LAB 2: Live Object Detection and Tracking

Due: Tuesday, March 1st during lab sessions

The objective of the second lab is to make Cozmo find and navigate to a cube with a specific color marker. In the template, we have used **yellow**, but you are free to use other colors as well. In order to complete this lab, you must enhance your color detection code from Lab 1 with new code to make Cozmo search for the cube and drive towards it. You are provided with the following files:

`go_to_cube/`

- `go_to_cube.py` – This file is where you will enter your navigation code. We have given you a framework which will run Cozmo and provided an image annotator, which can help you see detected cubes for debugging. To use the annotator set `BoxAnnotator.cube` to a keypoint from `find_cube()` within your main loop.

- `find_cube.py` – This file is a slightly altered version of the `count_cubes.py` file from Lab 1. You will need to copy most of your `filter_image()` and `detect_blob()` functions to this file.

- `marker.pdf` – This is a printable set of colored markers that can be cut out and tape over the symbol on Cozmo's cubes. You can use any of the colors on the template or even make your own color marker, but we suggest start from yellow. Also you don't need to cover all sides of a cube with these markers, taping these templates to two sides of the cube should be enough. Do not use any kind of glue that damages Cozmo's cubes, just use normal tape.

Lab Checkpoint [10 points]: Complete the installation of the Cozmo SDK. Instructions for this can be found on Blackboard and the Cozmo website. This step was done on Feb. 15th, 2022.

Main Lab [90 points]: Add code to `go_to_cube.py` and `find_cube.py` to make Cozmo search for a cube with yellow labels and drive to within 5cm (2 inches) of it, and to search for the cube again if it is moved.

Evaluation: This lab will be evaluated by running your code on our Cozmo and by watching your demo. During the lab session on Tuesday March 1st, 2022, bring your Cozmo+laptop+cellphone and necessary cables and demo. During the demo, when you execute the code, Cozmo should search for the cube [30 points], drive towards the cube [40points], stop within 5cm (2 inches) of the cube [10 points]. After the robot stops, you should relocate the cube and Cozmo should automatically restart the search without stopping and restarting the code [10 points]. Repeat the last step at least twice in your demo.

Submission: submit `go_to_cube.py, find_cube.py,` as a single zip file, before the end of the session (1:45pm) on Blackboard as a single zip file. Make sure your code is entirely

contained within these two files. If you relied significantly on any external resources to complete the lab, please reference them in the submission comments.

Tips:

- The method `robot.drive_wheels()` allows you to control Cozmo's motor speeds directly, and can help achieve smoother motion than just using `robot.drive_straight()` and `robot.turn_in_place()`.

- You might need to change the size parameters in the blob detector from Lab 1, since the cubes are no longer in a fixed location relative to Cozmo.

- Most action methods (drive commands, etc.) need to be called with the `await` expression in order to work properly (e.g., `await robot.drive_wheels())`

- You are **not allowed** to use high-level functions (e.g., `robot.GoToGoal()`, `robot.GoToPose()`, `robot.GoToObject()`) that take care of the low-level movements of the robot. We recommend using `robot.drive_weels()` or a combination of `robot.drive_straight()` and `robot.turn_in_place()`.