



# Automatic Train Operation

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# A new generation of suburban train technology with ATO over ETCS

## NCRTC – Delhi - Meerut

- Reduce the journey time to just 60 minutes, compared to the current 90-100 minutes
- Combination of the latest ETCS standard supported by the latest digital Interlocking and Automatic Train Operation (ATO) over Long Term Evolution (LTE) radio.
- Integrated Platform Screen Door (PSD) solution to provide utmost safety to passengers.

## S-Bahn - Stuttgart

- Implementing ETCS level 2 and level 3 as well as ATO in automation level 2
- With an overall smoother flow of rail traffic, passengers can look forward to more frequent service and faster connections.



NCRTC  
82 km Delhi – Ghaziabad –  
Meerut



Stuttgart  
215 of the S-Bahn (DB) trains

# Building blocks of automation: trains that can take safe decisions in real time

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Perception of the environment  
helps achieve  
safety and efficiency

Automated solutions must involve  
developing a train that can  
“**see**,” “**think**” and “**decide**” for itself  
**safely** and in **real time**.

# Environment perception: Alstom is developing 2 technologies for networks non-covered by ETCS

Function will be covered by ETCS but...

- 1 **Lead time** for deployment across ETCS is expected to be some decades
- 2 Will be needed in the transition time between ETCS level 2 lines and others
- 3 Some network will **not be equipped** (low density, depot,...)

## COMPUTING POWER

- In the frame of SNCF fret program, Alstom has developed a **Signal detection System**, in GoA2
- Aiming at being the **world's first certified SIL2 solution**.
- Feb 2022: first successful test for the **first semi-autonomous train** on a line equipped with lateral signalling

## ARTIFICIAL INTELLIGENCE

- Alstom participates in **SOB** proof of concept with a standalone equipment for **driving assistance**
- In the frame of research institute program, Alstom has developed an **Obstacle Detection prototype** able to managed the train in GoA3



# Environment perception through Computing power

## Signal recognition challenges:

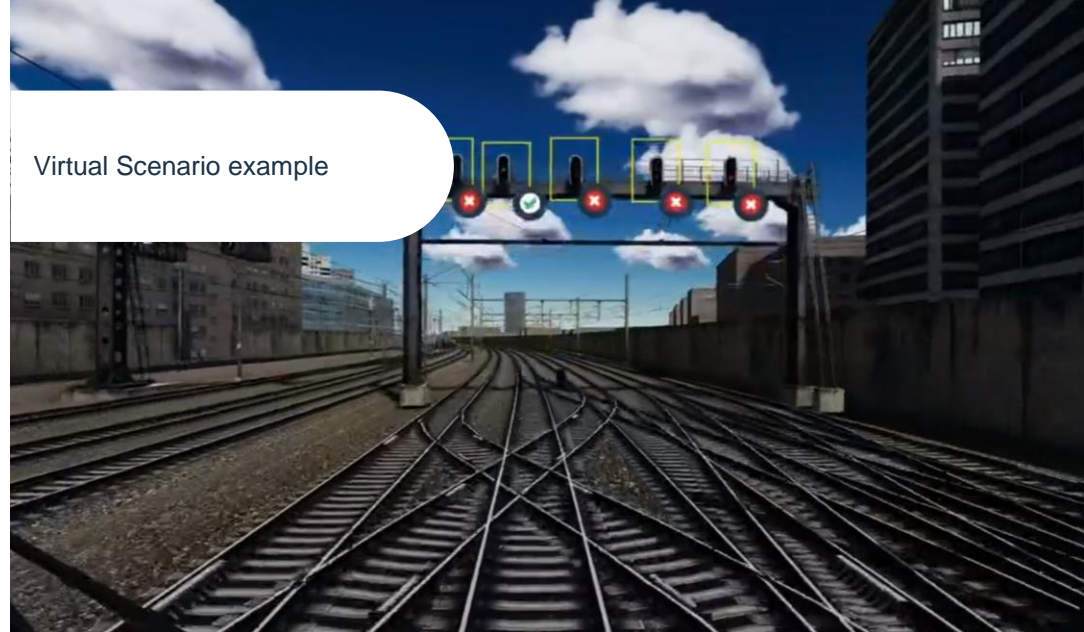
- Which route? Capture the scene with the appropriate equipment, the required field of view, resolution,..
- Which signal? Establish the position of the target signal
- Which signal state? Determine the target signal state based on analytical algorithms and to establish a confidence level

## Signal detection system based on several factors to secure the information:

- Signal position
- Frame type
- Train position (GPS satellite)
- Rail approach information (absolute positions during signal approach)

## Thousands of Virtual & Real scenarios for system validation

- Various weather situation
- Degraded and non-degraded modes
- Several signals
- Etc.



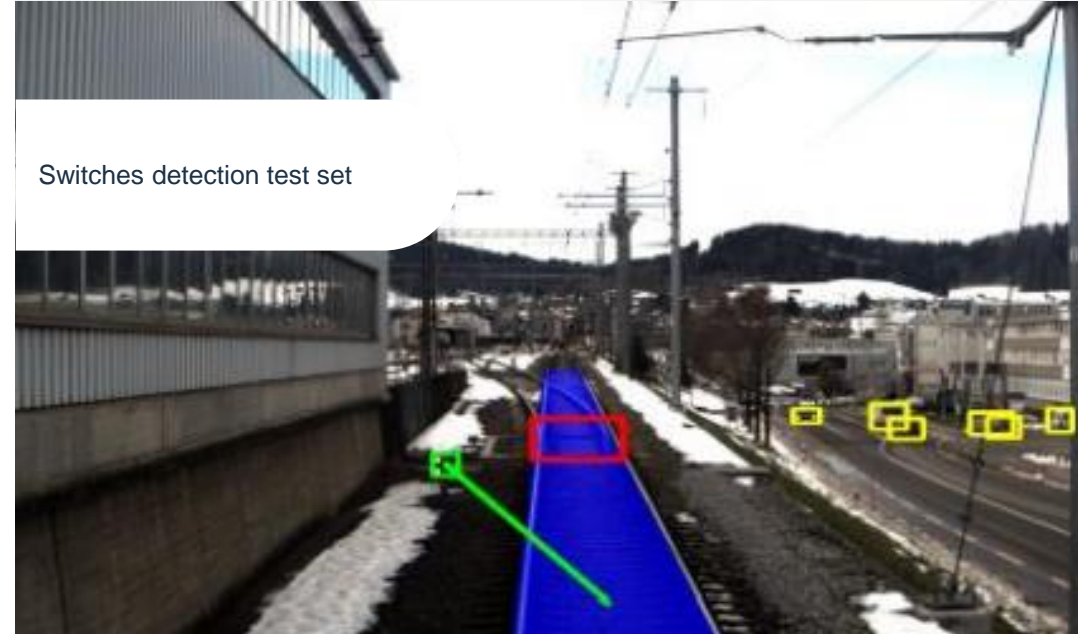
# Environment perception through Artificial Intelligence

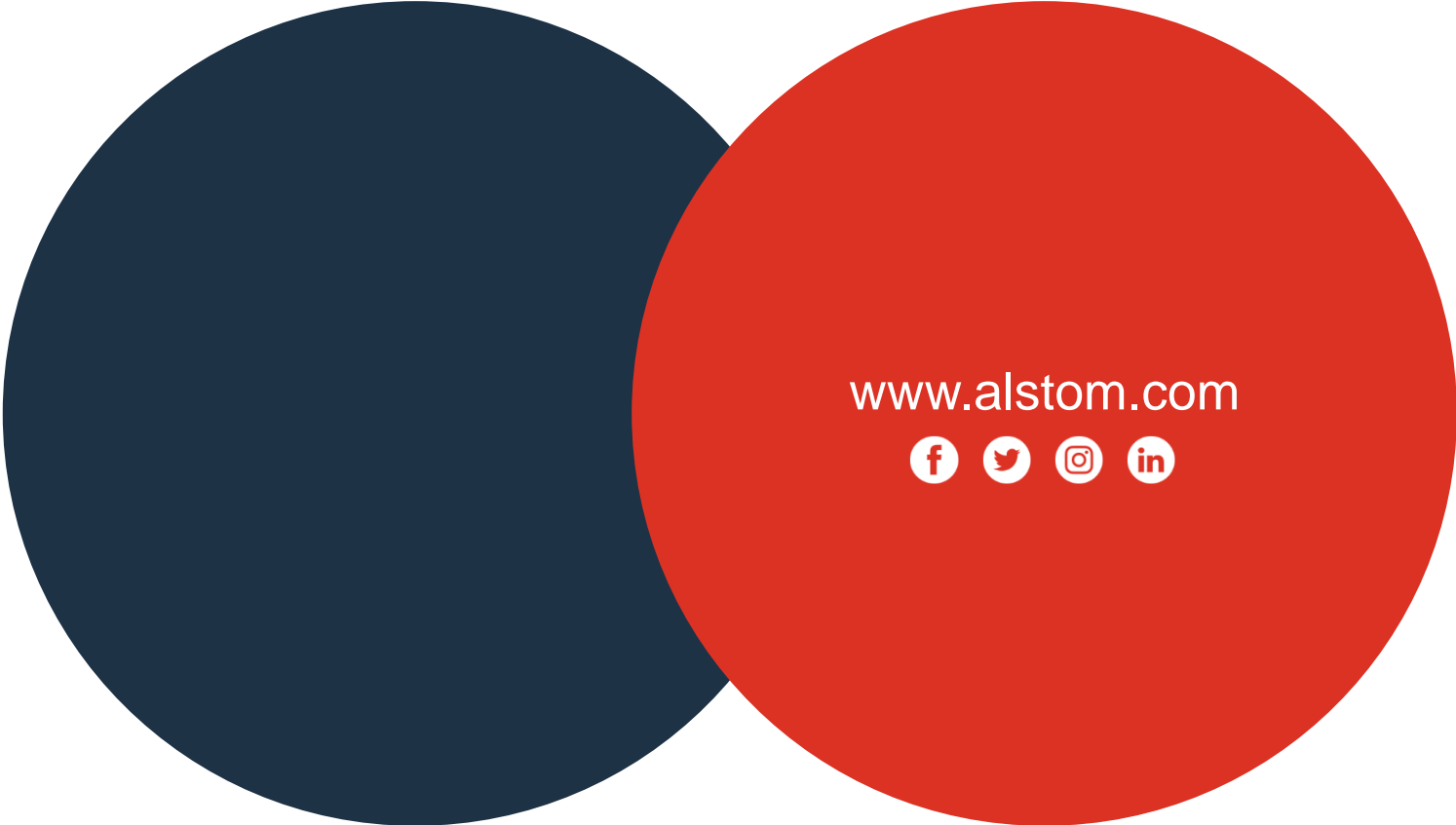
## Environment perception for Driver assistance:

- Proof Of Concept with **SOB**
- **Preliminary field tests** on train's ability to detect and recognize, along the tracks:
  - Switches
  - Signal
  - Obstacles
- Final field tests planned with a driver assistance standalone equipment to provide collision, overspeed prevention and automatic warnings.

## Environment perception for Autonomous Train:

- Collaborative project involving **SNCF**
- **Objective:** provide a system (Signal & Obstacle detection) implemented on board the SNCF autonomous freight train prototype
- **Successful test** in April 2022: ATO triggered braking in front of the obstacle





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