AuE 823: Sp'23: Autonomy Science and Systems

Department of Automotive Engineering

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ASSIGNMENT 4: VISION PROCESSING: TRACKING &

FOLLOWING (Due: Tuesday, 28th March 2023. 12:59PM)

LEARNING OUTCOMES:
1. Manipulating image data for tracking a point.
2. Implementing path tracking controllers in Python

Create a new ROS package called

`assignment4_trackingandfollowing`. *PART 1 - LINE FOLLOWING:*
1. The first part are merely the deliverables from Lab Handout 7 and Lecture 6b. It is upto you to choose the methodology: Blob tracking or Hough Transforms.
2. The second part involves the sim2Real aspect, wherein you will implement the code run in simulation and implement it on the real TurtleBot. Run your python source through a launch file. Submit videos of your TurtleBot working in Gazebo and the real world.

PART 2 - APRIL TAG TRACKING:

In this part you will make your robot follow an April Tag around the room. This part of the Assignment cannot be done in Gazebo, and therefore must be implemented only on the actual Turtlebot.

You will need:

- Print out of the April Tags.
- Print out of checkerboard for camera calibration

April tags are the visual aids which represent an id using the pattern in black and white.

Every April Tag has a unique id and unique shape. Thus the corners are at known distance and thus the world coordinates of the corners are known and thus correspondences in the image frame can be found.

Use the `apriltag_ros` package to extract the frame of the tag in the real world.

- `/camera/image_rect` : is the rectified image topic from any camera sensor

- `/camera/camera_info` : is the topic containing intrinsic camera parameters and resolution of the image.
- `/tag_detections`: is the output containing position and orientation of the April Tag.

Working with video streams: Tutorial

Now that you know the position and orientation of the tag the world frame, your task is to make your robot follow it around the room. You may need to modify the `continuous_detection.launch` file to match the topics being published by your robot.

Source to download April Tags: https://april.eecs.umich.edu/software/apriltag

(Use the Tag36h11 family).

SUBMISSION:
2. Save the submission videos in your workspace in a folder called `/videos`. (You will be graded for the video submission).
3. Create a README.md with a brief explanation of the launch file and what the launch file implements. The README file should also clearly contain the command the TA should enter into the terminal to run each part of the homework!
4. Push this to your GitHub repo. Submit the link to the repo on Canvas.
5. The assignment is due on 28th March, Tuesday, before the class.