TAS Tasks: Autonomous Driving and Optional Secondary Task

Khoi Hoang Dinh – 24th, Nov, 2016

1. Main Task

The main task is to go around the basement of N8 autonomously. It consists of two parts:

> 1. In the first round, the car is driven manually around the floor to construct the map by using hector_mapping.
>
> 2. In the second round, the car should move completely autonomously with the inputs are the map that has been constructed and the initial position if necessary.

The car should react to the hallway environment and the corner environment. Furthermore, there will be static obstacles introduced at random positions in the final demonstration to test obstacle avoidance. To win over the other teams, you should complete the lap in the fastest time without hitting obstacles or the walls. The moving direction of the car is described in the picture below:
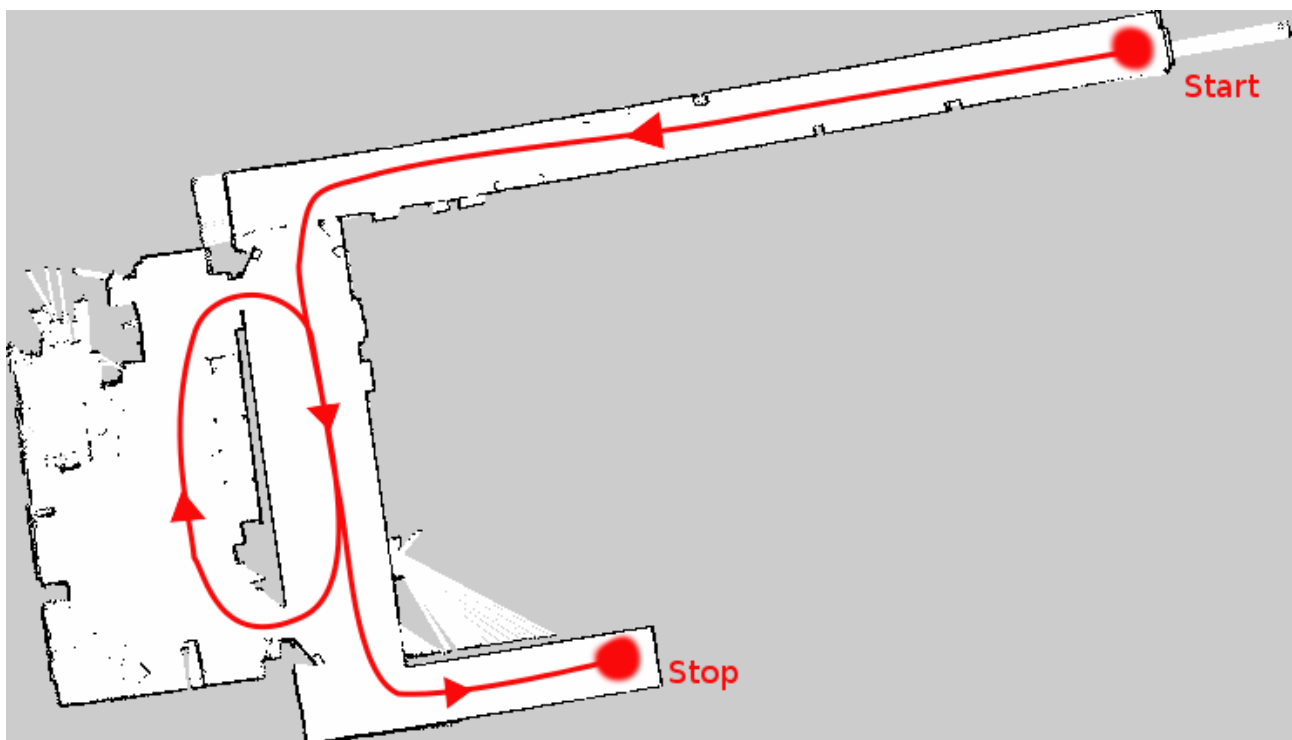
2. Secondary Tasks

For the secondary tasks, as we already announced, you are free to choose the second demonstration that you want to show. We encourage you to come up with new ideas but in case you are interested in the parallel parking and slalom course, here you can find some instructions:

2.1 The Parking Task

The Parking task is illustrated in Figure 1 (A-D). The dimensions of the obstacles are also portrayed. The car starts from position 1 (shown clearly in 1.B) and move forward to position 2 with a trajectory 1 as shown in figure 1.A. It should stop when a parking place is detected. The first task then is to write an algorithm to detect the parking space. Once this parking place is detected the car should perform a reverse parking maneuver that takes into consideration where the car position relative to the parking place is. A second task then is to calculate this relative position. The third task is to manipulate a "reverse parking" primitive trajectory given the input of the relative "stop" position (around position 2). Then the third task becomes to both identify and generalize a reverse parking trajectory such that a correct parallel parking is achieved. A final primitive is a correction trajectory to "fix" the final position. Summarizing (suggested) the tasks are then:

1. Move forward from position 1 to position 2.
2. Localize the car at position 2 (stop position).
3. Use the stop position as an input to manipulate a "primitive" reverse parking position.
4. Perform the parallel parking maneuver while reacting to laser scan/imu information.
5. Stop before hitting the obstacle.
6. Perform a corrective motion (front and to the right to finalize the car position)

2.2 The Slalom Task

The slalom task is shown in Figure 1.E. The dimensions are also shown. Just like the parking task, the idea is to react to environmental information and adjust "primitive" trajectories accordingly. There would be two main primitives: turn right, and turn left. Alternatively, this task could be performed by setting different goal points and focusing on the smooth transition between them using local planner.
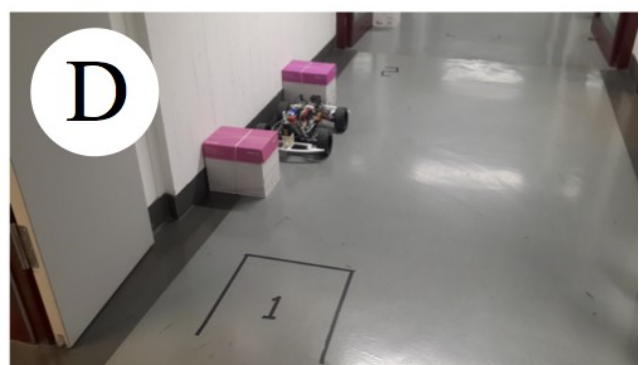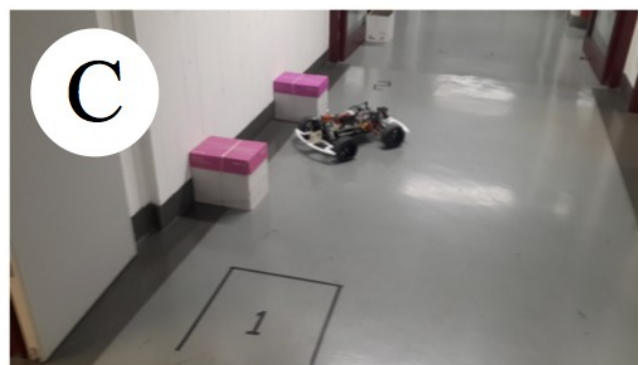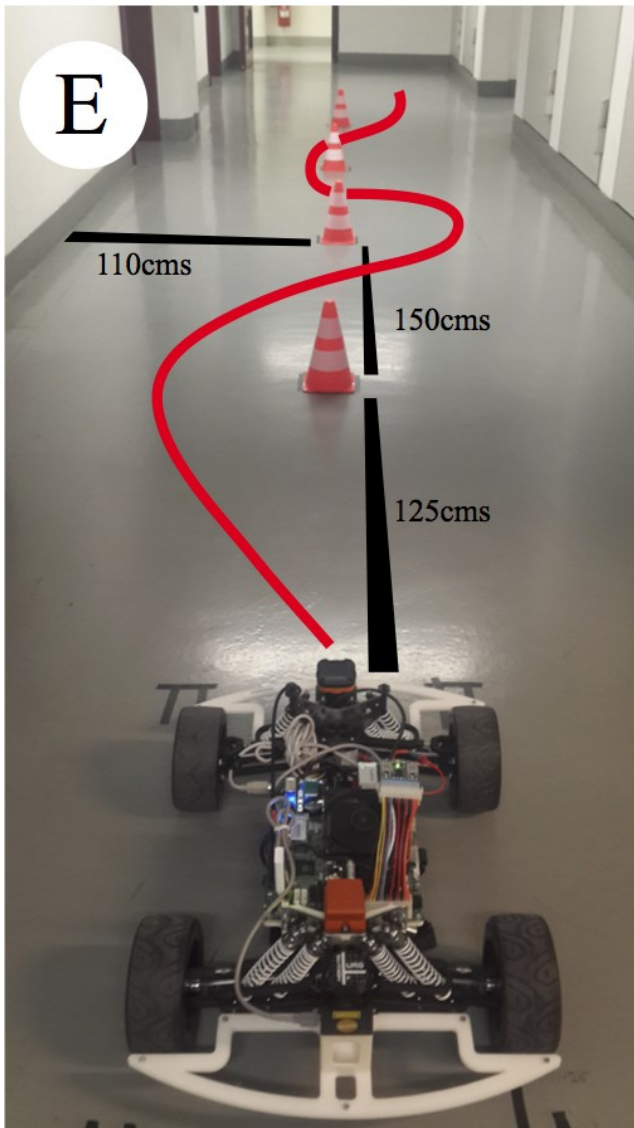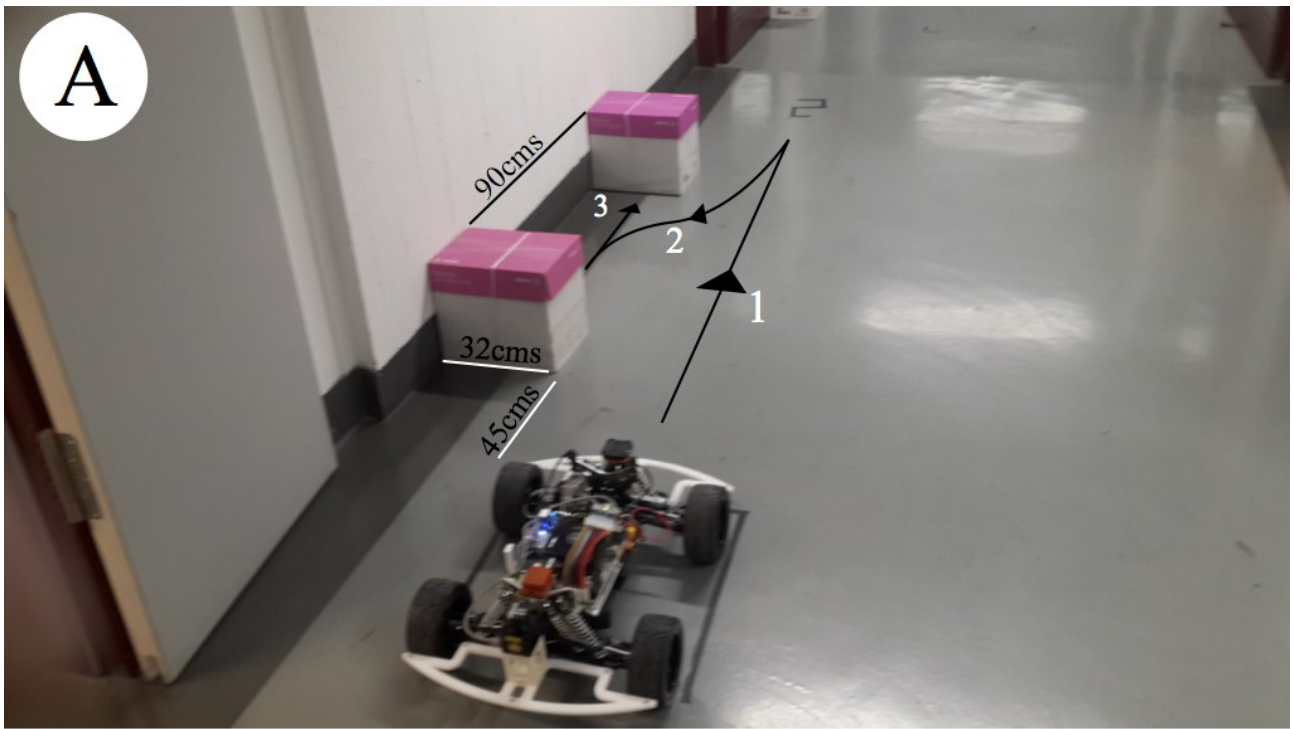
Figure 1: Illustration of parallel parking and slalom course tasks