

Scenario Dataset Creation using Matlab Automated Driving Toolbox

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Objectives

Scenario detection and recognition are important components of automated driving systems (ADS). They ensure safety, facilitate informed decision making, enable optimal planning and control, and enhance human interaction. The creation of a dataset containing information is crucial for the realization of an efficient driving scenarios recognition system.

Environment

MATLAB (Matrix Laboratory) is a high-level programming language and numerical computing environment used primarily for data analysis, visualization, and algorithm development.

To set up the necessary equipment to implement the scenarios, we relied on the **Automated Driving Toolbox** along with the **Driving Scenario Designer app**. Together, these two tools make it possible to:

- Design, simulate and test ADAS and ADS.
- Design of synthetic driving scenarios.
- Manual or programmatical creation of scenarios, adding roads, actors (vehicles, pedestrians, etc. etc.), and trajectories.
- Export the result as an OpenDRIVE or OpenSCENARIO file.

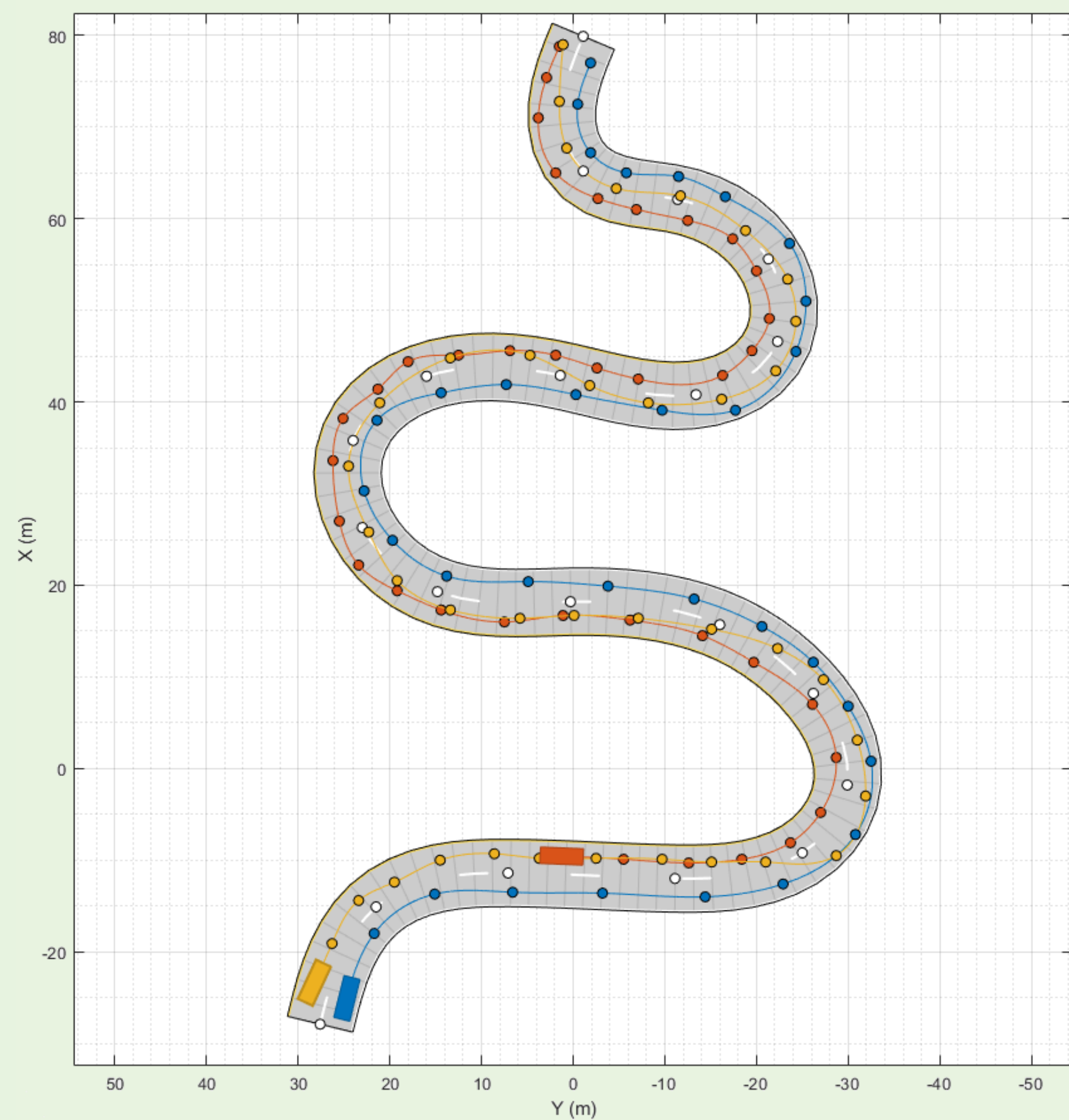


Fig. 1 - Example of Driving Scenario Designer application. This scenario consists of a road and three vehicles, each with its own trajectory, represented by the coloured dots along the road. The colours of the trajectory correspond to those of the vehicle.

Simulation

Simulation can be:

- Ego-centric (2D) from Driving Scenario Designer app.
- 3D using **Matlab Simulink**.

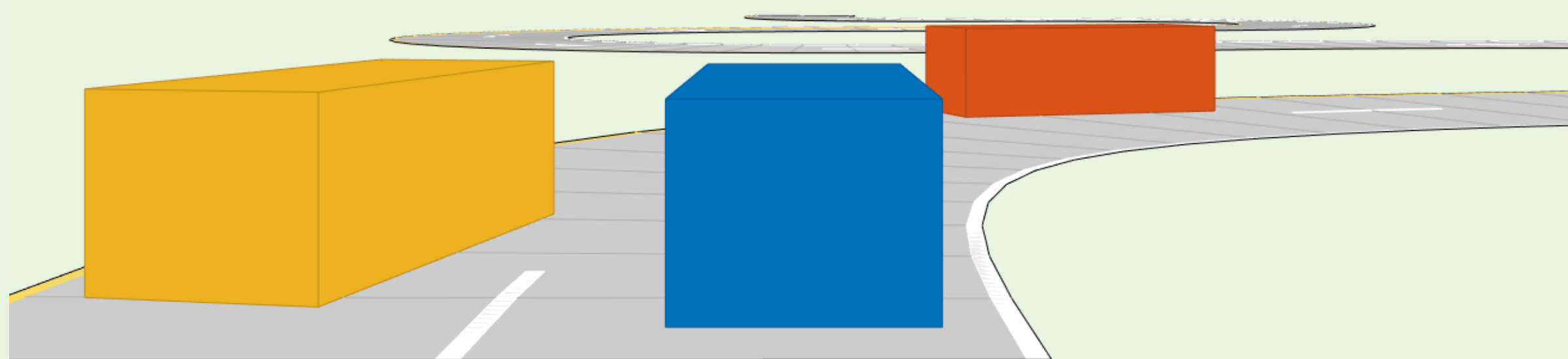


Fig. 2 - Ego-centric view (up) and 3D view (below)



Experiment

Our work is focused on the implementation of a **Driver Maneuver Intention Recognition (DMIR)** system. The DMIR relies on supervised ML techniques or Probabilistic approaches. Thus, the training phase requires an appropriate dataset and the synergy between Automated Driving Toolbox and the Driving Scenario Designer app is fundamental to the realization of such dataset.

We were able to efficiently implement a baseline use-case characterized by:

- Straight or Curve road.
 - If curved, different radii are taken into consideration. The curve can be left or right.
- Presence or absence of a leading vehicle.
- Different speed values.

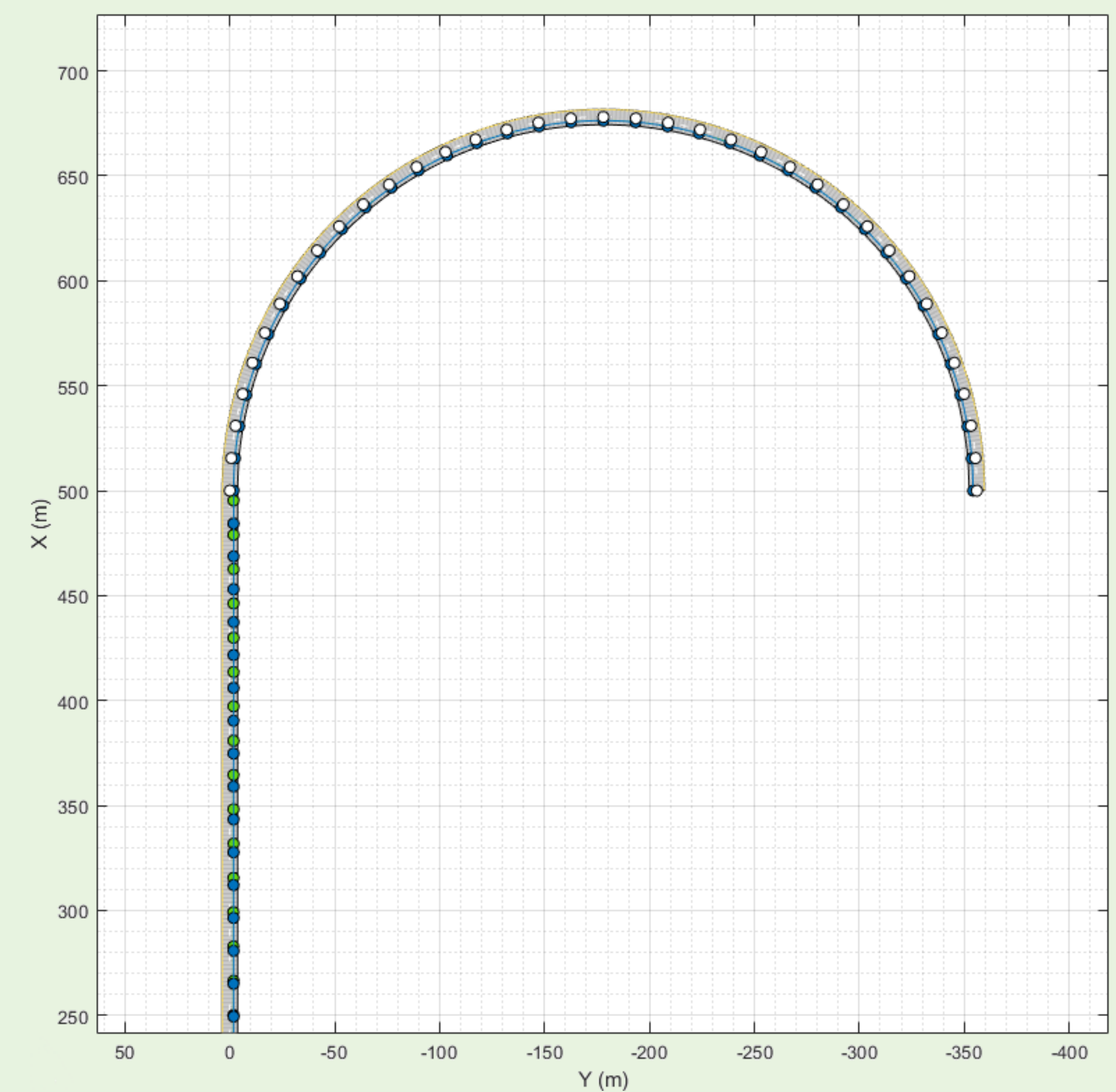


Fig. 3 - One of the adopted configuration for the dataset creation.

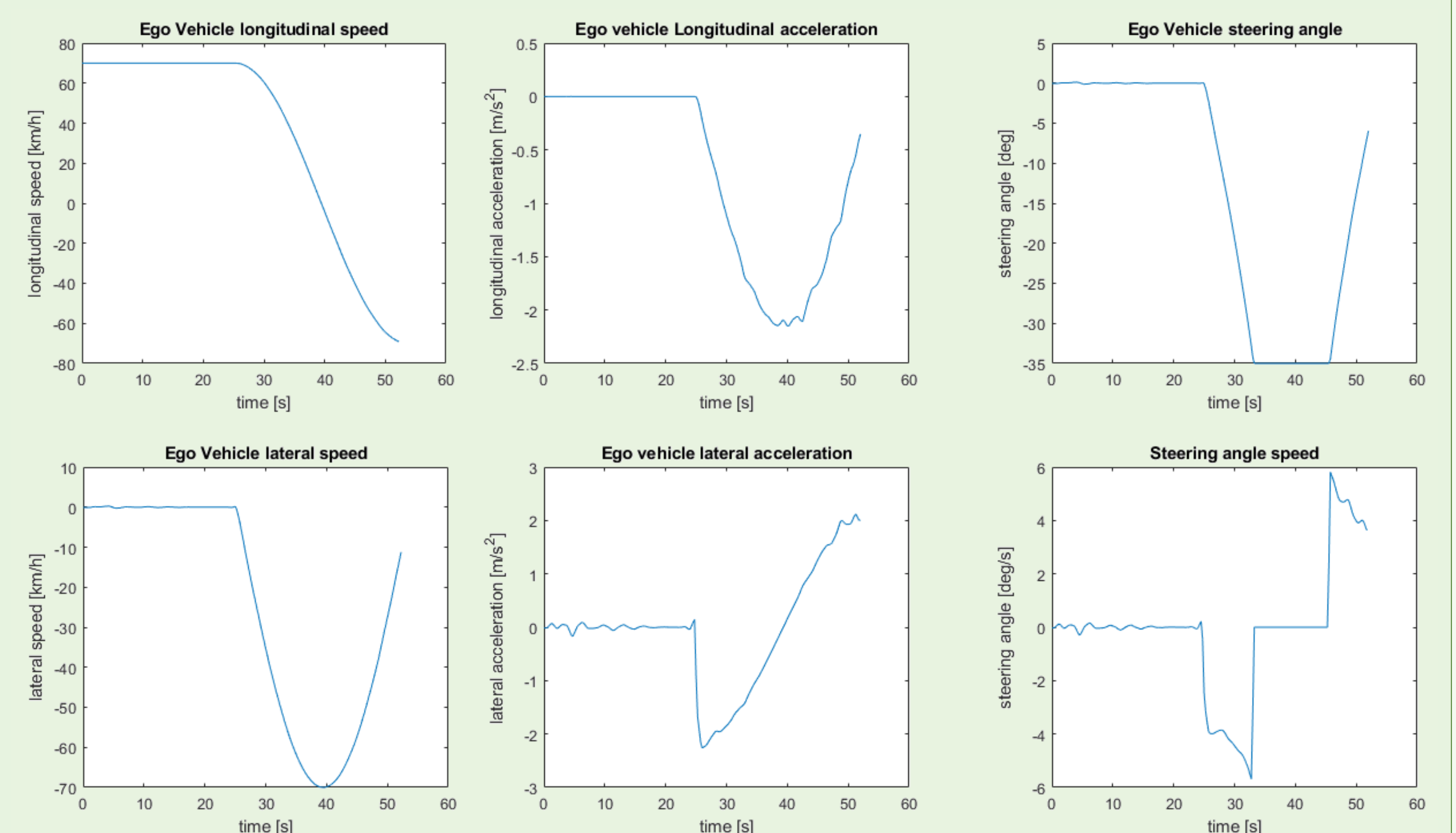


Fig. 4 - Is it possible to plot different variables. Here the trend of the most useful is shown

Future works

After the creation of the baseline, it is possible to programmatically implement other case scenarios, such as:

- Comfort overtaking
- Normal overtaking
- Hazardous overtaking

Based on the combination of vehicle speed and time headway. Alternatively, is it possible to exploit sensors like LIDAR and RADAR to implement scenarios for collision testing.