

Exercise 4: AprilTag

There are n-objects on the table and each object has a marker on the top. The pose of the markers can be obtained from the [AprilTag](#) library.

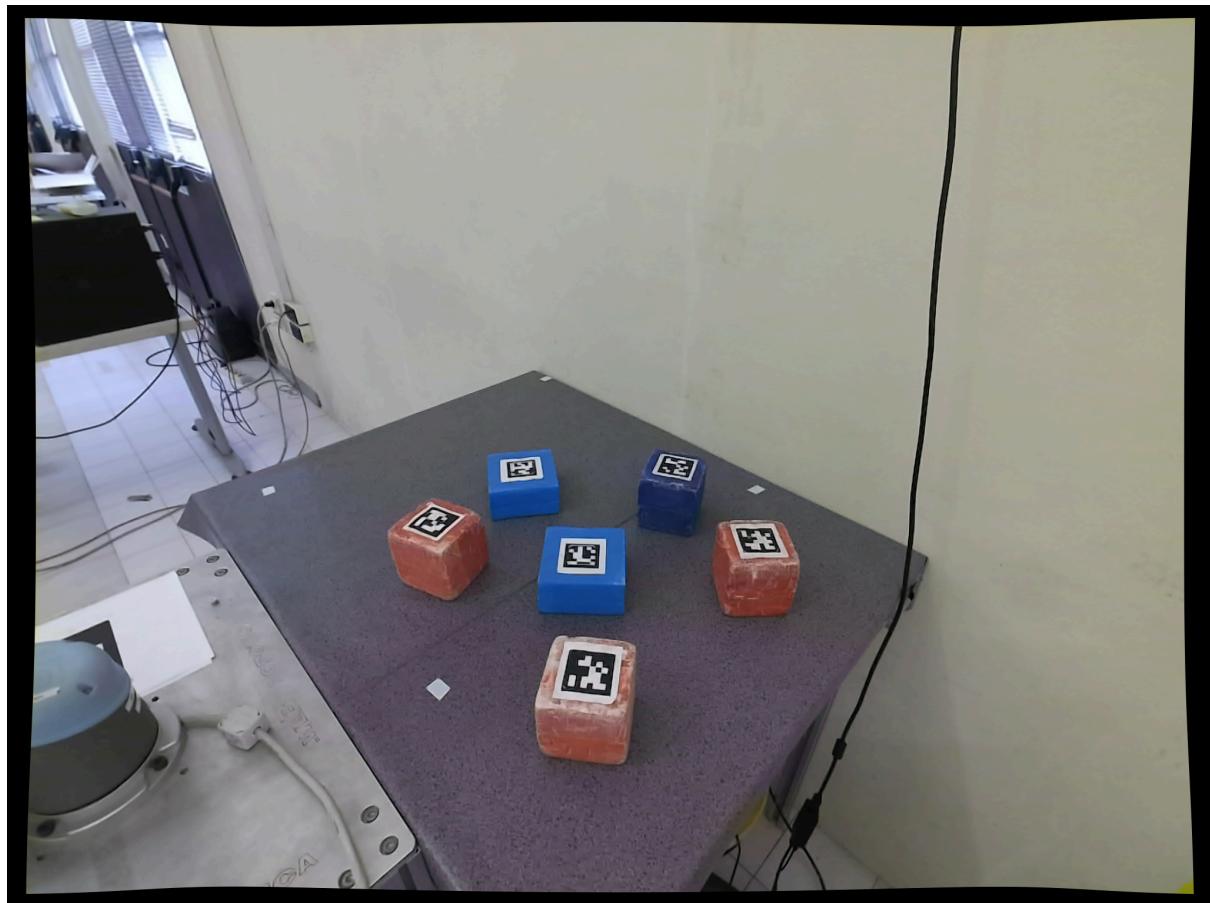
The Apriltag library detects the markers through their ids. Each marker has a specific identifier. Thus, the detected pose is the pose of every marker, that is its center.

Exercise 4.1

Using the ***bag_es_4_1_detection*** you have to do the following:

- A. Subscribe to the AprilTag topic “*tag_detections*” and print the object IDs in a terminal window.
 - a. Use the correct launch file in the *exercise_4_1* package
- B. Transform the poses of the AprilTags from the camera frame to the *base_link* frame and print the poses in a terminal window. Use the ROS package *tf2* and *tf2_ros*.
 - a. Before starting the bag launch the following command:
`roslaunch exercise_4_1 static_robot_tf.launch`

Suggestion: Use *rqt*, *rqt_image_view* and *Rviz* tools provided by ROS



Exercise 4.2

Using the ***bag_es_4_2_video*** you have to compute the marker's average pose, draw it in the image we provide, and print the pose in the terminal window.

In order to get the pixel position of the final mean point, there is a pre-defined function from the *Opencv* library,

```
cv::projectPoints( InputArray objectPoints, InputArray rvec,
                    InputArray tvec, InputArray cameraMatrix, InputArray
                    distCoeffs, OutputArray imagePoints, OutputArray
                    jacobian=noArray(), double aspectRatio=0);
```

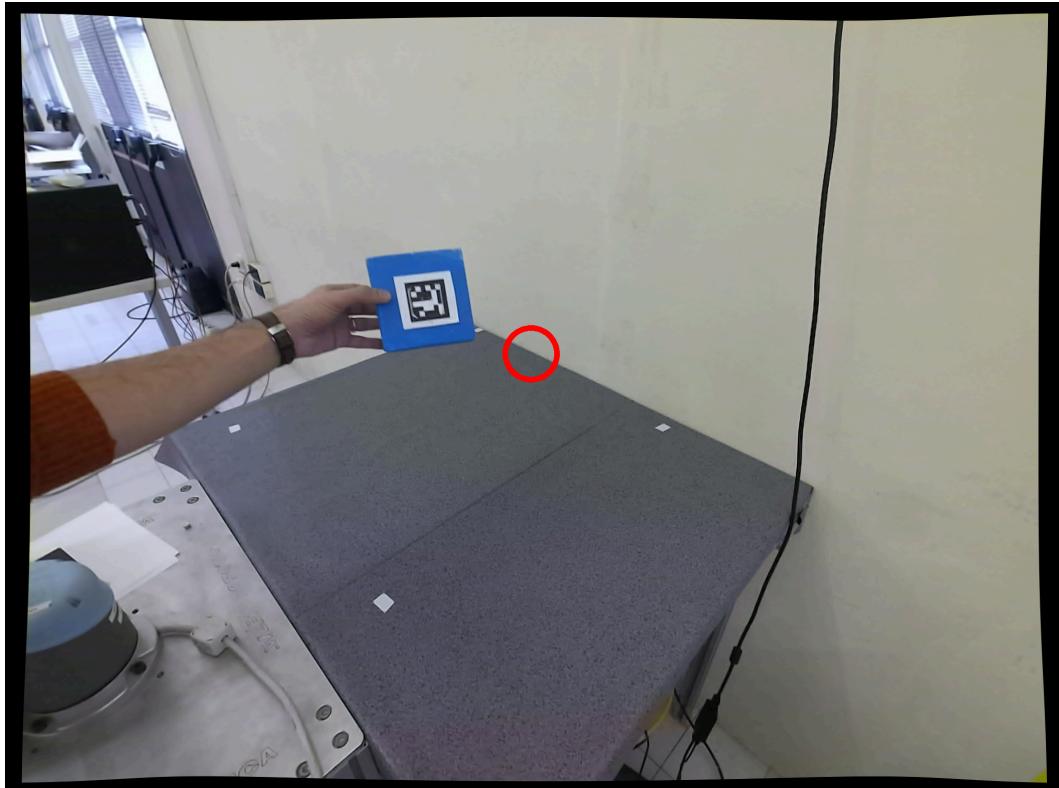
- *rvec* and *tvec* are the following one

```
rvec = (cv::Mat<float>(3,1) << 0.0, 0.0, 0.0);
tvec = (cv::Mat<float>(3,1) << pose_x, pose_y, pose_z);
where pose_x, pose_y and pose_z are the final mean coordinates.
```

- You can get the *cameraMatrix* and the *distCoeffs* reading the *bag_2* in topic */kinect/rgb/camera_info*, respectively *K* and *D*.
Given that they are needed for the final projection of the mean point obtained, read just one */kinect/rgb/camera_info* topic's message.

The image *image_final* is inside the repository.

Be aware to control that the point has to be inside the red circle.



How to install the ROS packages

Follow these instructions to install the environment and start the homework:

- Clone the following repositories in your workspace (src folder):
 - Apriltag: <https://github.com/AprilRobotics/apriltag.git>
 - Apriltag_ros: https://github.com/AprilRobotics/apriltag_ros.git
 - Exercise package: <https://github.com/albigotta/IntelligentRobotics2223>
 - Bags:
<https://drive.google.com/drive/folders/1owzL5lPekvqMW1mahz8Ifu-SZSq7vOzl?usp=sharing>