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# Software solutions for autonomous driving

20 September 2022

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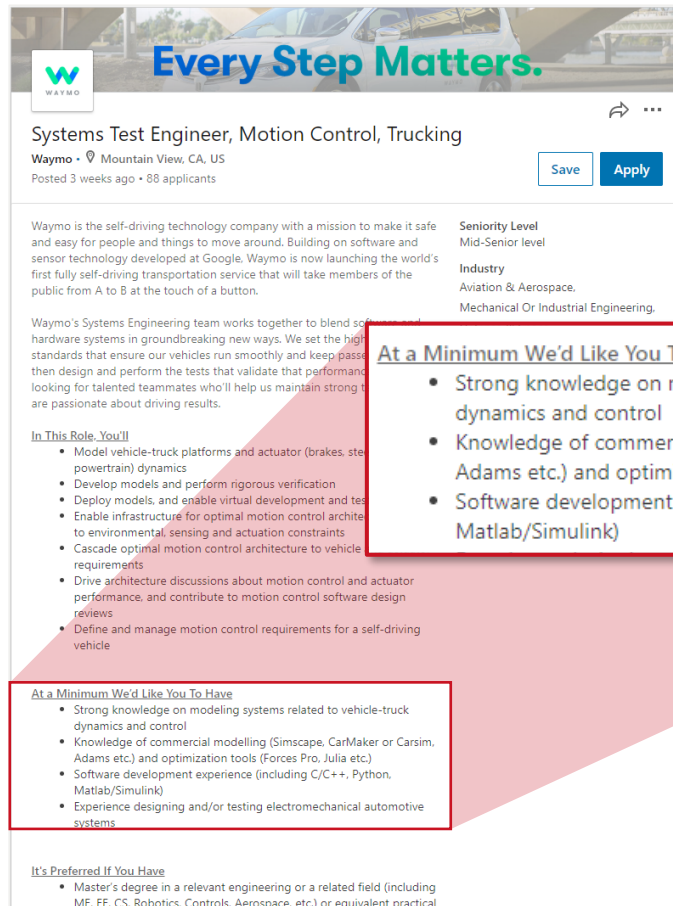
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# EMPOWERING AUTONOMOUS SYSTEMS TO MAKE BETTER DECISIONS



Real-time decision-making software for autonomous vehicles and industrial robotics

# OUR SOFTWARE SETS THE INDUSTRY STANDARD



**Every Step Matters.**

## Systems Test Engineer, Motion Control, Trucking

Waymo • Mountain View, CA, US  
Posted 3 weeks ago • 88 applicants

Waymo is the self-driving technology company with a mission to make it safe and easy for people and things to move around. Building on software and sensor technology developed at Google, Waymo is now launching the world's first fully self-driving transportation service that will take members of the public from A to B at the touch of a button.

Waymo's Systems Engineering team works together to blend software and hardware systems in groundbreaking new ways. We set the highest standards that ensure our vehicles run smoothly and keep passengers safe. We then design and perform the tests that validate that performance. We are looking for talented teammates who'll help us maintain strong performance and are passionate about driving results.

**Seniority Level**  
Mid-Senior level

**Industry**  
Aviation & Aerospace,  
Mechanical Or Industrial Engineering.

**At a Minimum We'd Like You To Have**

- Strong knowledge on modeling systems related to vehicle-truck dynamics and control
- Knowledge of commercial modelling (Simscape, CarMaker or Adams etc.) and optimization tools (Forces Pro, Julia etc.)
- Software development experience (including C/C++, Python, Matlab/Simulink)

**It's Preferred If You Have**

- Master's degree in a relevant engineering or a related field (including ME, EE, CS, Robotics, Controls, Aerospace, etc.) or equivalent practical

**Waymo**

### At a Minimum We'd Like You To Have

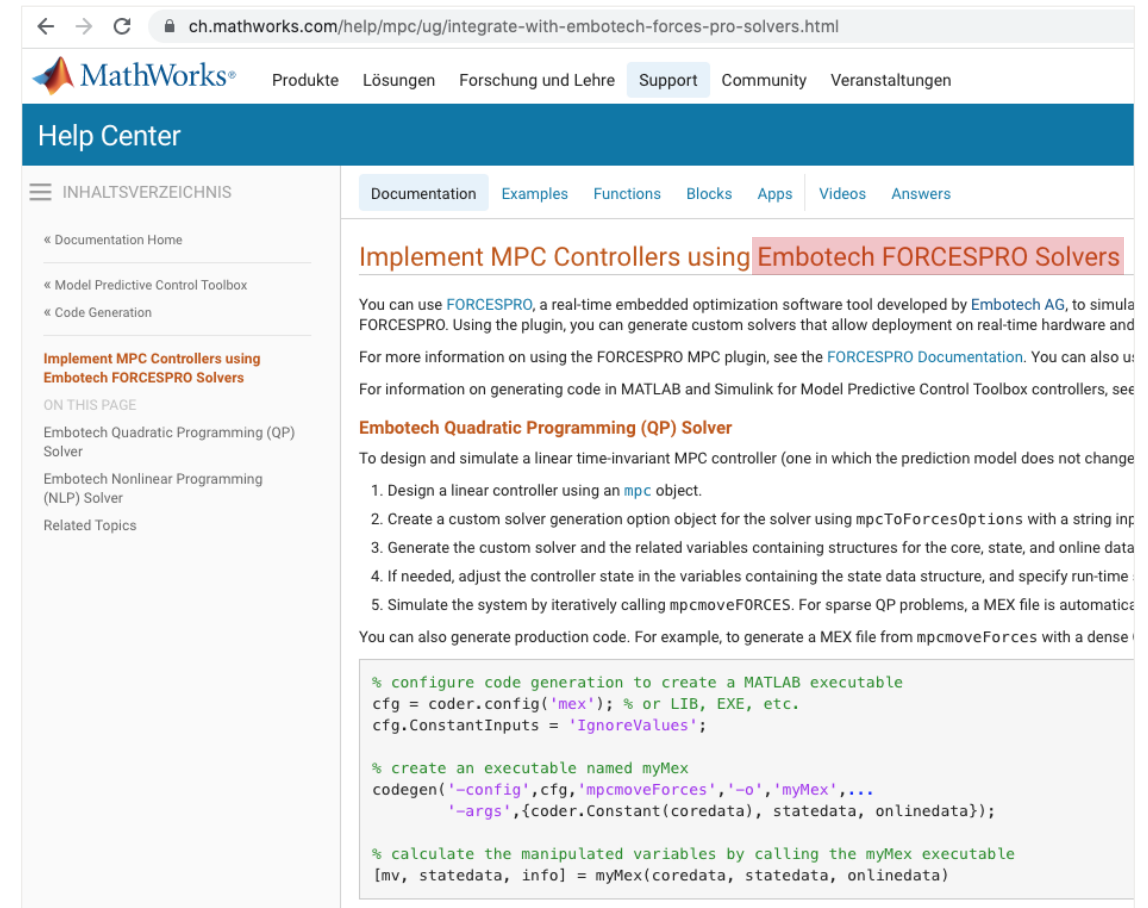
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- Experience designing and/or testing electromechanical automotive systems

### It's Preferred If You Have

- Master's degree in a relevant engineering or a related field (including ME, EE, CS, Robotics, Controls, Aerospace, etc.) or equivalent practical



ch.mathworks.com/help/mpc/ug/integrate-with-embotech-forces-pro-solvers.html

MathWorks® Produkte Lösungen Forschung und Lehre Support Community Veranstaltungen

## Help Center

INHALTSVERZEICHNIS

- « Documentation Home
- « Model Predictive Control Toolbox
- « Code Generation

**Implement MPC Controllers using Embotech FORCESPRO Solvers**

ON THIS PAGE

- Embotech Quadratic Programming (QP) Solver
- Embotech Nonlinear Programming (NLP) Solver

Related Topics

### Implement MPC Controllers using Embotech FORCESPRO Solvers

You can use **FORCESPRO**, a real-time embedded optimization software tool developed by Embotech AG, to simulate FORCESPRO. Using the plugin, you can generate custom solvers that allow deployment on real-time hardware and

For more information on using the FORCESPRO MPC plugin, see the [FORCESPRO Documentation](#). You can also use

For information on generating code in MATLAB and Simulink for Model Predictive Control Toolbox controllers, see

#### Embotech Quadratic Programming (QP) Solver

To design and simulate a linear time-invariant MPC controller (one in which the prediction model does not change

1. Design a linear controller using an `mpc` object.
2. Create a custom solver generation option object for the solver using `mpcToForcesOptions` with a string input
3. Generate the custom solver and the related variables containing structures for the core, state, and online data
4. If needed, adjust the controller state in the variables containing the state data structure, and specify run-time
5. Simulate the system by iteratively calling `mpcmoveFORCES`. For sparse QP problems, a MEX file is automatically

You can also generate production code. For example, to generate a MEX file from `mpcmoveForces` with a dense

```
% configure code generation to create a MATLAB executable
cfg = coder.config('mex'); % or LIB, EXE, etc.
cfg.ConstantInputs = 'IgnoreValues';

% create an executable named myMex
codegen('-config',cfg,'mpcmoveForces','-o','myMex',...
        '-args',{coder.Constant(coredata), statedata, onlinedata});

% calculate the manipulated variables by calling the myMex executable
[mv, statedata, info] = myMex(coredata, statedata, onlinedata)
```

# GLOBAL CUSTOMER BASE



## SERIAL DEALS SIGNED:

- US Tier 1 for Robotaxi application
- EU OEM for factory vehicle logistics
- Laser cutting machine tool provider

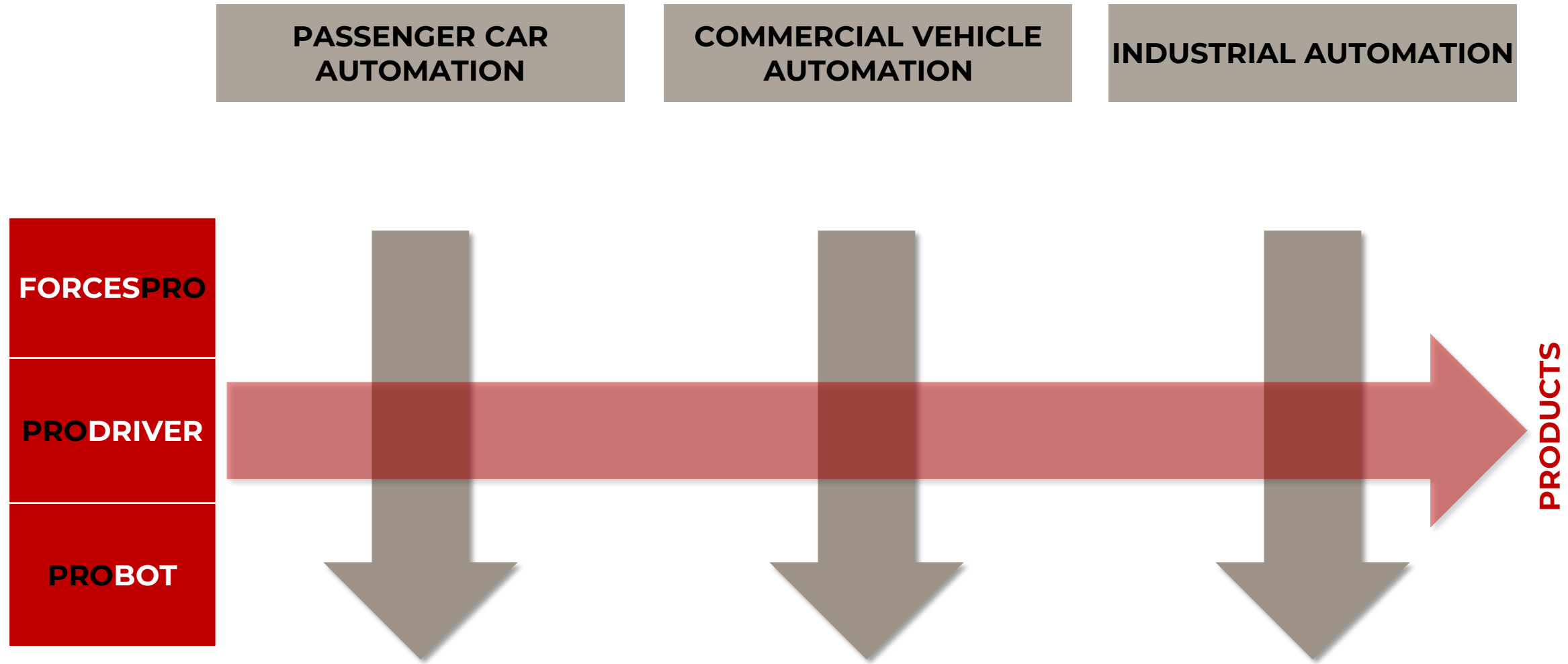
## OTHER NOTABLE CUSTOMERS:

- 5 large EU automotive OEMs
- 2 major German automotive Tier1s
- 2 large US automotive Tier1s
- 4 Asian automotive Tier1s
- 1 large US BigTech with AD program
- 2 Japanese tech conglomerates
- 1 Australian mining company
- NASA, ESA and other agencies

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# EMBOTECH BUSINESS UNIT SETUP

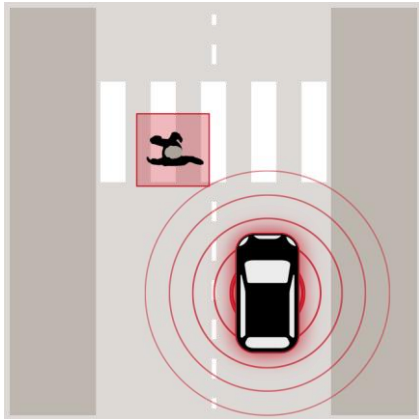


SYSTEMS / SOLUTIONS  
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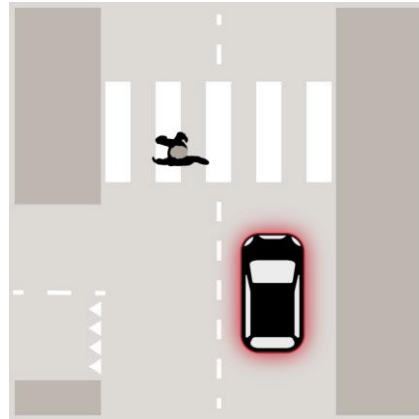
# PRODRIVER

# WHAT PRODRIVER IS

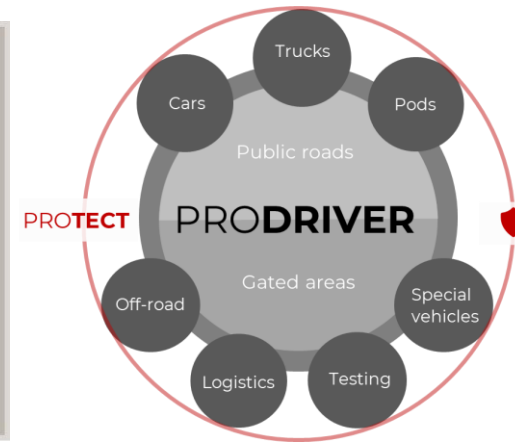
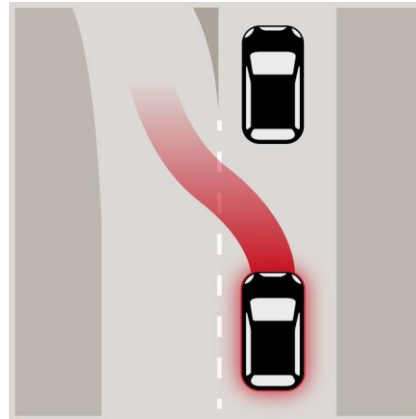
**SENSING**  
What's around me?



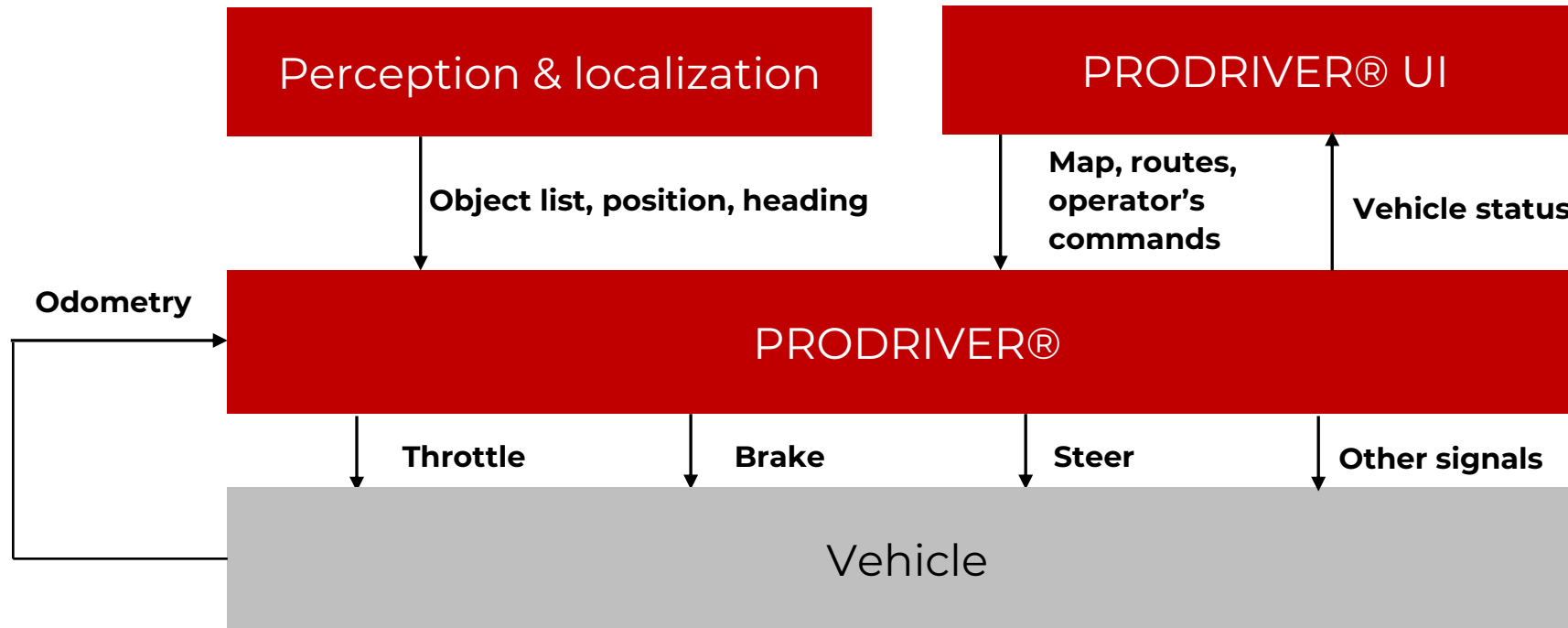
**LOCALIZATION & MAPPING**  
Where am I? Where can I go?



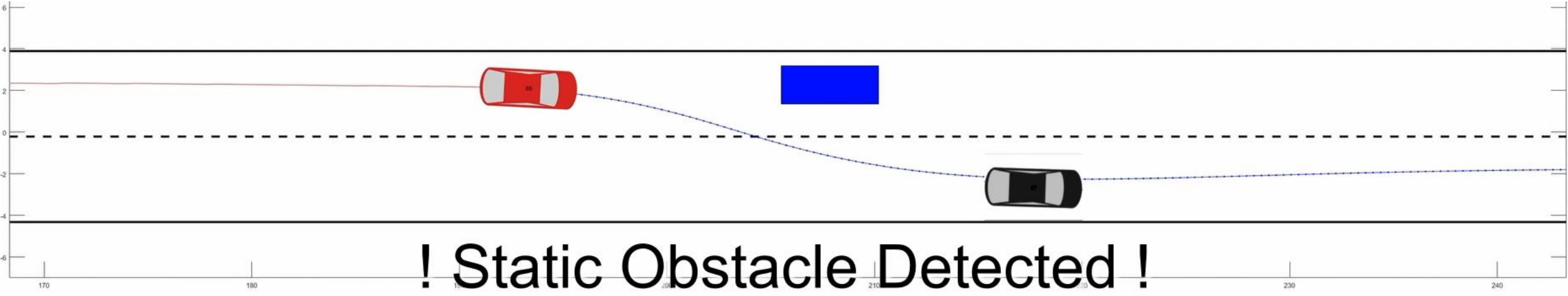
**MOTION PLANNING**  
This is where I should go



# SIMPLIFIED I/O







**EXAMPLE – PRODRIVER CAR ([VIDEO LINK](#))**

# FACTORY / LOGISTIC SOLUTIONS

# EMBOTECH'S SOLUTION FOR OUTDOOR LOGISTICS

## ONBOARD VS INFRASTRUCTURE-BASED AD



### EGO-AD

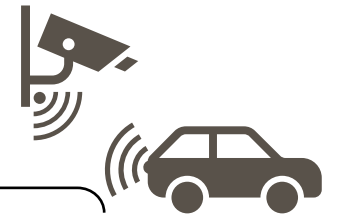
Sensing & intelligence on board

- + Optimal for few vehicles / large areas
- + Quick deployment

### HYBRID AD

Combination of sensing & intelligence onboard and offboard

- + Combines the advantages of both variants
- + More redundancy for safety

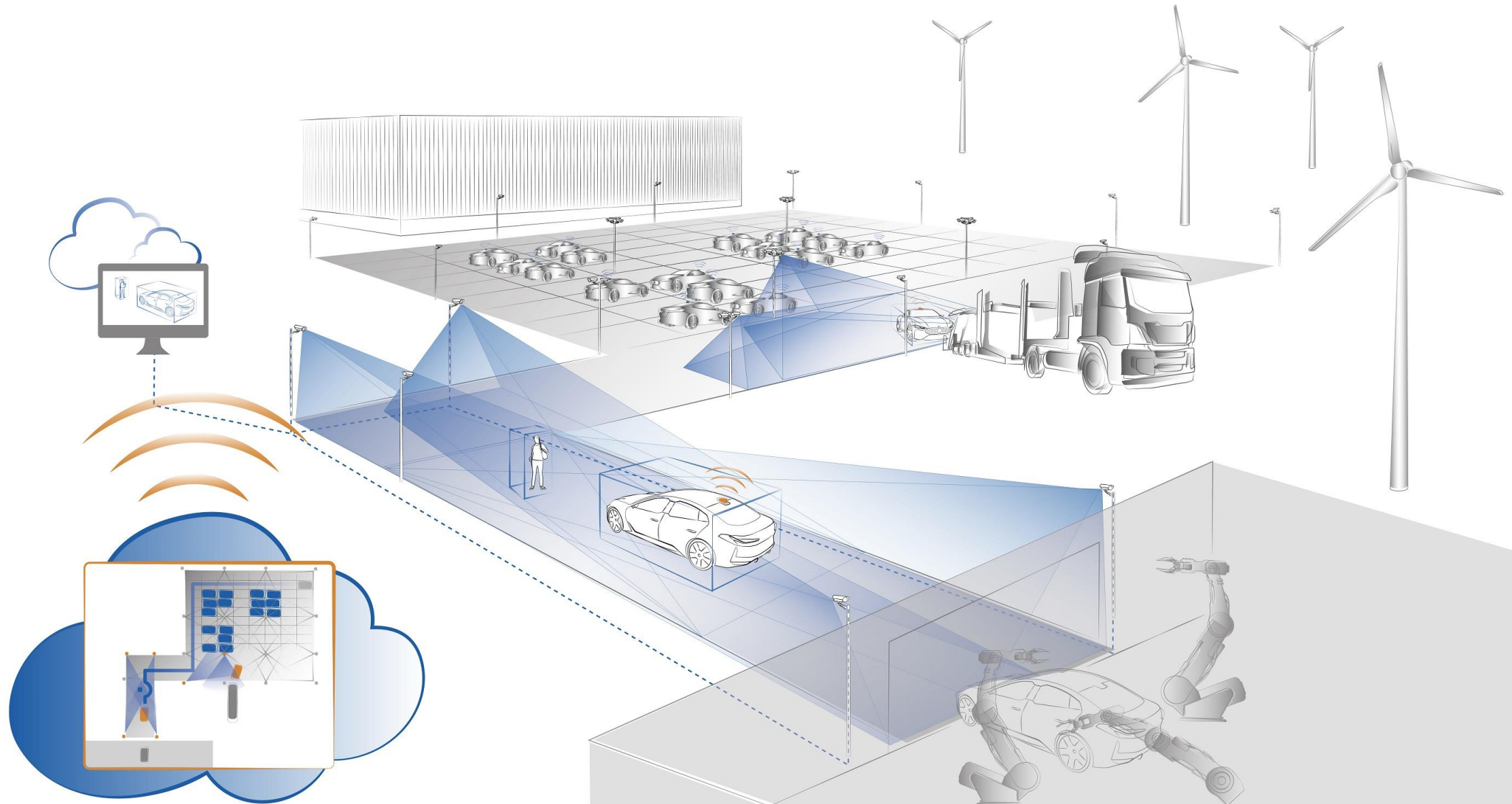


### INFRA-BASED AD

Sensing & intelligence on infrastructure, vehicles remote controlled

- + Optimal for small areas / many vehicles
- + Minimum requirements on vehicle
- + High operational flexibility

# AUTOMATED DRIVING IN OEM FACTORIES



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# BMW AUTOMATED DRIVING IN FACTORIES



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Watch online: <https://youtu.be/DSGlCSVseHU?t=727> **embotech\***

# OBSTACLE HANDLING AND LINE PARKING



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# AUTOMATED VALET PARKING @ IAA'21



# AUTOMATED VEHICLE CHARGING

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# USE CASE TYPES

## PORT TERMINALS



- Semi-trailers
- Shuttle use cases
- Trailer shunting
- Long stretches with high speeds
- Medium to heavy mixed traffic
- Harsh weather

## LOGISTICS CENTERS



- Mostly swap bodies
- Trailer yard and shuttle use cases
- Heavy mixed traffic
- Frequent small movements
- Small areas

## FACTORIES



- Mostly fix body and semi-trailer
- Trailer yard and shuttle use cases
- Heavy mixed traffic (Small city)
- Narrow passes, construction sites, tall buildings and hanging structures

# OUR TECHNOLOGY IS VEHICLE AGNOSTIC

**FIX CHASSIS**



**SEMI-TRAILER**



**BODY CARRIER**



30 Km/h, mixed traffic, interference zones, ego system, backwards maneuvers, coupling maneuvers

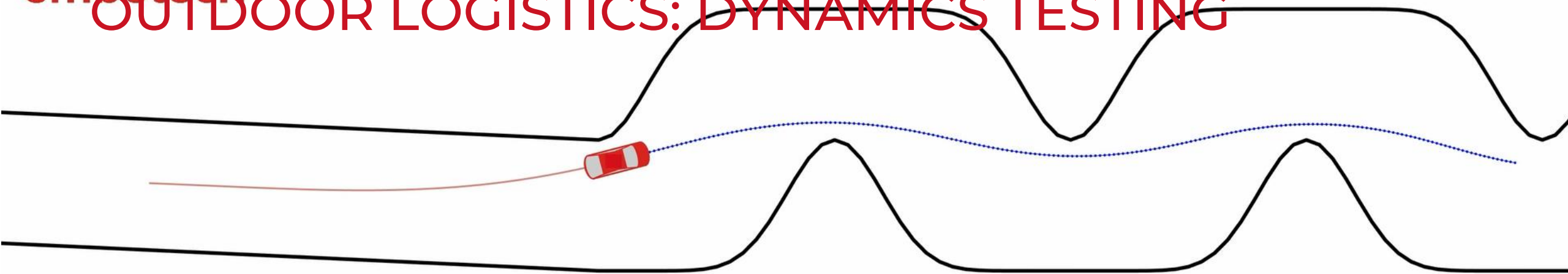
# ELECTRIC TRUCK RECORD ON TOP GEAR TRACK



# VEHICLE TESTING



# OUTDOOR LOGISTICS: DYNAMICS TESTING



# MINING SOLUTIONS



# MINING: AUTOMATION OF LIGHT VEHICLES





# ARTICULATED VEHICLES







[embotech.com](http://embotech.com)