

## Logistics Track in Robotics Grasping and Manipulation Competition 2019

### 1. Background

Logistics is the business of moving goods from suppliers to customers. Goods-picking in warehouses and distributions centers are critical components of any logistics business to make sure the right goods goes to the right destinations. The majority of goods-pickings today are done by human workers. However, it is not easy for companies to find enough employees and keep them due to the tediousness of the job. It is a common problem around the world for large and small businesses.

Robotic goods-picking technology has the potential to help the logistics business tremendously. Recently many innovative robotic picking technologies have been developed, many robotics start-ups have turned their focus to logistics, and billions have been invested in robotic goods-picking by large and small businesses. It is known as one of the most promising robotic applications that have great societal impact and financial impact.

Logistics for big e-commerce companies such as Amazon and Alibaba request goods-picking technologies that can handle millions of different goods in an infinite number of combinations. Recently, the new development in depth sensors, deep learning data-driven approach, and vacuum cup end-effectors have overcome many challenges in robotic goods-picking. Several start-ups have claimed that they had achieved near perfect picking success rates.

The purpose of this competition is to identify the state of the art of goods-picking and the remaining technical challenges that require attention from both industry and academia. Therefore, the competition is designed to emphasize on repeatability and adaptability.

### 2. Competition Setup

Two 6'x3' tables and three chairs will be provided. The teams have the freedom to place the bar-code scanner and bins at their convenience (confirm with the organizers for setup limitations). Each team will be provided the first bag of items, three bins, and one bar-code scanner on November 5. The team can set up their robotics systems, bins, and bar-code scanner on November 5. The remaining 9 bags are provided right before the competition. They will remain unopen until the competition starts. An example of bar-code file will be emailed to the team 3 months before the competition. Each team is allowed to have three members present in their station during the competition time.

### 3. Tasks

The task is to pick one item at a time from a bin, scan it and put it into one of the two receiving bins based on the instruction from the bar code scanner. After a bin is emptied or the team decides to move on to the next bag of goods, the team can manually empty the bin and open the next bag of goods and pour them into the bin. The team cannot position the goods in the bin. The team can pause their program at the end of each bin and restart their program after a new bin of goods is ready. All picking, moving, scanning, and dropping should be done by the robot automatically.

#### 4. Items

Each team will be provided the same 100 items. 90 items are randomly put in 9 bags with 10 items in a bag. The bags are randomly numbered from 2 to 10. The number 1 bag contains the same collection of items for all teams. The pictures of 30 items are provided on April 30, 2019. Pictures of another 20 items are provided on October 1, 2019. The rest items are unknown until the bags are open during the competition.

#### 5. Scoring

The items could have 10, 15, or 20 pts based on their difficulties. Each successful pick-scan-place will give the team 10/15/20 pts. If two teams have the same score, their completion times will be used to break the tie.

Dropping an item out of its target bin would be considered unsuccessful. Dropping in the target bin should be OK. However, dropping height should be less than 10 cm higher than the bin's height. Breaking item in any case would be considered unsuccessful.

#### 6. Tentative Timeline and Schedule

May 31, Release pictures of 30 items.

July 1, Competition registration deadline.

July 15, Selected teams are notified.

October 1, Pictures of another 30 items are released.

November 4, Teams move in and set up the robotic system and start a dry run. The bins and the first bag of goods are provided to the teams.

November 5, Competition. The exact time will be announced.

The competition will run in parallel. All teams will start at the same time. They will have at least two hours to set up right before the competition and 30 minutes for the competition.