

4th Home Assignment – Simulation

Autonomous Vehicle – Adaptive Cruise Control

We are currently in the design phase of adopting Adaptive Cruise Control to our intelligent buses. As an early prototype, we are planning to use vehicles with safety drivers. Initially, these drivers can turn on the ACC if they decide that the traffic conditions are appropriate. If the ACC is turned on, then the vehicle is responsible for maintaining a controlled speed.

High-level design

Currently we are working with the following architecture for the ACC component. The sensors work as designed previously. The driver uses switches and buttons to command the ACC, and the ACC Commander is responsible to transmit these commands. Finally, the ACC is connected to the Engine Controller to accelerate or decelerate the car. Figure 1 summarizes these blocks.

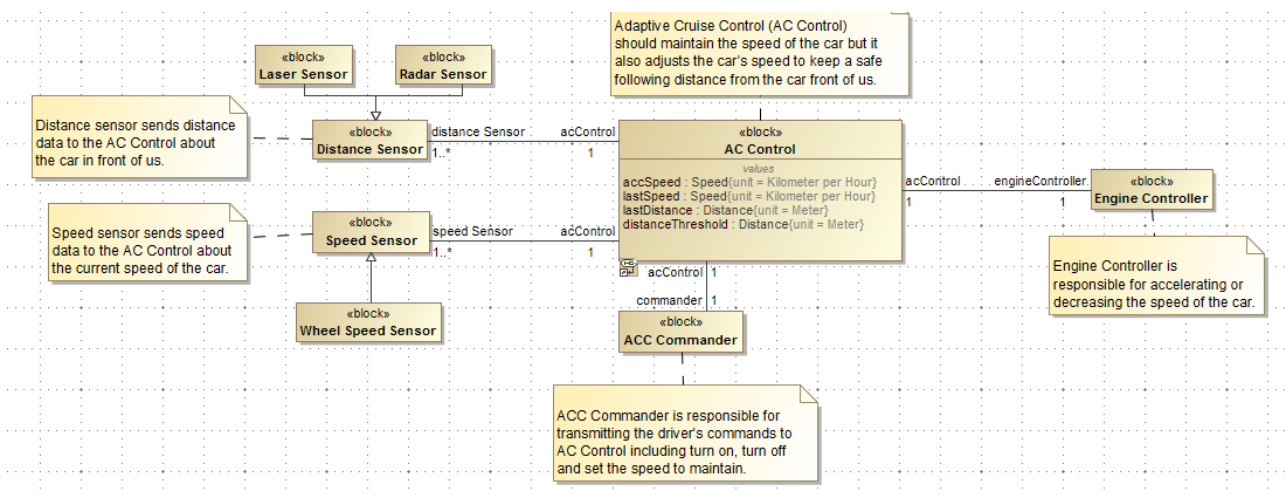


Figure 1: Blocks responsible for adaptive cruise control

The senior system engineers have already created a model of the AC controller's internal behaviour. The model is located at *ACC Evaluation / System*.

Environment model

The goal of this assignment is to perform simulation in order to determine whether the AC Controller is designed correctly. In order to simulate the environment our engineers have created a simple model that can calculate the speed of our vehicle based on the instructions sent to the *Engine controller* and report the speed back to the *AC Control* component. The environment model is located at *ACC Evaluation / Simulation / Components / Environment*. Unfortunately our engineers do not have any expertise in SysML or simulation and their model contains many elements described in natural language.

Tasks

Your job is to simulate the AC Controller.

- Replace the natural language elements of the environment model with SysML components that can be parsed and simulated automatically.
- In order to ensure the environment model can now be simulated, run a simulation on the model alone, invoking events manually. The simulation should cover all states and transitions of the model. Document the input sequence, the visited states and the result.
- Create new diagrams and components necessary to simulate the AC controller together with the environment model. You can use a simple Activity diagram to represent the driver turning the ACC on.
- Run simulation with the following initial conditions for 60 seconds.
 - The initial speed as well as the target speed is 50 km/h.
 - The initial speed is 45 km/h and the target speed is 50 km/h.
 - The initial speed is 55 km/h and the target speed is 50 km/h.
- (for extra IMSc credits) Based on the simulation results, propose a way to improve the AC controller.