RBE550 - Homework 0

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Component 1 - Motion Planning Application

The motion planning application I have chosen to look at is "Motion Planning for a Fixed-Wing UAV in Urban Environments"[1]. I find this method interesting for a two reasons. First is the wide array of applications that it can be useful for, from humanitarian search and rescue, to augmenting the supply chain by handling "last leg" deliveries in urban environments. More interestingly, though, is that the method explored in this paper applies to fixed-wing UAVs as opposed to more commonly used rotor-wing UAVs or ground based autonomous delivery drones. In order to do this, the authors employed a Rapidly-exploring Random Trees (RRT) algorithm, providing a start point, an end point, and a map of static obstacles. The basis of their algorithm was a 2D sub-optimal RRT strategy and expanded upon to create a 3D RRT algorithm. This allows the path planning algorithm to plan a route through the obstacle grid but also allows the algorithm to plan a vertical trajectory for the UAV.

I believe that this technology could be best implemented in larger cities that have some roof access to their buildings. Search and rescue as well as crime prevention are cases where this technology could be implemented almost anywhere, but there are also cases such as medical supply delivery or parcel and food delivery that would require some sort of drop location, either in front of the building or on top of it.

Component 2 - Turtle Graphics Victor Sierra Pattern

Figure 1 shows the turtle at the completion of the first Victor Sierra loop. Figure 2 shows the turtle at the completion of the second Victor Sierra loop. The code is designed to continue indefinitely in the same pattern, as shown in the accompanying video.

For code, please refer to "turtle_controller.cpp" in the "src" folder. Note that there is a launch file titled "turtle.launch" that initiates the turtleSim but does not launch the controller. I had some trouble getting the launch file to work with the controller for some reason, but will try to fix it for future code submissions to simplify testing.

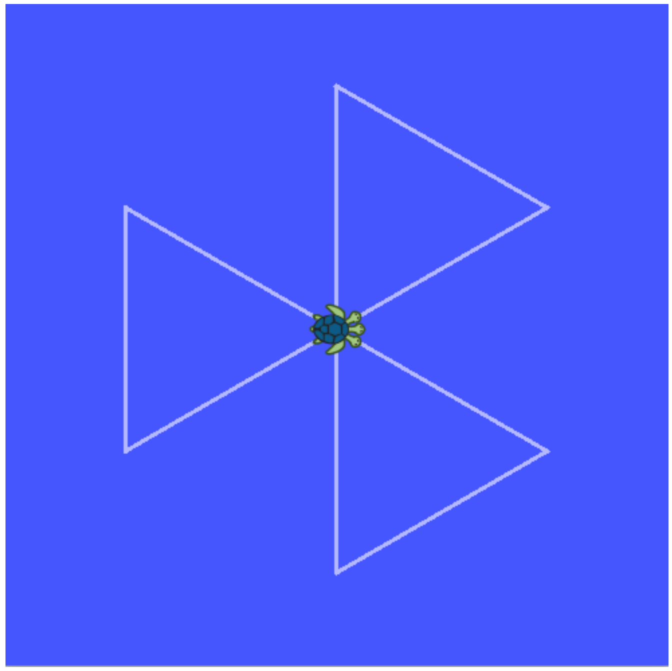

Figure 1: Incomplete Victor Sierra Pattern - First Loop

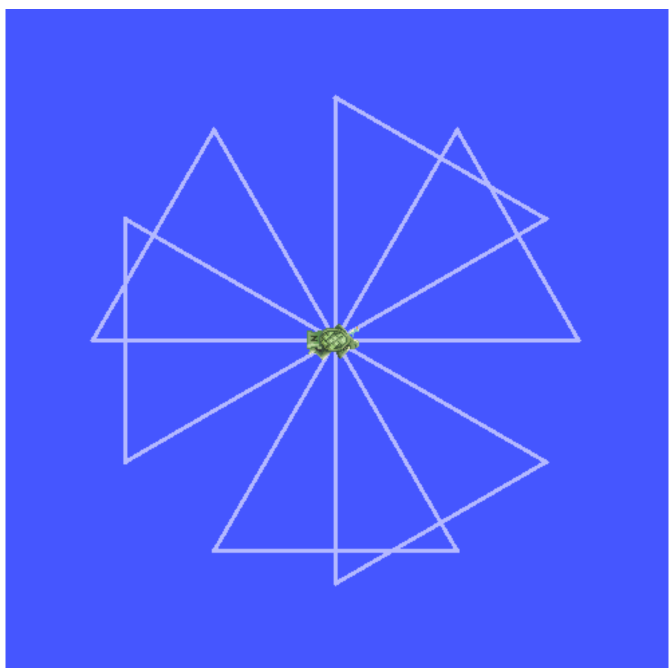

Figure 2: Completed Victor Sierra Pattern - Second Loop

Component 3 - Recording of ROS TurtleSim

Refer to video ”Victor Sierra Pattern.mov” in deliverables folder.

Component 4 - Obstacle Field Demonstration

For code, please refer to ”gridworld.py” in the ”scripts” folder.

Figure 3: Obstacle Field with 10 percent fill

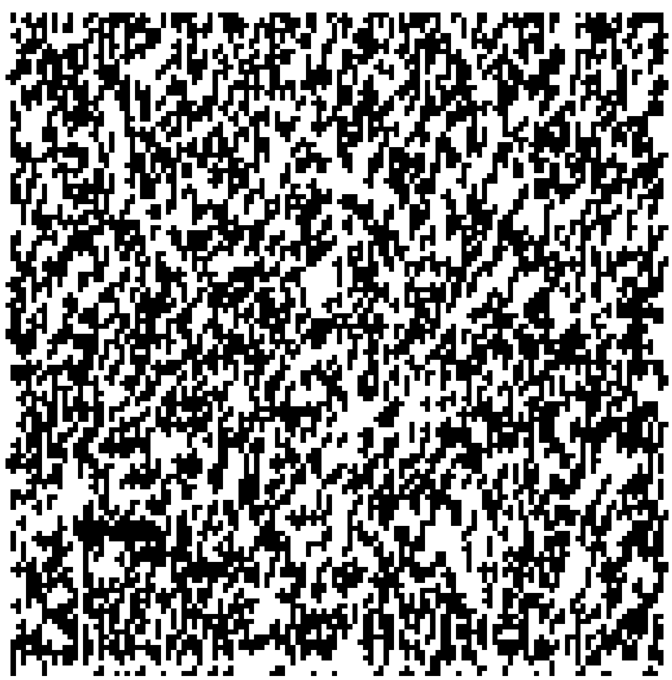

Figure 4: Obstacle Field with 50 percent fill

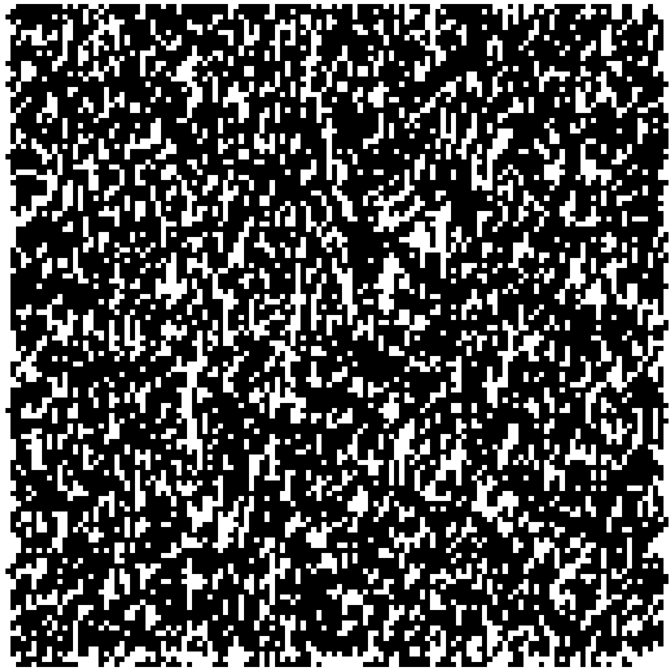

Figure 5: Obstacle Field with 70 percent fill

Component 5 - Introduction, Motion Planning Application

Refer to discussion board post.

References

[1] M.V. Ramana, S. Aditya Varma, and Mangal Kothari. Motion planning for a fixed-wing uav in urban environments. *IFAC-PapersOnLine*, 49(1):419–424, 2016. 4th IFAC Conference on Advances in Control and Optimization of Dynamical Systems ACODS 2016.