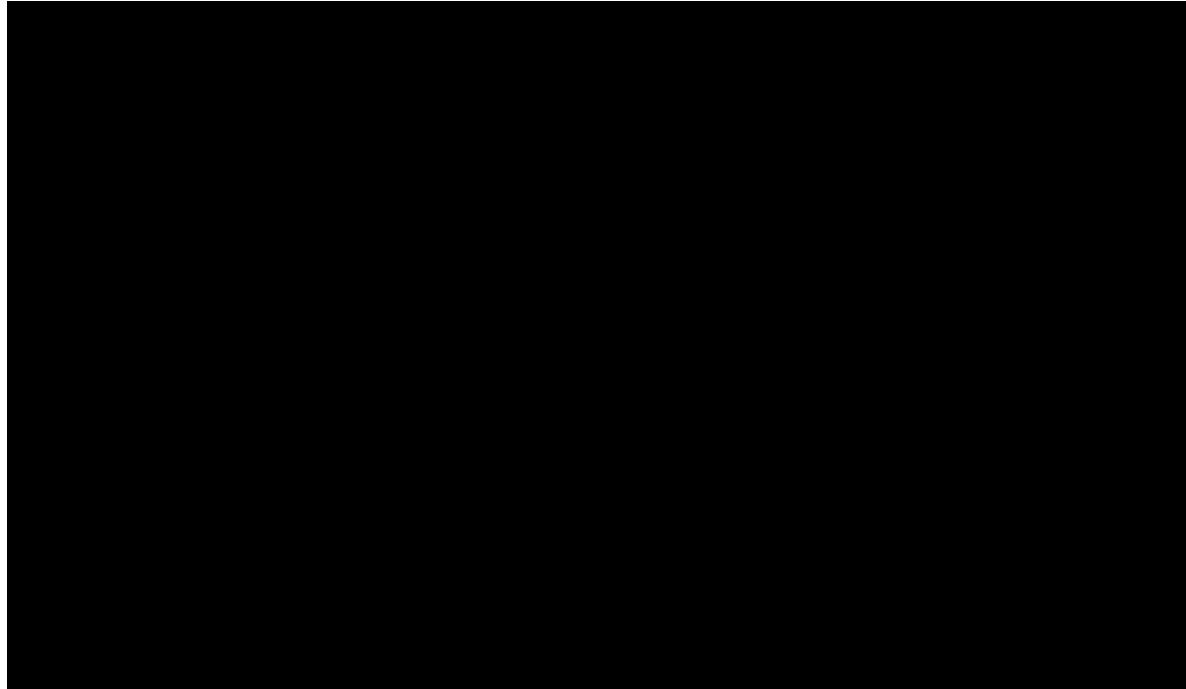 - Service
    - to move
    - to grasp

Motion Planning

- MoveIt strategy
  - 3D model of the environment
  - Plan the motion
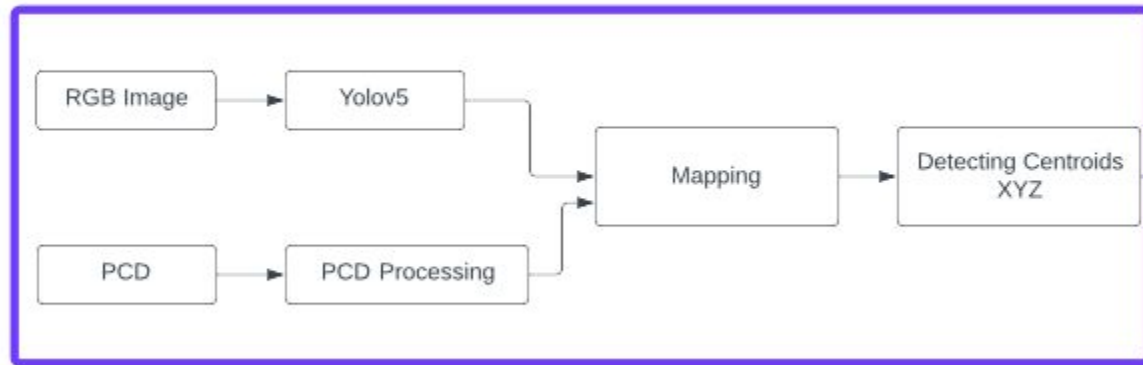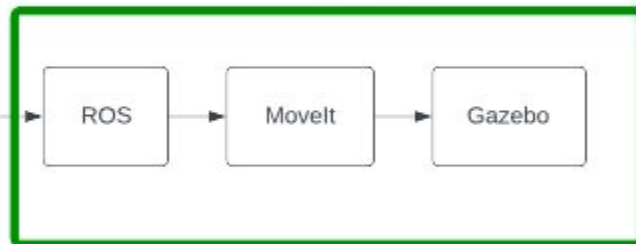 - Dynamically check the environment
- Gazebo

Video demonstration

Overall Architecture

Object Detection

RGB Image → Yolov5

PCD → PCD Processing

→ Mapping → Detecting Centroids XYZ

Grasping

ROS → MoveIt → Gazebo

Conclusion

Tools we used

1. Intel RealSense Depth Camera

2. Kinova Gen3

What we learned

1. ROS
2. Gazebo
3. ROS packages
4. Object Detection Architecture
5. Mapping Algorithm

Future Work

- To detect multiple objects

- Autonomous Motion Planning

- Occlusion

Thanks!

We also thank ALARIS lab for the collaboration.