LET'S STAY CONNECTED!

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Team Manager

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Technical Manager


Safety
First !

Current Situation

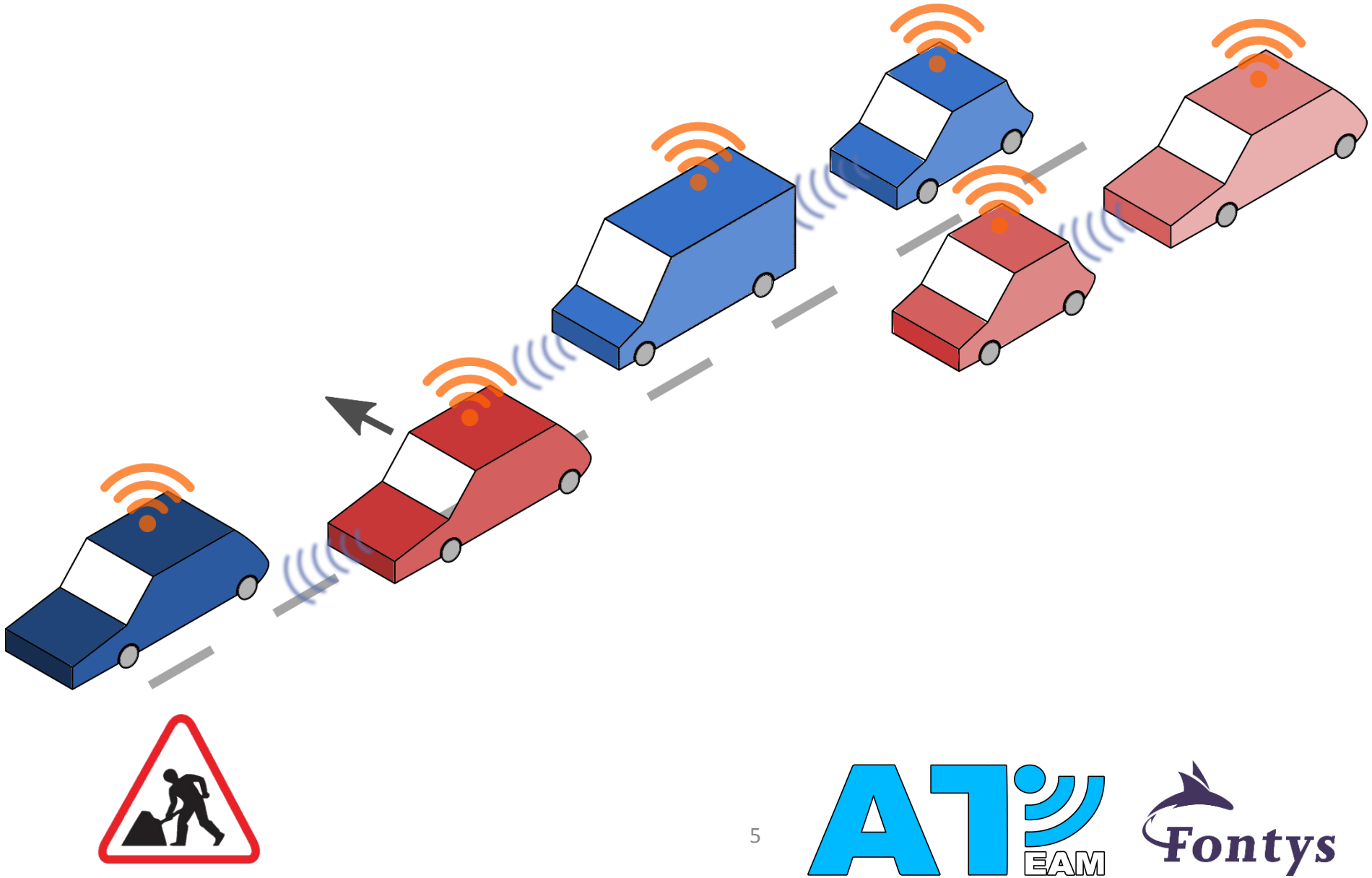
Source: University of Nagoya, Japan

Grand Cooperative Driving Challenge

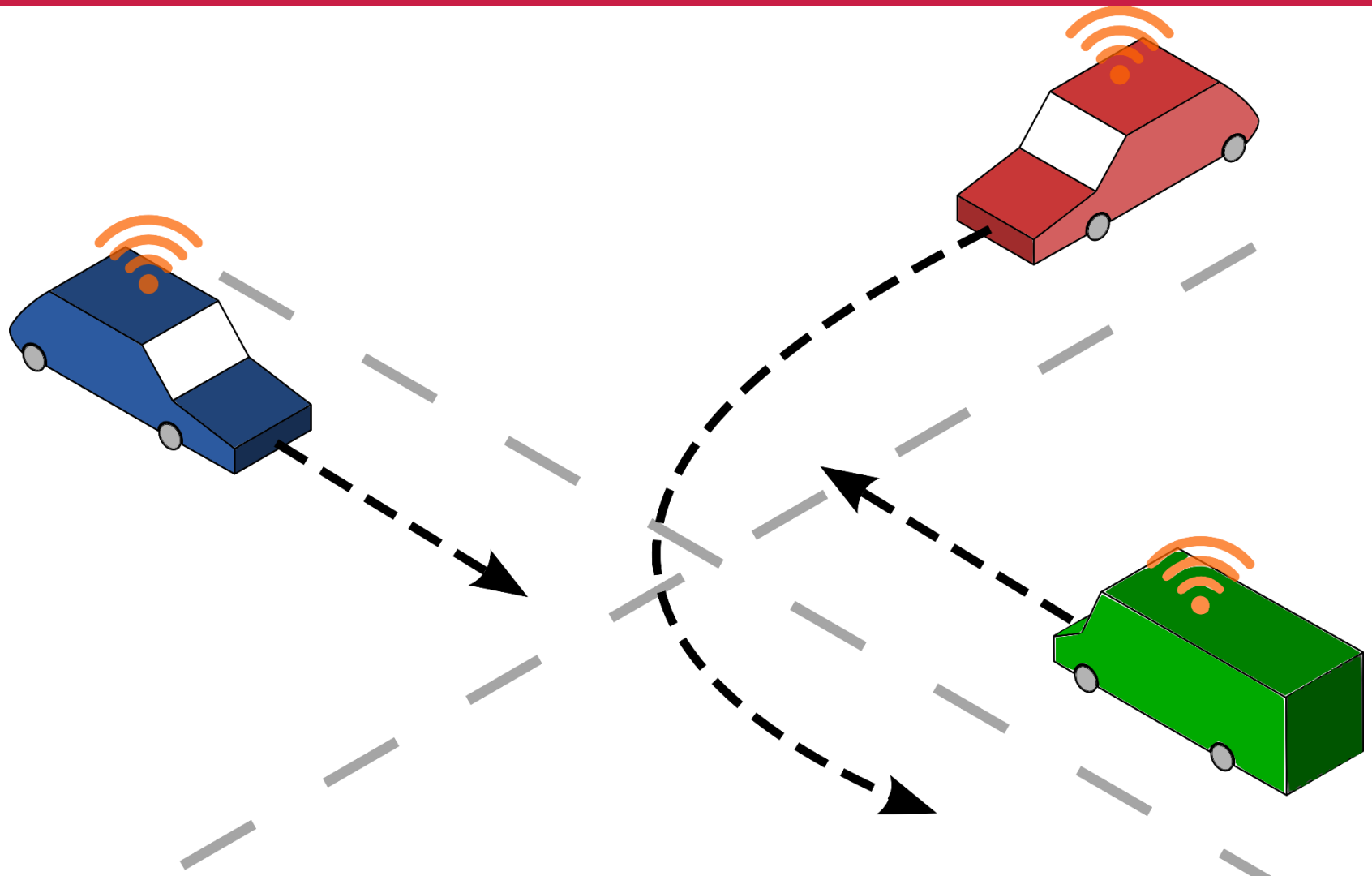
- Teams from across Europe
- Three scenarios
- Cooperative Driving

28-29 May 2016

Scenario 1 – Highway Platooning

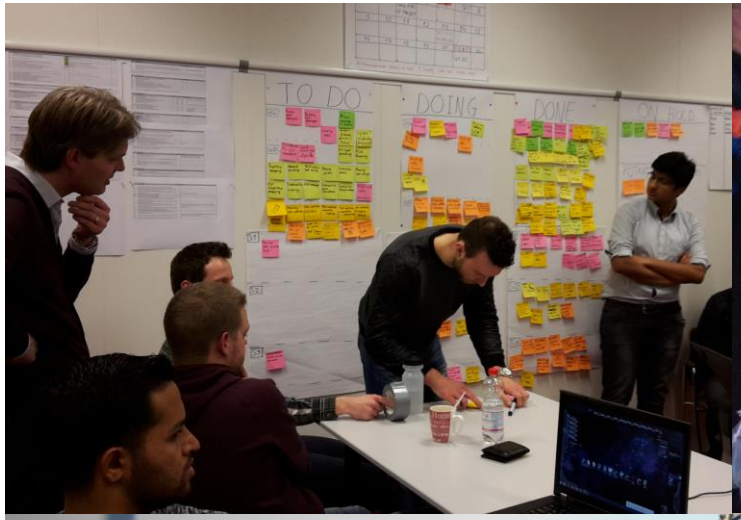


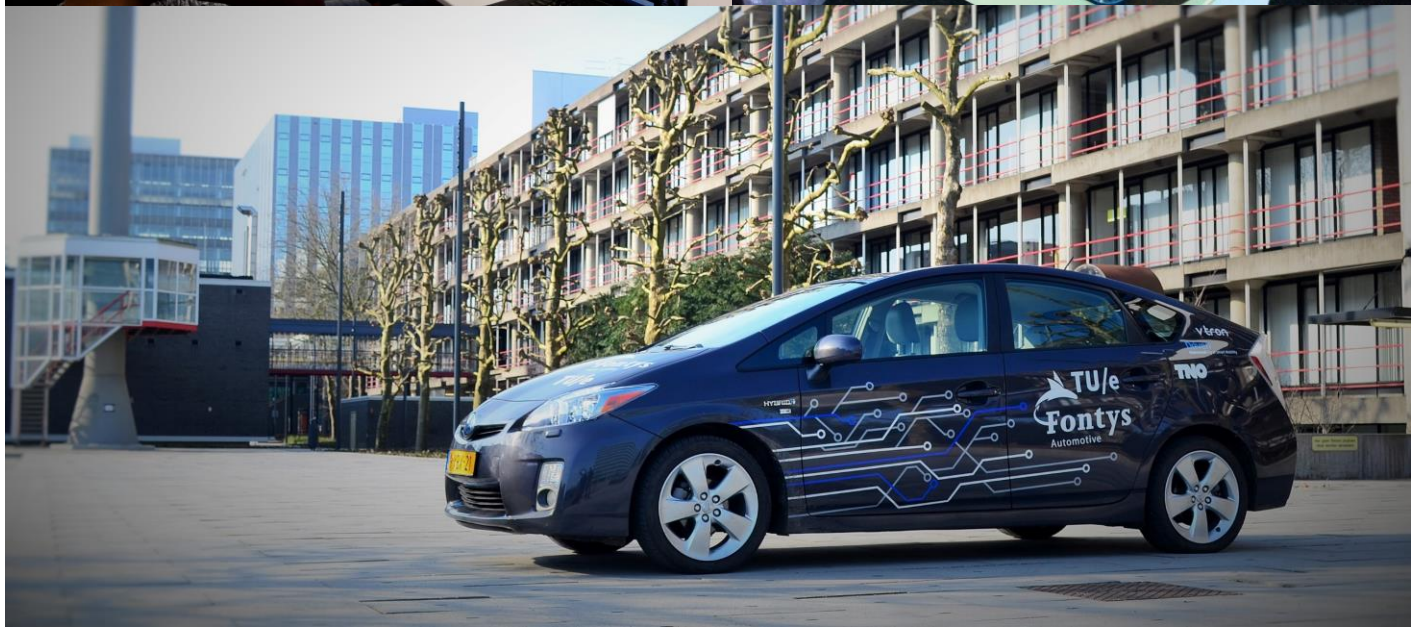
Scenario 2 – Intersection



Scenario 3 – Emergency Vehicle

Our Goals





- Take part in GCDC
- Win the GCDC
- To serve education
- Scientific output
- Technology promotion
- Get the minister in the car

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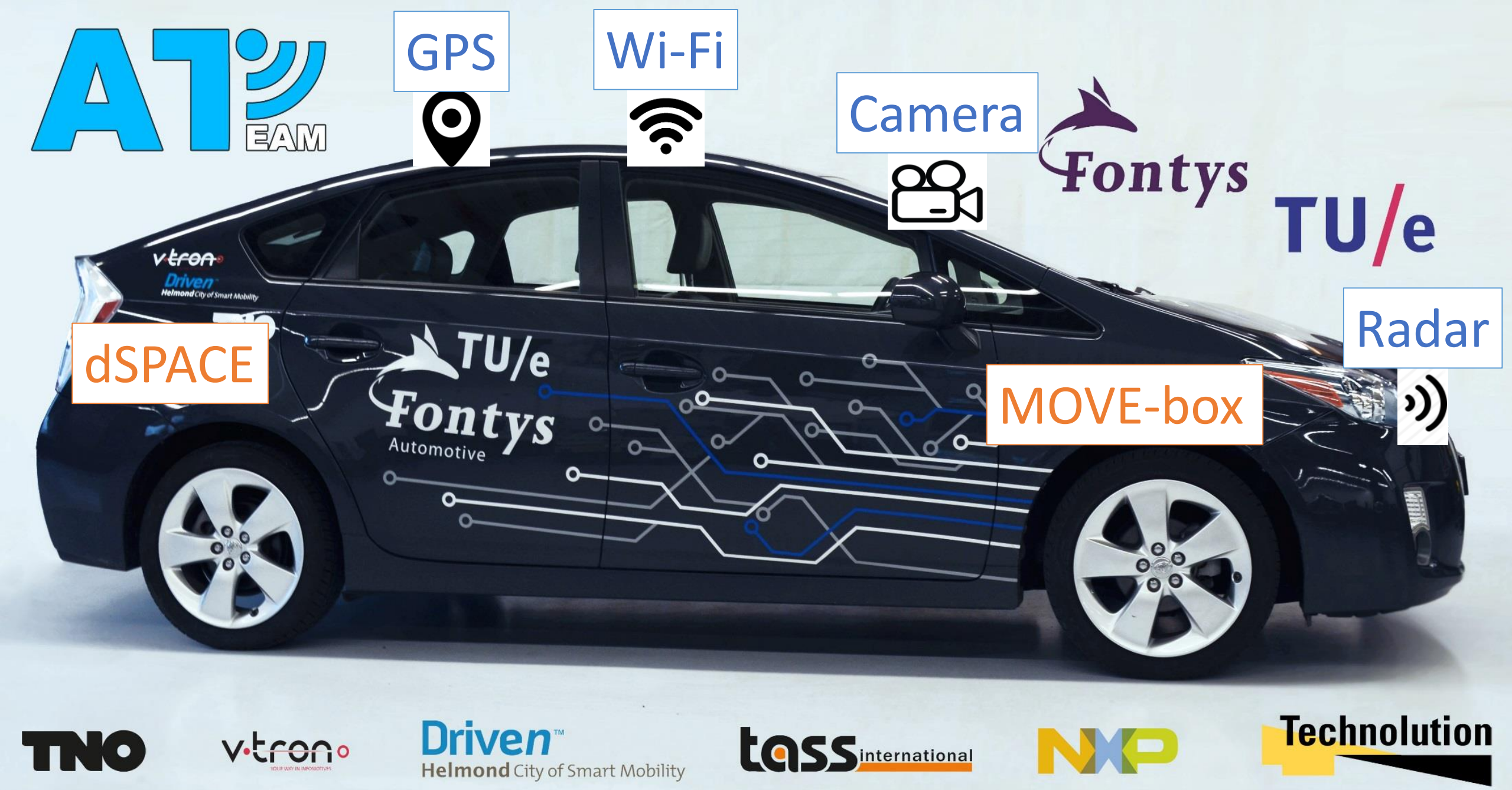
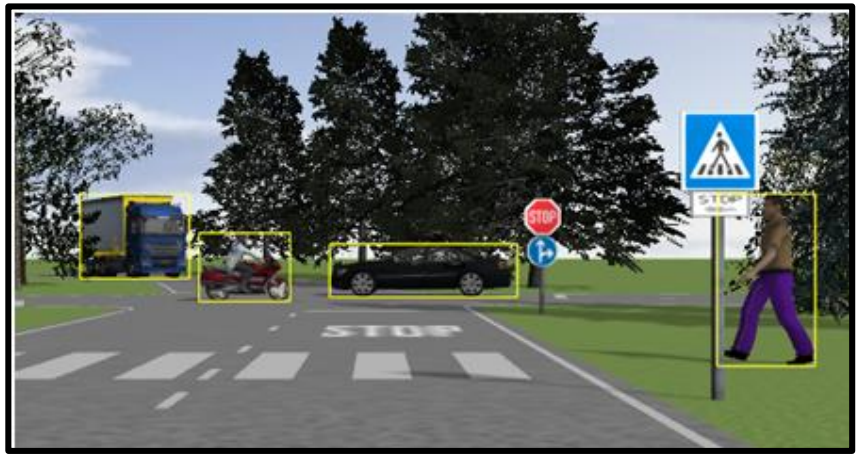
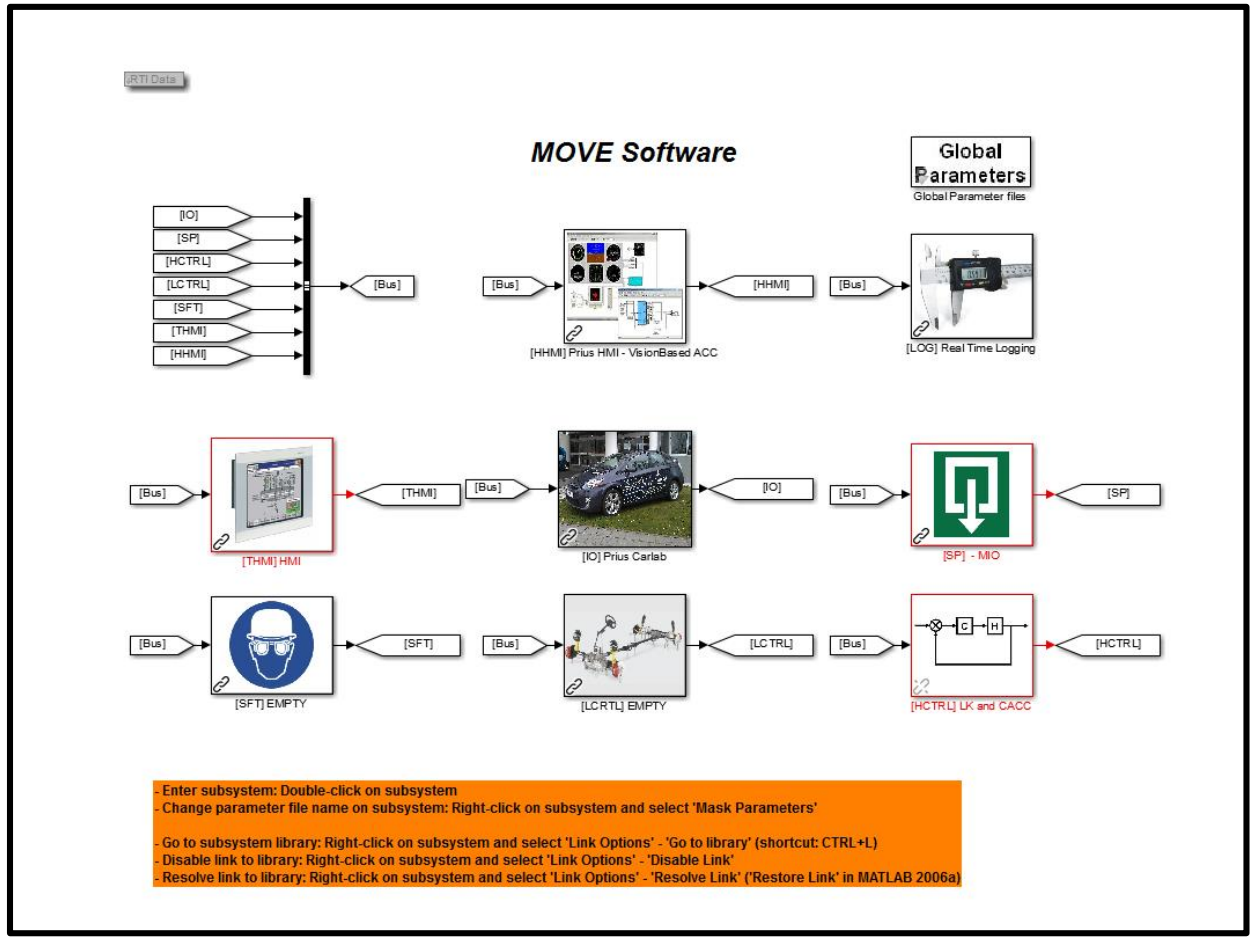
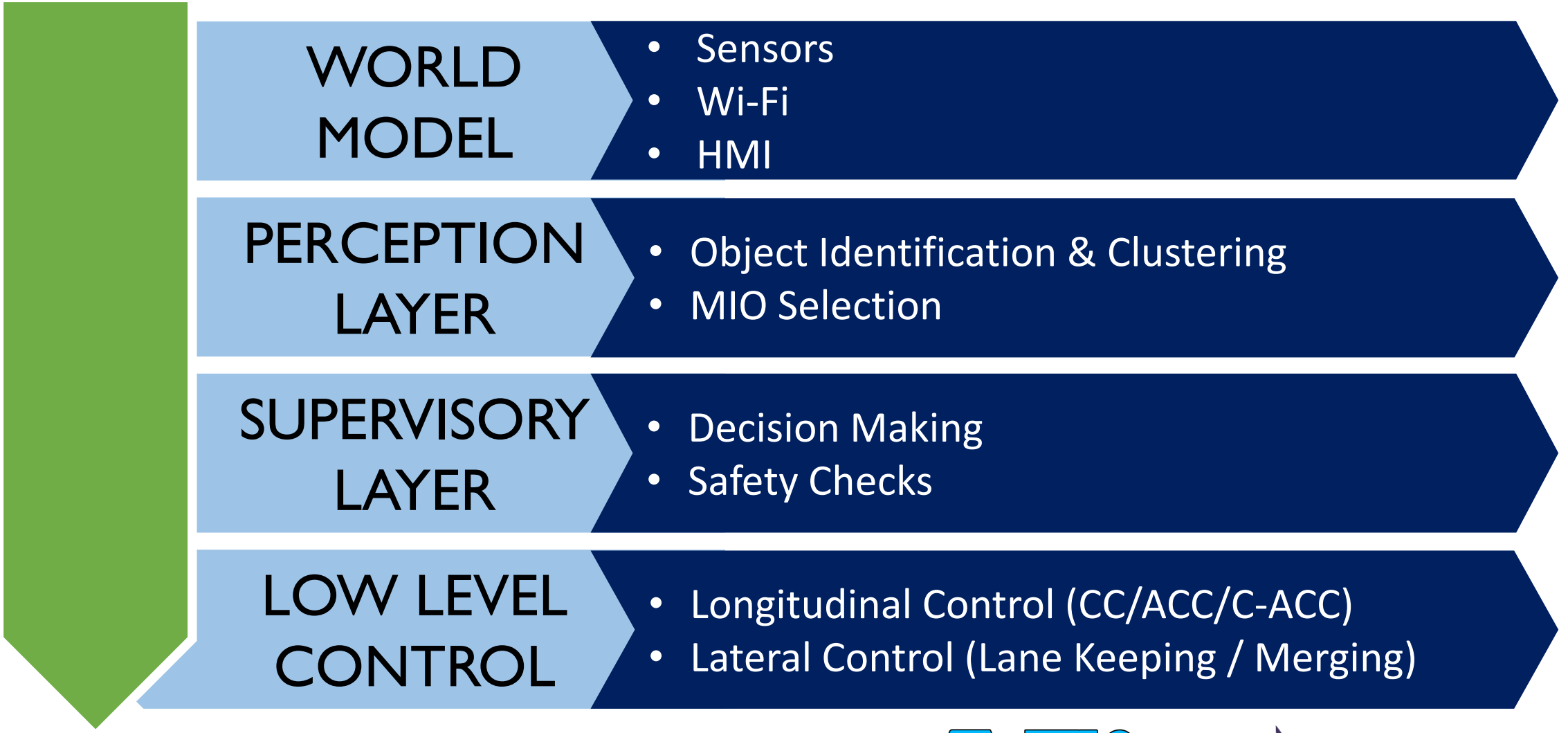

ATシ EAM
GPS
Wi-Fi
Camera
Fontys
TU/e
Radar
dSPACE
MOVE-box
v-tron
Driven
Helmond City of Smart Mobility
TU/e
Fontys
Automotive
TNO
v-tron
Driven™
Helmond City of Smart Mobility
tass international
NXP
Technolution
www.ateam-eindhoven.nl

Software

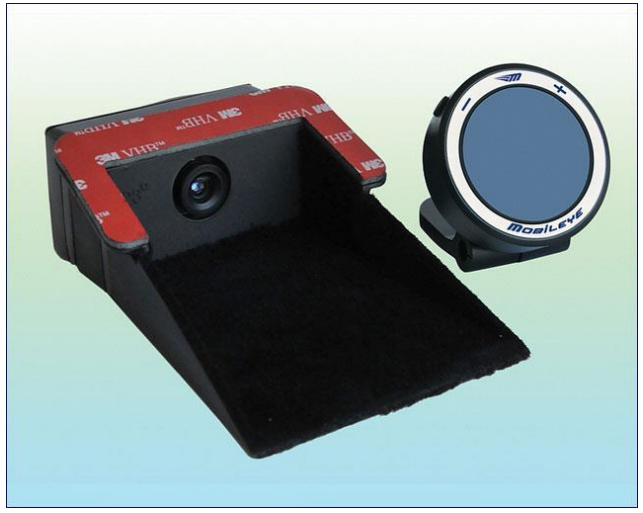

STOP


ControlDesk NG Project: Project_CAN Experiment: Monitoring, Logging, Replay
Signal Generator
Signal Form
Frequenz
Amplitude
Offset
rectangle
Sine
Addition
Pulse
Noise


MOVE Software
Global Parameters
Global Parameter files
[IO]
[SP]
[HCTRL]
[LCTRL]
[SFT]
[THMI]
[HHMI]
[Bus]
[HHMI] Prius HMI - VisionBased ACC
[LOG] Real Time Logging
[THMI] HMI
[IO] Prius Carlab
[SP] - MIO
[SFT] EMPTY
[LCRTL] EMPTY
[HCTRL] LK and CACC
- Enter subsystem: Double-click on subsystem
- Change parameter file name on subsystem: Right-click on subsystem and select 'Mask Parameters'
- Go to subsystem library: Right-click on subsystem and select 'Link Options' - 'Go to library' (shortcut: CTRL+L)
- Disable link to library: Right-click on subsystem and select 'Link Options' - 'Disable Link'
- Resolve link to library: Right-click on subsystem and select 'Link Options' - 'Resolve Link' ('Restore Link' in MATLAB 2006a)

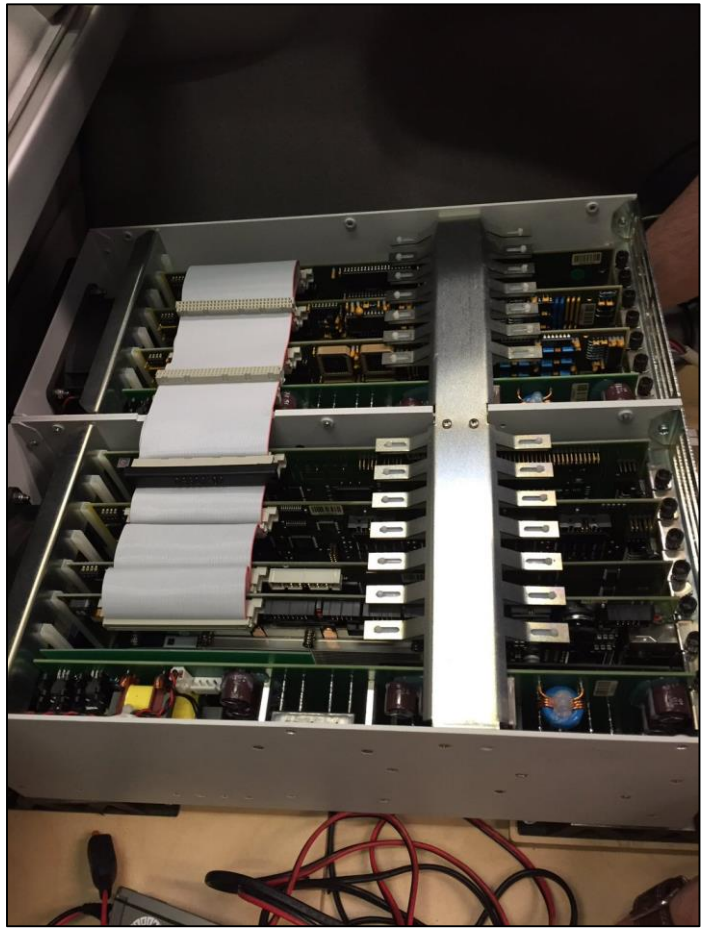

WORLD MODEL
• Sensors
• Wi-Fi
• HMI
PERCEPTION LAYER
• Object Identification & Clustering
• MIO Selection
SUPERVISORY LAYER
• Decision Making
• Safety Checks
LOW LEVEL CONTROL
• Longitudinal Control (CC/ACC/C-ACC)
• Lateral Control (Lane Keeping / Merging)

World Model



MobilEye Camera

Wi-Fi Module



dSPACE box

Radar

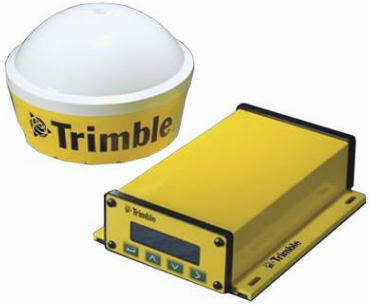
Sensors

Specifications:-

1) Radar
   - 76 GHz millimeter wave radar
   - Range 150 m
   - Angle 20 deg (each side)

2) Camera (MobilEye)
   - Full resolution- 752 X480
   - Frame Rate- 60fps

3) V2V & V2I (GPS and Wi-Fi)
   - GPS- Trimble (Differential GPS)
   - Wi-Fi P



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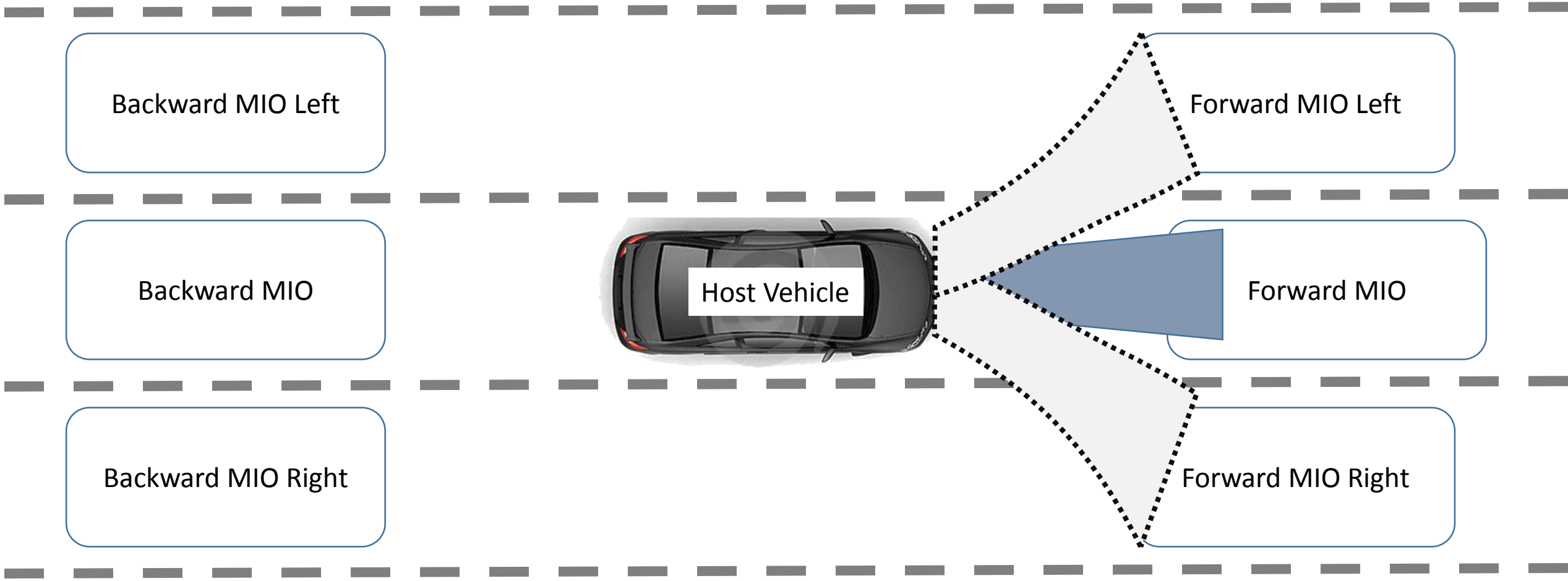
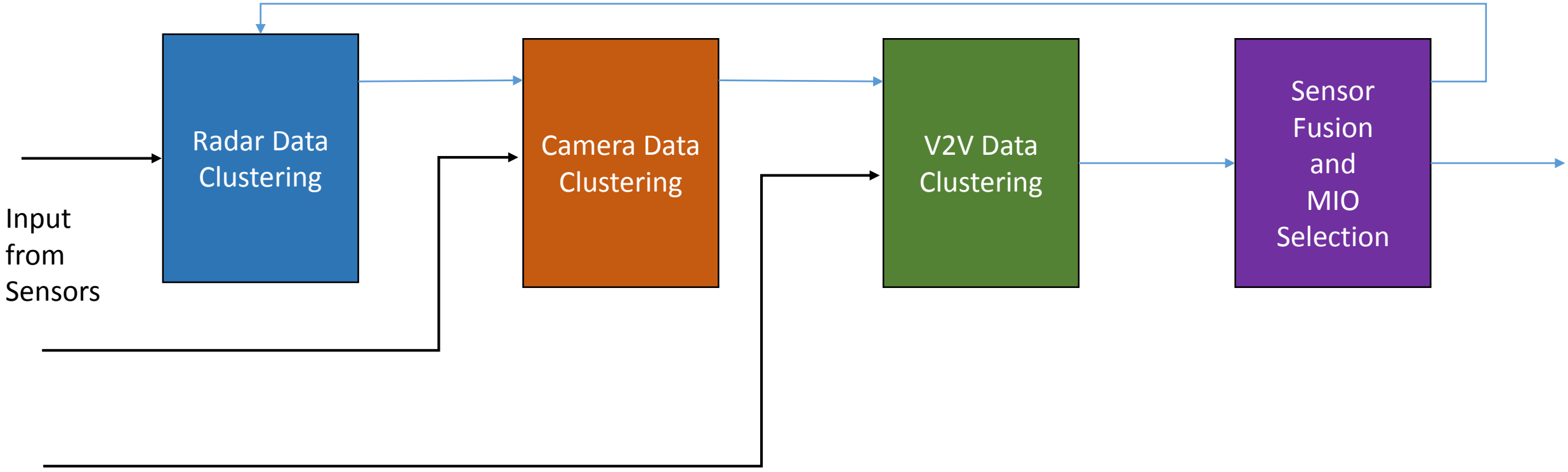
Perception Layer



Object Identification and Clustering

Cascading Filter

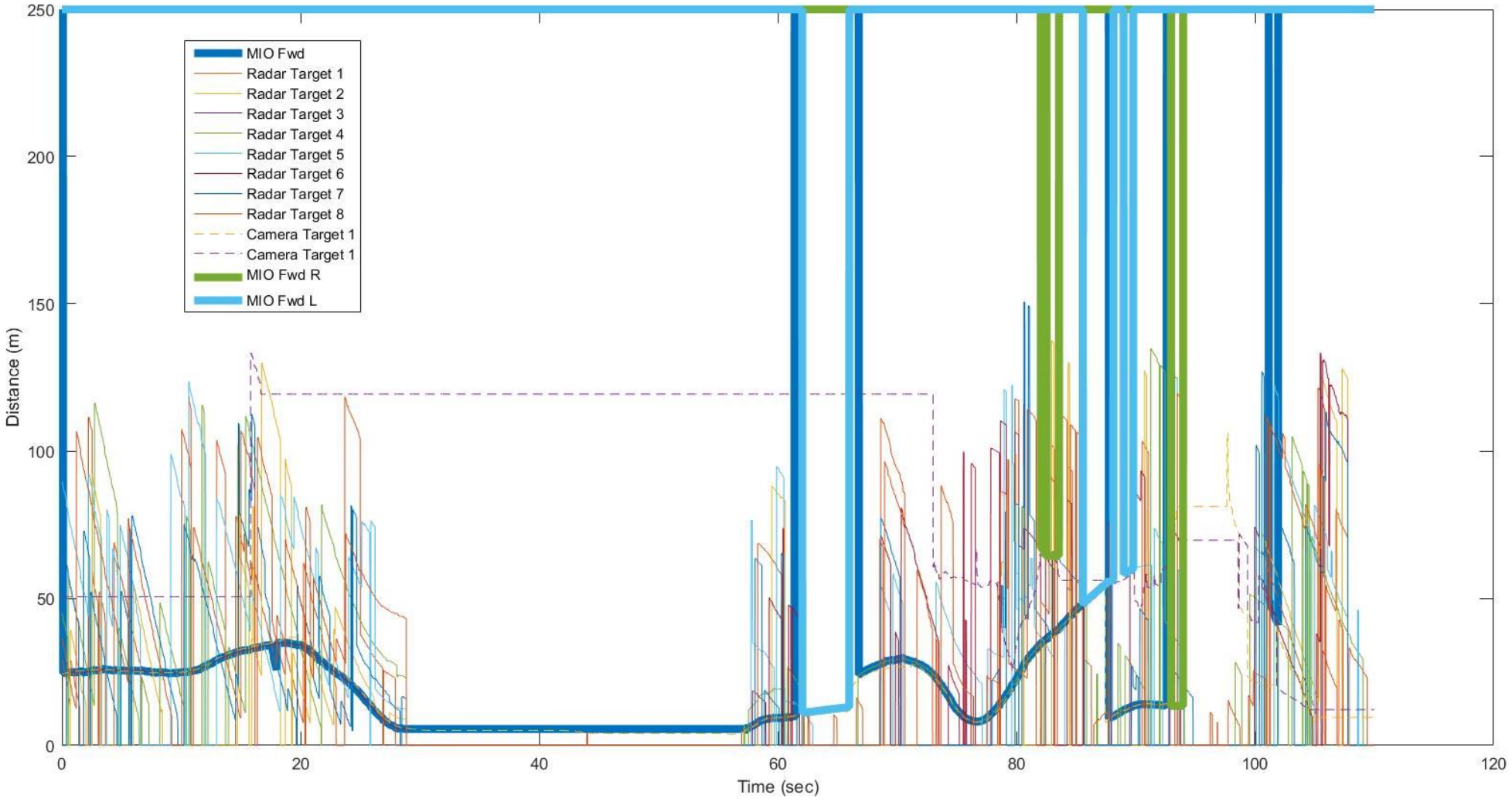


Sensor Fusion

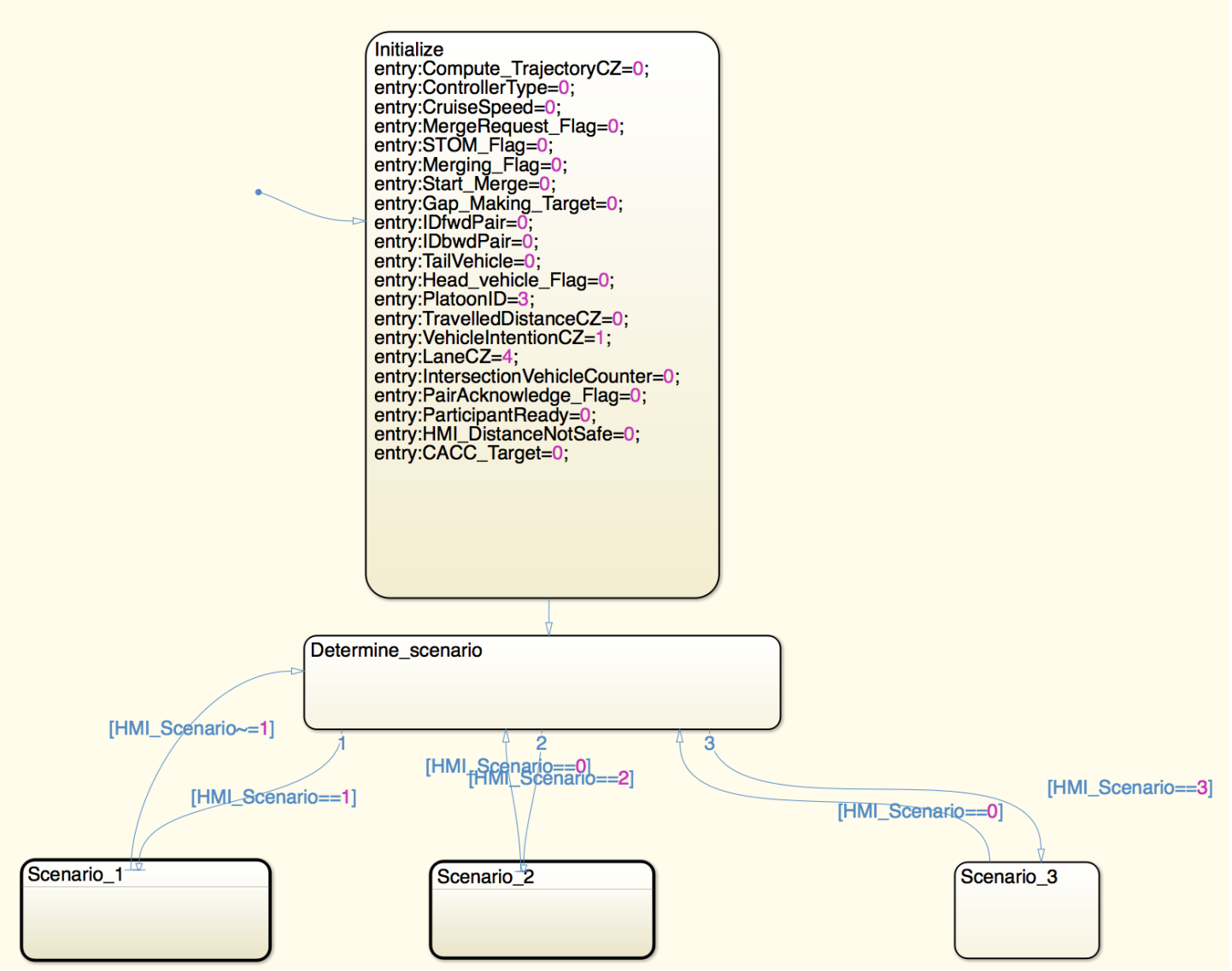
- Bundling of Radar, Camera and V2V data & Data mode determination
- Confidence Bounds
- Radar most more precise in longitudinal
- Camera more precise in lateral
- V2V used as feedforward and tracking vehicles behind
- Minimal Kalman Filtering

Determining MIO

- FWD MIO- all data modes
- BWD MIO- Wi-Fi


MIO Fwd
Radar Target 1
Radar Target 2
Radar Target 3
Radar Target 4
Radar Target 5
Radar Target 6
Radar Target 7
Radar Target 8
Camera Target 1
Camera Target 1
MIO Fwd R
MIO Fwd L
Distance (m)
Time (sec)
0
50
100
150
200
250
0
20
40
60
80
100
120

Supervisory Layer



- Decision maker
- Safety checks
- State flow diagram

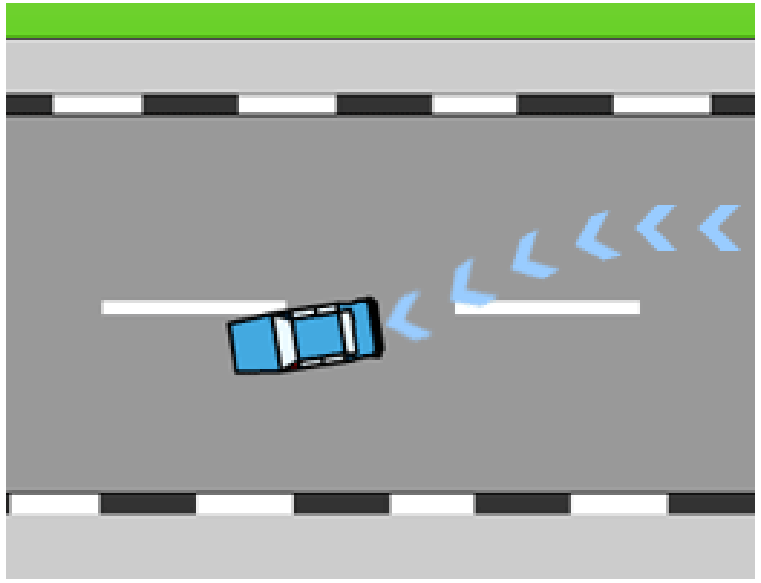
Low level Control

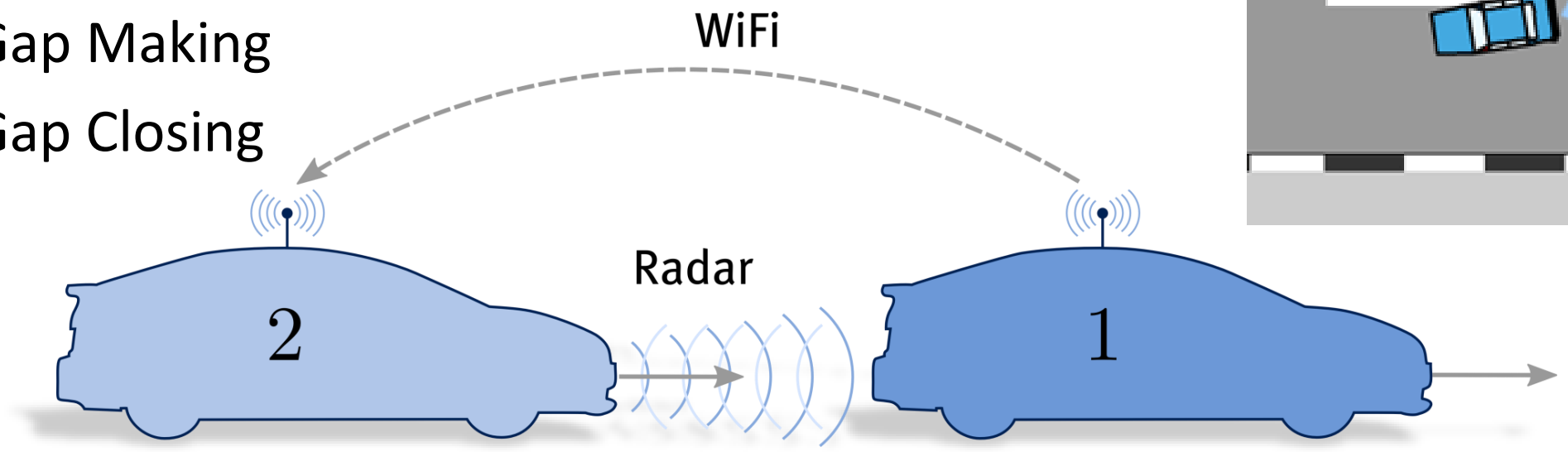
Longitudinal Control

- Cruise Control (CC)
- Adaptive Cruise Control (ACC)
- Cooperative-ACC
- Gap Making
- Gap Closing

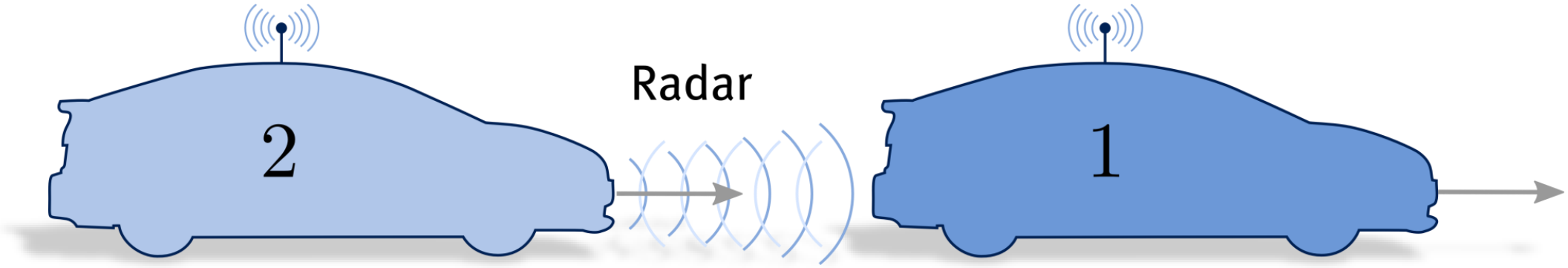
Lateral Control

- Lane Keeping
- Merging





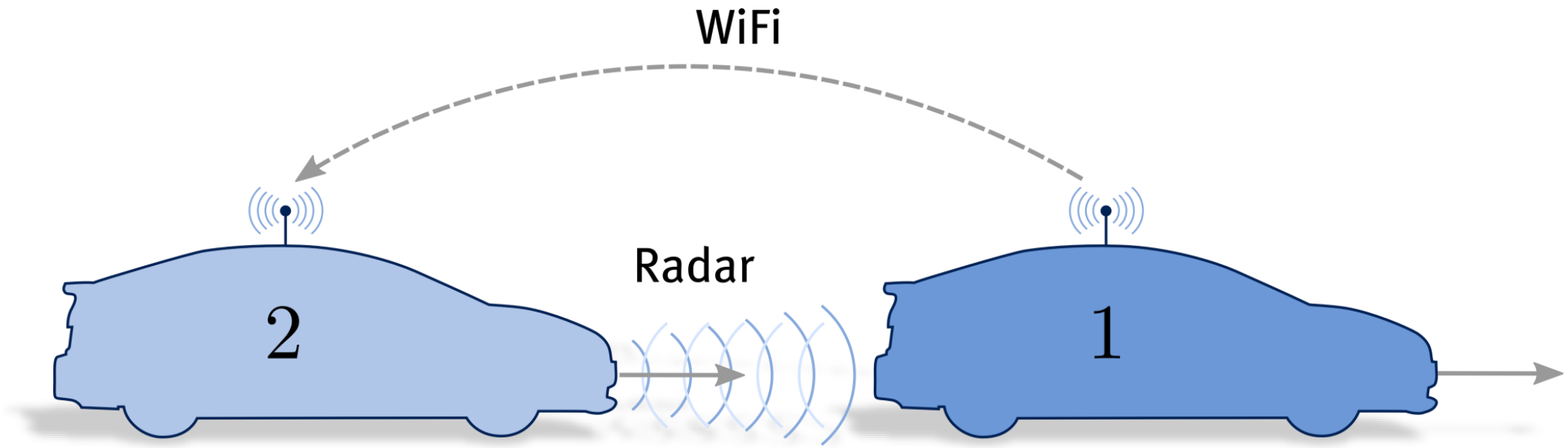
Adaptive Cruise Control (ACC)



Adaptive Cruise Control (ACC)

Radar: **Reactive => Phantom Traffic Jams**

Cooperative-ACC



Adaptive Cruise Control (ACC)

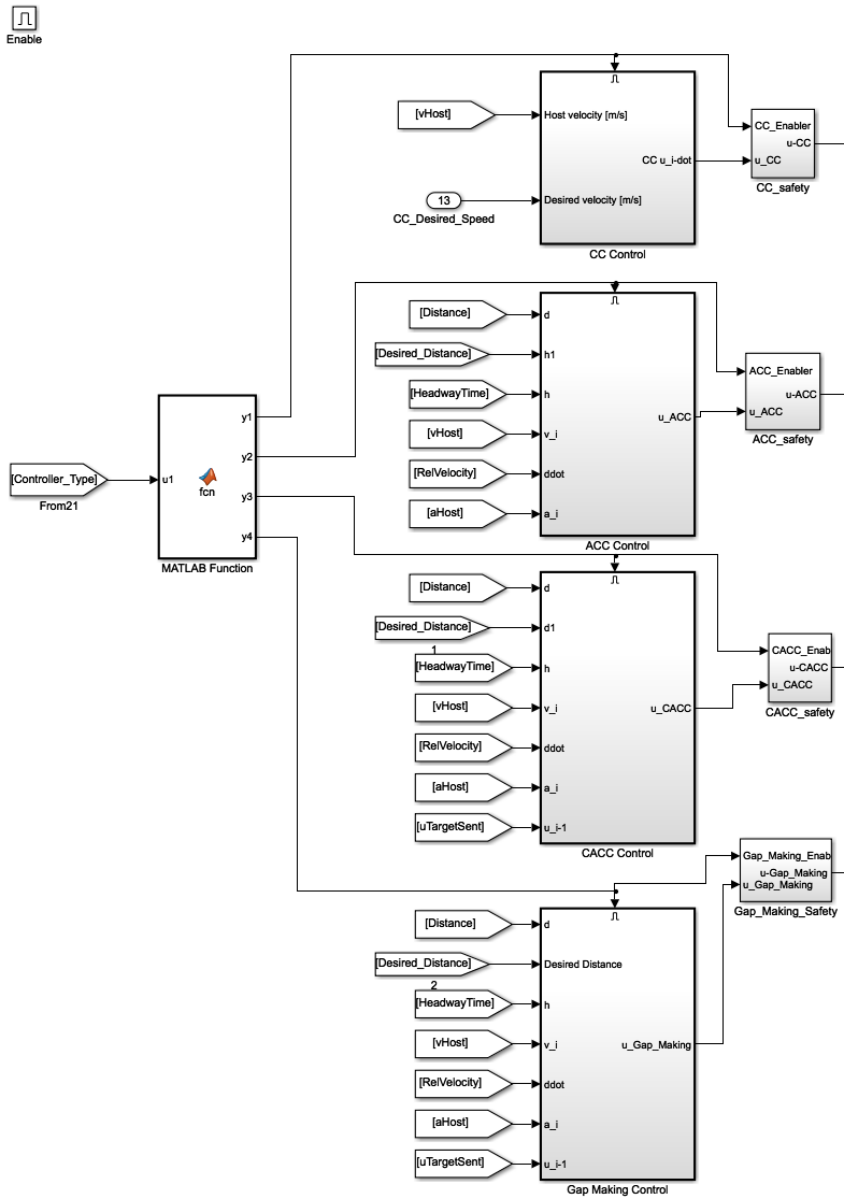
Radar: **Reactive**

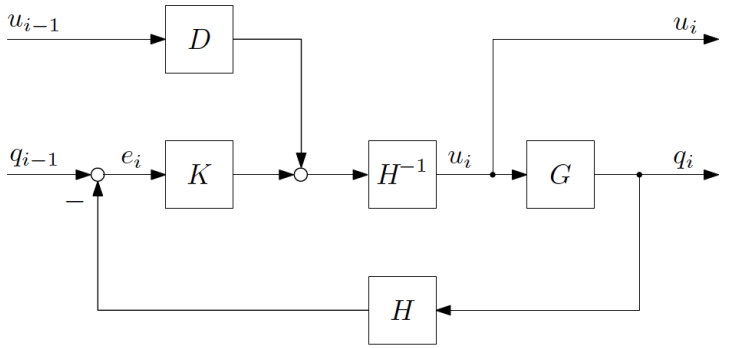
Cooperative Adaptive Cruise Control (C-ACC)

Radar + Wi-Fi-communication: **Proactive**

Cooperative Driving

Longitudinal Control

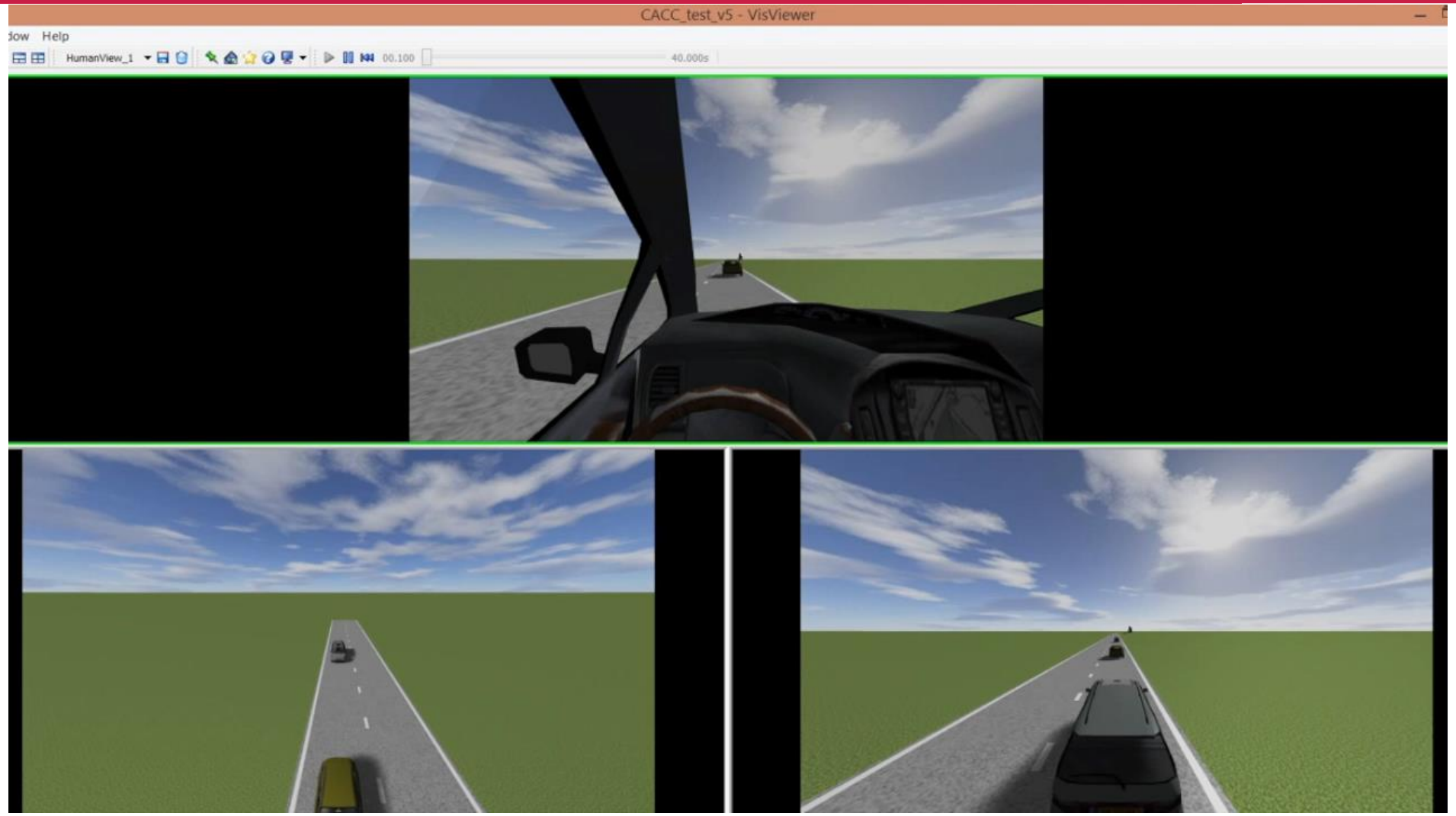




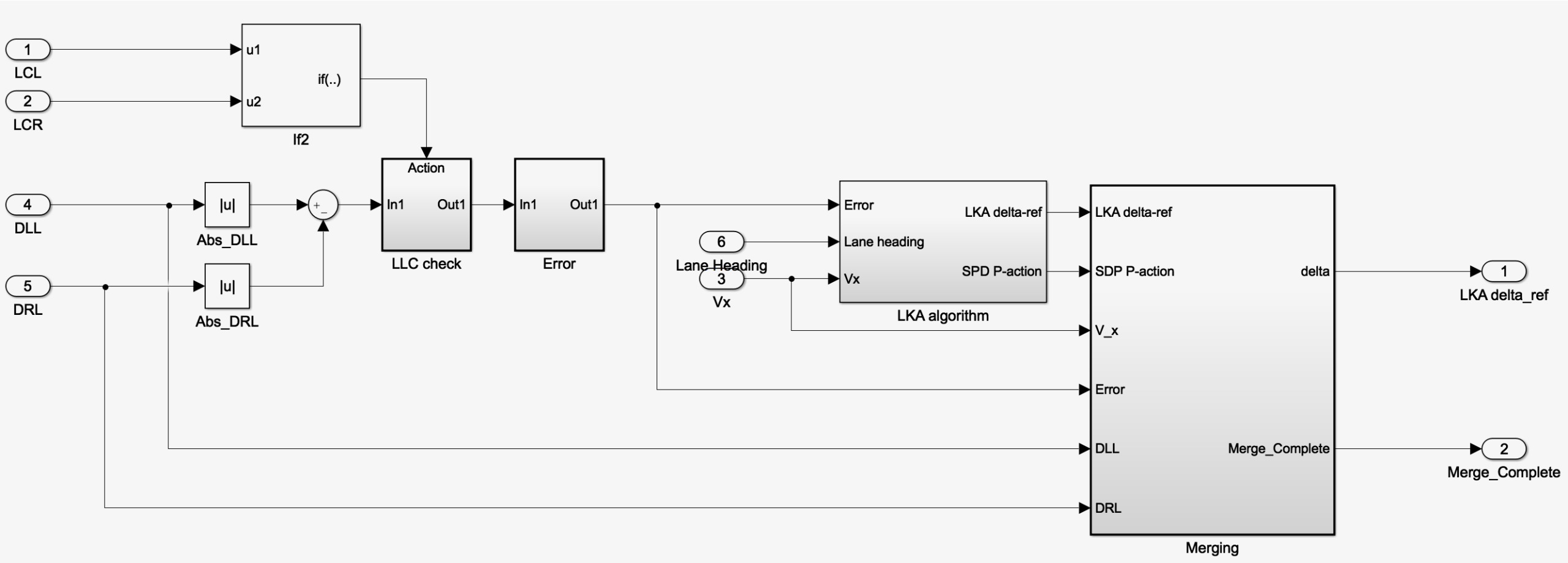
https://www.dropbox.com/s/854cctyfcv707ft/Ploeg2014%20-%20Analysis%20and%20design%20of%20controllers%20for%20cooperative%20and%20automated%20driving.pdf?dl=0

- Spacing Policy
  - Desired distance (r + h*v)
  - Error in distance
  - Error in velocity
- PD Controller
- Desired Acceleration

PreScan Simulation

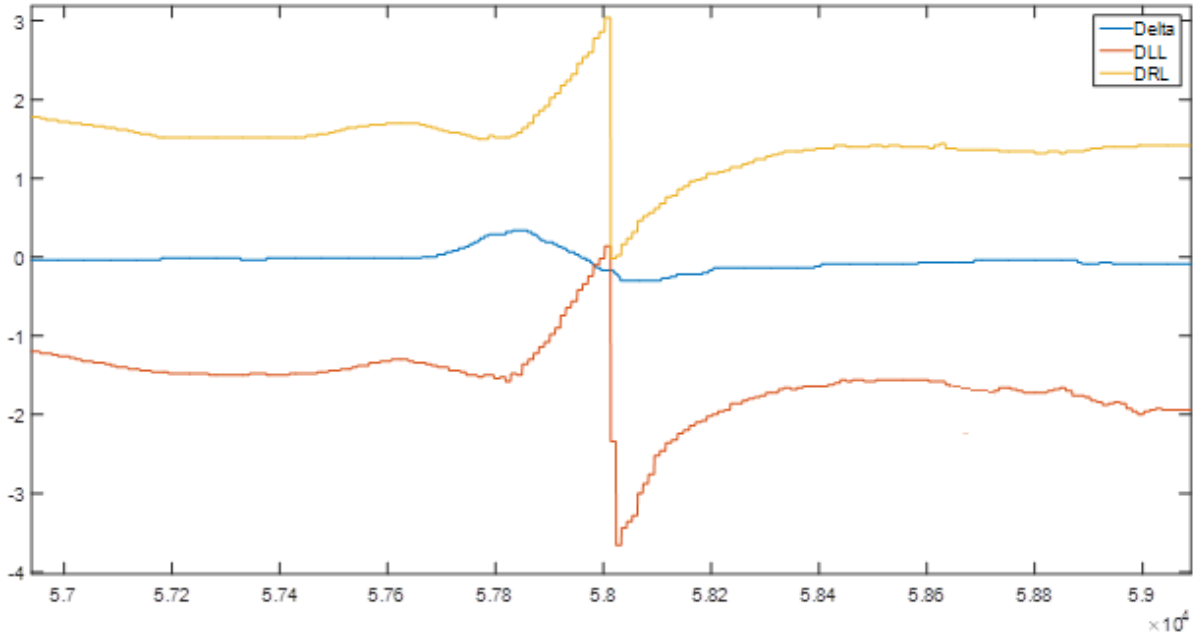


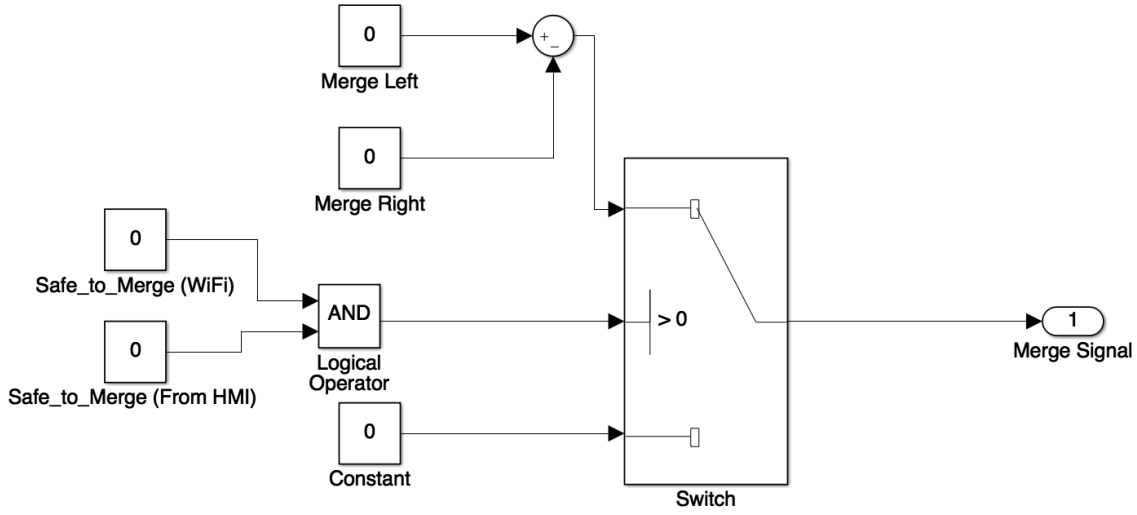
Lane Keeping

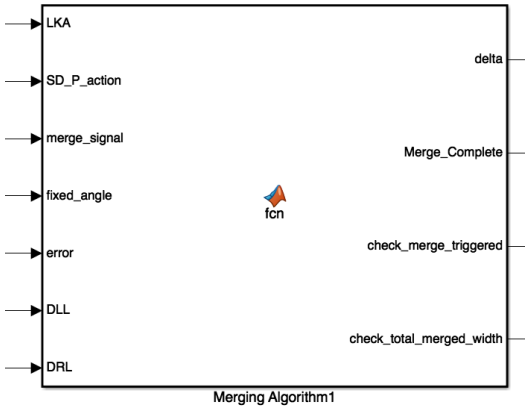


Lane Keeping

Distance to left/right lane (DLL/DRL) and steering angle (Delta)







Prius in Action

Prius in Action

Thank you for your attention!

28-29 May