Exercise 3 November 1, 2021

Submission online until **Tuesday, 09.11.2021, 11:55 a.m.**

Assignment 3-1: Simple Parking Maneuver (7 Points)

The goal of this task is to park the model car between two virtual boxes.

Please look at the source code of the `simple_drive_control` and `simple_parking_maneuver` packages:

`https://github.com/AutoMiny/AutoMiny-exercises`

You should have a copy of these two packages in your repository. We provide `empty.world` with the assignment which needs to replace the existing file in `autominy/catkin_ws/src/autominy_simulator/autominy_sim/worlds`. This places two boxes in your world which you should park the car in between.

```
cd autominy/catkin_ws/src
git clone https://github.com/AutoMiny/AutoMiny-exercises
catkin build simple_parking_maneuver
source devel/setup.bash # for bash
source devel/setup.zsh # for zsh
```

This task is based on a given **driving_maneuver** service which can execute simple driving maneuvers. We provide a launch file to start the driving maneuver service and your service conveniently:

```
roslaunch simple_parking_maneuver simple_parking_maneuver.launch
```

You can start the parking maneuver by calling the **parking_maneuver** service:

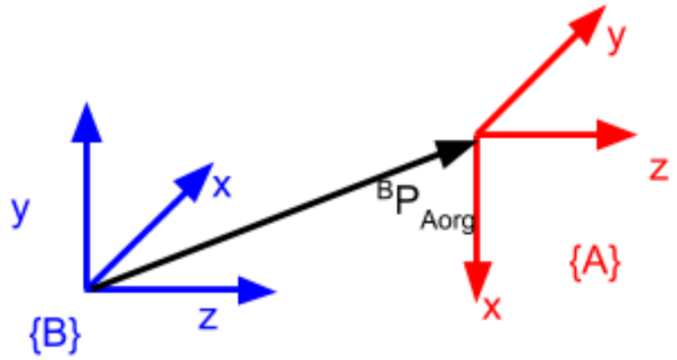
```
rosservice call /parking_maneuver "direction: 'left'"
```

The default maneuver will not park the car properly between the boxes. Your task is to tune the parameters and the driving maneuver sequence in the `parking_maneuver.py` file.

`https://github.com/AutoMiny/AutoMiny-exercises/blob/master/simple_parking_maneuver/src/parking_maneuver.py`

Commit the source code to your `catkin_ws_TEAMNAME` git repository. Record the parking maneuver and attach the video file (OBS, Kazam etc., maximum file size is 5 MB, video formats: mp4 or ogv), put a link to your source code in your final pdf.

Assignment 3-2: Coordinate System Transformation (2 Points)



Please provide the homogeneous transformation matrix ${}^{B}_{A}T$, which maps a vector represented in coordinate frame $\{A\}$ into the coordinate frame $\{B\}$. The translation vector between both coordinate frames is ${}^{B}P_{Aorg} = (-1, 4, 5)$.

What is the inverse of your transformation matrix?

Assignment 3-3: Coordinate Frames (1 Point)

Assume, you have the following vectors for coordinate axes of frame (or coordinate system) $\{A\}$:

$\{A\} : x = (-\sqrt{0.5}, \sqrt{0.5}, 0); y = (\sqrt{0.5}, \sqrt{0.5}, 0)$

Calculate the vector for the z-axis of this frame $\{A\}$.