An Easy-to-use Interface for Human-vehicle Interaction Researchers to Create Simulations in CARLA Driving Simulator[1]

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Problems and Objectives

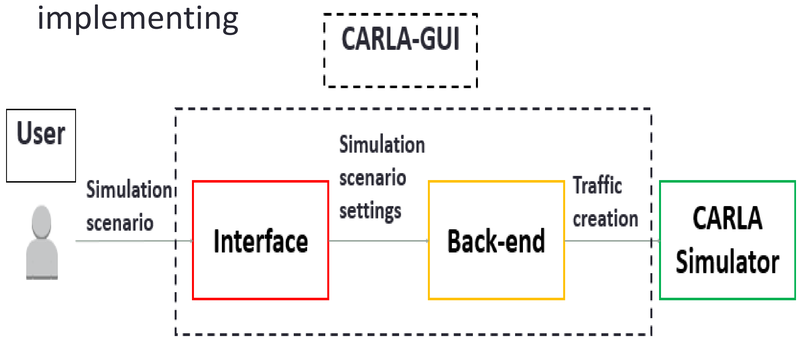
- Typical driving simulators use to study how people driver require the driving scenarios to be **programmed**.
- Vehicle behaviors in typical driving simulators also needs to be programmed, which involves **vehicle control knowledge**
- Human factors experts who conduct experiments of how people drive are often **not expert programmers**
- Even for expert programmers, writing code to specify what happens in experiment **takes too long**, so an **alternative** method to specify what happens in a driving experiment is **needed**.
- Therefore, we create an **experimenter interface (GUI)** for common urban and freeway experimental scenarios for the CARLA simulator

Design Steps

- Paper prototypes (to get quick consensus on ideas)
- PowerPoint simulations (to consider transitions and screen arrangement)
- Ask user feedback based on PowerPoint simulations and improve design

Implementation method

- Separate Interface (GUI) and back end when implementing



Implementation Method

Fig: The left-bottom figure shows the process of designing driving scenario with the GUI. The **Interface** accepts user input, feds the inputs into the **Back-end** and then create **simulation**.

Interface Features

Principles involved in interface design:

- Use consistent style for both **urban and freeway**
- Use clickable objects
- Use **color-coding** to separate item
- Standard arrangement, labels on left column, options on right

Fig: Interface for editing traffic light settings in **urban** scenario. Use color to separate lights.

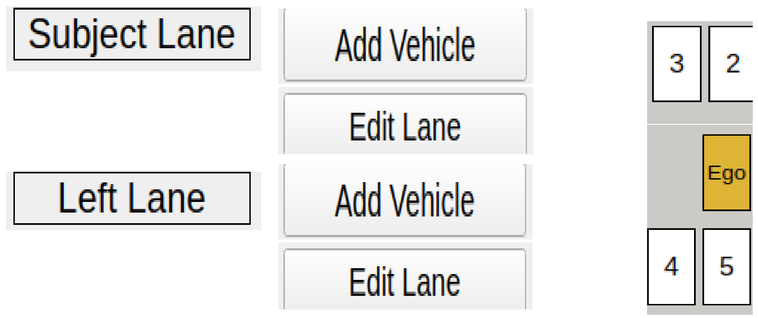


Fig: Interface for adding vehicle in **Freeway** scenario. Rectangles to the right represent vehicles. User can click on these rectangles to edit vehicle setting.

Back-end Features

freeway simulation

Urban simulation

- All scenarios – initial gap, max speed, safety distance and vehicle color can be specified for each vehicle
- Freeway – vehicle can change lane, vary speed or keep constant distance with respect to the ego vehicle (white vehicle in the figure above)
- Urban – up to 4 vehicles that respond to an individually programmable traffic light (green, yellow, red duration). 4 lights each intersection for up to 4 intersections.

Other vehicle maneuvers at intersections include stop before crosswalk (left), penetrate intersection somewhat, turn left/right, or go straight, including running lights

stop

penetrate

For more detail about back end function, see the back-end documentation[2]

References

1. CARLA simulator: https://carla.org/
2. Back-end document: https://carla-gui.readthedocs.io/en/latest/
3. Project link: https://github.com/CenturyLiu/Carla-GUI