



SAFER LEVEL CROSSING BY INTEGRATING AND
OPTIMIZING ROAD-RAIL INFRASTRUCTURE
MANAGEMENT AND DESIGN

SAFER-LC next steps: Lab tests and field implementations

Josep Maria Salanova Grau (CERTH)

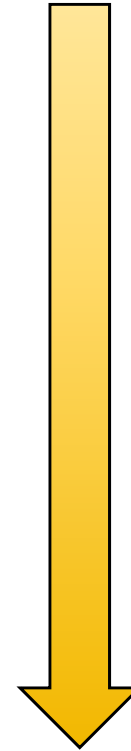
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Testing environments

- ▲ Simulation: laboratory simulation focused on driver behavior
- ▲ Controlled environment: prototype systems running in close-to-reality situations
- ▲ Real-world field tests

Simulation



Field

DLR Driving Simulator
SNCF Driving Simulator
VTT Driving Simulator
RWTH – mock-up LC field + rail vehicle
CEREMA Rouen test site for monitoring and remote maintenance
VTT Additional warning light system at front of the locomotive
DLR mobile traffic surveillance system
TRAINOSE + CERTH mobile communications testing
INTADER level crossings

Timing

Implementation April 2018 (M12)



October 2018 (M18)

Execution

November 2018 (M19)



April 2019 (M24)



Environment	Implementation	Execution	Responsible
Car simulator	September 2018 - ongoing	First test period January 2019 Second test period June 2019	DLR
Driving simulator	To be defined (about 4 months)	May/June 2019	SNCF
Two simulation environments: Junavaro data simulator & Road traffic simulator	September 2018 – To be defined	To be defined	VTT
LC mock-up installed at Aachen test sit	January 2019	January 2019	RWTH + CEREMA + IFSTTAR
Rouen test site for monitoring and remote maintenance	Test site ready Validation ongoing	December 2018	CEREMA + NTNU NTNU
Additional warning light system at front of the locomotive at a real rail enviroment	September 2019	To be defined	VTT
Mobile traffic surveillance system	Site identification ongoing	To be defined	DLR
Thessaloniki living lab	March 2018 - ongoing	First test period December 2018 Second test period June 2019	CERTH
5 level crossings	October 2018 - ongoing	February/March 2019	INTADER

Tests of LC safety measures in the DLR driving simulator



▲ Measures to enhance train detection:

- ▲ **Blinking lights near tracks** drawing driver attention (6_22, rank 11)
- ▲ **Lights on the train** to improve train visibility (6_03, rank. 9)
- ▲ **Bright train outside** for higher conspicuity (6_25, rank. 56)
- ▲ **Noise-producing pavement** (5_12, rank 60)
- ▲ **Sign look for train** (7_53, rank 39)

▲ Type of LC to be applied at:

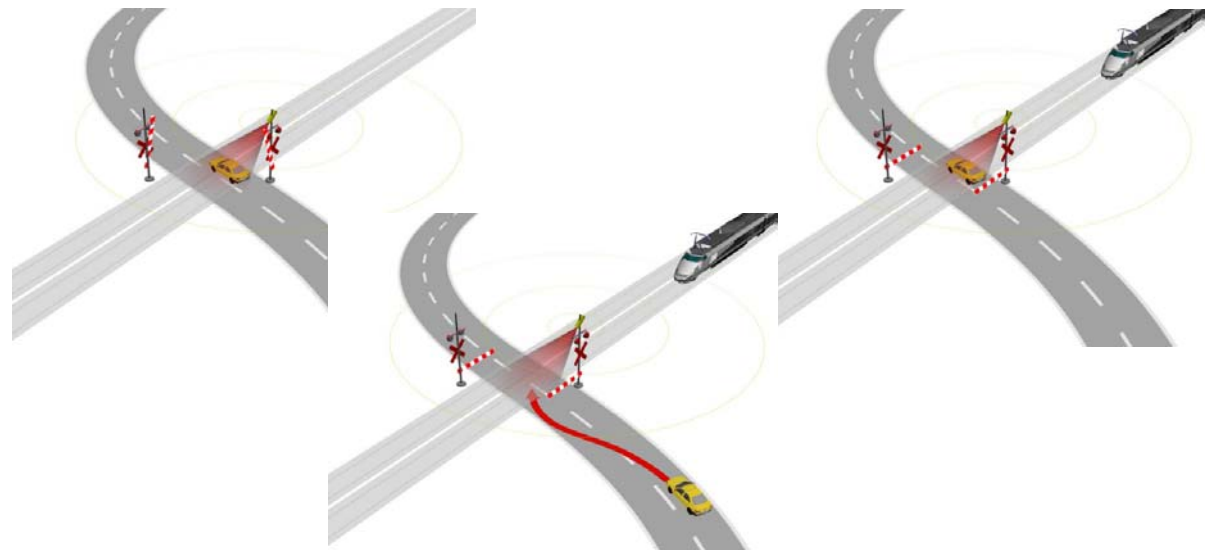
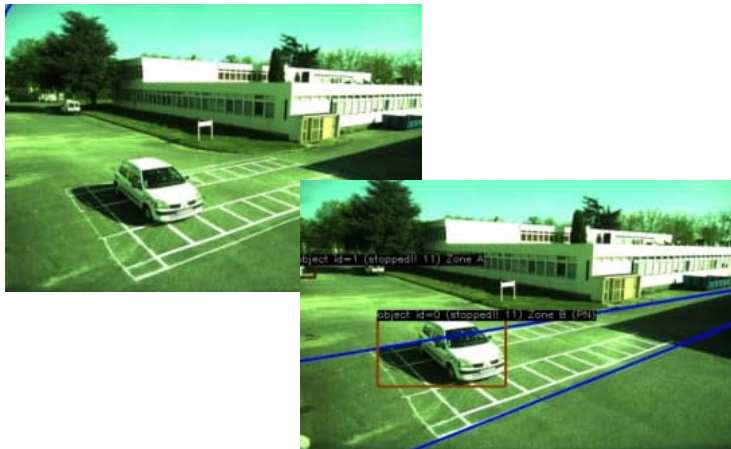
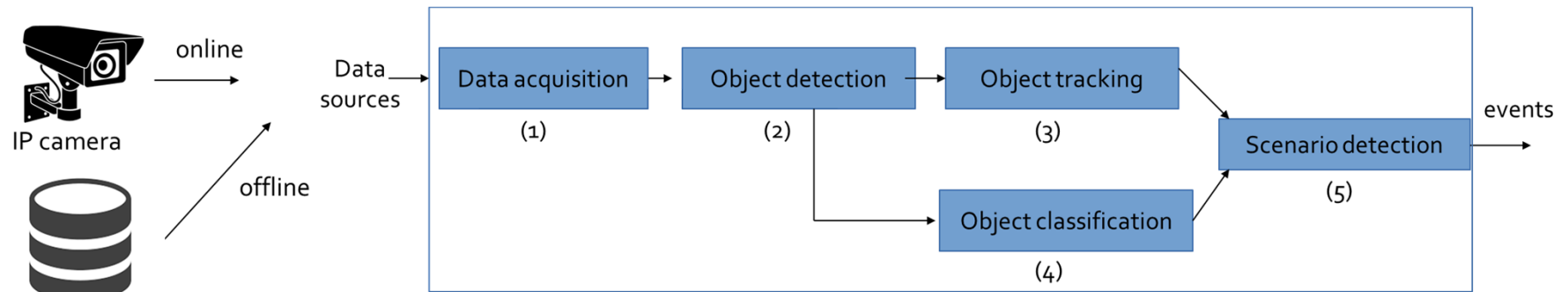
- ▲ **Passive LC**

▲ Expected safety effect:

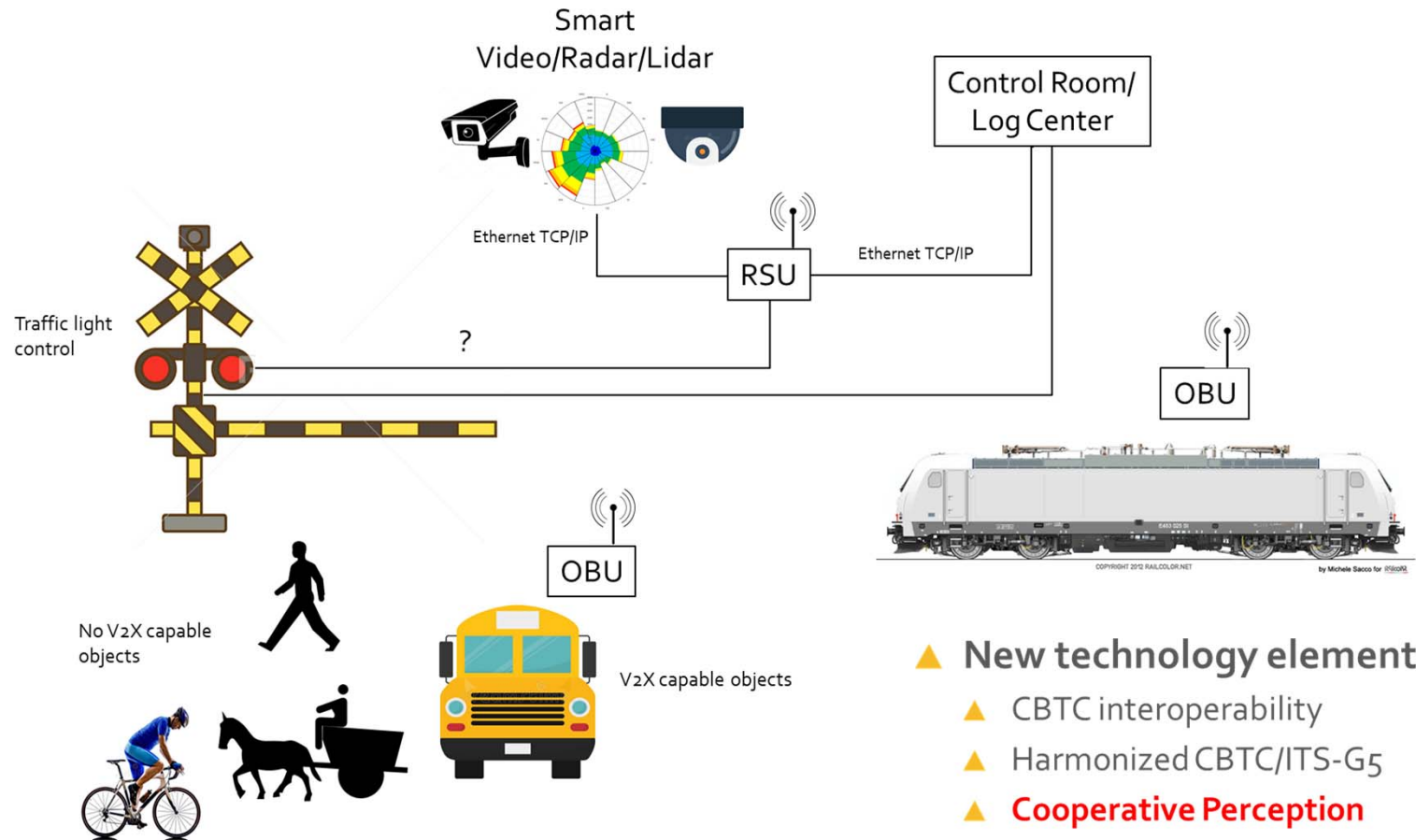
- ▲ **enhance the probability that an oncoming train gets detected**
- ▲ **By different mechanisms** (e.g. enhancing the salience of the to-be-detected object; capture attention to the relevant location ;impel the driver to do a voluntary visual search in the relevant areas)



Smart detection system

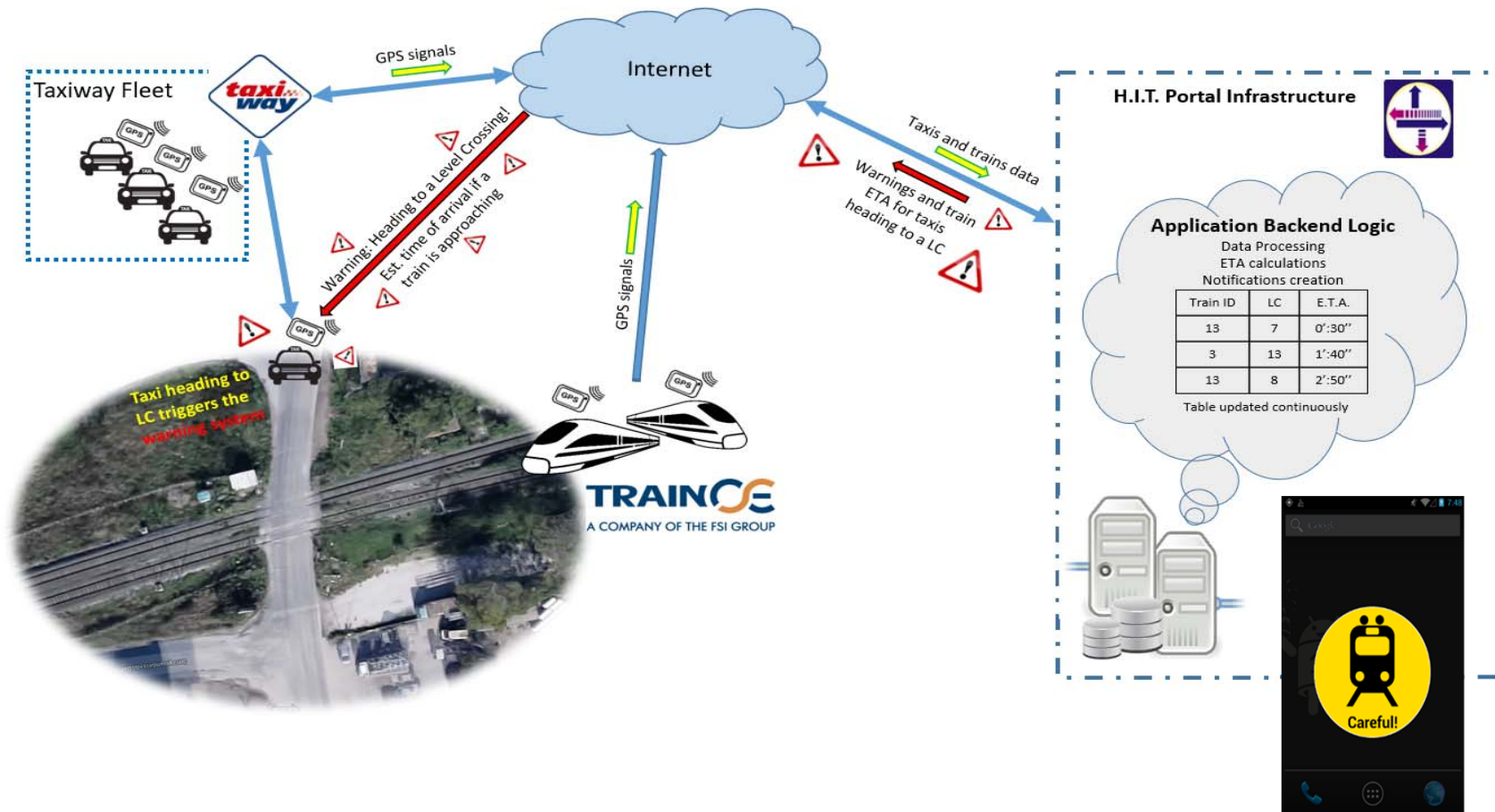


ITS-G5 communication system



- ▲ **New technology elements**
 - ▲ CBTC interoperability
 - ▲ Harmonized CBTC/ITS-G5
 - ▲ **Cooperative Perception**

In-vehicle advice about incoming train



Overview

Responsible partner	Detection of dangerous situations	Increase awareness of the users / infr. operators	Analyze human behavior to the implemented measures
CEREMA NTNU	Photogrammetry and other sensors (infrastructure status)	Alert to rail infrastructure manager	-
DLR, SNCF	-	Several measures	Various simulators
VTT	-	Light on the train ITS-G5 + LTE	
INTADER	Camera-based (obstacles)	Several measures	Cameras recording the LC
DLR			
CEREMA RWTH	Camera-based + V2X (obstacles)	ITS-G5 / V2X (car drivers)	-
CERTH	GPS – internet (potential collision)	LTE (car drivers)	GPS trajectories + cameras inside the vehicles

Interactive session topics

- ▲ Technical issues - Clarifications about the SAFER-LC technical developments
- ▲ Implementation and operation - Feedback - advice about the proposed measures and implementations
- ▲ Assessment - Data to be collected, analyses to be done
- ▲ Other
 - ▲ Exchange of experience, lessons learnt and related projects
 - ▲ Interest in receiving updates on project status and outputs





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Thank you for your attention

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