EECS 376/476 Spring, 2016
Problem Set 5: Trajectory Planning

This is a group assignment. Only one solution per group should be submitted. (This will be set up on Blackboard).

For this problem set, you should use the code in packages “mobot_pub_des_state” and “traj_builder.” See the text and the README files for details of theory of operation and running tests. In “traj_builder.cpp”, the function “TrajBuilder::build_braking_traj()” is not completed. You should edit this to construct a valid braking trajectory to bring the robot to a halt, whether moving forward, spinning or both.

In “pub_des_state.cpp” you should add code to listen for e-stop conditions, including a “lidar alarm” (using your own code to respond to LIDAR sensor data). Graceful braking should be performed when there is a detected obstacle. Graceful recovery should also be performed, picking up from the halted state and resuming progress towards the next (or previously unobtained) subgoal.

Additionally, you should monitor the topic "motors_enabled”, which carries messages of type std_msgs::Bool. This topic publication is based on the status of the robot's hardware e-stop. If an e-stop is hit (either by mechanical button or by wireless command), your code needs to respond appropriately. Desired states should stop being published—and when the e-stop is re-enabled, the robot should start up gracefully to resume its journey to its next (or previously unobtained) subgoal.

You should recommend values for speed limits (translational and rotational) and acceleration limits (translational and rotational). You should demonstrate proper functioning of the following behaviors:

- graceful halt from LIDAR alarm
- graceful recovery from LIDAR alarm
- graceful recovery from wireless E-stop
- ability to execute open-loop control corresponding to a prescribed polyline path
- ability to append subgoal poses to a prescribed path plan
- ability to flush a path plan and replace it

Your group solution should include:

- a motion capture of the “mobot” model in gazebo performing the above (except for the wireless e-stop signal, which is not present in simulation).
- A movie of the above being performed on “Jinx” in the lab.
- A zip of your group's source code (you should set up a shared repository for your group).
- A report describing your theory of operation, recommended dynamic values and any interesting observations from your experiments.