5.4 Manipulation and Object Recognition

Description

The robot must reach a collection location (bookcase with shelves or table) in which there are 10 objects. The robot must then identify and grasp 5 of those objects and put those into a delivery location (another shelf or another table).
Main goal: The robot has to identify, grasp and correctly place several objects at different heights or positions.
Optional goal: Finding a hidden or occluded object

Focus

This task focuses on *object detection*, *object recognition* and *object manipulation*

Setup

- **Locations:**
  - This task takes place inside the *Arena*.
  - The robot will start at a random distance between 1.0m and 1.5m from the collection location .
- **People:**
  - There is no people in this task.
- **Furniture:**
  - One of the bookcases or tables in the apartment is used for this test.
- **Objects:**
  - Objects are randomly organized at the collection location and by category at the delivery location.

Procedure

1. The referee requests the team to move the robot to the start location.
2. The referee gives the start signal and starts the timer.
3. The team leaves the area after the start signal.
4. The referee follows the robot ready to press the emergency stop button.
5. The robot approaches collection location and starts searching for objects.
6. **Optionally**, the robot can search for hidden or occluded objects.
7. Any object found by the robot may be grasped by it.
8. Before or right after grasping the object, the robot has to announce which object it has found.
9. After grasping the object, the robot has to safely place it on the delivery location.
10. Scores can only be gained a single time for each specific object.

Additional rules and remarks

- Slightly touching the shelves, the bookcase or the table is tolerated. Driving over the objects or any other form of a major collision is not allowed, and the referees directly stop the robot.
- Robots must create a PDF report file including the list of recognized objects with a picture showing the object and the object name/label. This file may be stored on a USB-stick on the robot which is given to the OC after the test. The PDF file name should include the team name and a timestamp. It must be unmistakable which label belongs to which object. Objects must also be recognizable in the report by a human (OC) so that it can be scored. An overview of the shelf with bounding boxes and labels attached to the bounding boxes is handy for the TC to score. False positives in the report (labeling an object which is not an object but e.g. the edge of the shelf) are penalized.
- A post-it with constrasting colors can be glued to the front of the object to create occlusion.

Instructions:

To Referee

The referee needs to:

- Place the objects in the collection and delivery locations.
- Make sure there is space to place objetcs.

To OC

The OC needs to:

- **2 hours before the test:** Select and announce the robot start location.

Score sheet

Maximum time: 5 minutes

Action	**Score**	1^{st} **try**	2^{nd} **try**	3^{rd} **try**
Regular Rewards				
Detection of object name.	*10×20*			
Detection of object class.	*10×20*			
Pick the object (The object cannot be touching the shelf and remain in the robot's possession for at least one second).	*5×100*			
Place the object in the delivery location.	*5×120*			
Bonus Rewards				
Finding a hidden or occluded object.	*100*			
Regular Penalties				
False positive for object name.	*∞×–40*			
False positive for object class.	*∞×–40*			
Drop the object. (Only applied if the robot picked up the object)	*5×–50*			
Score per try	*1600*			
Total Score	*1600*			