ABS (Avinery Biton Skoran)
User Guide

Intro:

The project is a combination of both a mechanical and algorithmic motion planning problem.

The mechanical part refers to the Lego MindStorm NXT Robot that was designed and constructed for the purpose of this project. (Will be detailed later)

The algorithmic part refers to the Hybridization algorithm that was written in order to combine the results of 4 other motion planning algorithms (RRT, PRM, Bi-Tree, EST) to a better and more efficient solution.

Design the Workspace:

1) The workspace can be designed using Google SketchUp with the OOPSMP plugin (supplied with the project files), with some limitations and guidelines.

2) You can use the following tutorial video in order to correctly construct the workspace for use with motion planning:

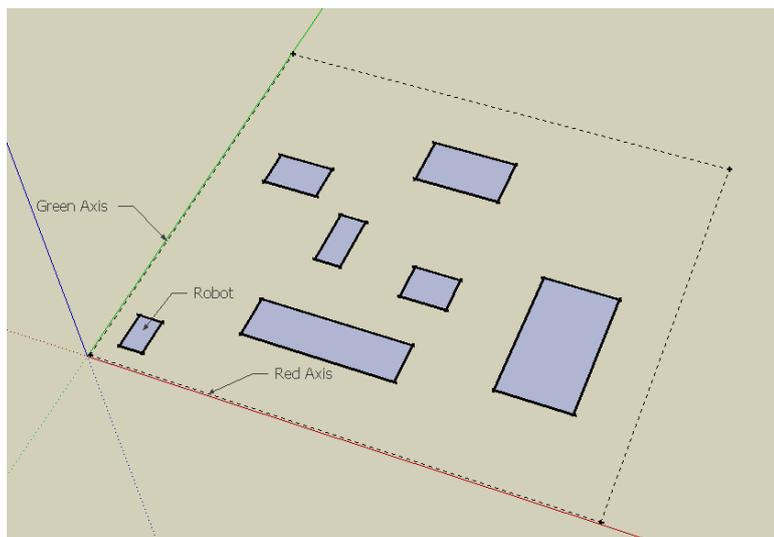http://www.kavrakilab.org/sites/default/files/osudi/part2.mov

Note:

- The world should be in 2D (only on the red and green plane) and not 3D like in the instructions.
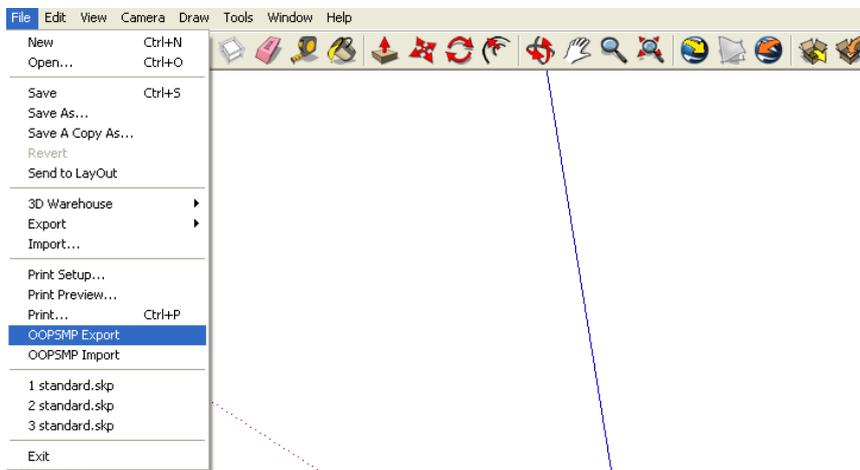- The robot should be a 12cm X 20cm rectangle

3) After designing the workspace you can proceed with solving the motion problem
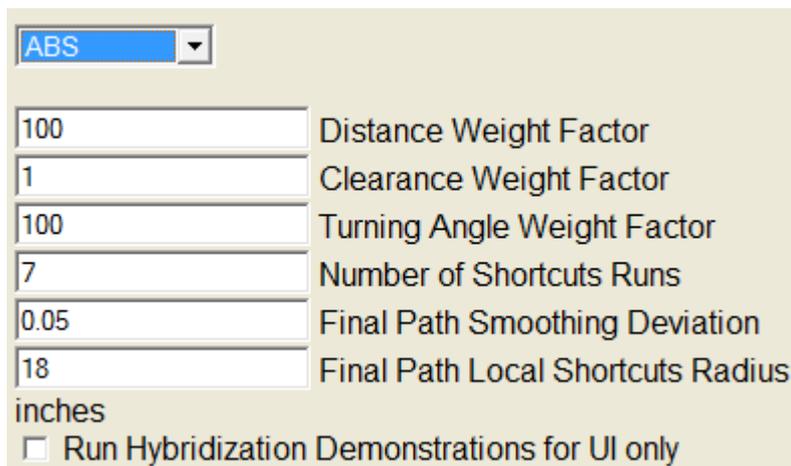
Example:

Solving the problem

1) Make sure that the robot is turned on and that Bluetooth is enabled.
2) In Google Sketchup select file → oopsmp export:

3) Select "ABS" under "global planner"
4) Fill the parameters for the Planner.

   a. Weight Factors – they multiply the weight/cost calculated for minimizing their respective parameter. The higher the number – the more important this minimization becomes.

b. Distance Weight Factor – minimization of the final path's length

c. Clearance weight factor – minimization of the final path's proximity to obstacles

d. Turning angle weight factor – minimization of the final path's turning effort (it considers amount of turns and their magnitude at the same time, with emphasis on number of turns)

e. Number of shortcut runs – Determines the number of times that the shortcut process would run on each path (each time a maximum of half of the paths vertices might be removed). These shortcut paths are added along with the original paths as input to the hybridization process.

f. Final path smoothing deviation – The maximal proportion of deviation from the original path while smoothing it.

g. Final path local shortcuts radius – The radius in which we inspect regions of the final path in order to attempt shortcuts (in Inches).

h. Run Hybridization demonstrations – Select this only if you're using our debugging UI, to see the effects of different parameters configurations.

5) Press Run – After the computation has finished, a dialog box will appear asking if you want to run the robot for the solution.

Troubleshooting

1) The algorithm finished running but the robot is not moving.
   - Make sure the robot is turned on.
   - Make sure that Bluetooth is turned on in your computer and has a green filling

2) The algorithm solution takes too much time (over 2-4 minutes)

- Make sure that there is a theoretical path from the start to finish.

3) The robot doesn't go according to the solution
   - Make sure the amount of millstones along the path is not very high and that the distance between the points is big enough (bigger than a few centimeters). The solution file can be found at the Google Sketchup folder under the name " MotionPlanningSolutionsFile.txt"
   - Make sure the robot has enough power (fully charged batteries)

4) Google Sketchup cannot find OOPSMP
   - The model's file should be located in Sketchup's folder
   - Try opening the model's file by double-clicking on it instead of through Sketchup's menus (it's an issue with the program's current working folder)