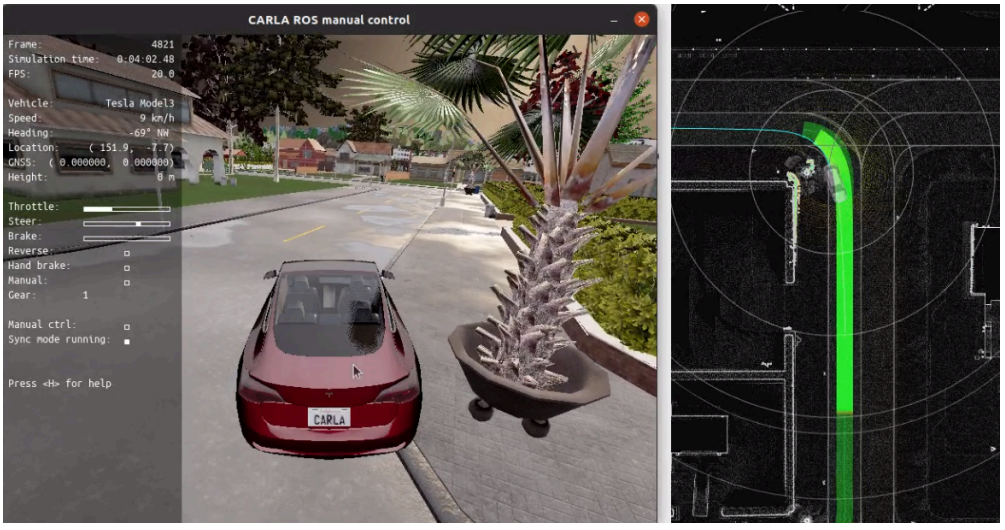
Too sharp turn with new vehicle and carla sim #3526

Answered by maxime-clem **Robotics010** asked this question in **Q&A**

Robotics010 on May 25, 2023 edited

I'm preparing vehicle & control configuration for testing Autoware in CARLA simulator, but I'm stuck with the too sharp turn problem (look at the screenshot below) and I'm asking of recommendations how to fix the problem.



Vehicle description

Current vehicle description was copied from `sample_vehicle` vehicle model and is placed here. It differs only with `wheel_base`, `wheel_tread` and `max_steer_angle` values.

Control to Vehicle interface converting

Desired steering tire angle from Control command is converted with 1d polynomial here so, that it converts a steering tire angle to carla's steering range (for example, 0.73 rad to -1.0).

Control tune

I was trying to tune lateral control as described here, but it doesn't fix the problem, however it still has a high lateral error (from 1m to 0.5m).

How it looks like

Here is a video - https://youtu.be/pAueA7qMnn0 and a rosbag - here.

Category
🙏 Q&A

Labels
None yet

2 participants

And a screenshots from control_performance_analysis package:

↑ 1

Answered by **maxime-clem** on May 27, 2023

If I understand correctly, there is currently a delay between the steering angle requested by Autoware and the actual steering angle of the CARLA vehicle and Autoware is not aware of this delay. This could definitely be the cause of the issue.

View full answer ↓

2 comments · 12 replies

Oldest | Newest | Top

maxime-clem on May 25, 2023 Collaborator

What is the delay between (a) when the Autoware controller outputs a positive acceleration and (b) when the Carla vehicle actually starts moving (or similarly, between the controller steering angle and the wheel turn in Carla).
By default, the lateral controller assumes a 240ms delay but maybe the delay with Carla is different (can be changed here: https://github.com/autowarefoundation/autoware_launch/blob/main/autoware_launch/config/control/trajectory_follower/lateral/mpc.param.yaml#L48).

↑ 1

11 replies

Robotics010 on May 26, 2023 Author edited

Hey Maxime! Thanks for suggestion.
I've measured the input delay in longitudinal stimulation and got 250ms. I've changed it in mpc.param file but it looks like there is no effect on the problem (turns are still sharp, lateral error is still high at turns). I've tried input_delay 0.05 and 0.0 as well, but still - there is no effect on the problem .

Robotics010 on May 26, 2023 Author edited

One note though. I didn't find yet an adequate steering feedback from CARLA sim, could it cause this problem? By inadequate steering feedback I mean, that the bridge publishes steering_status, which is equal to control input (not the current steering tire angle). For instance steering_status has desired right position, however the steering wheels are still turning to that desired right position.

maxime-clem on May 27, 2023 Collaborator

If I understand correctly, there is currently a delay between the steering angle requested by Autoware and the actual steering angle of the CARLA vehicle and Autoware is not aware of this delay. This could definitely be the cause of the issue.

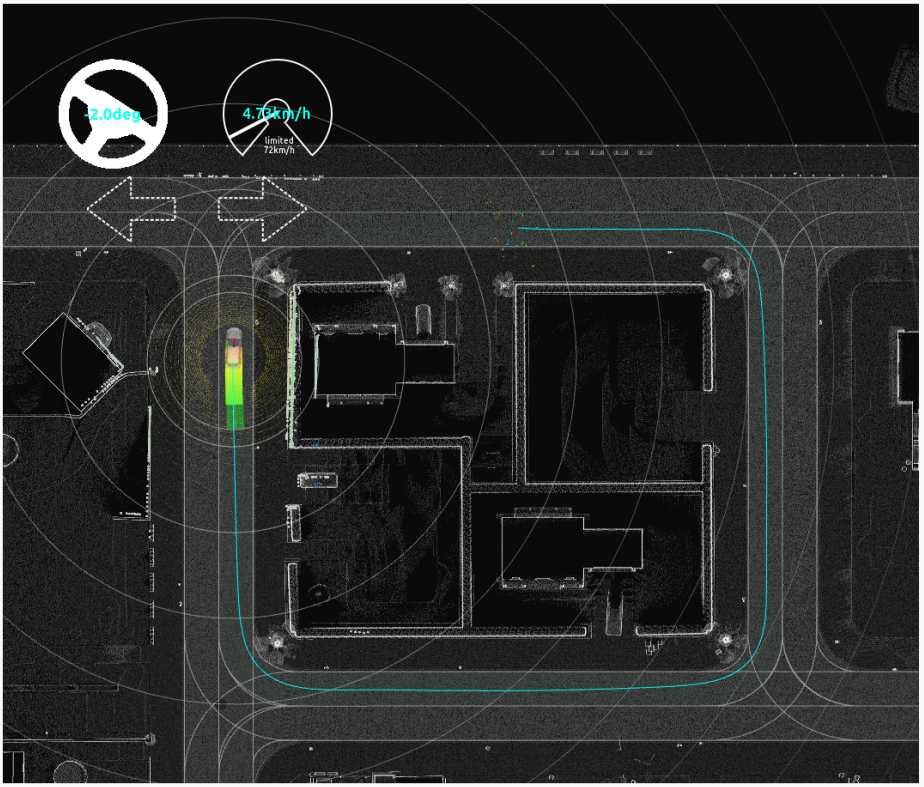
Can you double check that the steering rate limit is correctly set (https://github.com/autowarefoundation/autoware_launch/blob/main/autoware_launch/config/control/trajectory_follower/lateral/mpc.param.yaml#L50) ?

Marked as answer

Answer selected by **Robotics010**

Robotics010 on May 27, 2023 Author edited

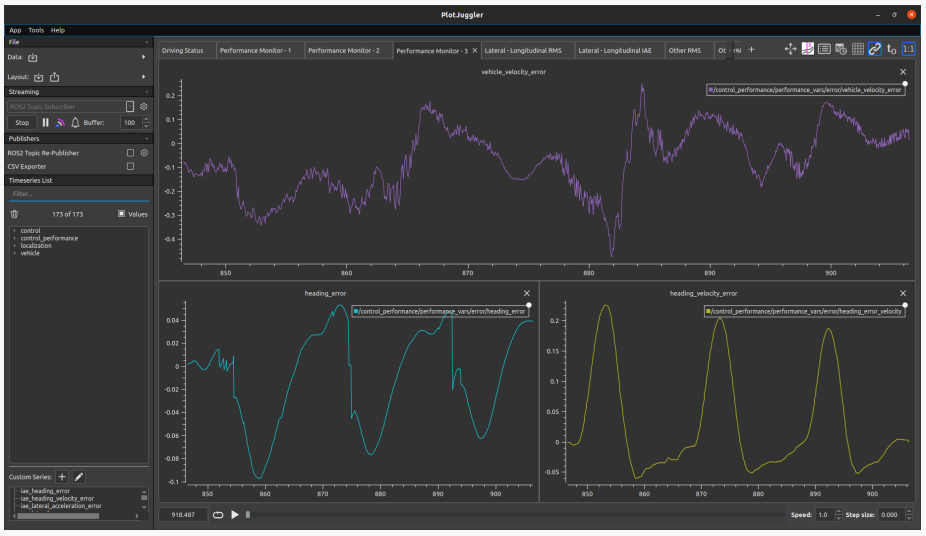
Big thanks for the advice for configuring `steer_rate_lim_dps`, it has allowed me to decrease the lateral error significantly (from 1m to 0.4m), but turns are still sharp (here is a path):



I've measured the maximum steering rate as well as the input delay and got `steer_rate_lim_dps: 140.0` and `input_delay: 0.055`. Also I've tuned mpc to get lateral error lower as possible and I've ended with the following lateral control config:

lateral_controller.param.zip

And here is the performance charts:



I'll fix the steering feedback (lateral control will be getting an actual steering angle feedback), but what else can I check to eliminate lateral error?

Robotics010 on May 29, 2023 Author edited

Maybe a setting of width of vehicle could influence lateral error? Or can I ask planning to narrow down drivable area?

maxime-clem on May 30, 2023 Collaborator

You can try to force the trajectory to stay closer to the centerline (by reducing the drivable area, or by tuning the `obstacle_avoidance_planner`), but I do not think it is a robust solution.

Ideally we want to reduce the lateral error but I am running out of ideas.
Here are a few more things you can check:

- Is there a significant delay in the data coming from Carla ? I know I already asked you to check the *control delay* (Autoware -> Carla), but there might also be a delay in the other direction (Carla -> Autoware) which could cause issues.
- Does running at a lower velocity produce the same lateral error ?
- Does running the simulation at a lower rate produce the same lateral error ? (I am not sure if you can control the simulation time

with Carla).

Robotics010 on May 31, 2023 Author

I've already tried to lower speed to 2 m/s and I still get the same lateral error.

Show 4 more replies

Robotics010 on May 26, 2023 Author edited

If you look at control_performance_analysis graphs you can see, that `Driving Status` / `current - desired steering tire angle` chart has `desired steering angle` (green color), which has even more angle, that `current steering tire angle` (red color). It means that lateral control has to turn even more sharply than it does now.
Am I understand it right? Does it mean that planning send such a trajectory with a sharp turn already?

↑ 1 1 reply

Robotics010 on May 27, 2023 Author edited

Well, no, that is indeed the control problem. If you look at lateral error from later_control diagnostic messages, then you can see, that there is the same big lateral error (1m). And it looks like the `desired steering angle` is derived from trajectory curvature and MPC does not minimize difference between current and desired steering tire angle directly.