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SimDaaS AI

Safer Roads Through Simulation

Accelerating end-to-end System Autonomy design cycles with Synthetic-data-driven development, validation, and integration at scale.

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We all have lost our dear ones in road accidents!

- India
  - 11% of global road accidents
  - 170,000 deaths/year
  - 3% GDP loss
  - 90% due to human error
  - Increasing

Youtube-crazy accidents

Alerting a driver 2 seconds in advance can save 80% fatalities

"ADAS* technology can alert a driver well in advance"

- Problem Statement
  - Before being commissioned, ADAS functions need thorough testing
  - Field tests are expensive and accident-prone
  - **Simulation** for designing ADAS becomes a MUST
  - ADAS services designed elsewhere will need to be adopted to Indian traffic scenarios
  - **Lack of Indian traffic scenarios and simulation!**

*Advanced Driver Assistance System

Problem: How to Train and Test AV/ADAS Functions?

भारत का राजपत्र
The Gazette of India

Ministry of Road Transport & Highways draft notification of 20 March 2025 for implementation of ADAS for M2, M3 and N2, N3:

- Blind Spot Information Systems
- Moving off Information Systems
- Lane Departure Warning System (LDWS)
- Advanced Emergency Braking Systems
- Driver Drowsiness and Attention Warning Systems

Bharat NCAP 2.0

VOLKSWAGEN
ADAS Sistemleri

TOYOTA SAFETY SENSE™ 3.0

- **SimDaaS Solution**
  - **SimDaaS Simulation Platform facilitates training and testing of AV/ADAS functions with a focus on Local traffic scenarios**

SimDaaS AI

Solution Offered: SimDaaS Simulation Platform

"For training and testing of AV/ADAS functions with a focus on Indian traffic scenarios"

01

3D Town Creation

- Simulation of road network
  - From OSM
  - From OpenDRIVE
- Simulation of side environment
- SimDaaS Asset Library (**Indian**)
- Testbed virtualization

02

Scenario Generation

- Scenario simulation through OpenSCENARIO 2.x (1.x)
- Video to scenario (**patent filed**)
- LLM to scenario (**patent filed**)
- Crowd-Source to scenario
- Auto traffic simulation
- Scenario editor

03

Sensor Simulation

- Sensor packaging on any vehicle
- **AI for Realistic** sensor simulation
  - LiDAR, Radar
  - Camera, Depth camera
- Reference data
  - Semantic segmentation
  - Bounding box

04

Verification & Validation

- Validation of perception engine
- Validation of control engine
- **KPI/Report** generation

- Simulink integration
- IPG Carmaker integration
- CARLA integration

ScenarioFactory and V&V

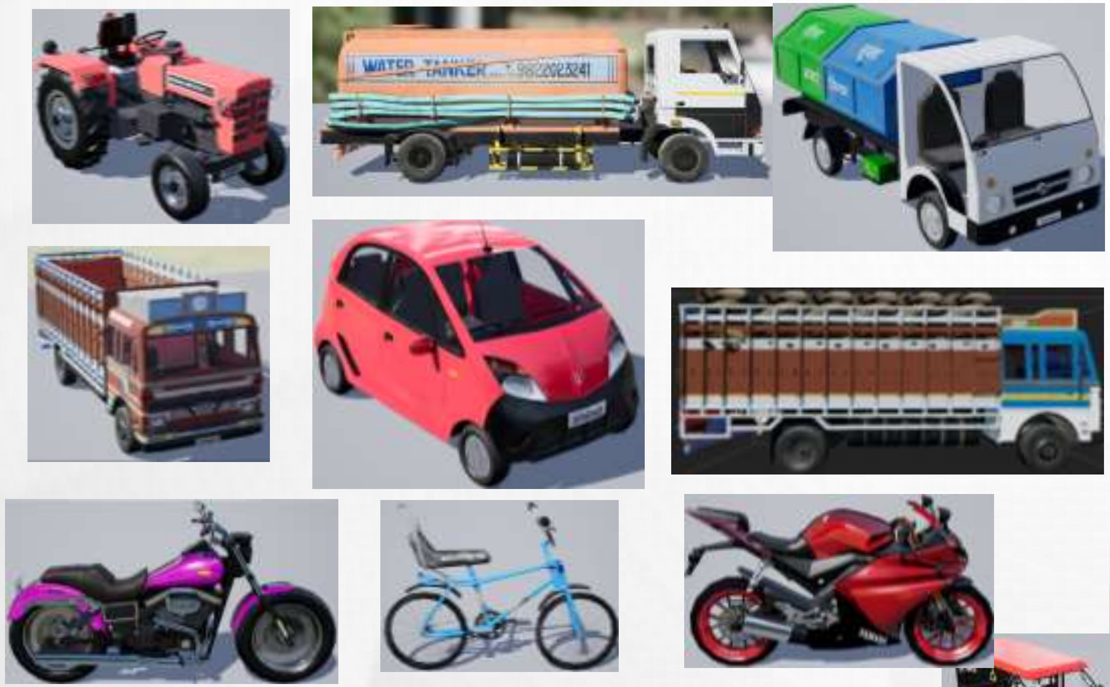
Side Environment Simulation

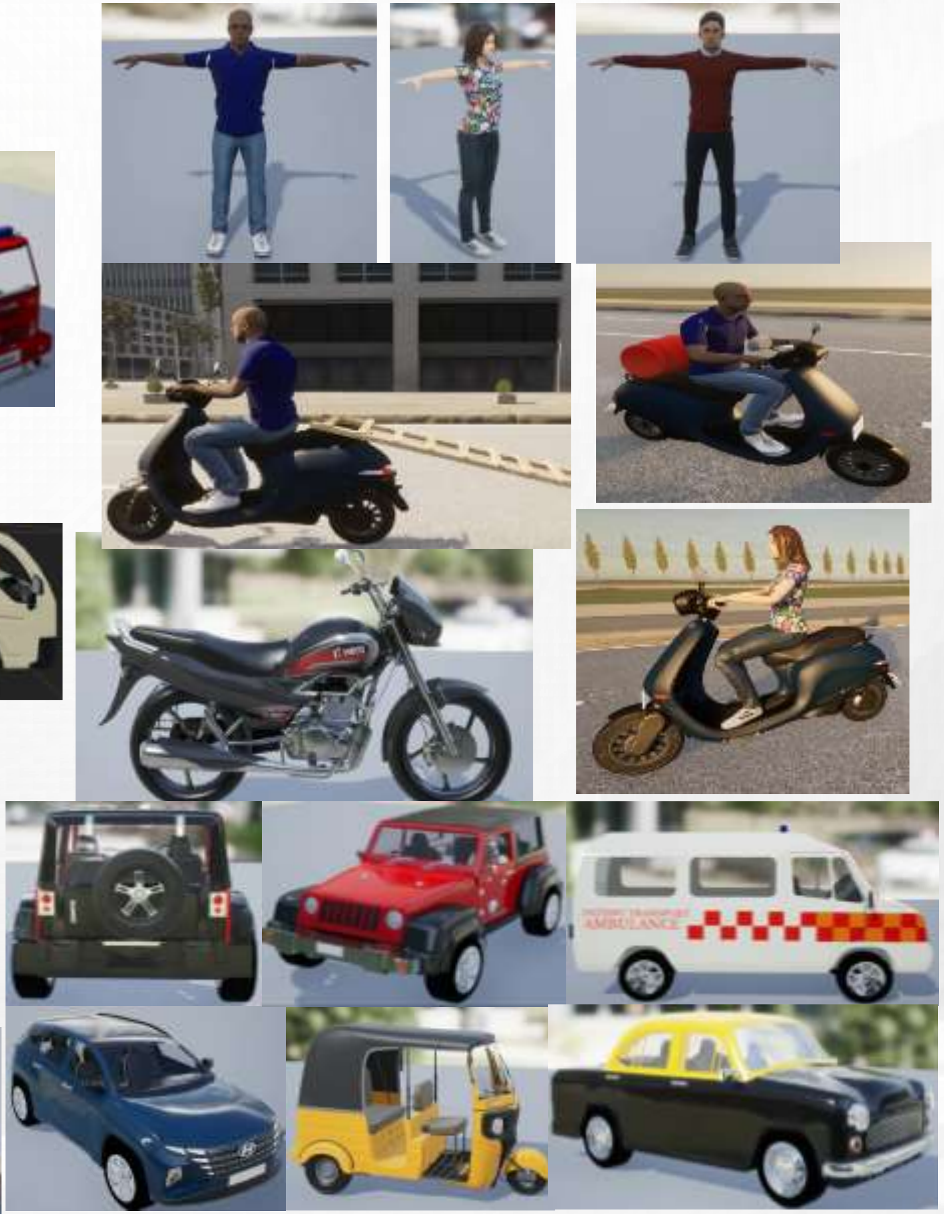
MapmyIndia

SimDaaS Asset Library

- Domain-specific assets are available for creating AV/ADAS scenarios
- Ready-to-use dynamic asset
  - Rigged and animated
  - High-quality material and texture
- Materials ready for
  - Intensity simulation for LiDAR
  - Class and Instance annotation
- On-demand assets can be created

SimDaaS Asset Library



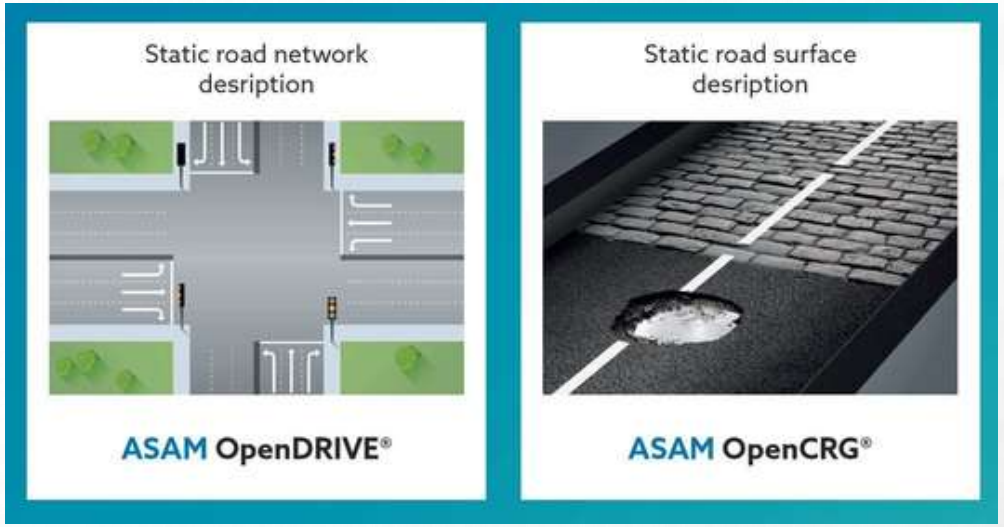


3D assets
Total assests:1047
Indian assets: 213
Vehicles: 96
Pedestrians: 60

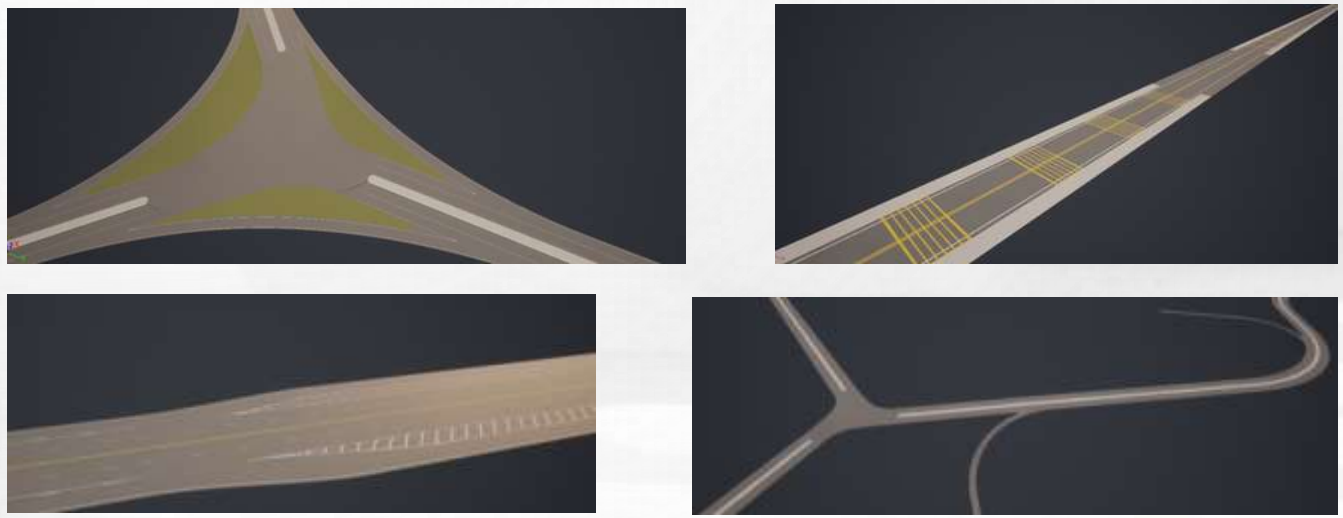
Maps: 17
- City maps: 5
- Testbeds: 2
- Offroad maps: 4
- Orchards: 6

SimDaaS AI

Simulation of Road Network



- SimDaaS follows ASAM standards
- OSM to OpenDRIVE conversion
- HD map to OpenDrive
- SimDaaS XODR Library - different road designs
  - 115 nos. of XODR networks



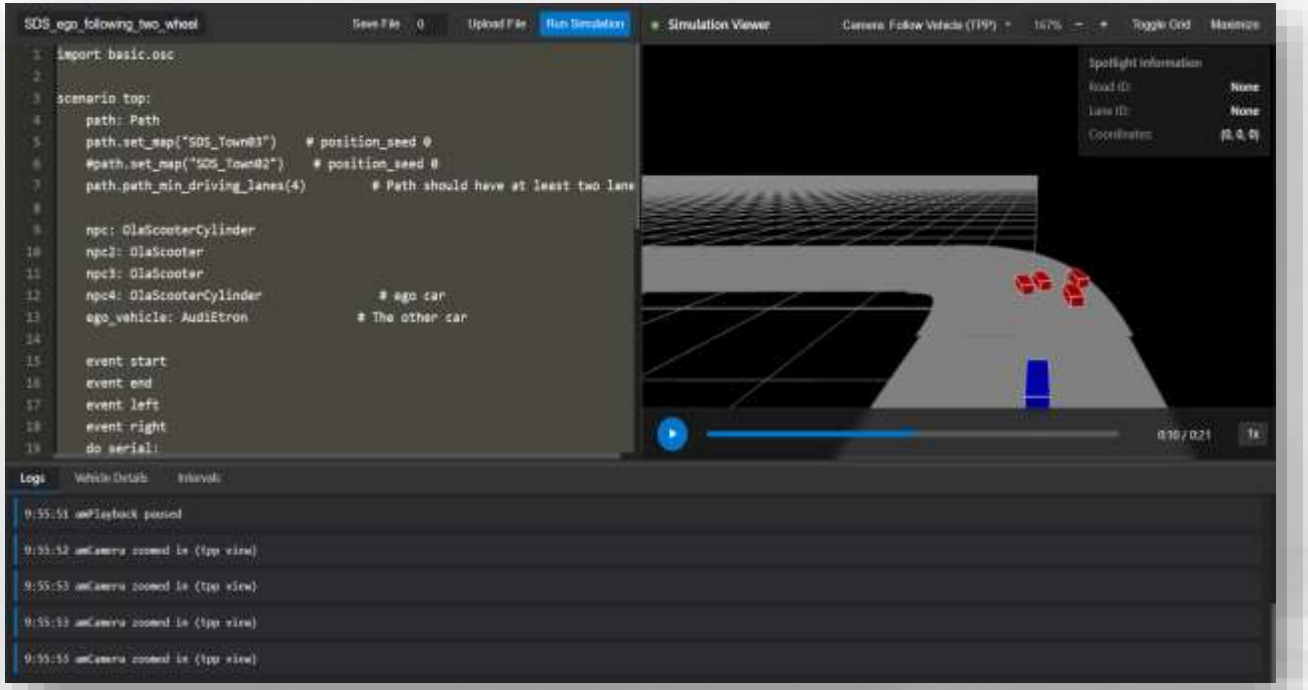
Example Road Network XODRs for Simulation

- Surface simulation using OpenCRG

SimDaaS AI

Scenario Generation in OpenSCENARIO-DSL:Through Scenario Editor

- Diverse and challenging driving scenarios
- Library of scenarios
  - Logical
  - Concrete
- Includes different terrains, traffic situations, weather conditions, and unexpected events
- Thousands of variations can be generated
- SimDaaS Scenario Editor helps manage scenarios



SimDaaS Scenario Editor

Scenario Simulation Through OpenSCENARIO 2.x

Non-Ego avoids wrong side autorickshaw in night

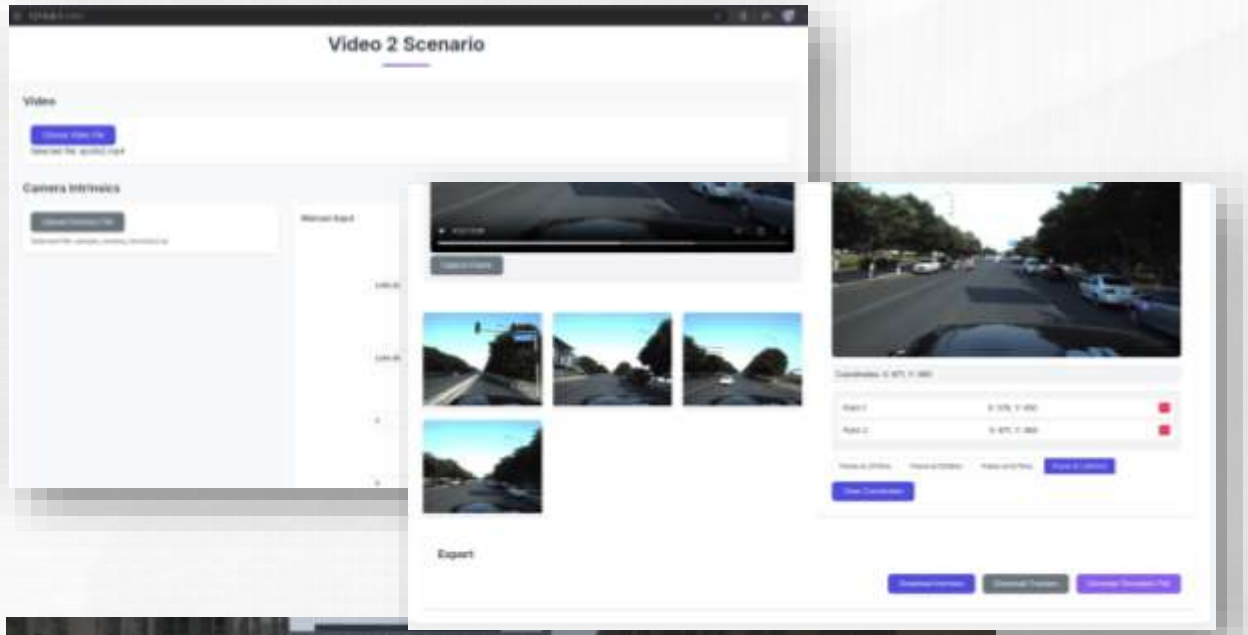
Ego gives pass to emergency vehicle

Non-Ego avoids bullock cart on highway

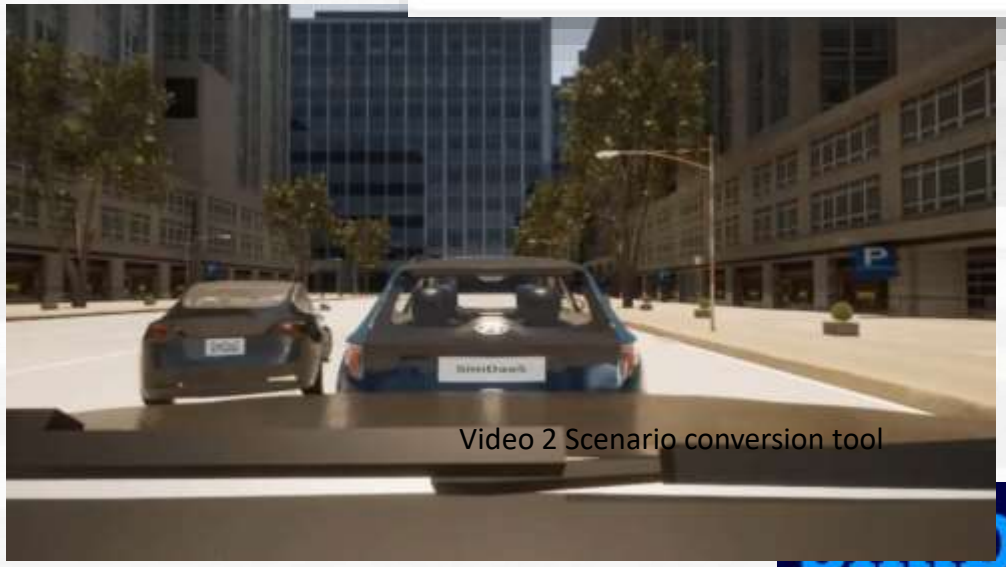
Ego avoids collision with cow herd

Video to Scenario (*Patent filed*)

Link to Video



- Scenarios can be exported in **OpenSCENARIO-DSL**
- Enabling the simulation of hundreds of **variations**
- Scenarios can be simulated across **diverse maps and various locations** within a single map
- Scenarios can be simulated under diverse **weather** and **time-of-day** conditions



Video 2 Scenario conversion tool

LLM to Scenario (*Patent filed*)

Describe a traffic scenario to generate OpenScenario code

Scenario Description

Give me a accident scenarios that is relevant to test Advanced Emergency Braking System

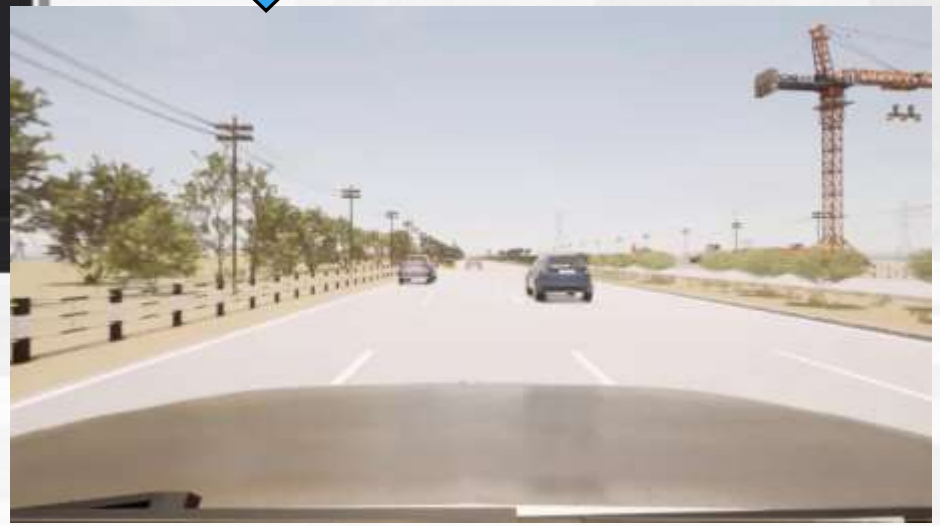
▶ GENERATE CODE

Press Ctrl+Enter to generate instantly

Generated Code

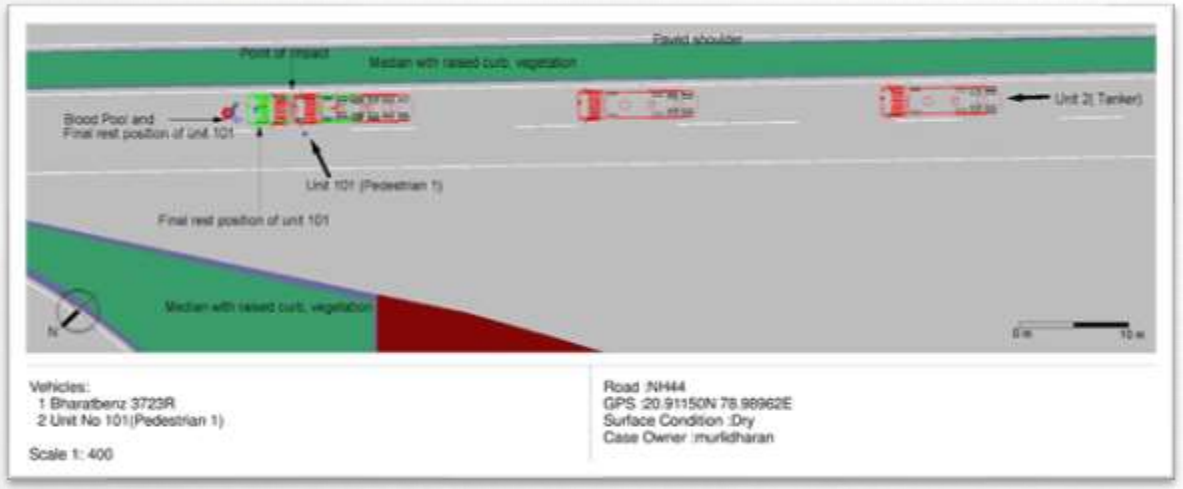
```
import basic.osc

# Accident scenario to test Advanced Emergency Braking System (AEB

scenario top:
    path: Path                      # A path in the map
    path.set_map("SDS_Town02")    # position_seed 0
    path.path_min_driving_lanes(3)          # Path should have at le

    ego_vehicle: Model3
    npc1: Mercedes
    npc2: Creta
    npc3: AudiEtron
    npc4: Mkz2017
    npc5: AshokTruck

    event start
    event end
    event left
```

SimDaaS AI-based Tool



SimDaaS AI

RASSI to Scenario

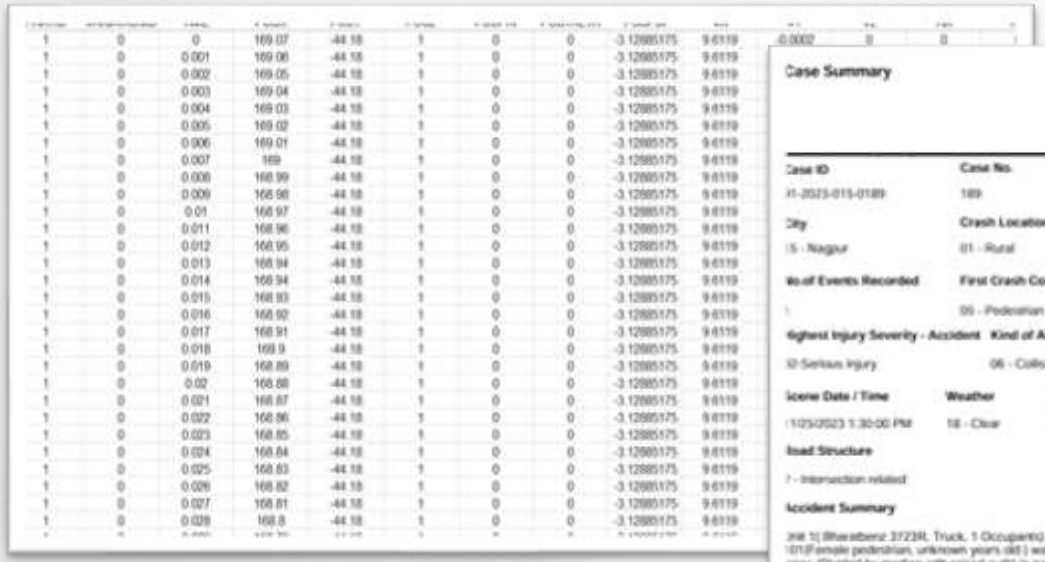


2D scene diagram

SimDaaS AI-based Tool

```
Serious injury collision in rural Nagpur on NH44 involving a tanker truck and pedestri

scenario top:
   path: Path                          # A path in the map
   path.set_map("Town03Sidewalk")      # Using SDS_Town02 as closest suitable map for rur
   path.path_min_driving_lanes(4)      # Four lanes as per NH44 description

   ego_vehicle: AudiEtron    # Tanker truck as ego vehicle

   npc1: Man01 #Pedestrian                # Female pedestrian crossing diagonal

   event start
   event end
   event left
   event right

   do serial:

      spawn: parallel(duration: 6s):
         ego_vehicle.drive(path) with:
            speed(25kph)
            sensors()
            lane(2, at:start)              # Assuming ego vehicle on lane 2 (left sic
            position(0m, at:start)
         npc1.walk(path) with:
            speed(0.5mps)
            lane(right_of:ego_vehicle, at:start)  # Pedestrian approaching from righ
            position(130m, ahead_of: ego_vehicle, at:start)
            # No orientation provided, so omitted

      drive_approach: parallel(duration: 5s):
         ego_vehicle.drive(path) with:
            speed(9.6mps)                          # Approx 34.6 kph as dynamic da
```

OpenSCENARIO file



Vehicle dynamics data

RASSI's accident report

Scenario simulation

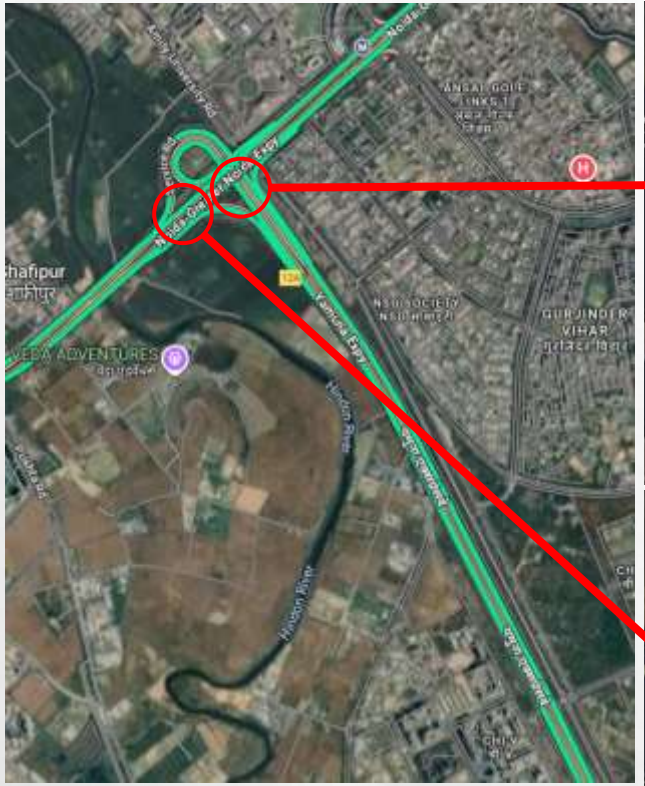
Auto Traffic Manager

- Generation of road traffic automatically
- Includes different terrains, traffic situations, weather conditions, and unexpected events

Spawned vehicles negotiate traffic under some rules

Vehicle stops at red traffic light

Scenario Simulation on MMI's HD Map



Yamuna Expressway (Image Google)

Traffic simulation- as seen on bird's eye view

Traffic simulation -as seen on Ego camera

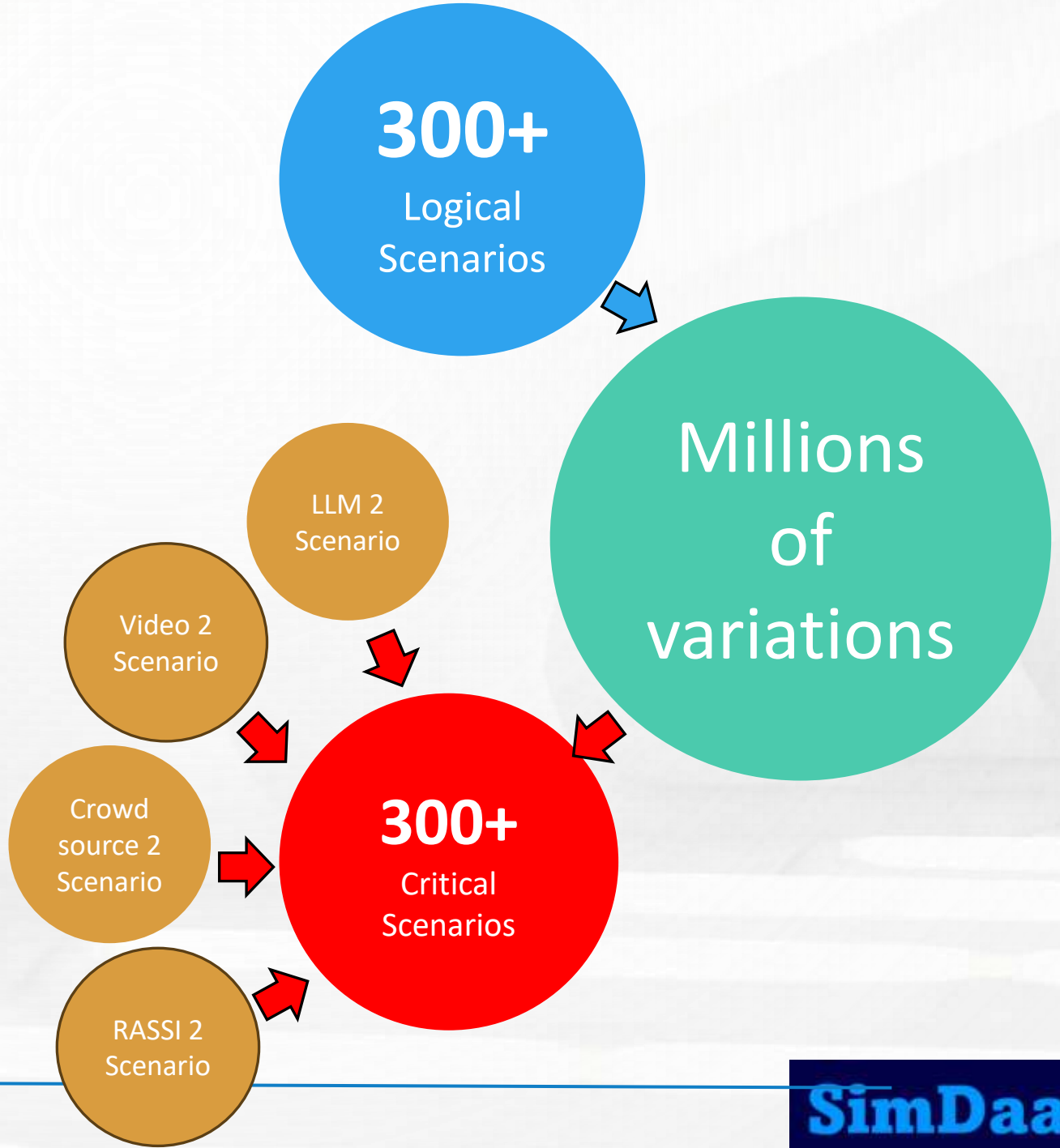
HD map source: MapmyIndia

SimDaaS Scenario Library

Covering the regulations

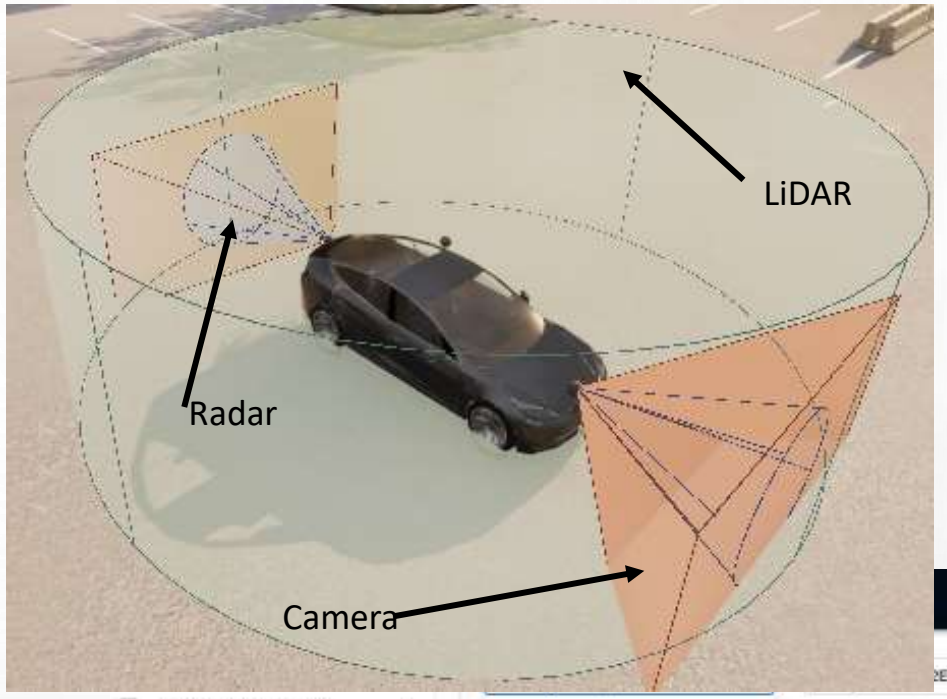
- Automotive Industry Standards (AIS)
- Real accident scenarios e.g. **RASSI**
- **SimDaaS curated** scenario
- LLM generated

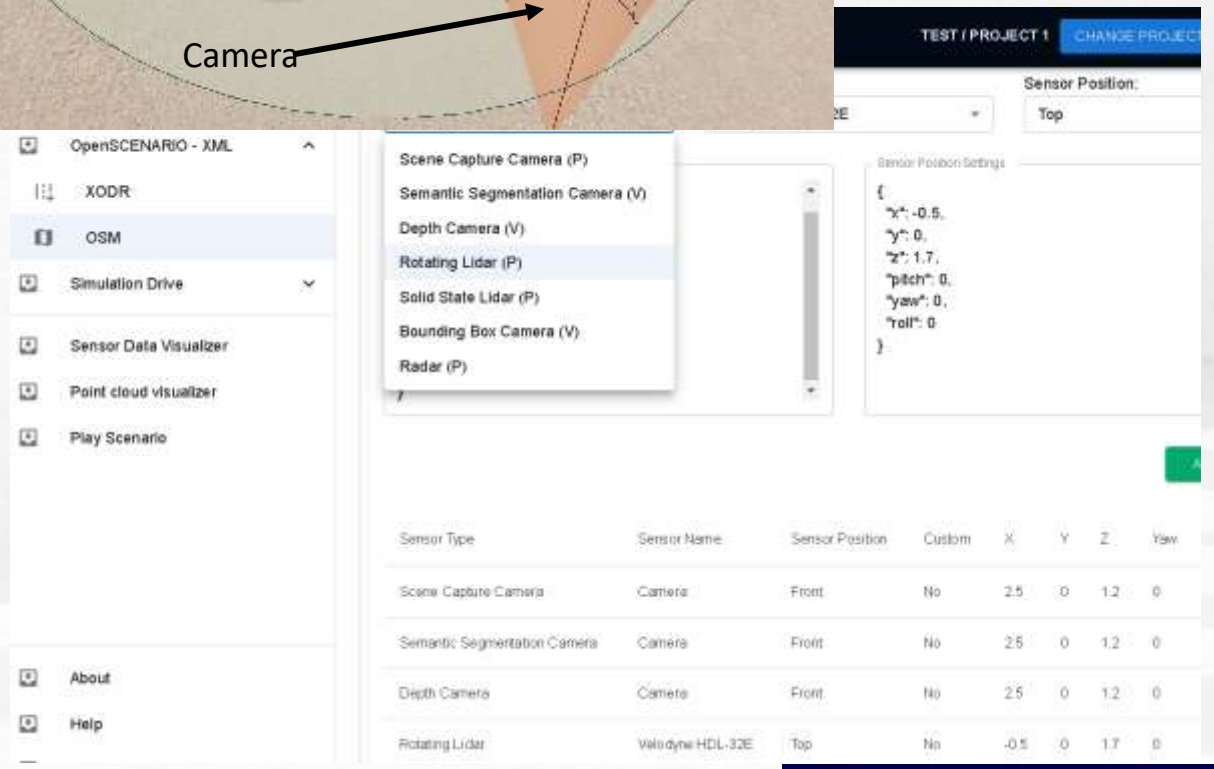
- UN Regulation No - 157
- Euro NCAP 2026



Sensor Packaging Tool

- SimDaaS Sensor Library
  - Sensors available in the market
  - For a conceived sensor
- Quantitively evaluate and compare sensor performance
- Experiment with difference sensor mounting positions, FOV, PFR, etc

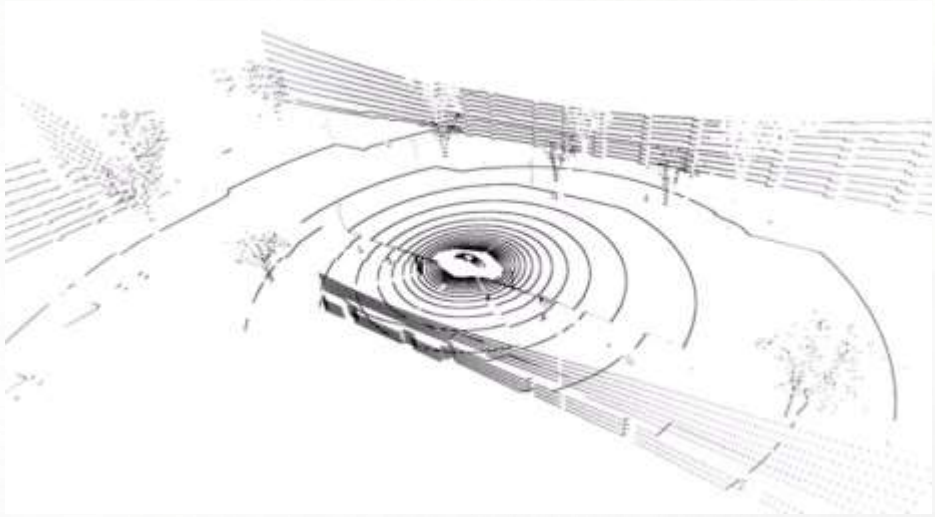




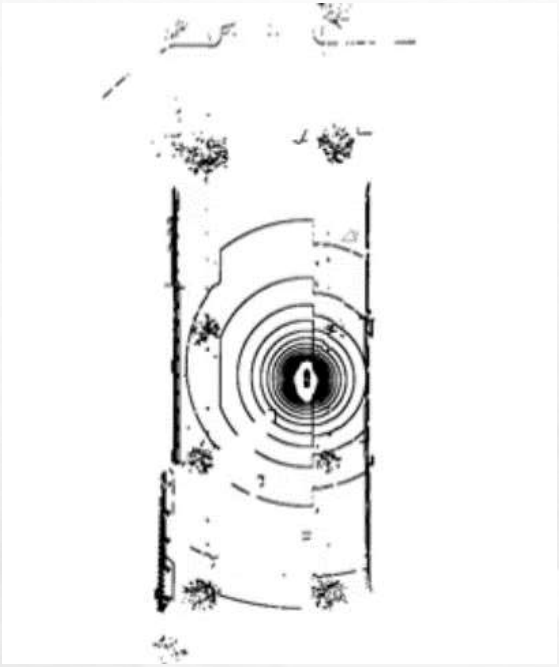
SimDaaS AI

LiDAR

- Sensor parameterization
- Different scanning mechanisms
- Including noise



Rotating LiDAR side view



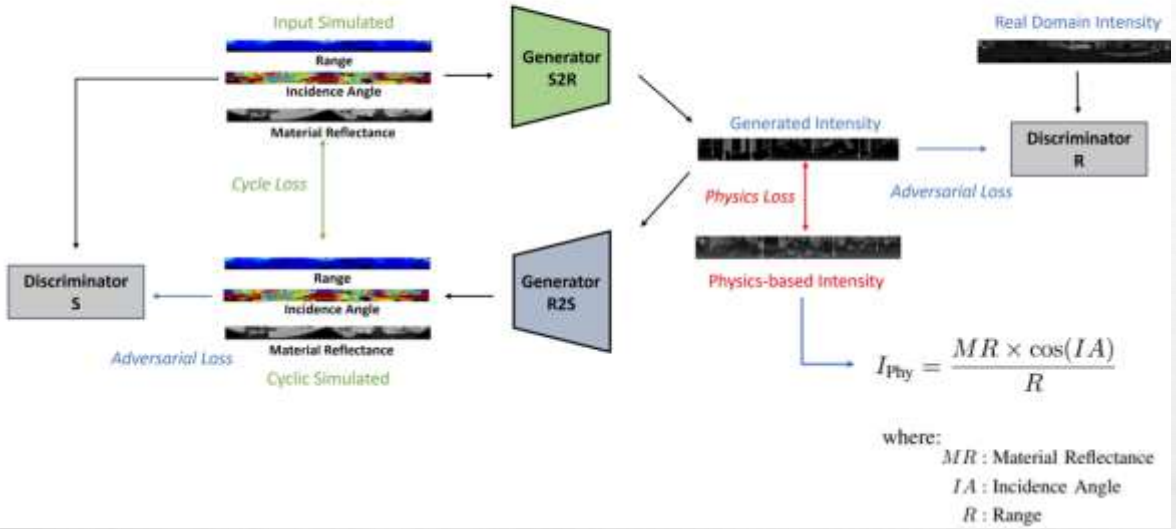
Rotating LiDAR top view

Solid State LiDAR top view

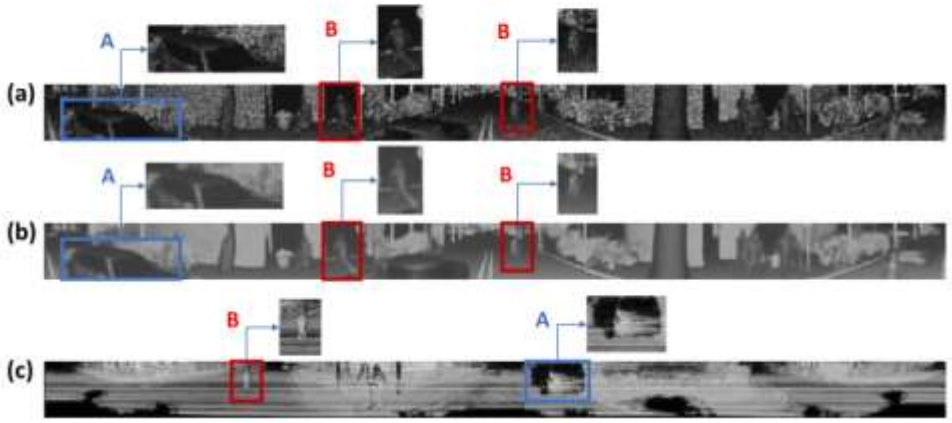
Closing Sim2Real Gap

- Physics-based simulation does not represent intensity correctly
- Our Physics-informed-CycleGAN method ensures intensity of simulated data is realistic as in field

Training Pipeline – Physics-Informed CycleGAN



CycleGAN with Domain Adaptation from SemanticKITTI Dataset



SimDaaS AI

Radar

- Simulation of automobile radar sensor
- Using multi-beam ray casting technique
- Configurable parameters – range, FOV (Vertical & Horizontal)

Radar simulation

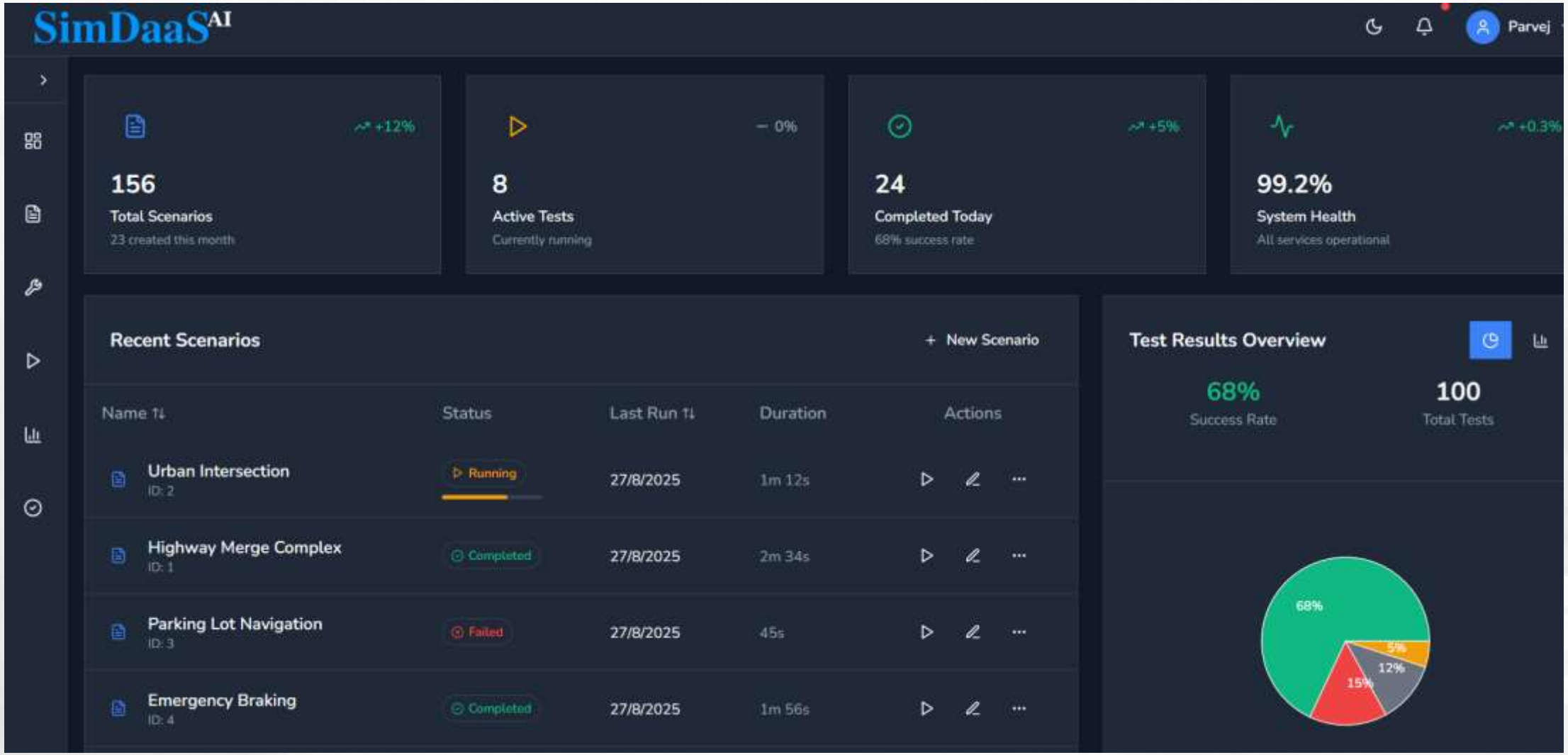
Camera & Depth Camera

- RGB Image simulation
- Post-processing effects for better realism
- Generic design for parameterization in detail

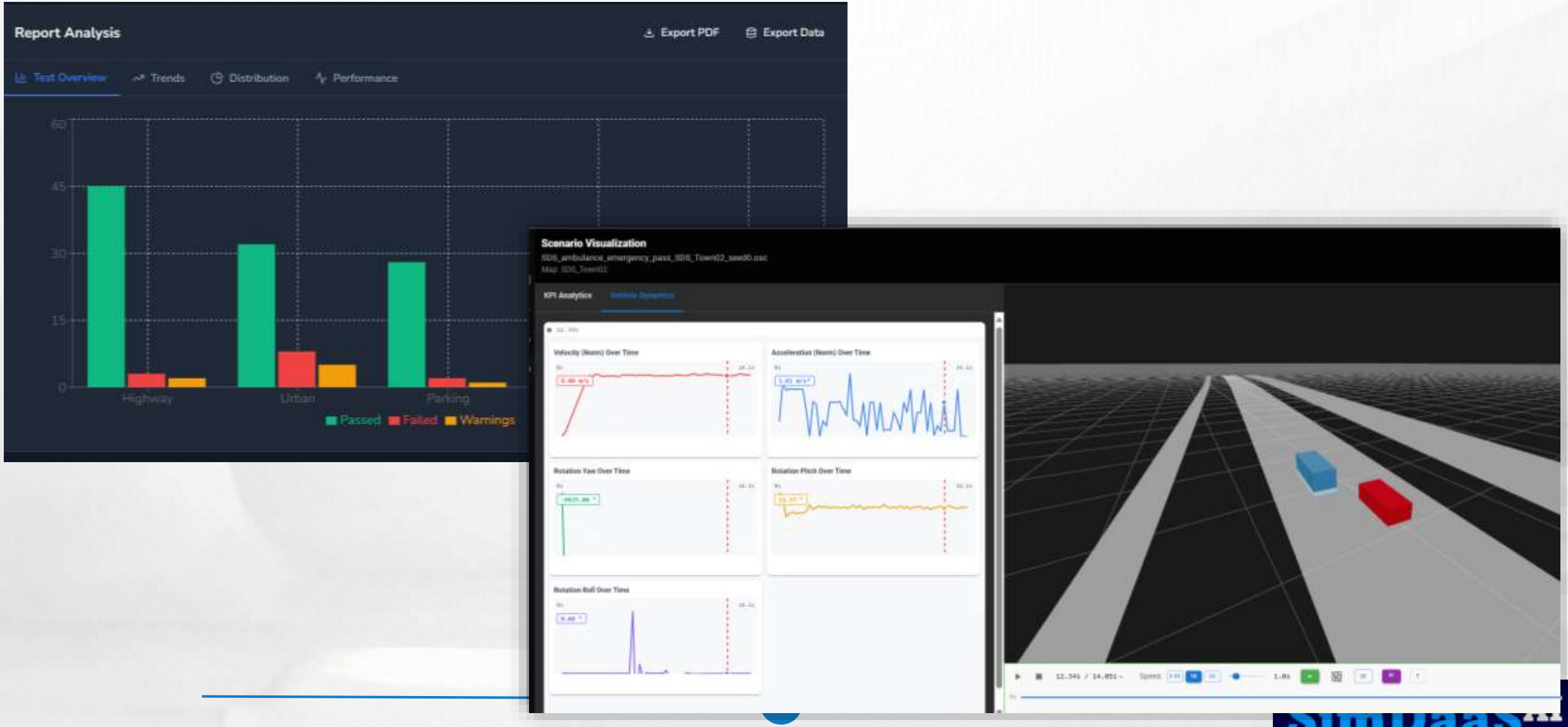
RGB camera

Depth camera

Test Orchestration



KPIs and Report



THANKS

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SimDaaS AI

SimDaaS Scenario Library

Scenario Sourcing

- **Regulation**: AIS, Euro-NCAP, UN-R, NHTSA
- **Crowed source**: Volunteer-driven ideas and experiences
- **Dashcams**: Real world footage for realism
- **Accident data**: RASSI and real crash cases
- **AI tool**: LLM-driven extraction
- **Auto-traffic generator**: Rule-based traffic simulation

Scenario generation tools

- Scenario Editor
- Video 2 Scenario
- LLM 2 Scenario
- RASSI 2 Scenario

	ADAS Feature	Logical scenario files (Corresponding runs)	Logical scenarios files for rigorous testing
1	Moving Off Information System (MOIS)	12 (12)	4
2	Automatic Emergency Braking (AEB)/Forward Collision Warning (FCW)	77 (1130)	152
3	Adaptive Cruise Control (ACC)	48 (200)	67
4	Emergency Lane Keeping System (ELKS)	14 (480)	50
5	Lane Departure Warning (LDW)	16 (580)	52
6	Blind Spot Information System (BSIS)	21 (21)	7

- Variation can be generated based on weather, time of day and environment
- Logical scenarios can be used to generate huge variation as per the parameter range