AIRLab Delft Stocking Challenge

Rules and Requirements

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AIR Lab.

PAL ROBOTICS

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1 Introduction

At Artificial Intelligence for Retail Lab (AIRLab), our focus is to redefine retail through technology. In Delft, we do this by exploring the possibilities to deploy robotic agents in retail store environments.

With the stacking challenge, we want to give teams from all over the world the opportunity to explore this challenging field of robotics. Every team will get access to a simulated retail store environment including TIAGo robot (see the docker image on GitLab). The goal of the challenge is to place all provided cans correctly on the shelf as fast as possible. In the simulation, the challenge setup is included as a gazebo world. Every team will then create their own solution to the challenge and test it in this simulated environment. Information on how to correctly submit the solution can also be found on GitLab.

2 Competition Setup

2.1 Group size

Groups are allowed to be anywhere from 2 to 6 people, and anyone (students, start-ups, professionals) is allowed to join.

2.2 Simulation

All teams will have access to the same simulation environment based on ROS Melodic. The challenge setup in simulation aims to reflects the situation on the real robot as good as possible. To this end, in the simulation a Gazebo world will be made that closely represents the challenge setup.

2.3 GitLab

Information regarding how to setup your development environment will be provided in the READme on GitLab.

2.4 Questions / Support

If you have any questions about the TIAGo robot or the simulation it is possible to create an issue on GitLab. For questions about the rules and regulations or general competition setup you can contact c.salmi@tudelft.nl.

3 The Challenge

The challenge is outlined as follows: Initially, TIAGo will be in front of a table that contains 12 randomly placed cans (let's say canned tomato cubes). To the side of TIAGo, the shelf will be located on which the cans should be stocked. Naturally this shelf is initially empty. Your objective is to program TIAGo to

pick the cans from the table using either of it's grippers and stock the shelf. The goal is to stock as many cans as possible within 5 minutes. If multiple teams manage to stock all 12 cans correctly in time, the winner will be determined by who stocked the shelf faster.

Importantly the shelf has to be stocked 3 cans wide by 2 cans deep and 2 cans high. The dimensions of the shelf in simulation will reflect this arrangement. A can is considered correctly stocked when all of the following applies:

- The can is placed upright.
- If there are already 6 cans correctly placed on the shelf, the can has to be stacked upright on top of another can.

3.1 Setup

The setup will be as follows:

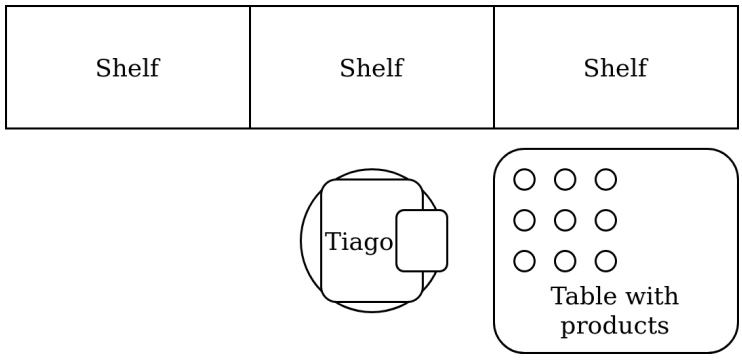

Figure 1: Stacking challenge setup

The height of the shelf will vary between 0.8 meters and 1.2 meters. The position of the products on the table will also vary. The products will have the shape of standard canned goods. The labels and dimensions of the cans in simulation will be the same as in real life. The robot is placed next to the table and shelf in an attempt to avoid excessive navigation. We want to focus on object manipulation for this challenge. However, it is not guaranteed that small movements of the mobile base of TIAGo won't be required to reach all cans.

In gazebo, the setup looks like this:

Figure 2: Stacking challenge setup in Gazebo

4 Points

The following will score you points:

Action	Points
Placing a can upright on the shelf	10
Placing a can upright on top of another can on the shelf	15
Fully stocking the shelf (all 12 cans correctly stocked)	50

Table 1: Gaining points

The following will lose you points:

Action	Points
Dropping a can	-20
Collision between TIAGo and shelf	-25

Table 2: Losing points

5 Restrictions

Doing any of the following will disqualify the team from further participation:

- Drop more than 5 cans;

- Have the TIAGo bump into the shelf or table more than 2 times;
- Use non-sensory information in the simulation (e.g. data provided by gazebo)
- Change any of the physical parameters in Gazebo (e.g. gravity, friction, weights)[1]
- Submit a solution in the first stage that the jury cannot test (e.g. due to an incomprehensive README, or dependencies that are not in the docker image and that the jury can not realistically meet).

[1]It is, however, allowed to use a package like the gazebo_ros_link_attacher to be able to reliably fix and object to TIAGo once it has been grasped.