

Che-Yen Lu

Team E: PLAID

Teammates: Michael Beck, Akshay Bhagat,
Matt Lauer, Jin Zhu

ILR08

March 02, 2017

1. Individual progress

For this progress review, we aim to integrate all sub-systems to demonstrate the whole picking scenario which is very similar to last progress review. In demonstration, items are classified and bounding boxes are created by the vision sub-system, and apriltag which attach on the draw will be used to localize draw and draw point cloud will be segmented in the apriltag frame. After localization, the grasping sub-system will ask item point cloud to grasp items based on point cloud surface and position. My individual progress for this goal includes three main parts: ASUS Xtion bring up, draw point cloud segmentation, and item point cloud segmentation.

We decide to change camera from Microsoft Kinect to Asus Xtion since the camera size matters when arm need to move into bottom draw. However, the model of Asus Xtion we get is older one, whose version number is 1d27:0600 instead of 1d27:0601. From ROS forum, older version could only work in USB 2.0 mode(xhci). Although all USB ports in our system are USB 3.0(xhci), luckily, I figure out USB 3.0 could be disabled and downgrade to USB 2.0 in BIOS.

For draw point cloud segmentation, apriltag ros package is used. Point cloud transformation is performed before cropping the point cloud. However, the wooden draw is not perfect made so part of draw point cloud could still be seen in Figure 1.

Method for item point cloud Segmentation is very straightforward. I use the bounding box information from CNN and filter out all point cloud outside of bounding box. Roservice is created for the grasping sub-system.

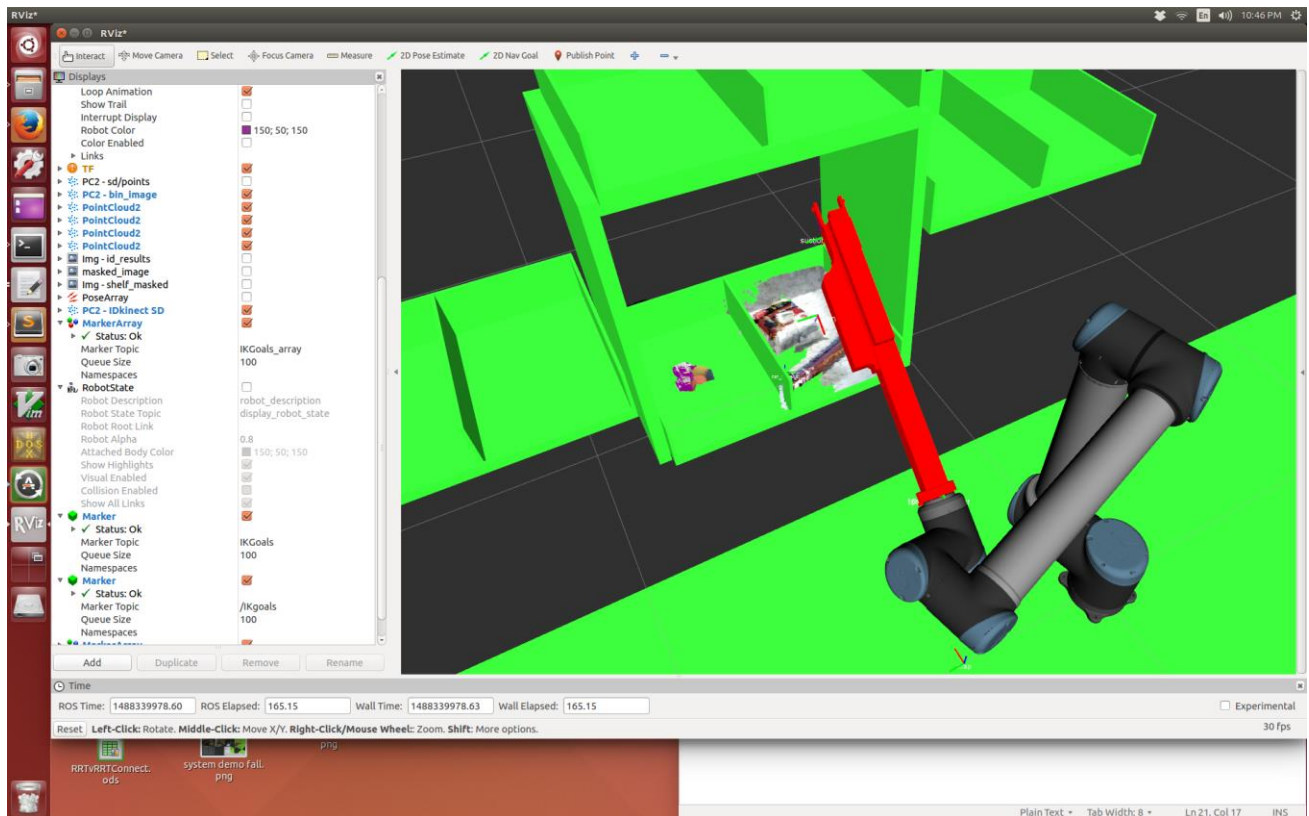


Figure 1. Localized Draw with Point Cloud and Planning Scene

Challenges

To my knowledge, the biggest risk now is the shelf and frame design. We are still using wooden shelf and frame, which could cause problems when whole system need to migrate from current shelf to final design. Rotary motors could be out of function. Lighting and material selection could affect the accuracy of CNN since it uses RGB color as input. From past experience, we have to reserve at least two weeks to solve all kinds of issues. Also, the timing of shelf fabrication affects perception schedule hugely, since all training data should be got from final draw design for CNN. Without proper configuration, we can't collect images and label them for CNN.

2. Teamwork

For progress review eight, we focus on different domains and break down the tasks as follows:

- Michael Beck – Project manager. Michael handles project schedule and goal. He keeps helping team to break tasks down and monitor progress of sub-tasks. He also helps team to order and assemble shelf and hardware components.
- Akshay Bhagat – Akshay implemented grasping planner and visualize top poses on rviz by using marker.
- Matt Lauer – Matt create planning scene for linear actuator and UR10. He also helped team to integrate planning service with grasping poses.
- Che-Yen Lu – I helped team to solve ASUS Xtion bring up issues. I also integrated Apriltag to localize draws in our system, and segment draw point cloud. Item's point clouds are obtained by removing point clouds outside of bounding box.
- Jin Zu – Jin helps MSCV teammate to annotate images.

3. Future plans

For my personal plan, I still want to focus on software architecture. There are a lot of software improvement we could do in the future month. First, I want to use github issue tracking system so that all issues could be tracked and updated easily. Second, coding review should host weekly to make sure everyone is on the same page. Third, uni-test framework should be implemented to enhance the software quality of all modules before system integration. We can save a lot of time because 80% or 90% of issues could be fixed by using uni-test, and then people don't need to wait for owners to make sure basic functionalities work. Forth, hardware in the loop is needed when system become much more complex. This feature should be introduced so that everyone could work independently and be more productive.

For team, although we fixed all MVP issues, new features compromise the functionalities of

MVP, so top priority currently is to get MVP up and running again. For high level goal, we aim to finish a fully functional frame before the middle of April. As for perception, Fast-R-CNN and FRCN methods will be evaluated under different environments and scenarios. A mechanism for camera calibration will also be designed and implemented before PERCH comes into play. Schedule of unknown objects' identification will be pushed off till we are confident with the result of known items.