El cotxe autònom a les competicions de *formula student*

OUR PAST AND FUTURE

2007

ETSEIB Motorsport first combustion car for Formula Student

2011

The electric car is born with the CAT5e

2018

A year for new challenges: 4WD & Driverless UPC

2021

Some dynamic events will be in driverless mode. Driverless CUP

2022

No combustion teams in the competition

OUR TEAM

AUTONOMOUS DESIGN

Same idea, different implementations

SCHOOLS

UPC

telecos BCN

ETSEIB

KEY SPONSORS

DV sensors are expensive, so let's get them for free

DV EVENTS

Acceleration, Skid Pad, Autocross & Trackdrive

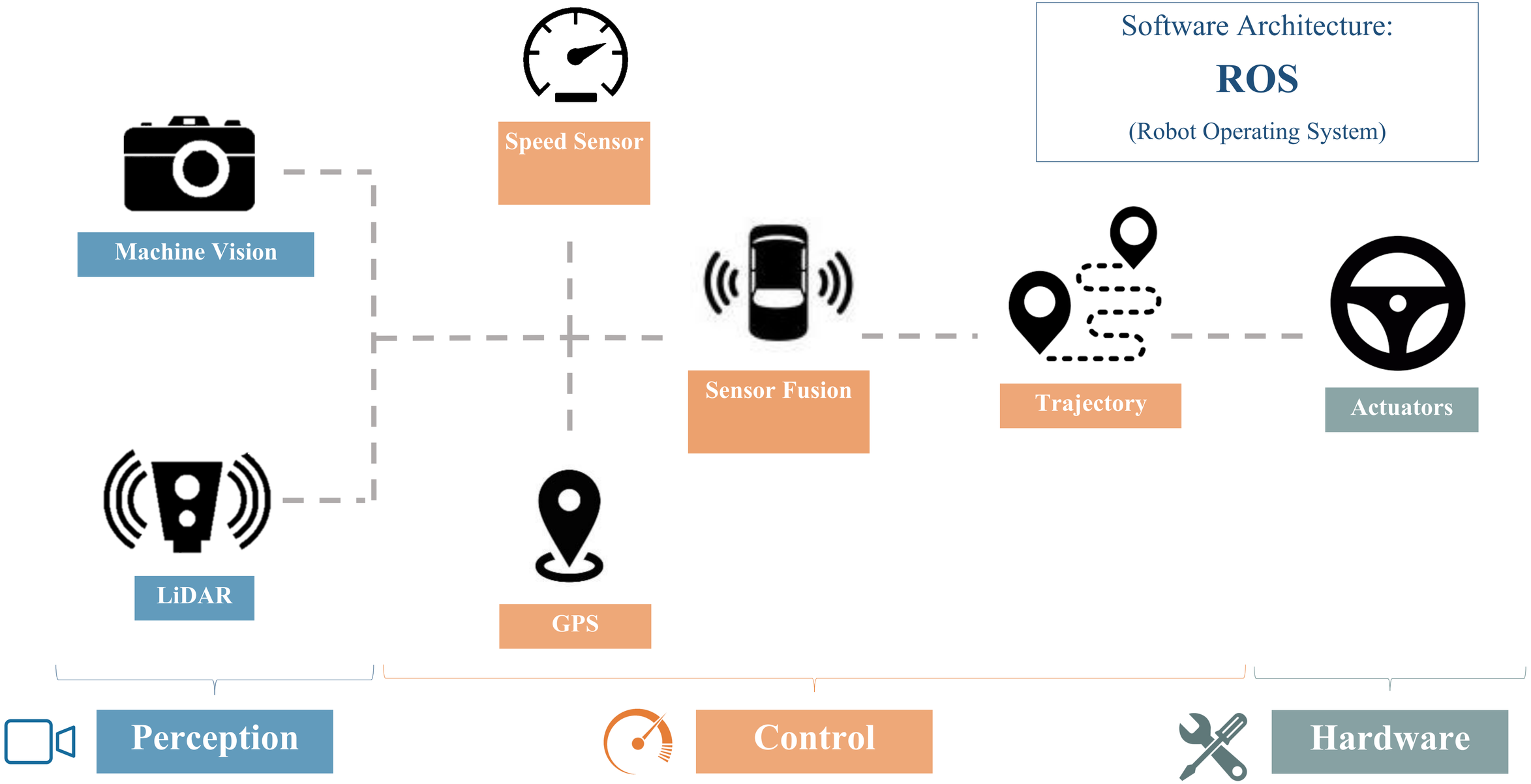
CAT10e

Reuse electric car

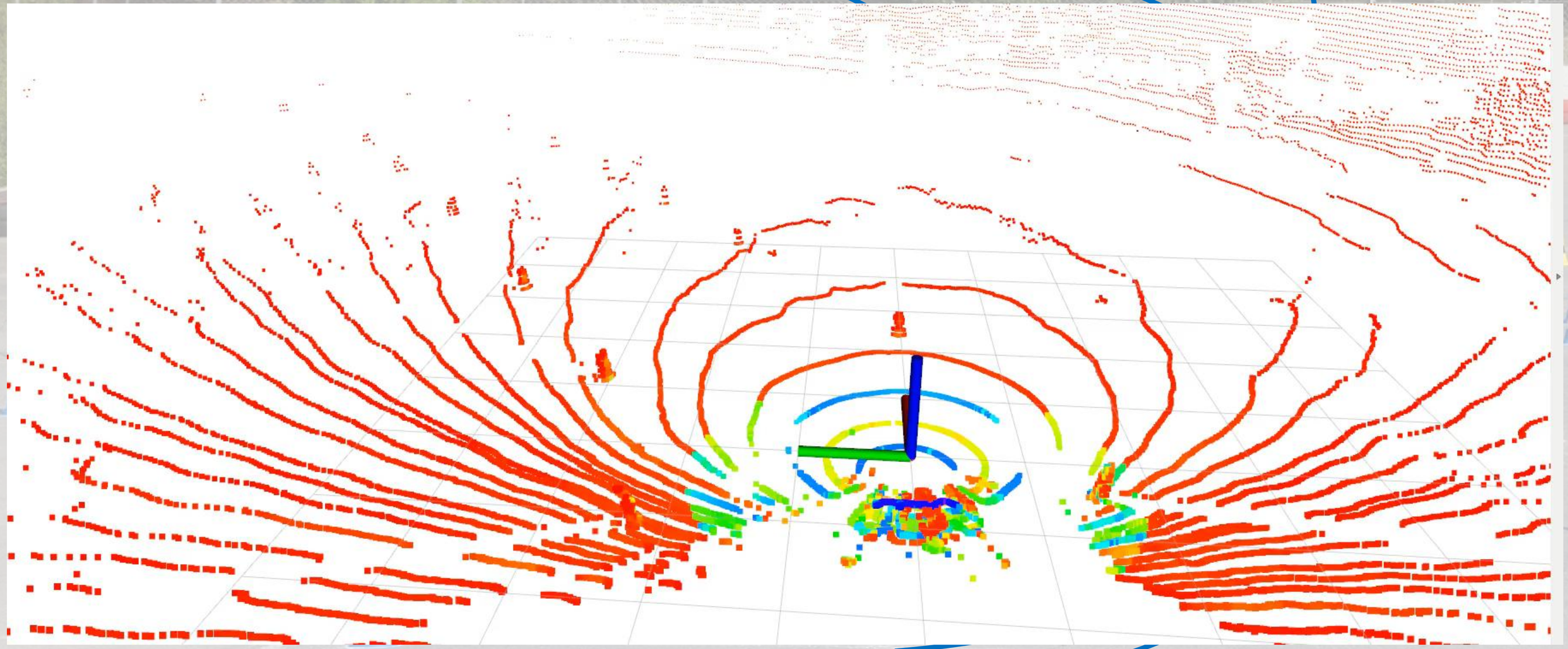
SMALL TEAM

Compare with EV team

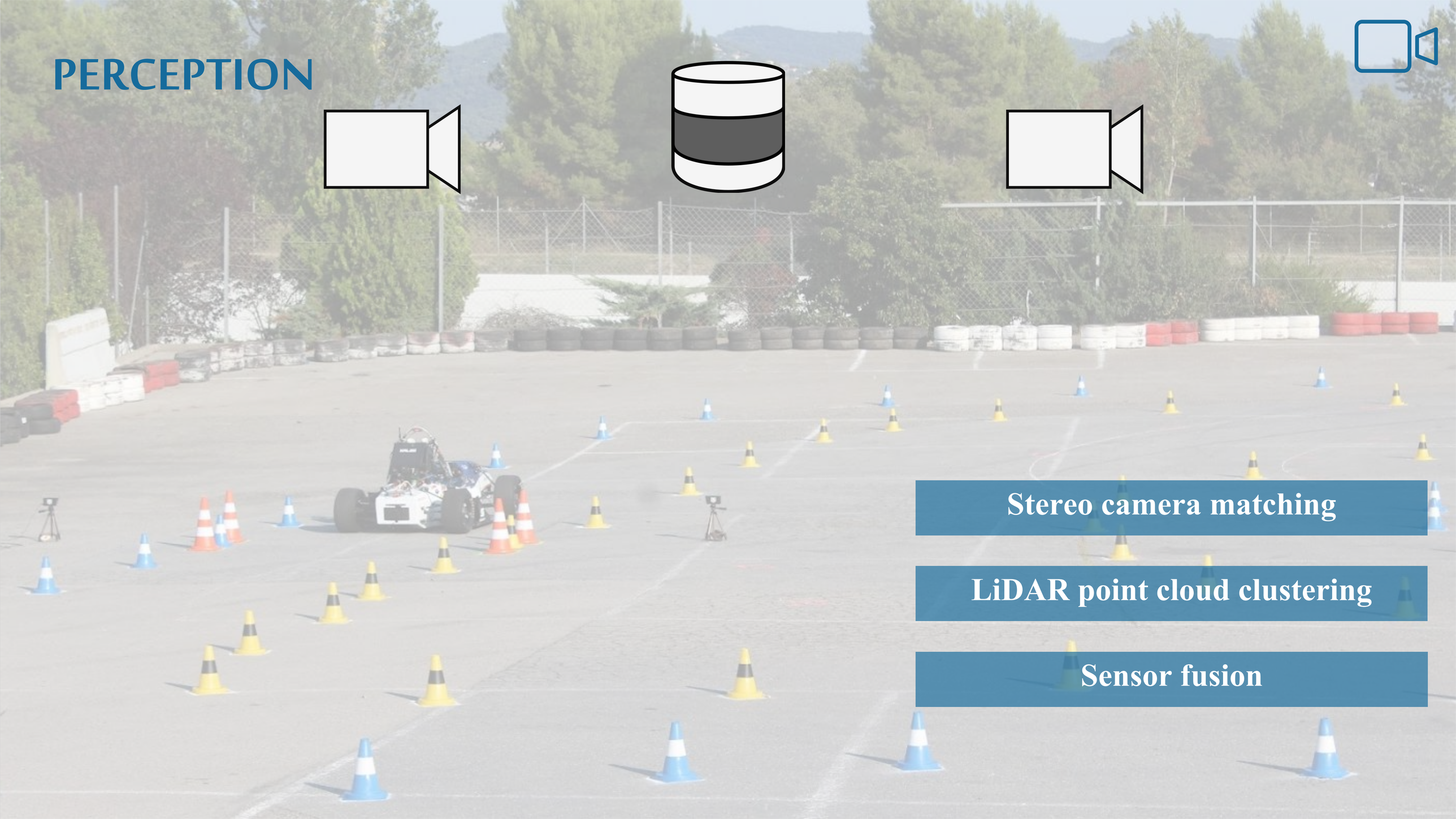
THE AUTONOMOUS SYSTEM



PERCEPTION



PERCEPTION

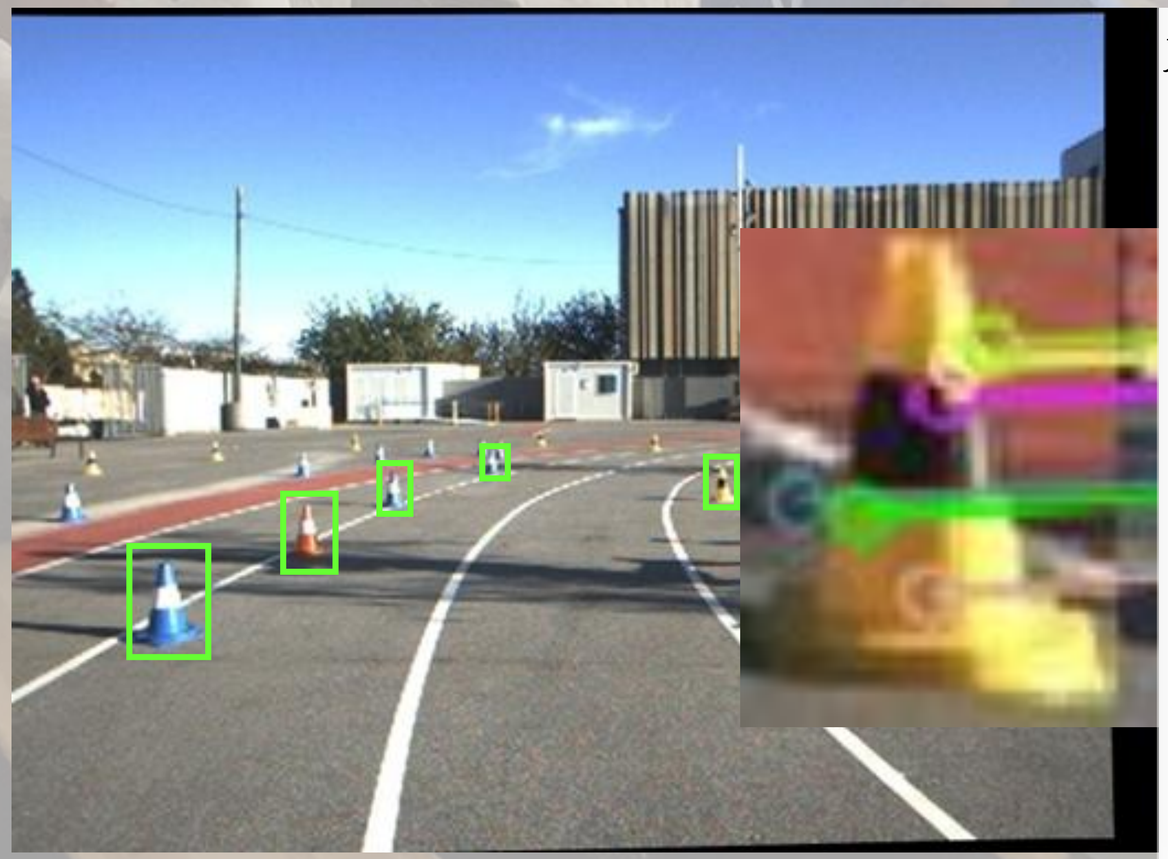


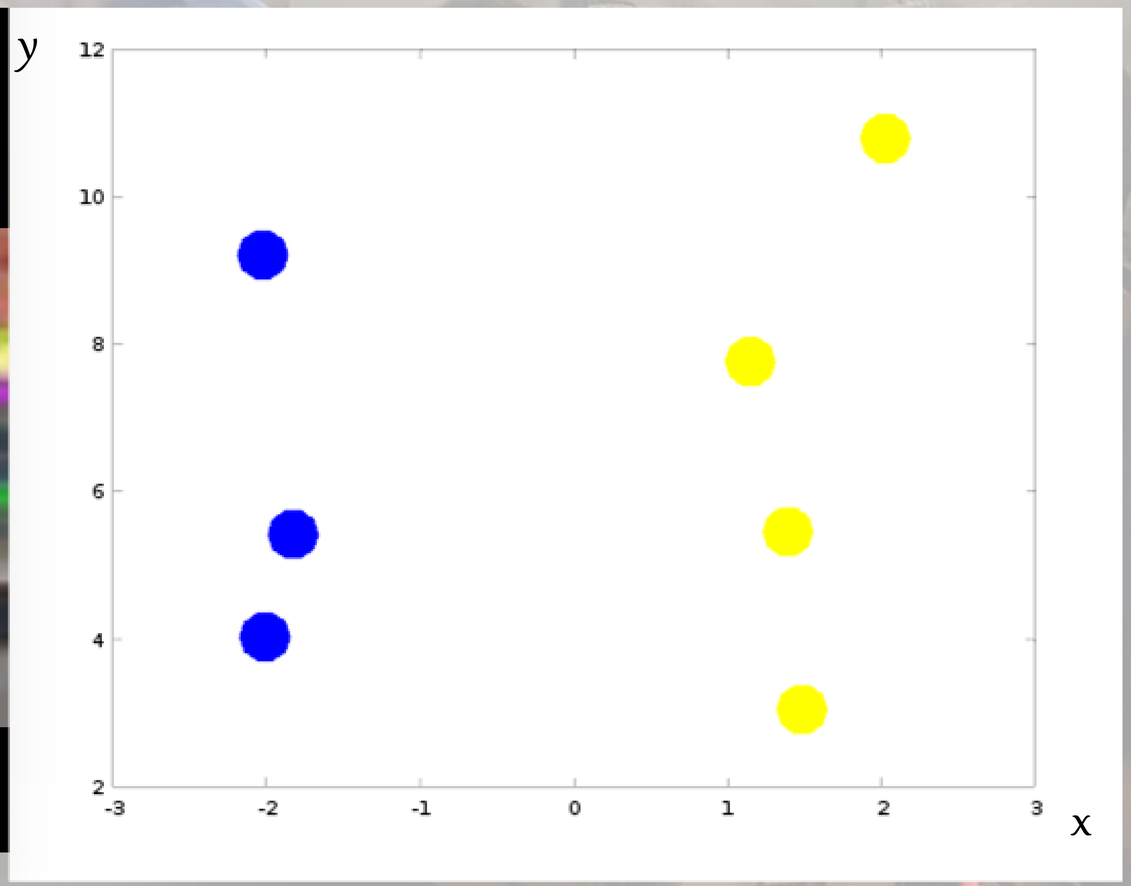
Stereo camera matching

LiDAR point cloud clustering

Sensor fusion

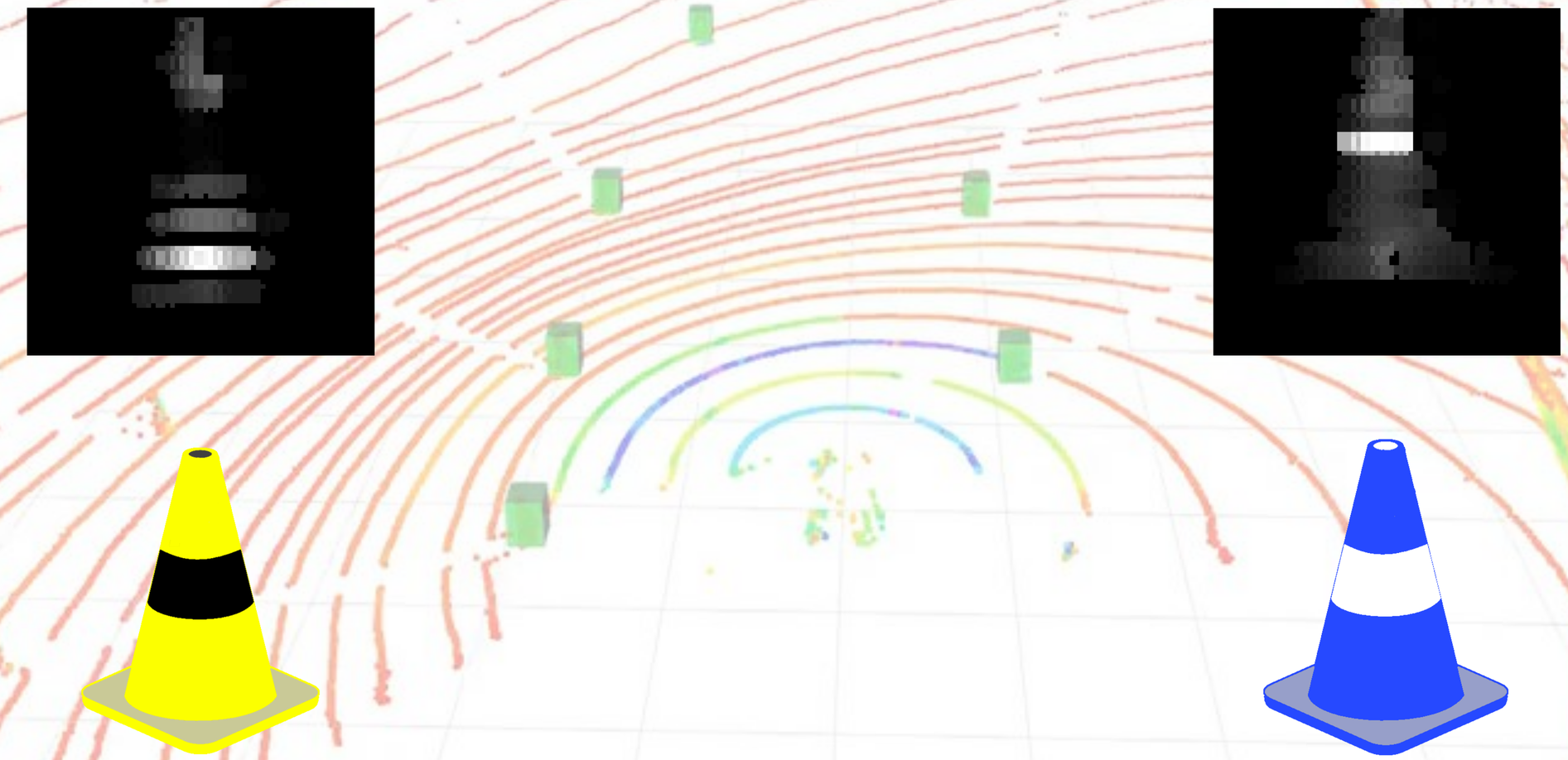
PERCEPTION





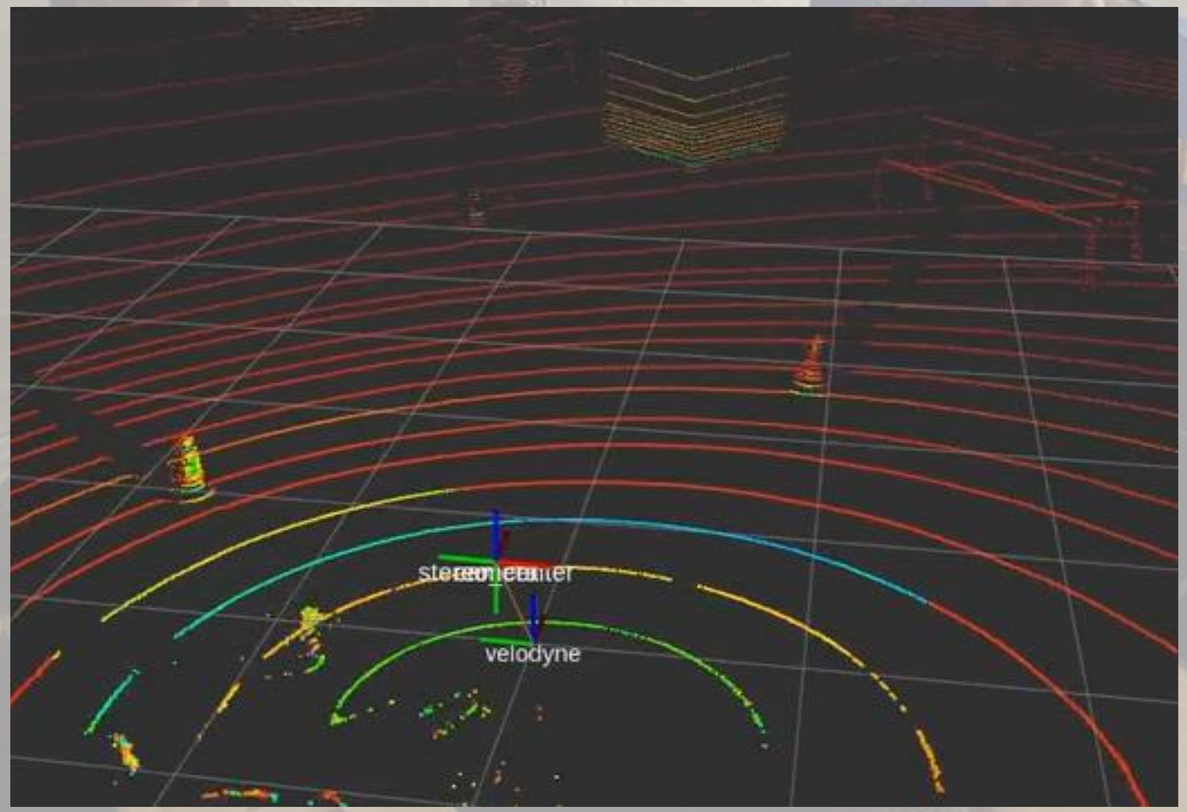
Stereo camera matching

PERCEPTION



LiDAR point cloud clustering

PERCEPTION

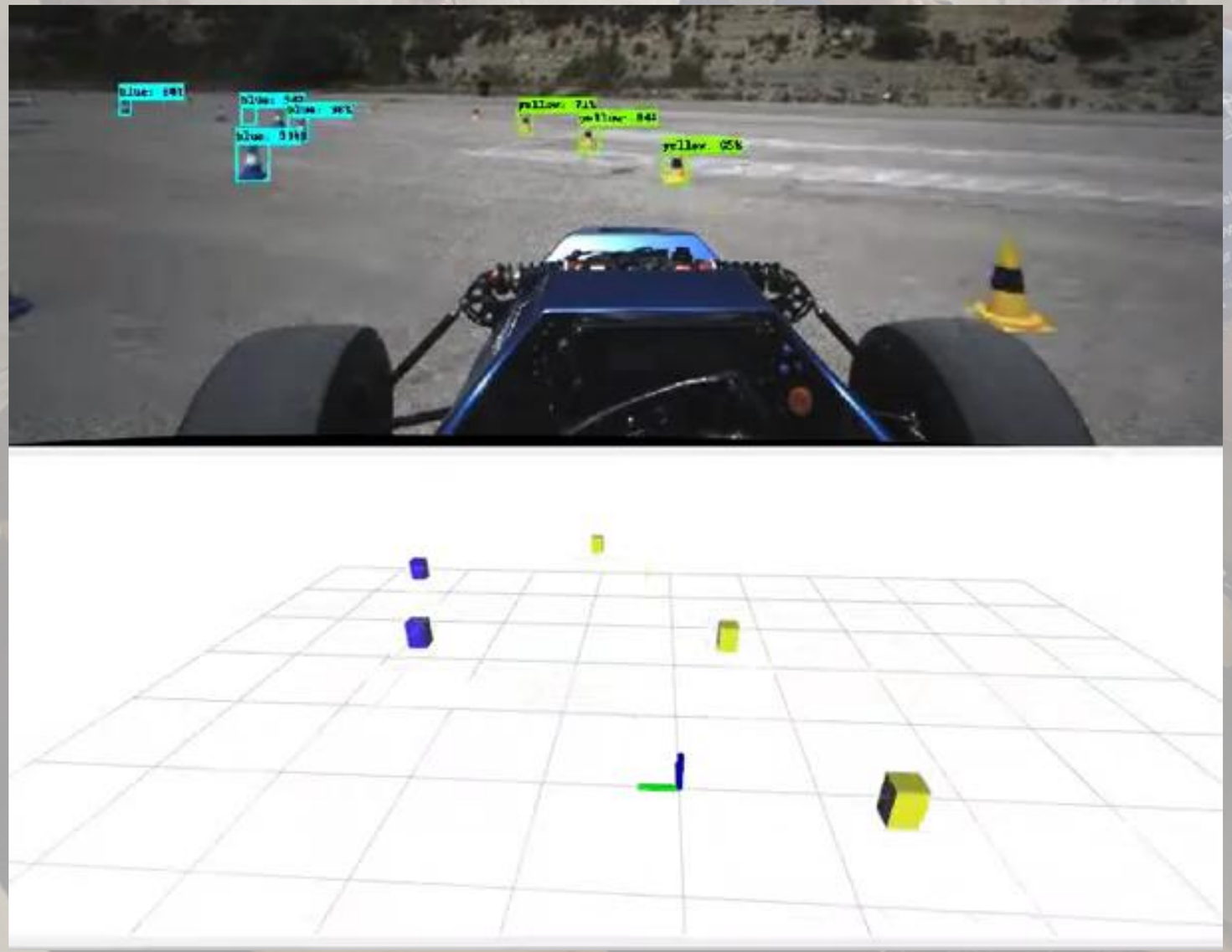


Sensors calibration

Point cloud projection

Sensors fusion

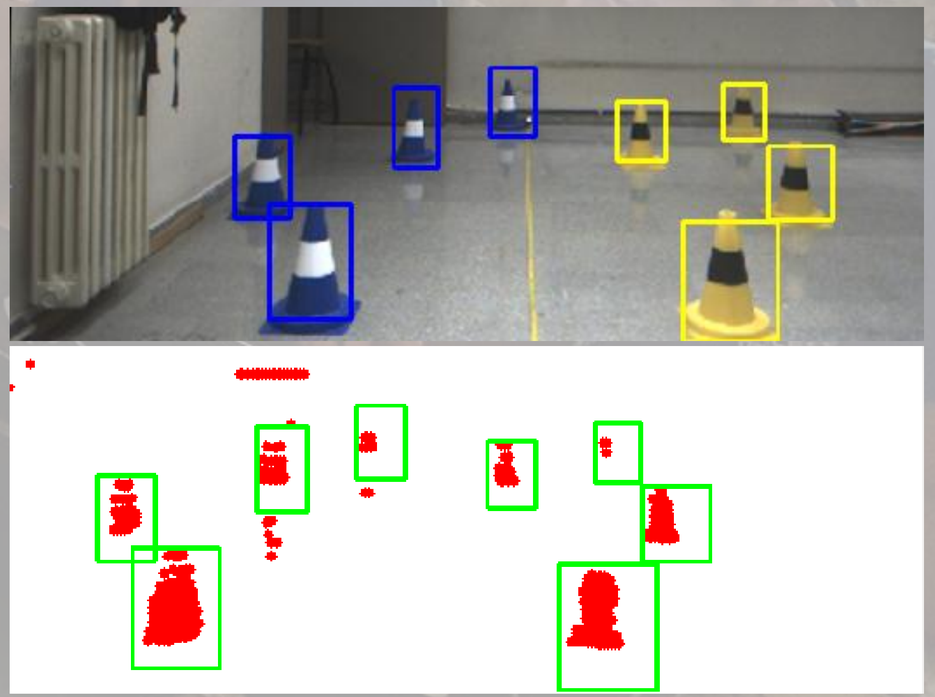
PERCEPTION



Cone detection

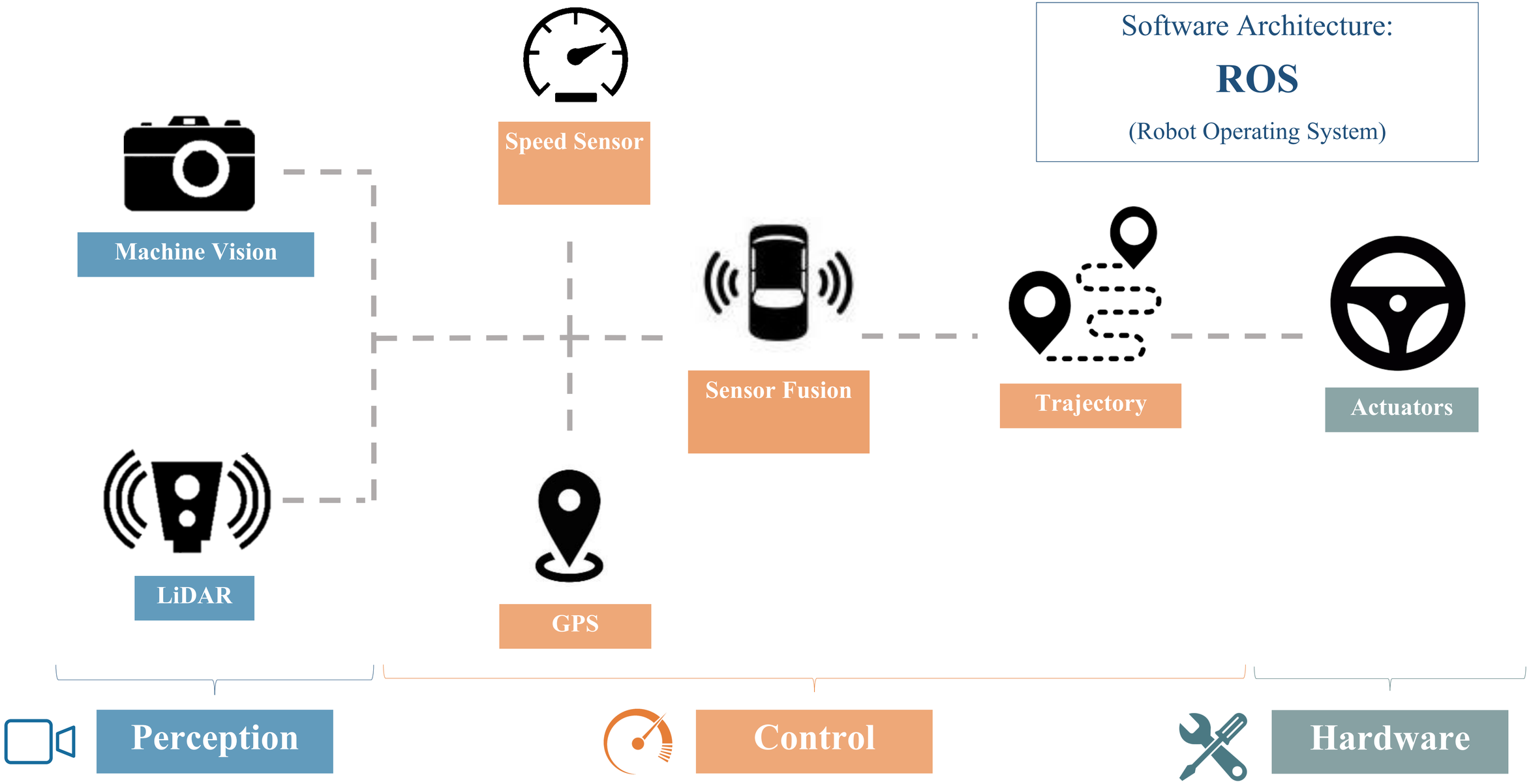
-Point cloud translation & projection

-Detection: from 2D to 3D



Sensors fusion

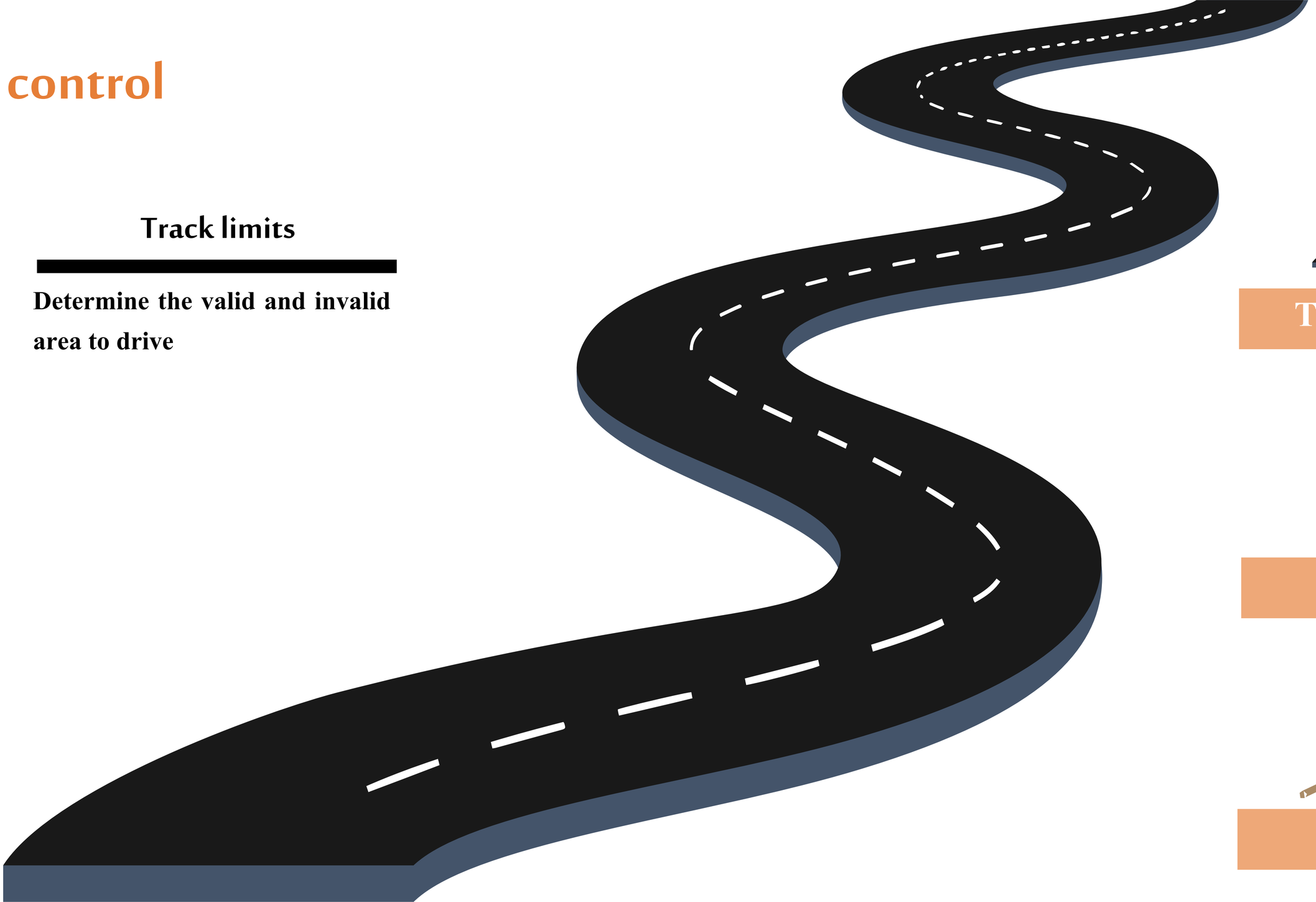
THE AUTONOMOUS SYSTEM



control

Track limits

Determine the valid and invalid area to drive

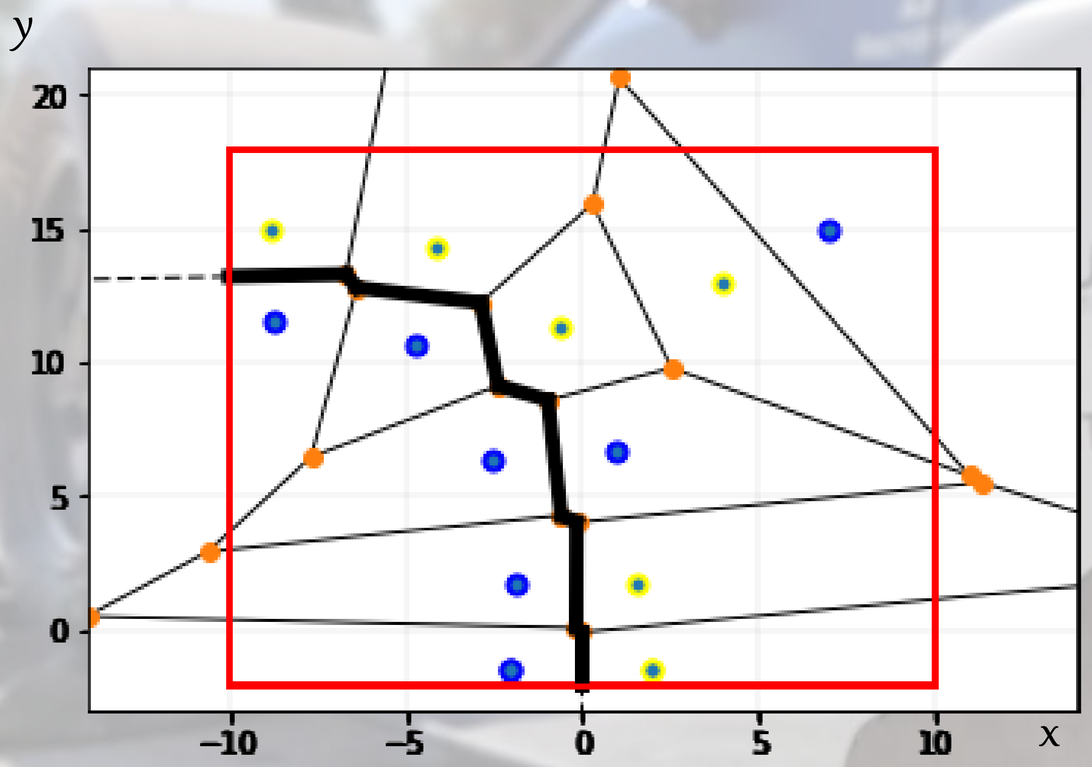


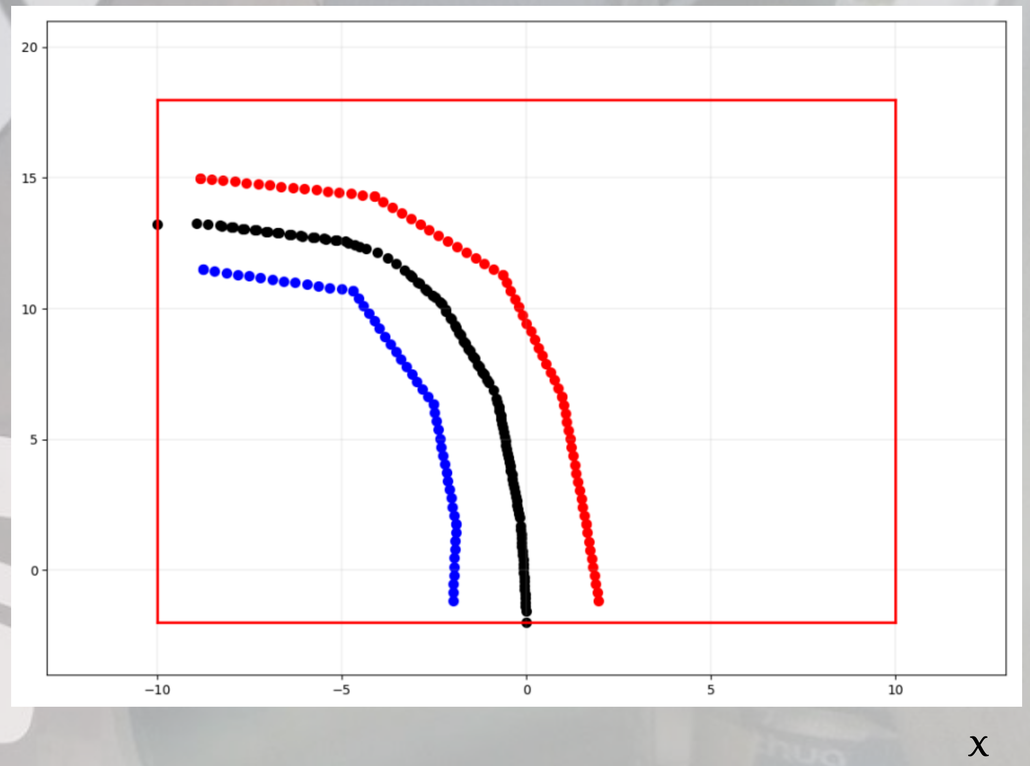
Track limits

Planner

Control

control



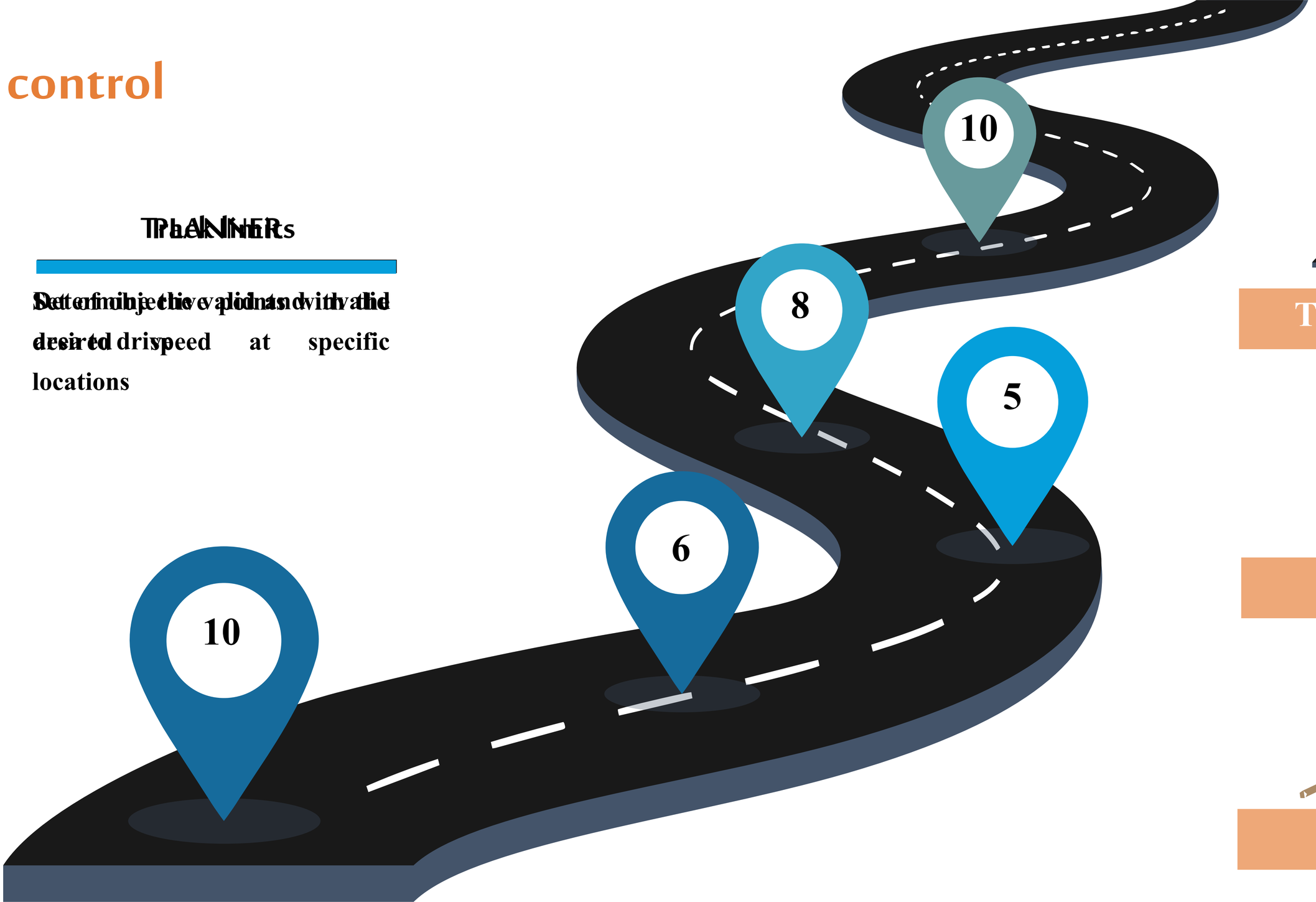


Track limits

control

PLANNERS

Determine the valid and desired drive speed at specific locations



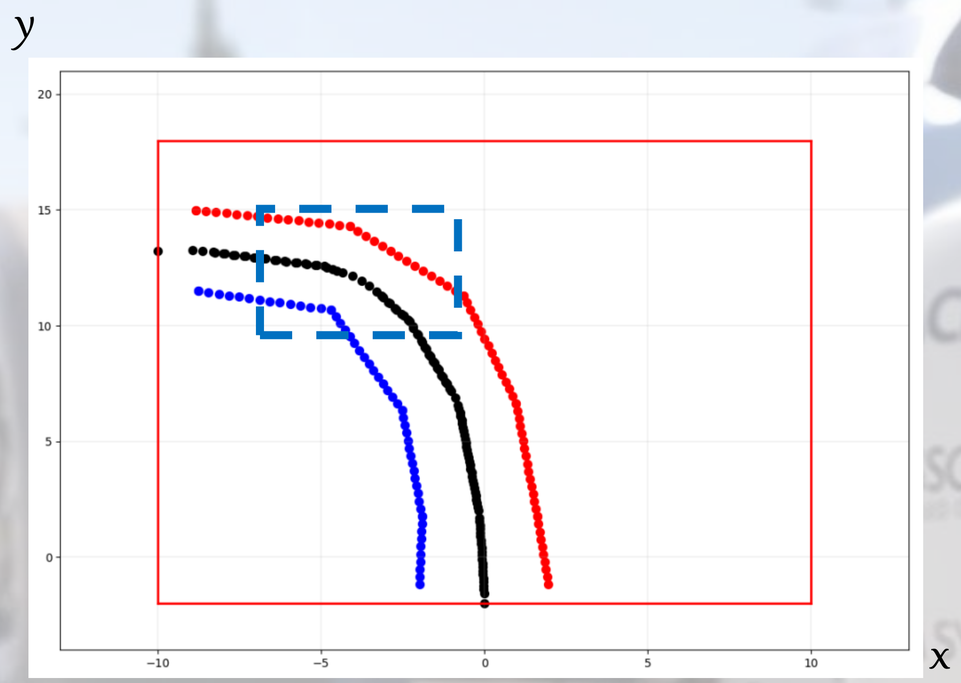
Track limits

km/h

Planner

Control

control

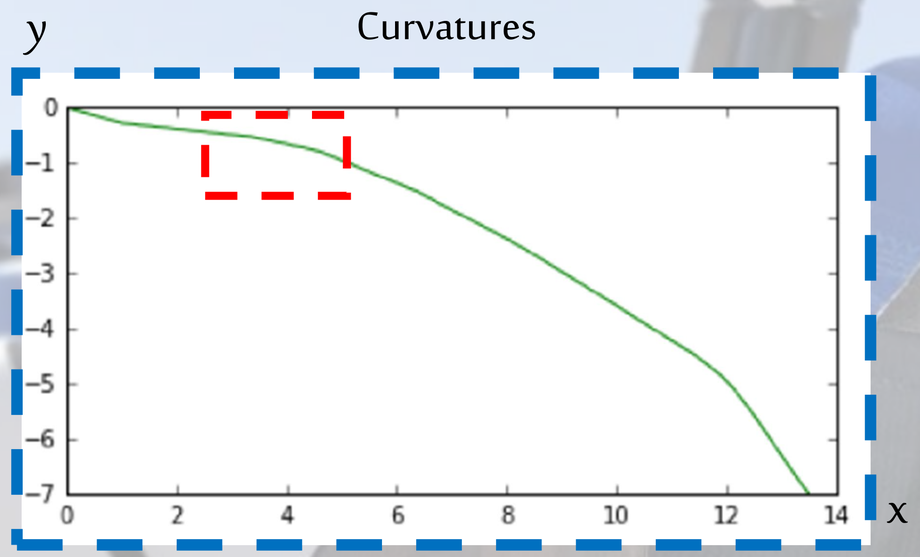


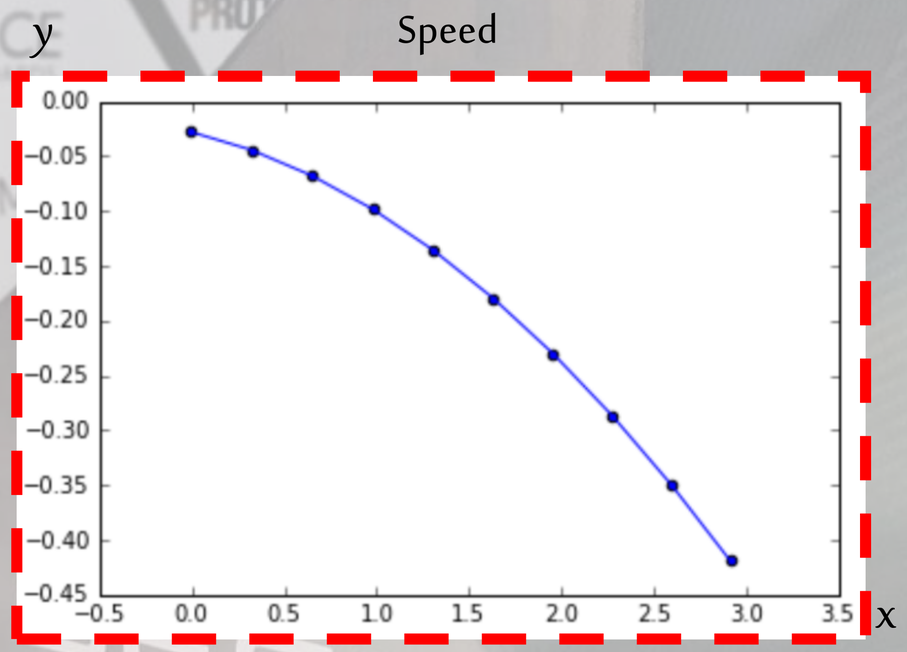
Planner points

Equispaced in <u>time</u>

Difference in <u>distance</u>

Target <u>speed</u>





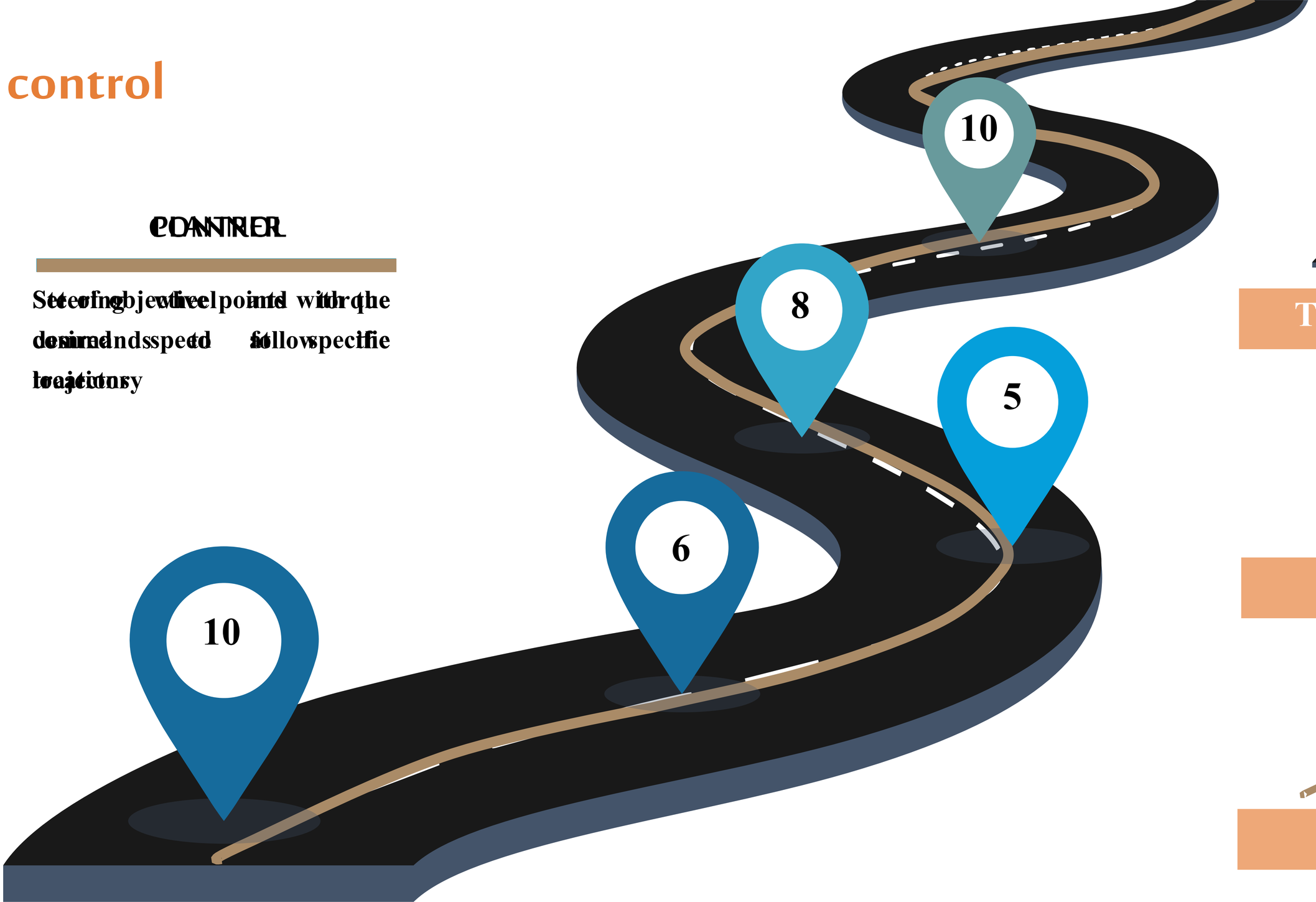
Track limits

control

CONTROLLER

Steering wheel and throttle to follow the desired trajectory

Steering wheel and throttle to follow the desired trajectory

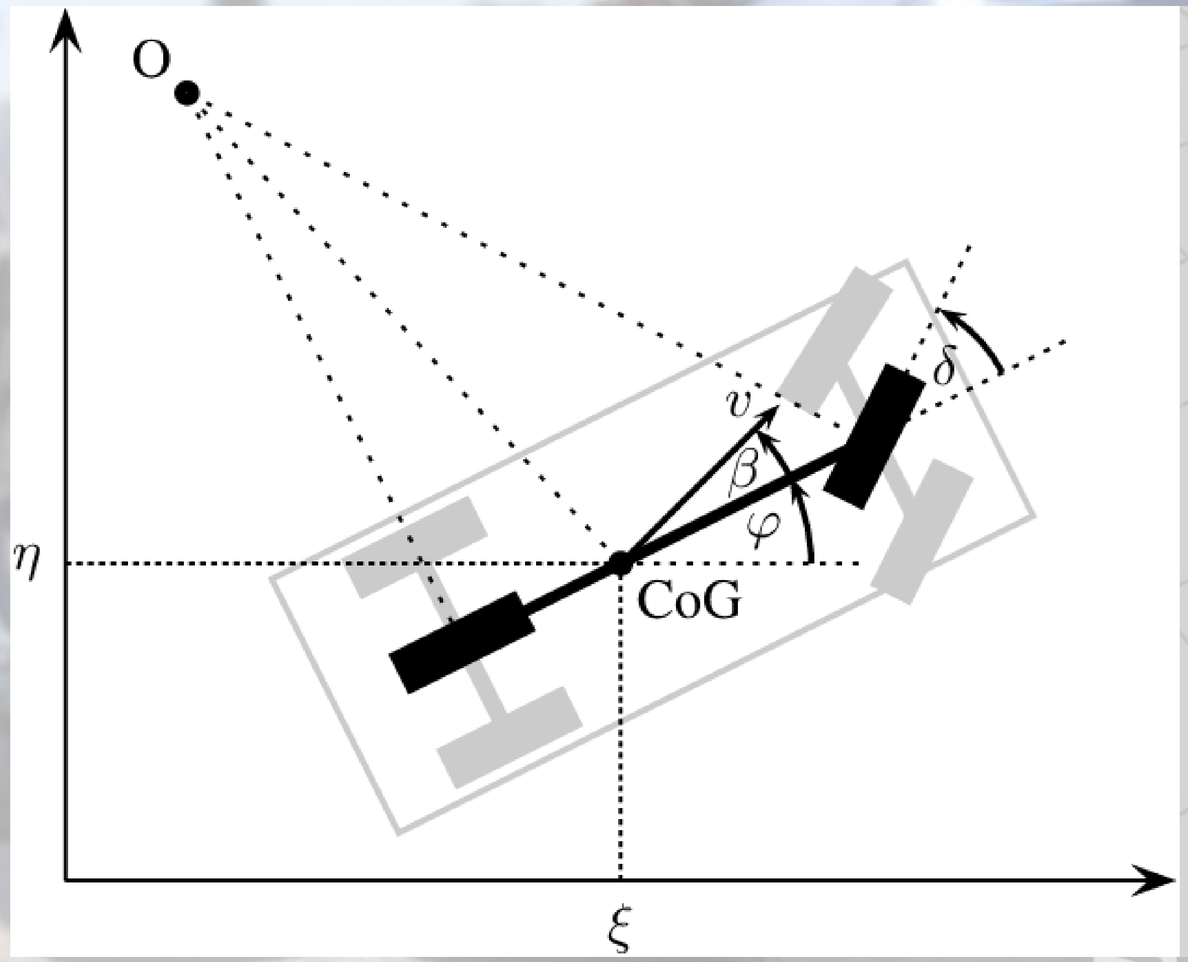


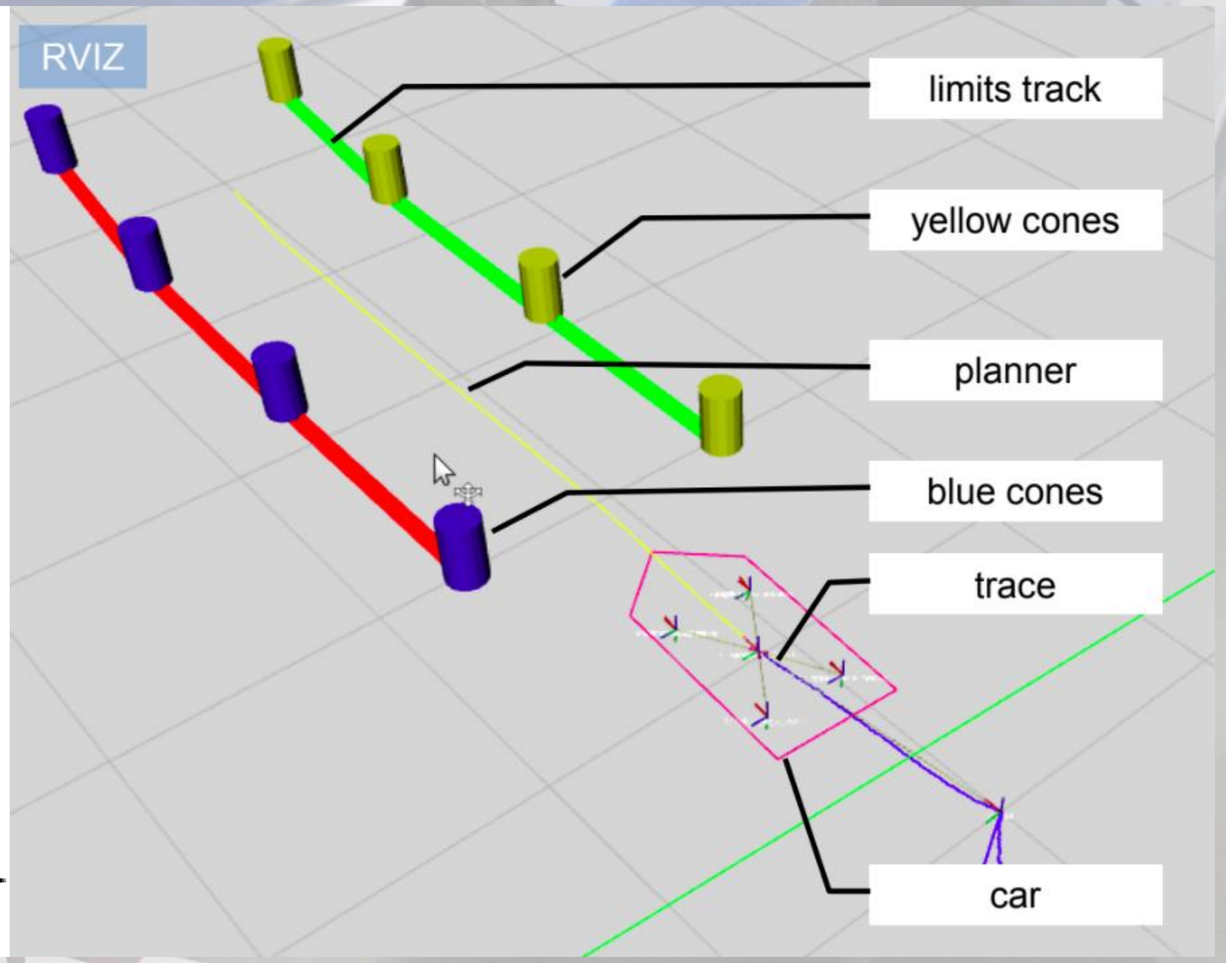
Track limits

Planner

Control

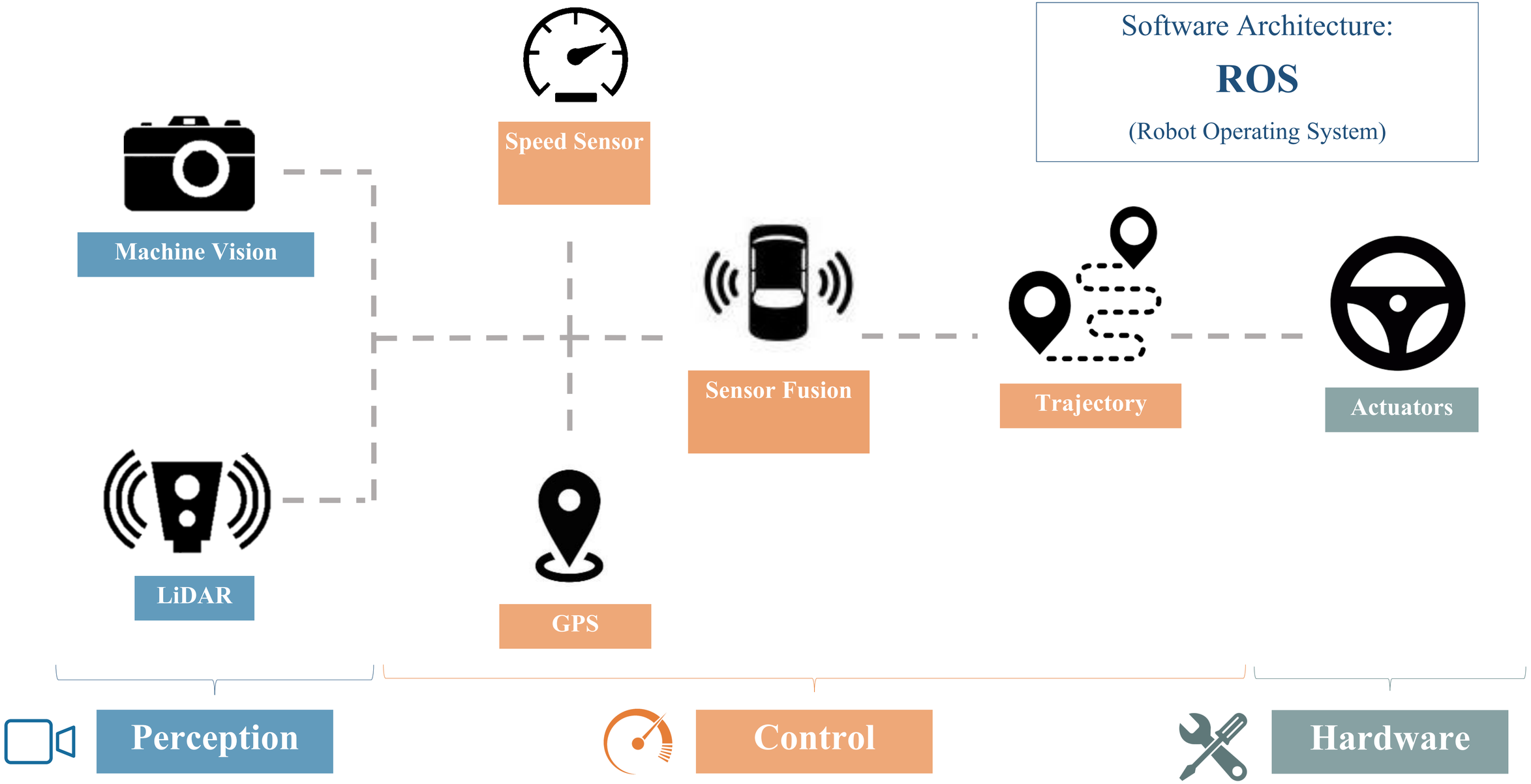
control



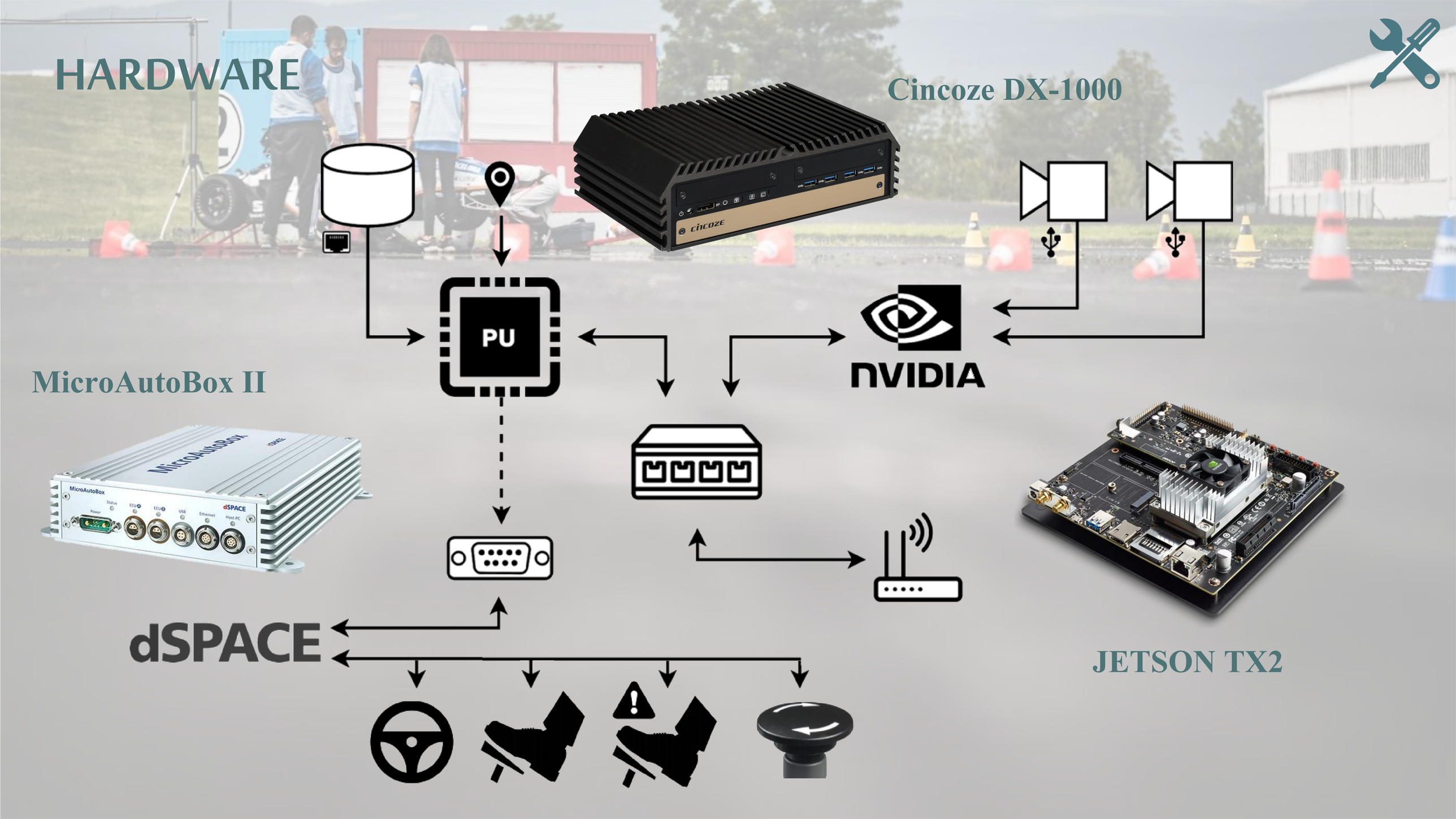


MPC & Gazebo

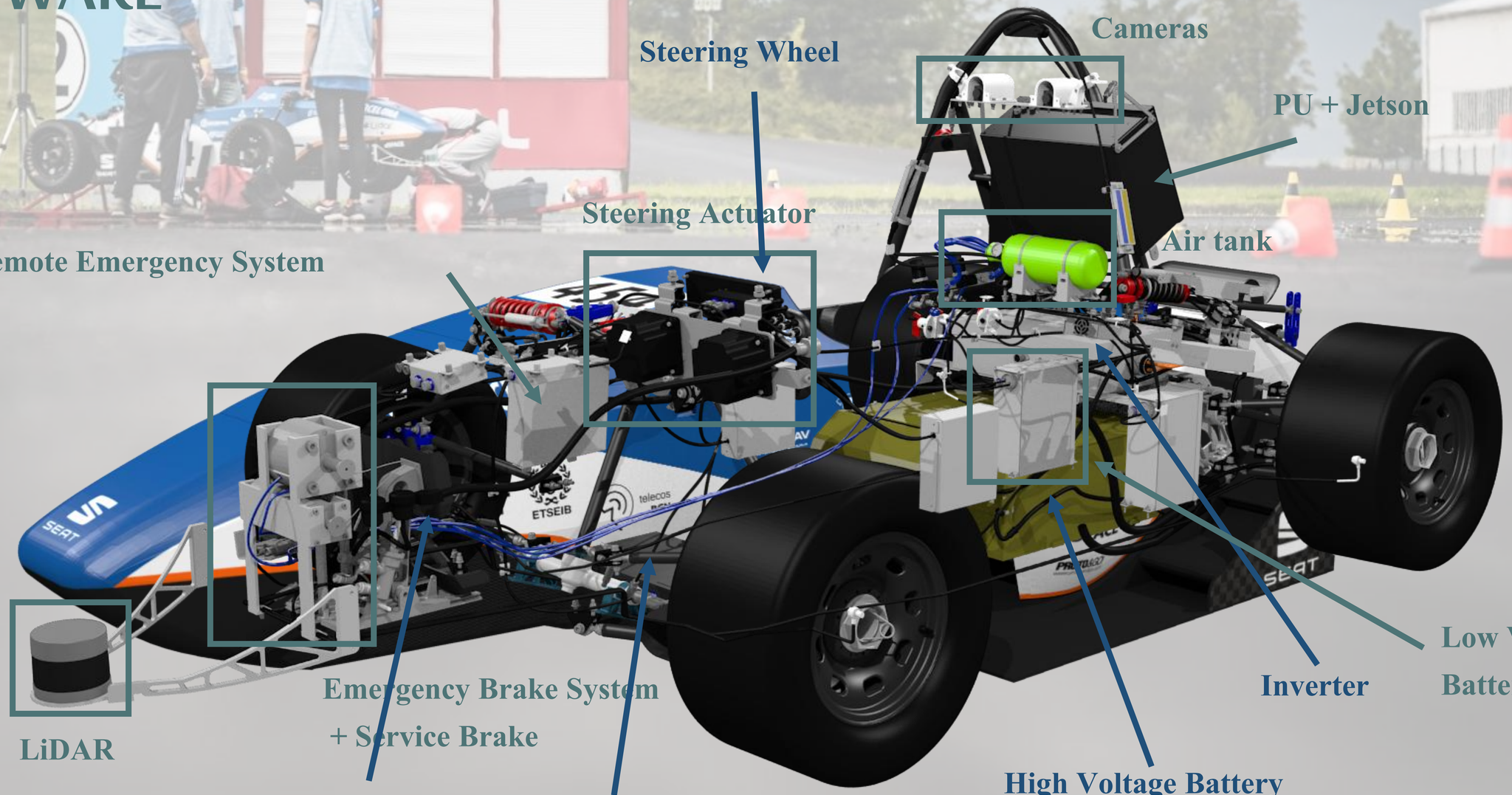
THE AUTONOMOUS SYSTEM



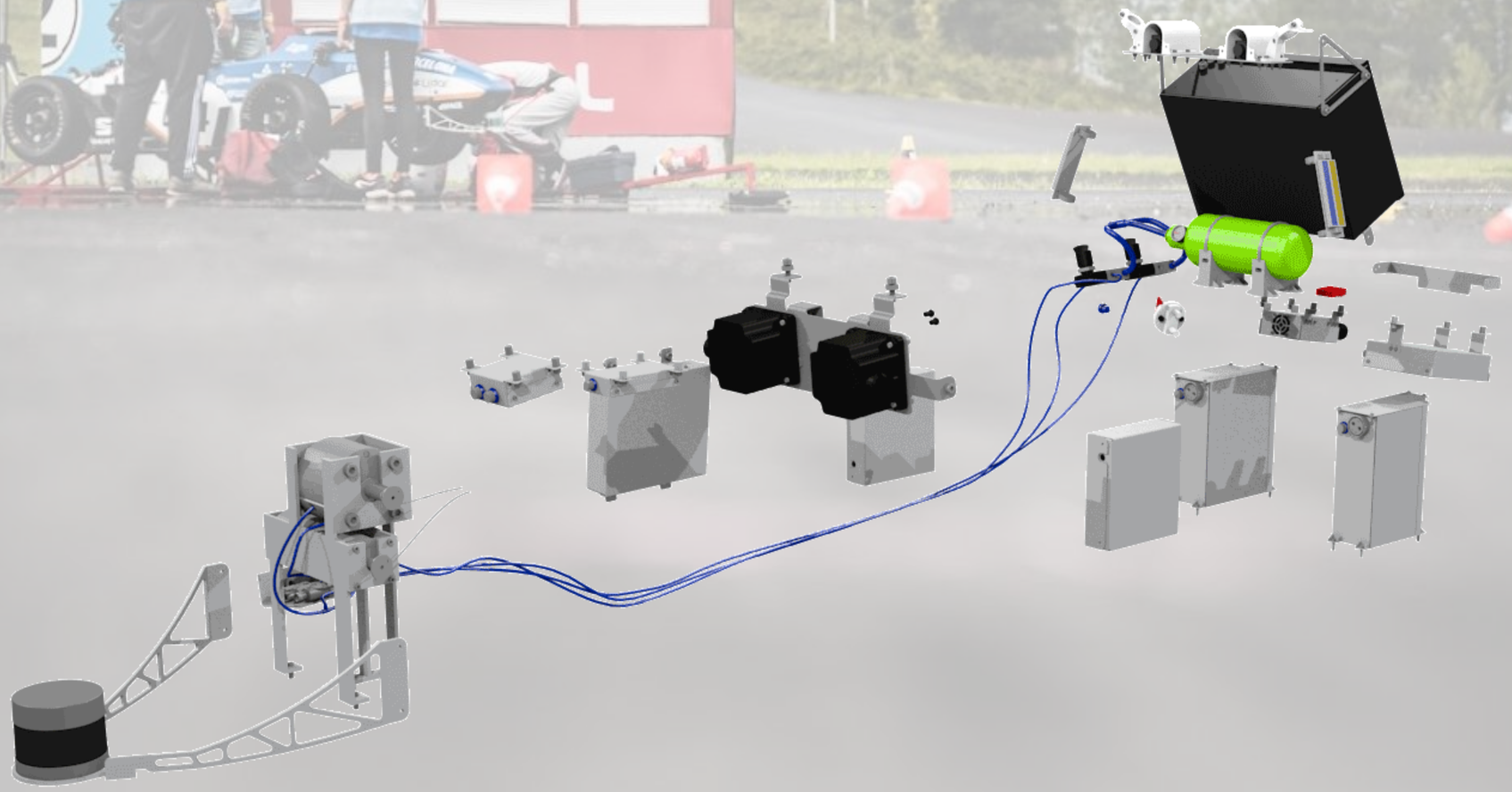
HARDWARE


Cincoze DX-1000
PU
NVIDIA
MicroAutoBox II
dSPACE
JETSON TX2

HARDWARE


Cameras
Steering Wheel
PU + Jetson
Steering Actuator
Air tank
Remote Emergency System
Low Voltage Battery
Inverter
Emergency Brake System + Service Brake
LiDAR
High Voltage Battery
Pedals
dSpace

HARDWARE



2018-2019 season

Formula Student Germany

14/20

Formula Student Czech Republic

2/5

- Cost event
- Business Plan
- Engineering Design

Formula Student Spain

4/8

- Acceleration
- Cost event
- Autocross
- Trackdrive
- Business Plan

ka.racing combustion. electric. driverless.

DART RACING

TU fast RACING TEAM

GREEN TEAM UNI STUTTGART
Formula Student Electric & Driverless Team Universität Stuttgart

AMZ

TEAM TALLINN

TU Delft

SEASON 2019-20

One team, two cars

BUILD A COMPETITIVE CAR

We know that the vehicle works, now we want to win

GO TO FSG

If you want to compete with the best teams, you must go to the best competition

TEAM BUILDING

Teamwork and share spaces outside workshop work

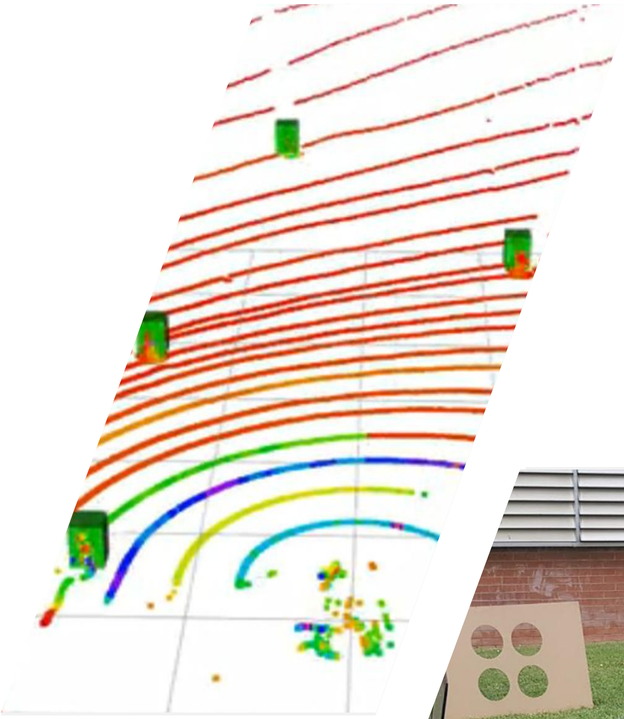
FUSION OF EL + DV

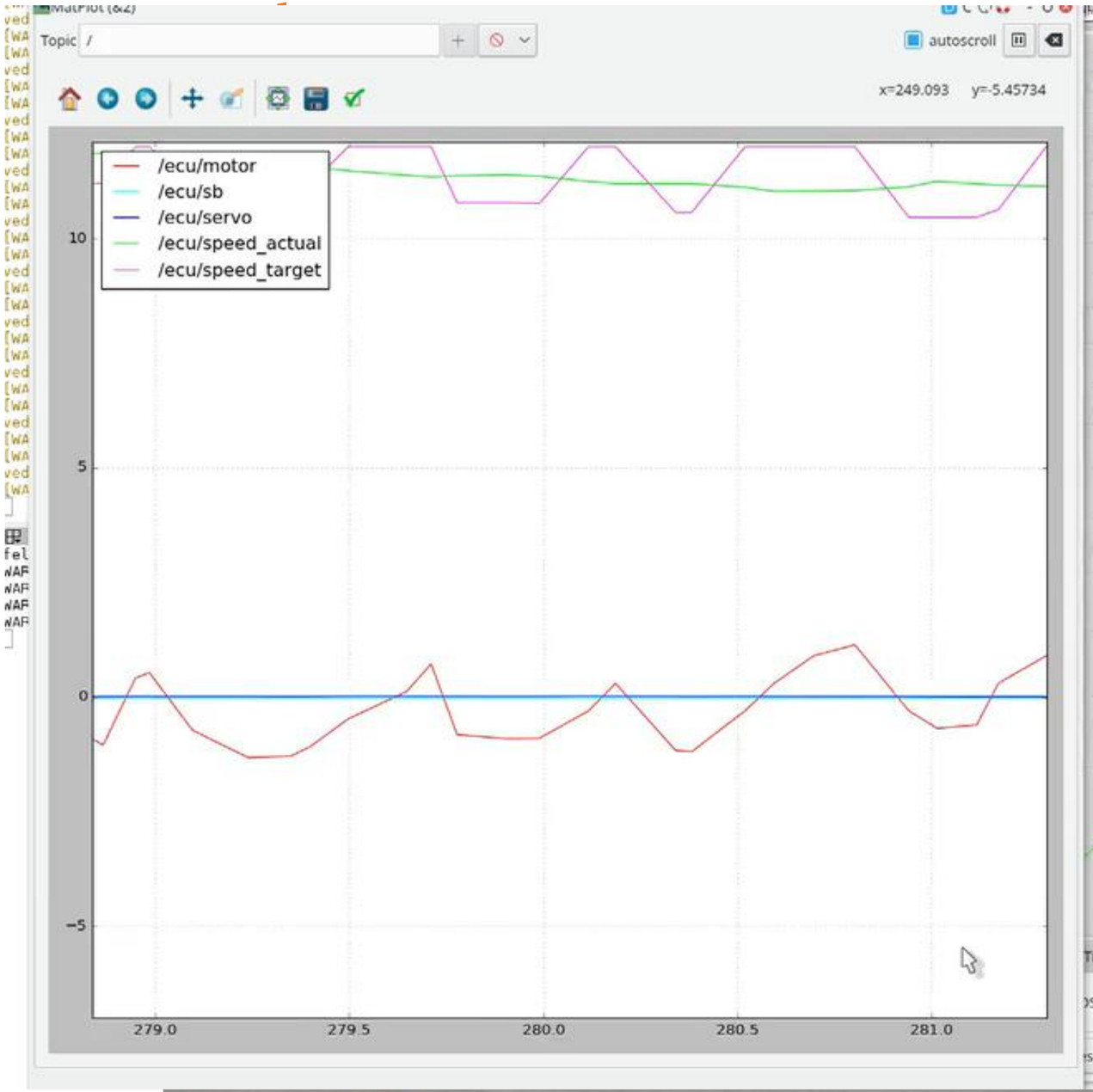
Lay the groundwork of the next season when the team will only make one car.

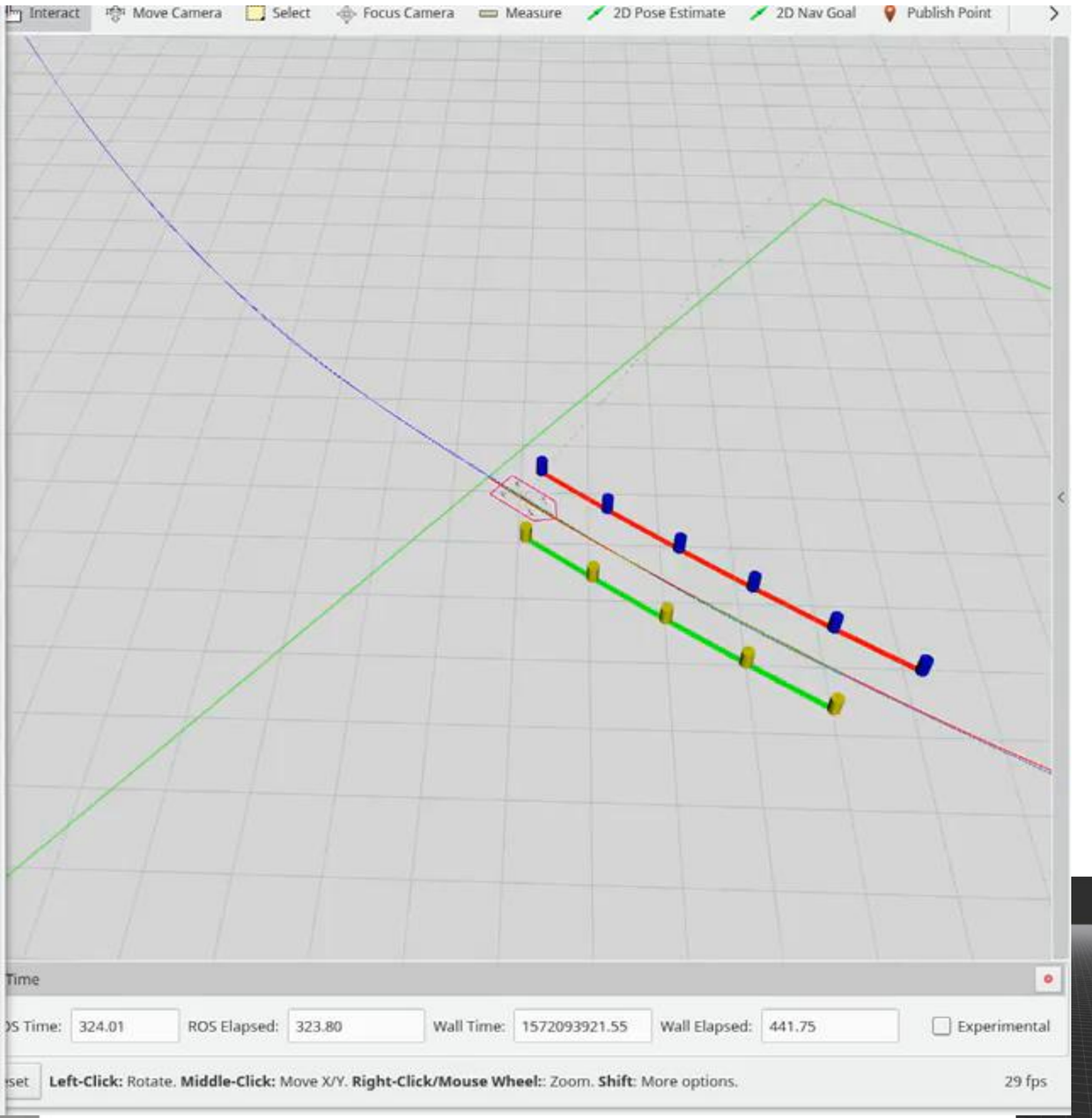
PERCEPTION

Same system design, improve algorithms

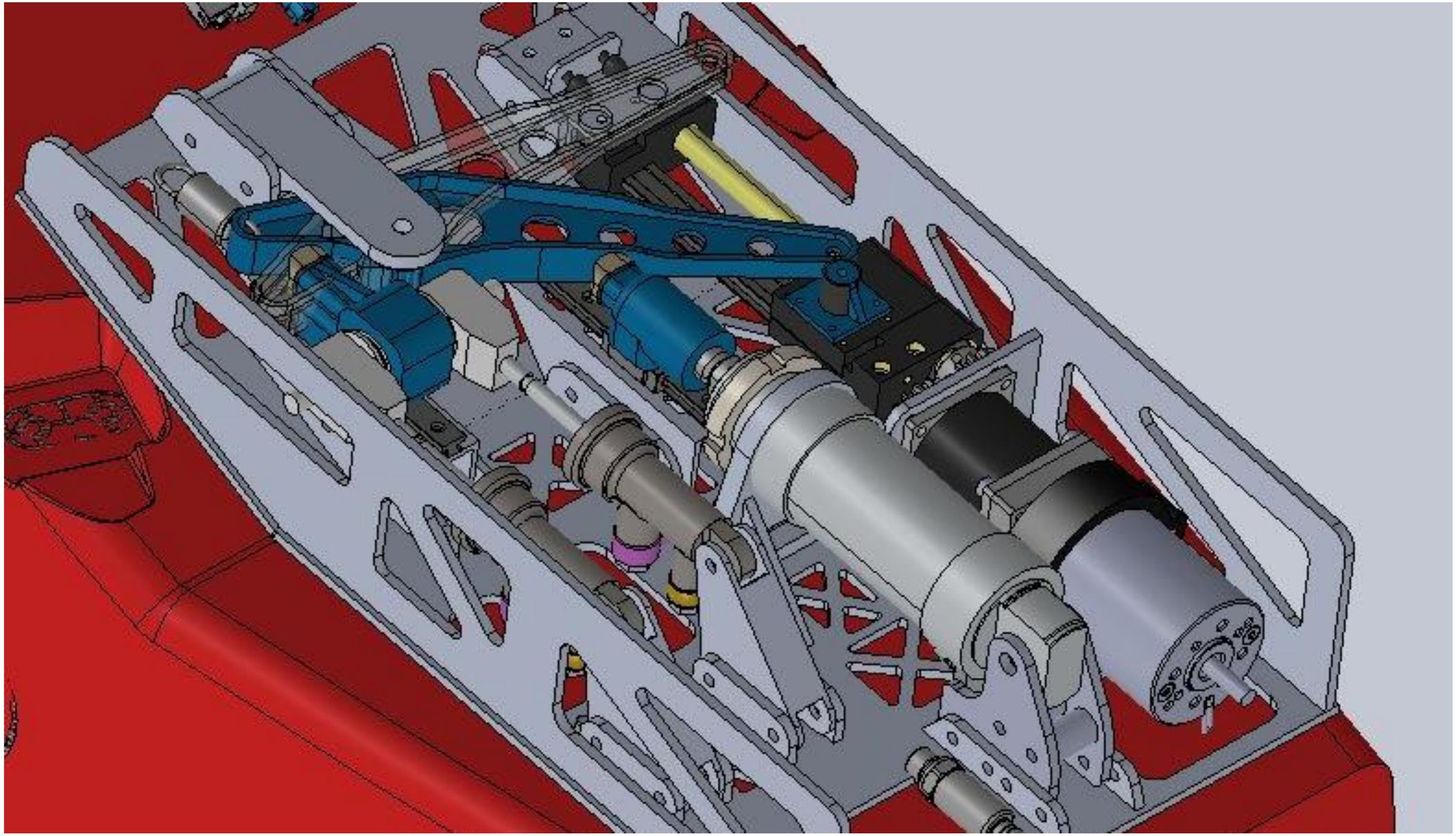
- Improve detection
  - Range: 15m
  - FOV: >120º
- Robustness to high speeds
  - New NN architecture
  - LiDAR movement compensation




Topic /
autoscroll
x=249.093 y=-5.45734
/ecu/motor
/ecu/sb
/ecu/servo
/ecu/speed_actual
/ecu/speed_target
10
5
0
−5
279.0
279.5
280.0
280.5
281.0


Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Time
ROS Time: 324.01
ROS Elapsed: 323.80
Wall Time: 1572093921.55
Wall Elapsed: 441.75
Experimental
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
29 fps

HARDWARE



OUR ACTUAL SPONSORS

telecos BCN
ETSEIB

SEAT
Velodyne Lidar
LAB CIRCUITS
SBG SYSTEMS
THE IMAGINGSOURCE TECHNOLOGY BASED ON STANDARDS
KVASER
KUKA
TANESA CONSTRUCCIONES METÀLICAS
CARNET FUTURE MOBILITY RESEARCH HUB
CIM UPC UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH
dSPACE
LEMO
altran
BETWEEN
repro disseny
SEGURINSA División ESP
silicon gears
VECTORNAV Embedded Navigation Solutions
IPG AUTOMOTIVE
HRS
molex
LOGIC SUPPLY
Parc Tecnològic Barcelona Activa
prat casajoana S.A.
TE connectivity
NISSAN
Extintors BARCELONA
Cervi
NG Brake Disc www.ngbrakedisc.com
Applus IDIADA
KELVIN
Fundació Privada CELLEX
tormetal
RS
disscopi centre d'impressió digital
URSSA ACEROS ESPECIALES
SCHROTH RACING
PROTO&GO! www.protoandgo.com
LOIMEX
dextron


REPSOL
MONSTER
DRIVERLESS
UPC