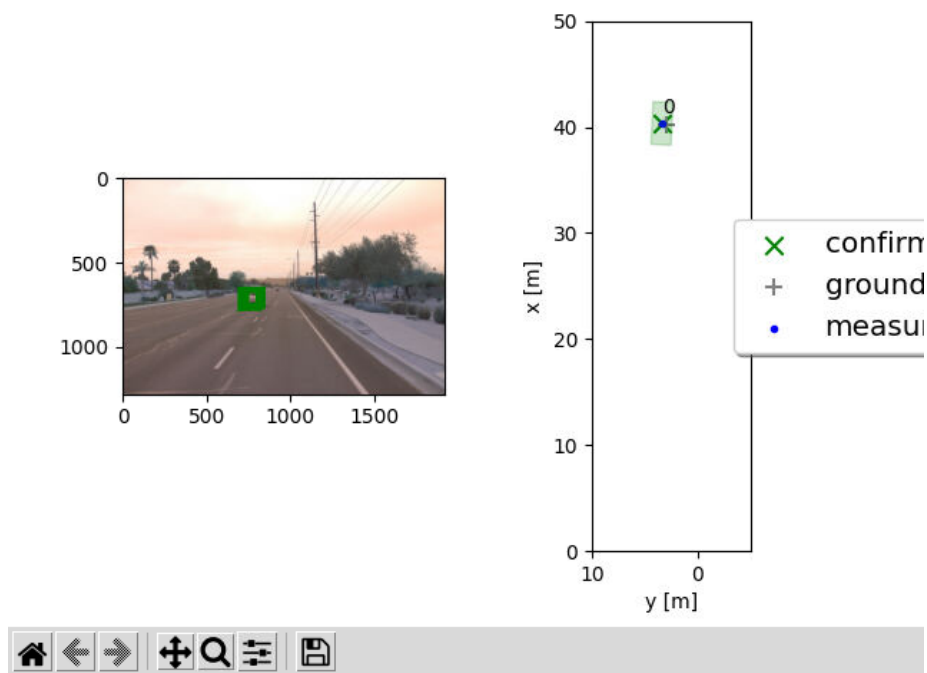
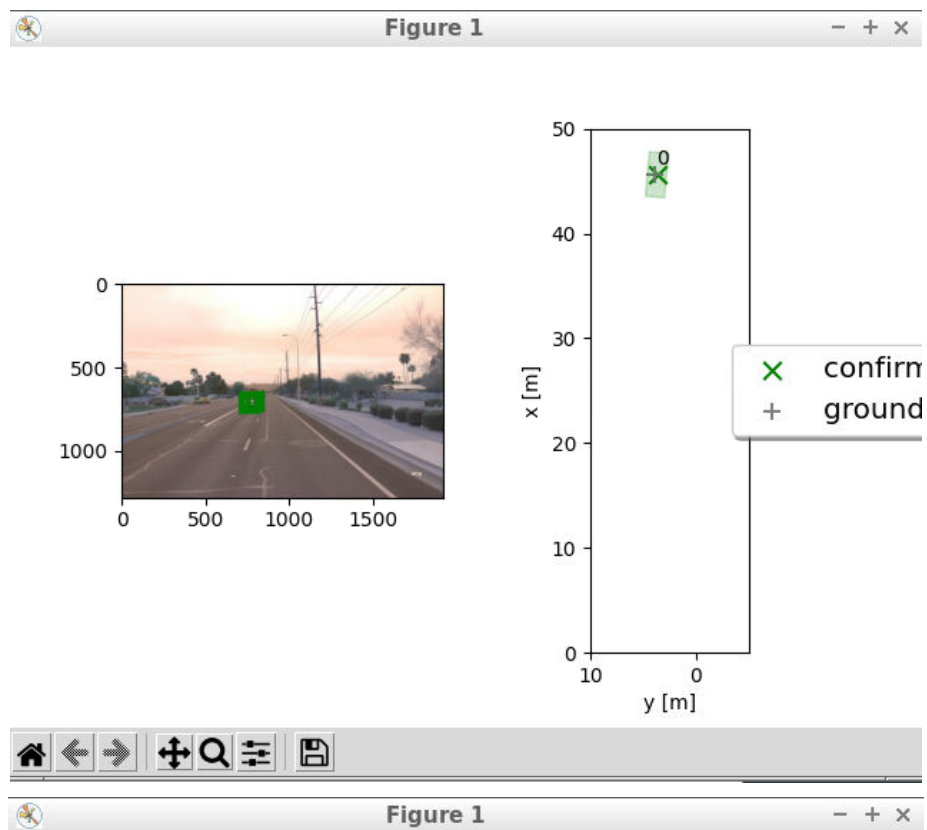
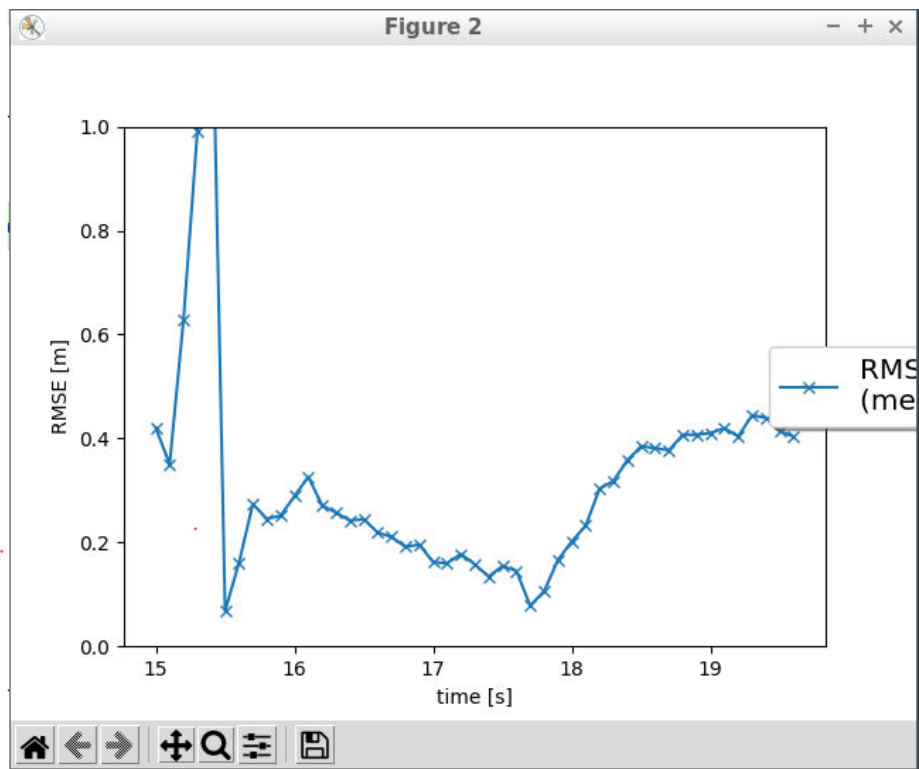


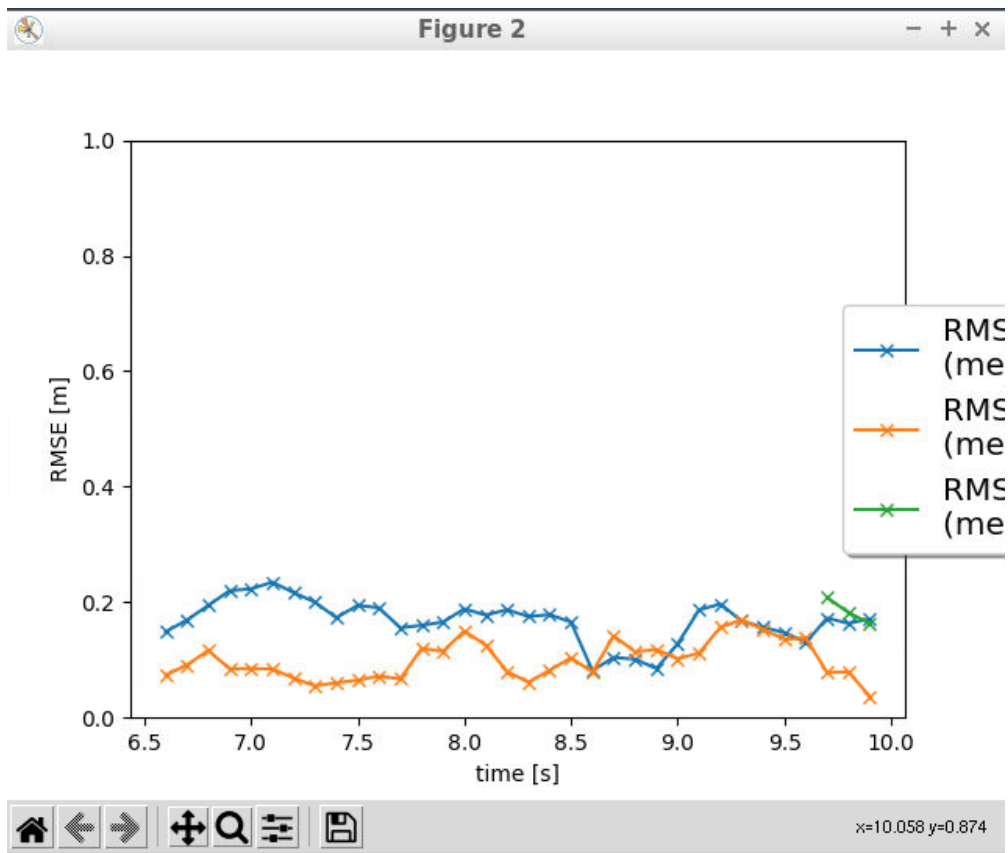
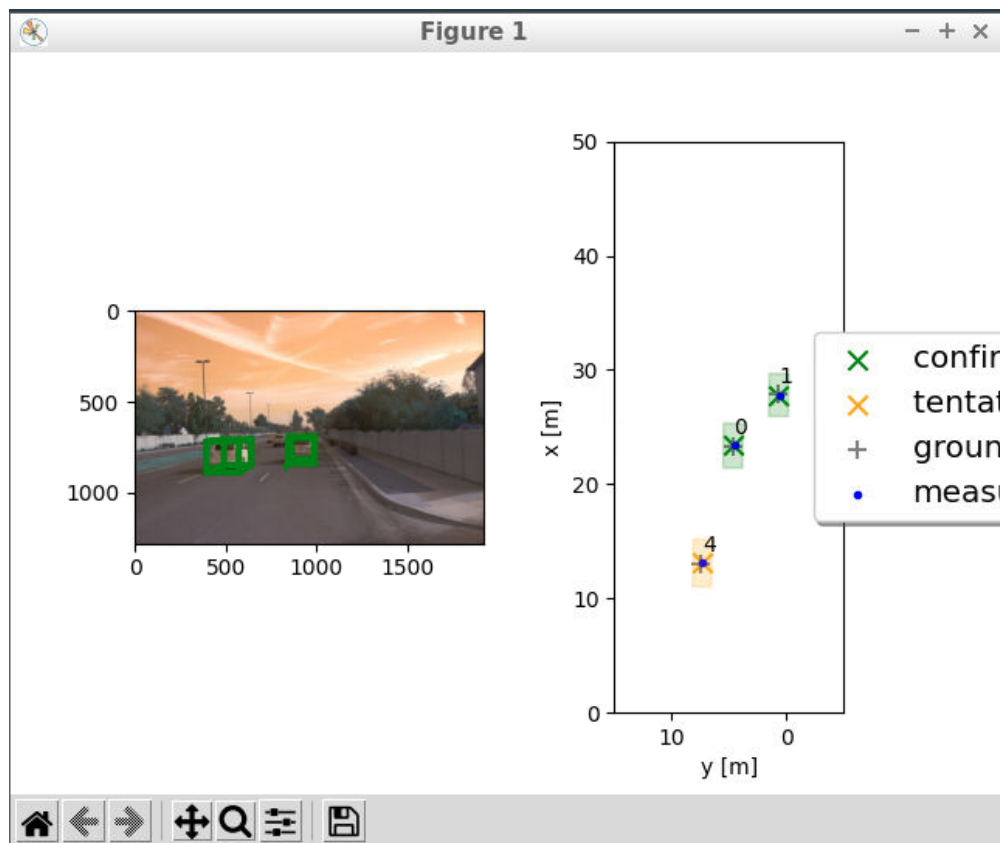
Control and Trajectory Tracking for Autonomous Vehicles

Step 1: Build the PID controller object

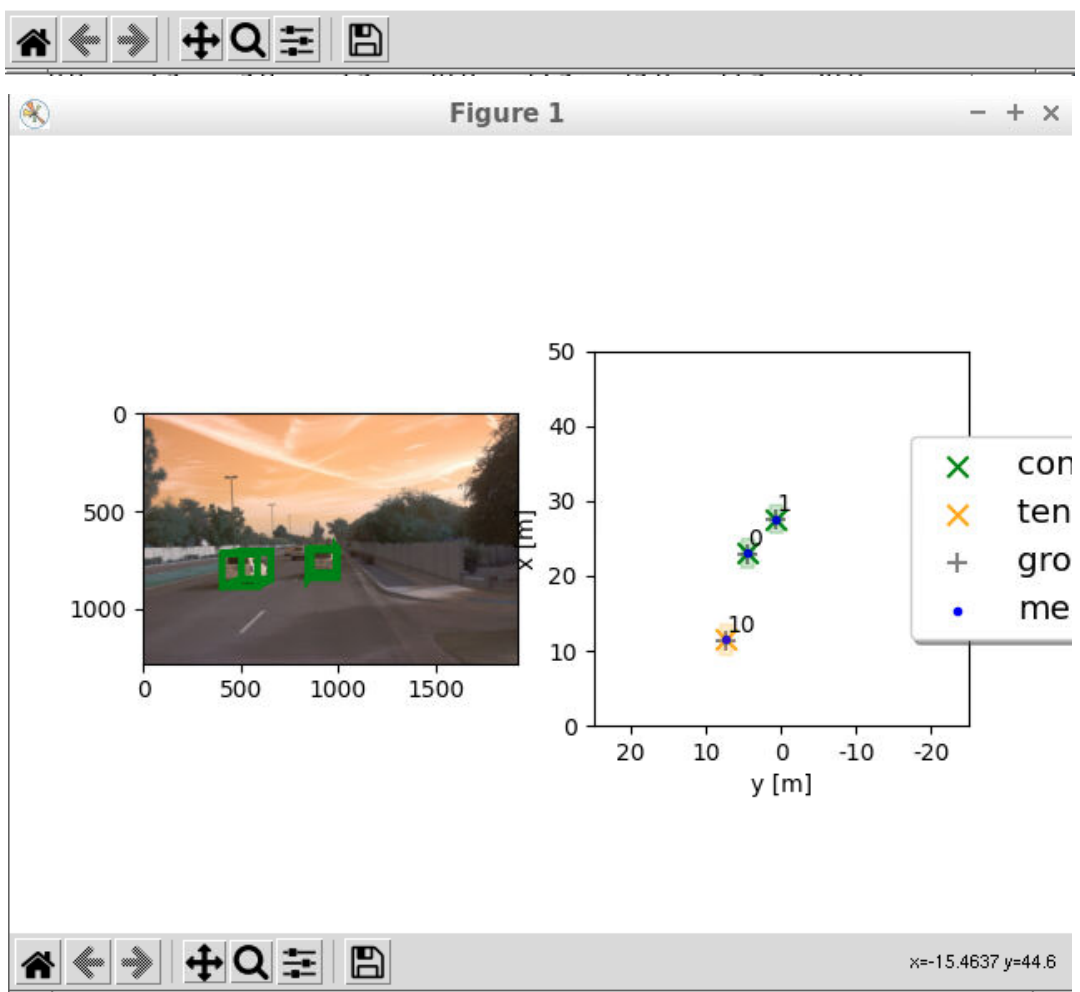
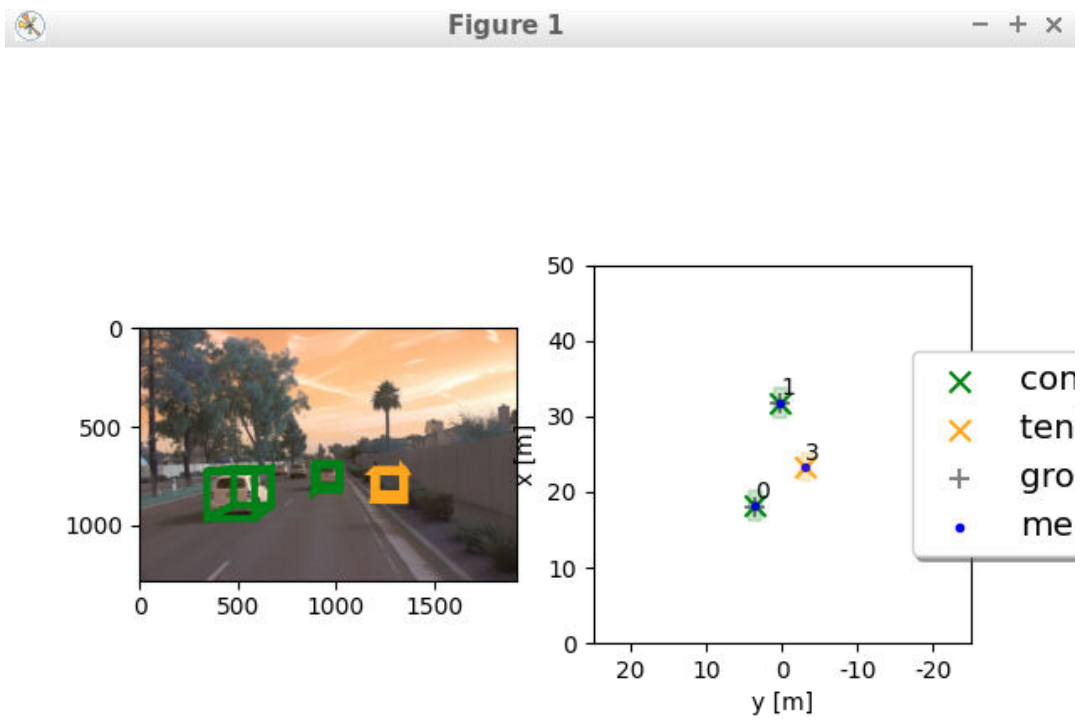


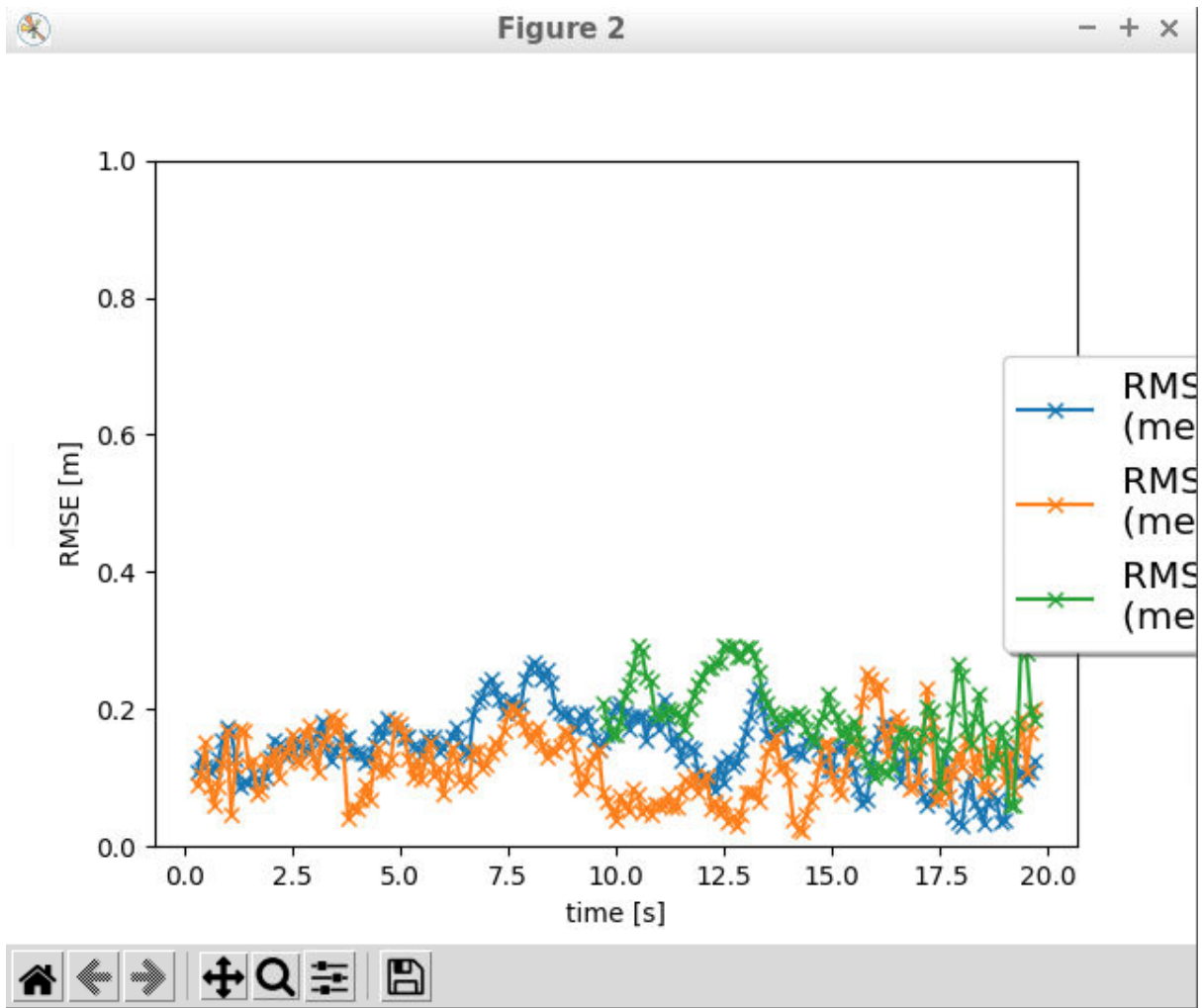


Step 2: PID controller for throttle:

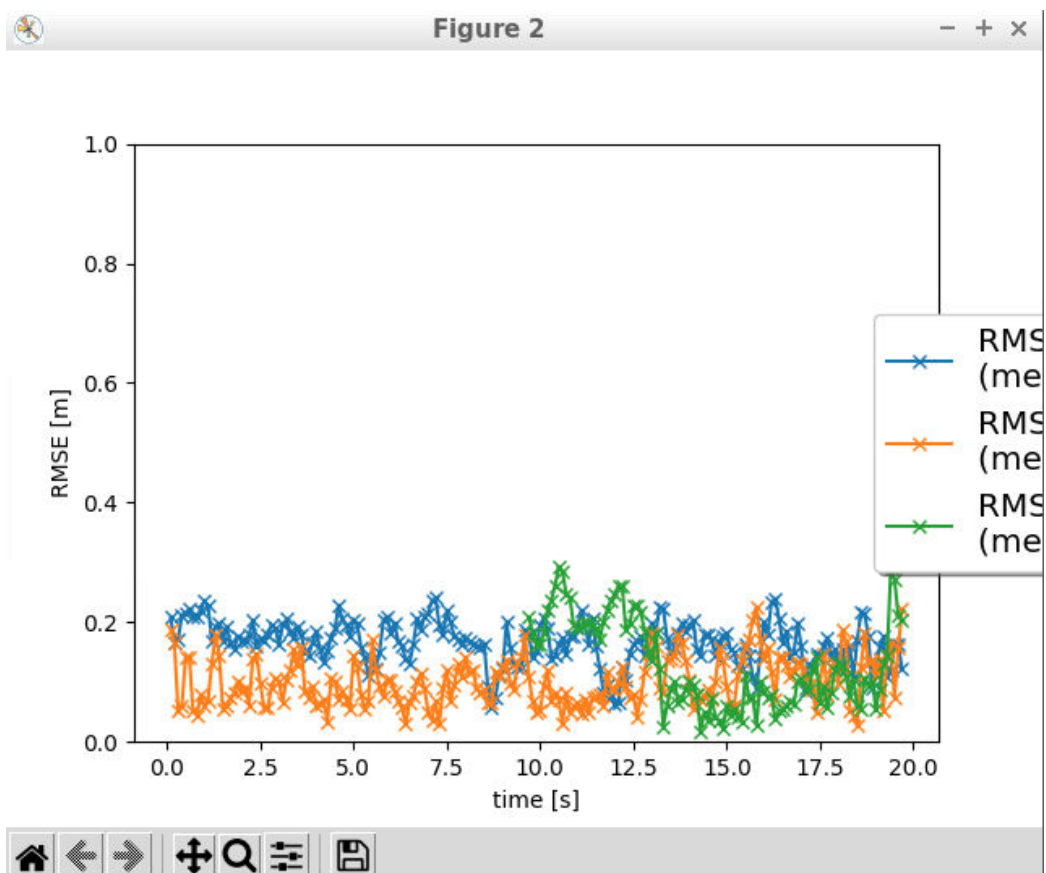
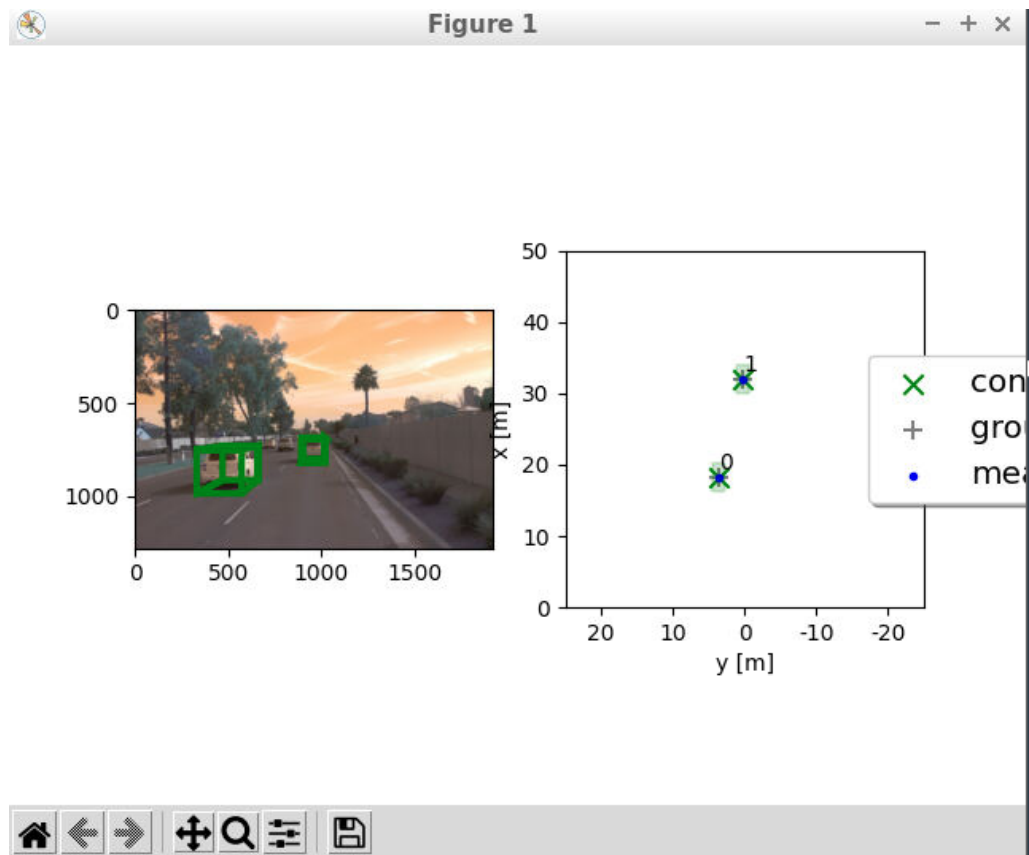


Step 3: PID controller for steer:





Step 4: Evaluate the PID efficiency:



Project conclusion:

The steps we made in this project made the car able to track vehicles over time with real-world camera and lidar measurements!

In order to do that we had to go through 4 main steps divided into smaller steps:

- First, we implemented the 6D Kalman filter with all of its functions using the parameters provided and the track and measurements parameters,
- Then in order to distinguish between the right and wrong tracks and delete whatever is not necessary we had to do track management, to keep the right tracks, increase the score depending on the threshold, adjust the state and delete unconfirmed tracks.
- And to to associate measurements to tracks we had to implement a single nearest neighbor data association and get on with our multi tracking.
- then, to get the best result we merged the camera readings with the lidar readings and that is the main purpose of sensor fusion in the first place.

Personally, the most difficult part of the project was step 2 because I was not familiar with all the parameters I should use for the score and state modification.

Benefits in camera-lidar fusion:

In theory, of course the camera-lidar fusion is better compared to lidar-only tracking, in my concrete results it also is because the error margin decreases and the results are based on more than 1 observation and the accuracy in detection increases.

Sensor fusion system challenges in real-life:

In real life there can be a lot of objects that could give a wrong result, and that actually happened in the project on a small scale when the car detected a bush as a car.

Future improvements:

To improve the results, we can add or modify the conditions to be more precise in calculating the score or evaluating the state, maybe raise the threshold and fine-tune the parameters to be extra sure of the detections and get better results in the RMSE.