Exercise 3:

The exercise is max 10 points + 3 bonus points

Exercise 3 uses the same definition files and launch files as exercise 2. In tasks a) through c), use the robot controller of exercise 2 to follow the smooth path of exercise 2. You may use either your own implementation or that of the example solution.

a) **(2 points)** Implement robot localization based on known feature locations using Monte Carlo particle filtering.
b) **(2 points)** Implement feature based simultaneous localization and mapping (SLAM) using extended Kalman filters.
c) **(2 points)** Assume the features are not distinguishable one from another (they are all blue!). Implement feature based robot localization using EKF addressing data association problem with range and bearing measurements.
d) **(2 points)** Demonstrate algorithms a) to c) in a simulated Gazebo environment.
e) **(2 points)** Write a concise report describing your work.
    - Deliver the report as a single pdf file covering all the tasks.
    - Embed all relevant code and explain what is being done.

BONUS

f) **(3 points)** Implement occupancy grid mapping assuming known localization. In practice robot location may come from a feature based localization or SLAM. Note however that occupancy grid map generation must be only activated when the location estimates are relatively accurate, for example after the initial transition phase.

   You can teleoperate the robot around the environment to get the best map coverage possible. Compare the generated map with that provided.