

# Object Manipulation in RoboCup@Home

[RoboBreizh](#) is a project of the Lab-STICC (Brest, France) / IRL CROSSING (Adelaide, Australia) in collaboration with LITIS (Rouen, France). The RoboBreizh project was launched in 2019 by Cédric Buche ([buche@enib.fr](mailto:buche@enib.fr)). The current goal of this project is to participate to the RoboCup@Home international competition 2023.



The RoboCup@Home is part of the RoboCup initiative, one of the biggest international robotics competitions, held this year (July 2023) in Bordeaux, France. Tasks for the competition typically take place in a domestic environment where the humanoid companion robot Pepper has to address human needs (e.g. tidy up the room, find and bring drinks). Challenges for this competition are numerous, but one of the most critical is object grasping.

Pepper is a challenging platform (RGB camera, RGB-D camera and no GPU).

To solve the grasping problem, some algorithms require a 6D pose estimation of the object (3D pose + 3D rotation). Some 6D Pose Estimation algorithms using GPU with RGB [1] or RGB-D camera [2] exists. Others approaches uses 2D object detection on the RGB image and then compute the depth value manually using the depth image [3]. Once a valid grasp pose has been found, the system executes the arm movement that results in the desired position for the end effector. To do so, it needs to solve the Inverse Kinematics equation. MoveIt! is a ROS package that implement solutions for manipulation on several different robotic platforms. To compare solutions, we will use the YCB-Dataset as a reference [4]. This dataset is composed of 80 000 images from 60 different objects of daily life (e.g. knife, can, sugar box...). All objects are small enough to be taken by a robotic arm.

## Internship

The internship will be half time in Adelaide, half time Brest, with the objective of the competition in July 2023. The goals of this internship are:

1. to explore solutions (state of the arts)
2. to develop the best approach (using ROS)
3. to test on YCB with virtual robot
4. to test in real conditions



## **References**

- [1] Yi Li, Gu Wang, Xiangyang Ji, Yu Xiang, and Dieter Fox. Deepim: Deep iterative matching for 6d pose estimation. In: *Proceedings of the European Conference on Computer Vision*. 2018, 683–698
- [2] Nuno Pereira and Luís A Alexandre. MaskedFusion: Mask-based 6d object pose estimation. In: *2020 19th IEEE International Conference on Machine Learning and Applications*. IEEE. 2020, 71–78
- [3] Neau M. A Domestic Service Robotics study case. Master thesis. 2021
- [4] Berk Calli, Aaron Walsman, Arjun Singh, Siddhartha Srinivasa, Pieter Abbeel, and Aaron M Dollar. Benchmarking in manipulation research: Using the Yale-CMU-Berkeley object and model set. *IEEE Robotics & Automation Magazine* 22:3 (2015), 36–52