LAB 2: INTRODUCTION TO COZMO

Due: 5pm on Tuesday, September 17th

The objective of this lab is to get familiar with the functionality provided by the Cozmo SDK. This lab has 2 parts: Part I is an individual assignment (25 points) and Part II is a team assignment (75 points).

Lab Part I [25 points] (complete individually): For this lab, each student must have the ability to run code on the robot. To ensure this, the first part of this assignment is a checkpoint to check for this functionality.

1. Complete the installation of the Cozmo SDK and cozmo_sdk_examples on your laptop, then demo to a TA during office hour or during class time on September 17th to show that you can run the code on Cozmo using one of the example tutorials, or part (2) below. (10 points)
2. Next, we want to collect many images to help improve the image recognition performance of the robot under different lighting conditions. Each person will collect 8 images with the robot using the provided `collectImages.py` script and upload the images to Canvas. Each image should correspond to one of the eight image classes we want the robot to recognize (the seven symbols, and 'none'). The script expects a subdirectory called `imgs/` to be available, and is of the following format:

   ```
   python3 collectImages.py numImgPerLabel label1 label2 …
   ```

   To collect 8 images in a row, containing one of each image type, run

   ```
   python3 collectImages.py 1 drone inspection order plane truck hands place none
   ```

   The script will cause the robot to take 8 pictures, with a 4-second pause in between. The resulting images will be automatically assigned a unique filename; do not change the filename. Note that you have to show the robot symbols in the order specified in the script arguments. The above list corresponds to the following symbols:

   
   drone inspection order plane truck hands place

3. Upload the images as a zip file on Canvas under Assignments→Lab 2 Part I. (15 pts)

Submission: Lab Part I is submitted separately and individually. To receive full credits for Part I, each student must upload the zip file to Canvas under the Lab 2 Part I assignment by the due date, and demo Cozmo functionality individually during TA office hours or class time on Sept 17th.

Lab Part II [75 points] (complete with partner): Write a Finite State Machine that encodes the following robot states and behavior:

State: Idle (this is the starting state)
Activity: Monitor stream of images from the camera. Classify each image using the model you developed in Lab1. If one of the symbols is recognized (i.e. not "none"), use the built-in text-to-speech functionality to have the robot say the name of the recognized symbol, then switch to the appropriate state (see below). Note that the SDK can provide both grayscale and color images, at resolutions of 320×240 and 160×240, respectively. More specifically, the SDK reduces the width resolution of color images by half, transfers them from the robot, then resizes color to match the grayscale at 320×240. You are welcome to use the color images if you find it helpful, but be aware that as a result of rescaling they are not as detailed as the grayscale images.

State: drone (activated by showing "drone" symbol)
Activity: The robot should locate one of the cubes (one will be placed in front of it within view), pick up the cube, drive forward with the cube for 10cm, put down the cube, and drive backward 10cm. Then return to Idle state.

State: order (activated by showing "order" symbol)
Activity: Use the `drive_wheels` function to have the robot drive in a circle with an approximate radius of 10cm. Then return to Idle state.

State: inspection (activated by showing "inspection" symbol)
Activity: Have the robot drive in a square, where each side of the square is approximately 20 cm. While driving, the robot must continuously raise and lower the lift, but do so slowly (2-3 seconds to complete lowering or raising the lift). Lower the lift at the end of the behavior, and return to Idle state.

Submission: Part II will be graded as a demo during office hours or in class on September 17th. Please also submit your code by the end of class by uploading a zip file named `Last1First1_Last2First2.zip`, corresponding to the first and last names of partner 1 and 2, respectively. The zip file can contain just a single python file, but turning it into a zip file will prevent Canvas from renaming the file. Also make sure you enter the names of both partners in a comment at the top of the Python file. Only one partner needs to upload the submission on Canvas.

Grading Rubric:
Say recognized symbol *5 pts*
Pick up the cube when drone picture is shown *14 pts*
Drive the cube forward and put it down *14 pts*
Drive in a circle when order picture is shown *14 pts*
Drive in a square when inspection picture is shown *14 pts*
Raise lift up and down while driving in square *14 pts*