Report

Problem:

Implement a motion planner that finds a motion plan for a 6DoF rigid body Shaft out of the transmission engine's body. This motion planner should use an RRT / RRT variant algorithm to create and explore the roadmap in the given environment. This RRT algorithm should work with 6DoFs of the rigid body (i.e. x y z roll pitch yaw). Simulate this motion plan trajectory in 3D visualization space.

Tools:

For this project, I Have used Matlab instead of python. This choice of Matlab over python is based on the ease of simulating 3D geometry and in-built collision checking functions in Matlab. I have used *collisionbox()* and *collisioncylinder()* functions to define my transmission environment and shaft rigid body.

Methodology:

I defined the transmission engine object as an instance of the custom class MakeEngine. This class creates a static engine block using *collisionbox()* function *collisioncylinder()* function. These elements of the engine then can use the inbuilt function of Matlab to check collisions. Similarly, I defined a shaft variable to store the main shaft element using the class MakeShaft. These objects are scaled down by a factor of 100.

I defined the bounds of the Config space in the c_space_bounds variable and used these bounds to define a statespace variable ss using the inbuilt Matlab function *StateSpaceSE3()* function. Then I created an occupancy map and stored it in SV.

I used the inbuilt Matlab plannerRRTStar function to create a roadmap and find the path from start to goal.

Once I had the motion path I smoothed it and ran the animation function to show the visualization of it.

I built my whole project based on an example code of 2D rrt for furniture moving in 2D space on the Matlab website.[1]

Plots:

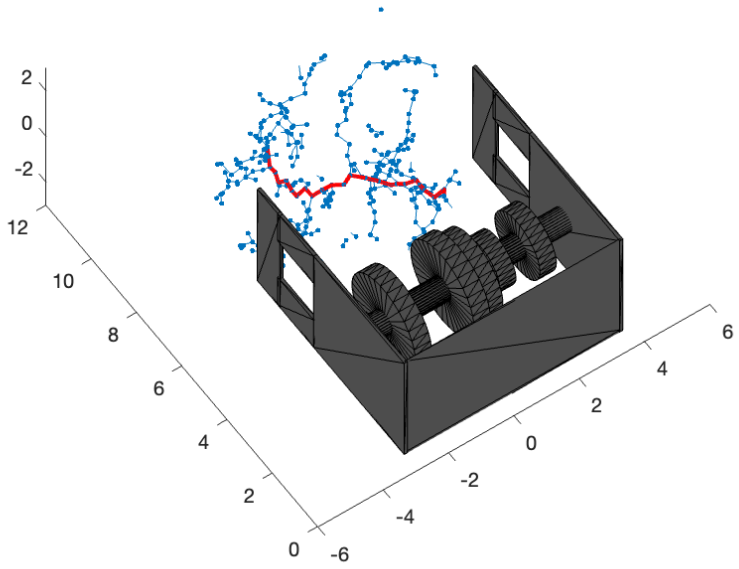

Fig: RoadMap

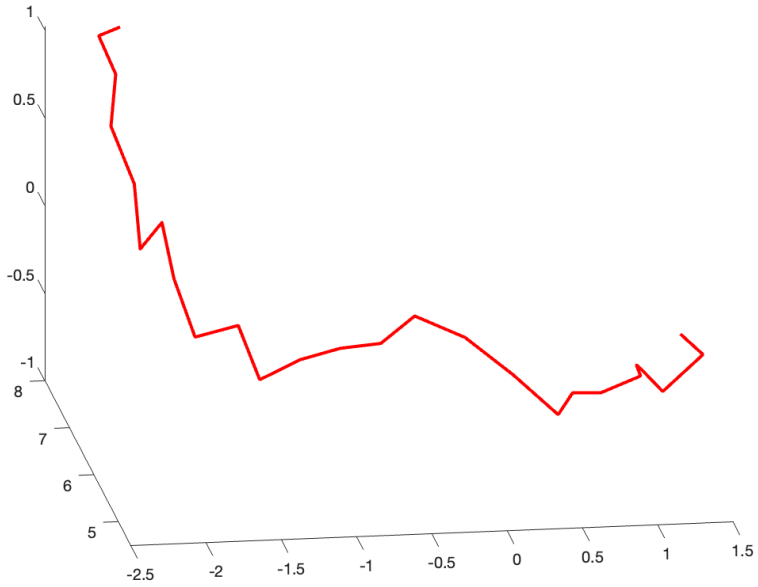

*Fig: Trajectory of the main shaft in 3D (*coordinated are scaled-down by 100)*

Ugliest Car with SM-465 transmission:

[2]

References:

[1] https://www.mathworks.com/help/nav/ug/moving-furniture-in-a-cluttered-room-with-rrt.html
[2] 1971 FJ40 VINTAGE MOD BBC SM465 Trans Lifted 33's Custom ...smclassiccars.com