# Assignment - Ground vehicles navigation

**Instructions:**

Follow the instructions on the POLARIS_GEM_e2 simulator README to install it:

🦊 GEMillins / POLARIS_GEM_e2 · GitLab

Once installed and the workspace built you should be able to run this simulation:

```
1   roslaunch gem_gazebo gem_gazebo_rviz.launch velodyne_points:="true"
```

You will see a car-like robot model simulated. The vehicle is equipped with a front laser, sonar, 3d Velodyne lidar, single camera, GPS, and IMU.

**Assignment tasks:**

Given the simulation the main tasks of this assignment are:

1. Prepare a model predictive controller which given a specific path, is able to follow this path with max 20km/h with a path tracking accuracy of at least 1m and at the same time will be able to avoid obstacles.
   a. Inputs to your controller:
      i. Path ros message, with GPS coordinates 🔗 nav_msgs/Path Documentation
      ii. Odometry ros message 🔗 nav_msgs/Odometry Documentation
      iii. Obstacle positions
2. Prepare the ROS package to launch the robot ( feel free to add more sensors if you consider it necessary), the world (including static and dynamic obstacles), and your motion planning algorithm.

**Deliverables :**

1. A repository of the code with a README which describes the implementation and a dockerfile with all the dependencies in order to run your code and the simulation.
2. A video that should involve the following :
   a. Include launching of the robot from the terminal.
   b. Show the gazebo environment showing the robot following the path and avoiding obstacles.
   c. Show the Rviz which visualizes the path it needs to follow and the robot as well.
   d. At the end of the video show the plot of the cross track error while path tracking.
3. An image of the plot showing the cross-track error while path tracking.

In case you have any issues or there is something that you are not sure how to do or if something is not clear, please feel free to contact us.