A DeepLearning.AI community meetup hosted by <<AGICAFET>>

CARLA
OPEN-SOURCE SIMULATOR

Local AI for Autonomous Vehicles:

From CARLA Decision-Making to Context-Aware and Resilient Urban Mobility.

27 June 2026
1:00 – 6:00 p.m.

Cleverse Rama9

Aueaphum Aueawatthanaphisut
Founder & CEO,
Tensai Thaizen Co., Ltd.

- CARLA Simulation & Decision-Making
- AI & Machine Learning on the Edge
- Context-Aware Perception
- Resilient & Safe Urban Mobility

Special thanks to: DeepLearning.AI

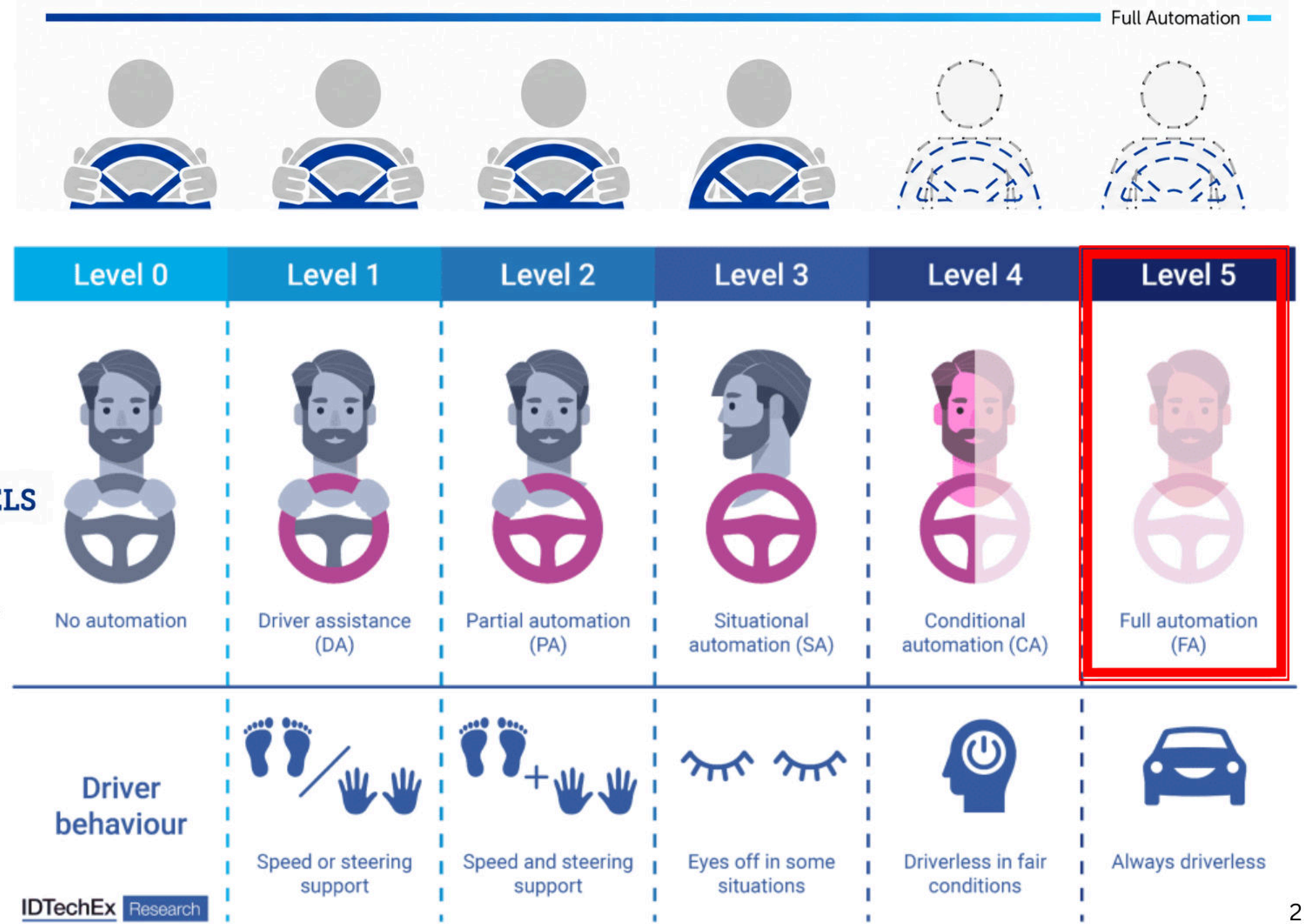
SCG PACKAGING

IBM

true together

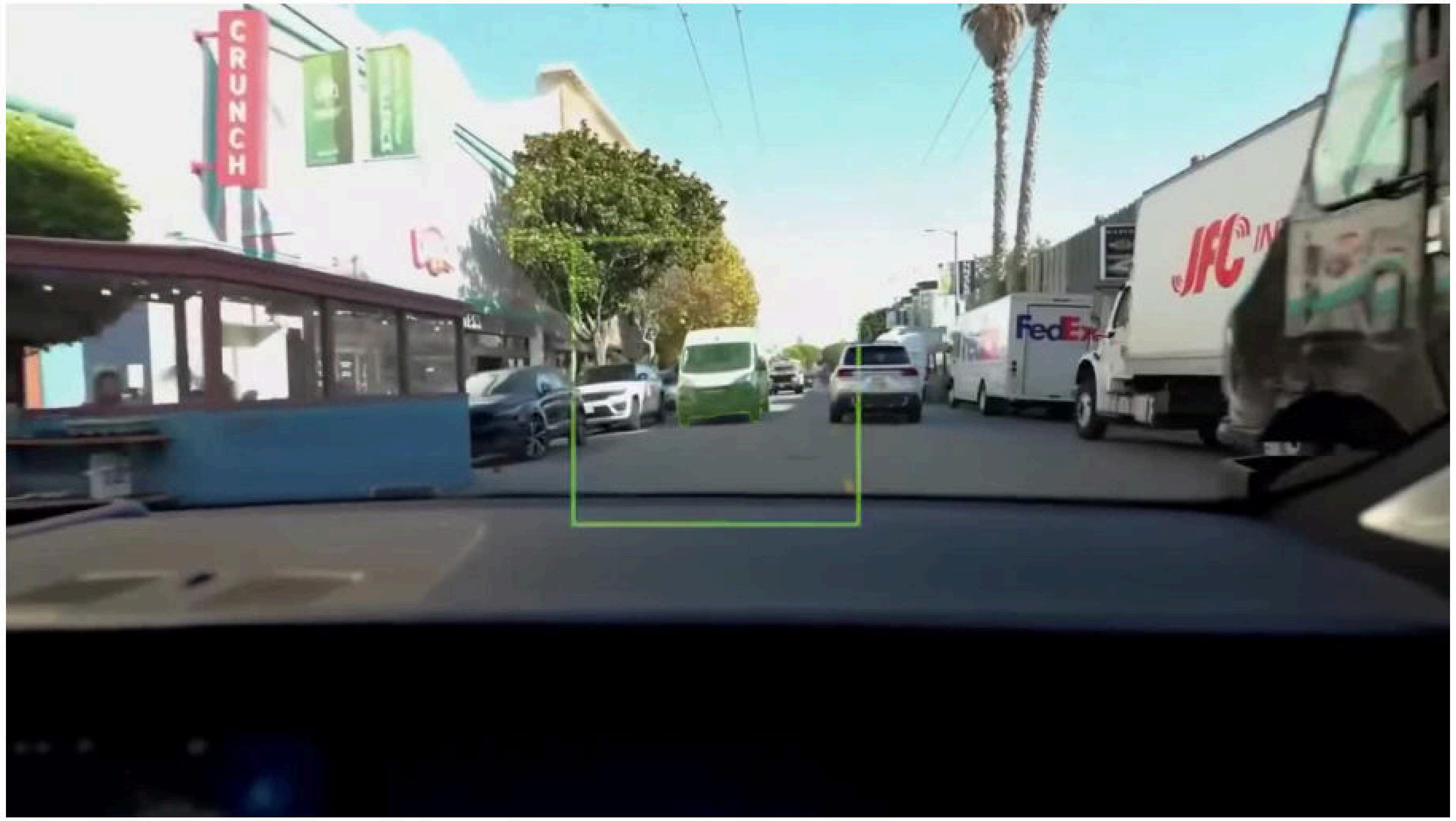
SAE AUTOMATION LEVELS

SAE International stands for the Society of Automotive Engineers International, a global professional association for engineers and technical experts in mobility industries.



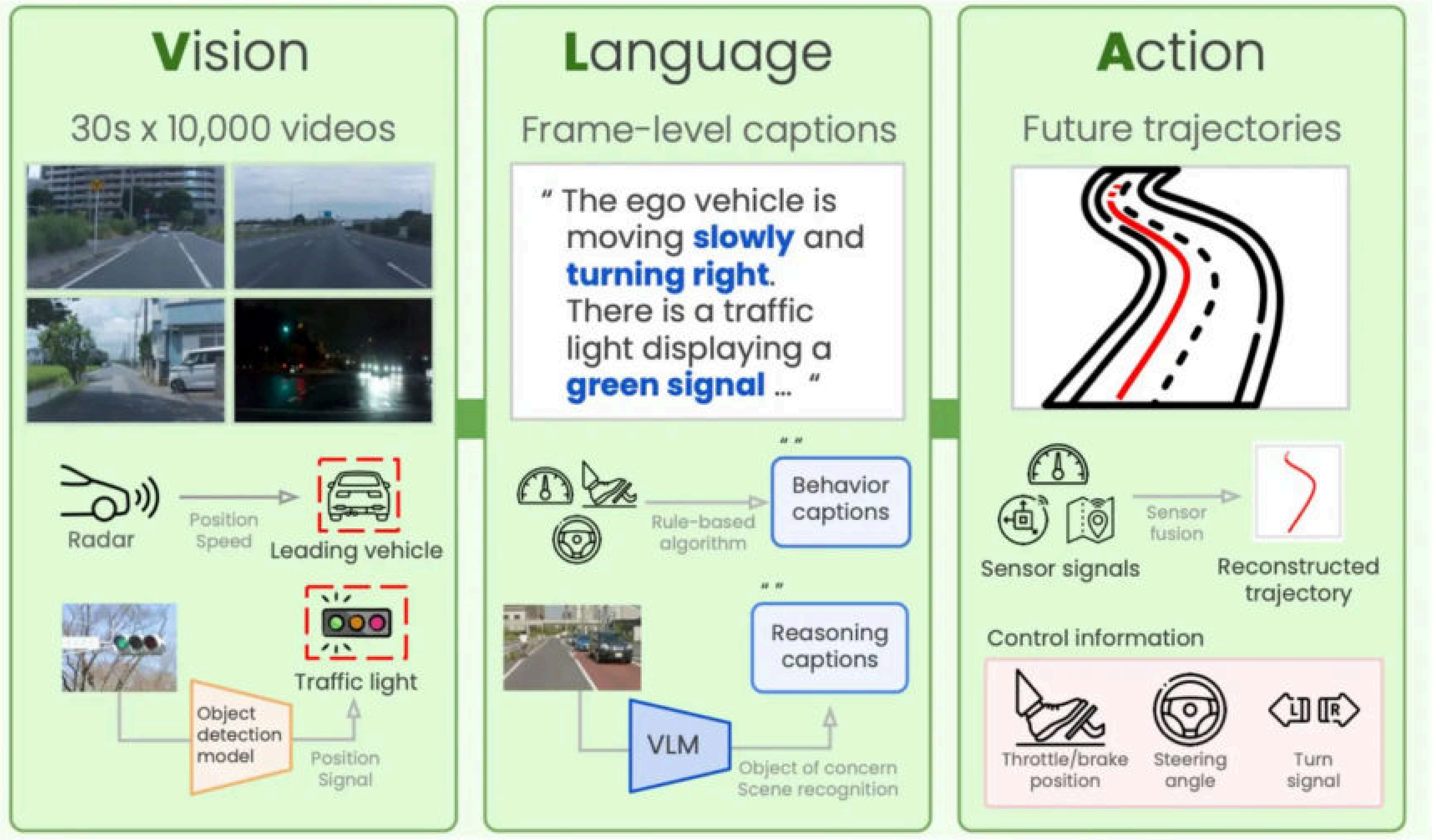
NVIDIA Launches Alpamayo 2 Super Open Reasoning Model for Robotaxis

May 31, 2026 https://nvidianews.nvidia.com/news/nvidia-alpamayo-2-super-robotaxis



Vision-Language-Action

VLA reads visual context and reasons before taking action.



NVIDIA Alpamayo 2 Super is an open 32B-parameter reasoning VLA model for Level 4 autonomous driving.

- Perceives, reasons, plans, and acts across the full AV stack
- Supports 360° perception for safer urban driving decisions
- Trains AV models in closed-loop simulation before road deployment
- Enables safer, explainable, and scalable autonomous vehicle development

Traditional AV

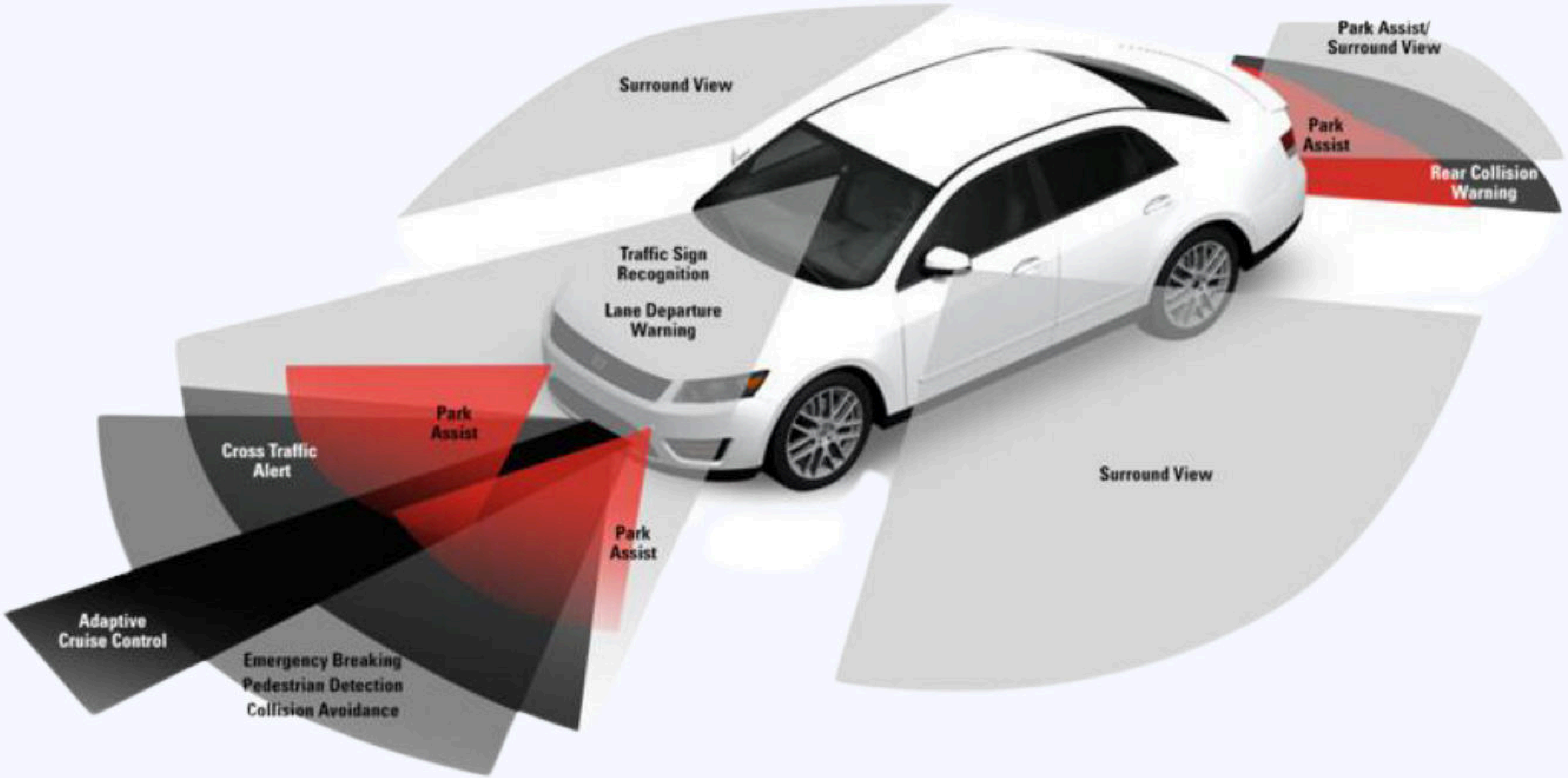
Object Detection • Rule-based Reaction • Fixed Logic • Trajectory Prediction • Reactive Driving • Limited Explanation

VLA / Alpamayo 2 Super

Scene Understanding • Vision-Language-Action • Reasoning-based Decision • Meta-Actions • Context-aware Planning • Explainable Autonomous Driving

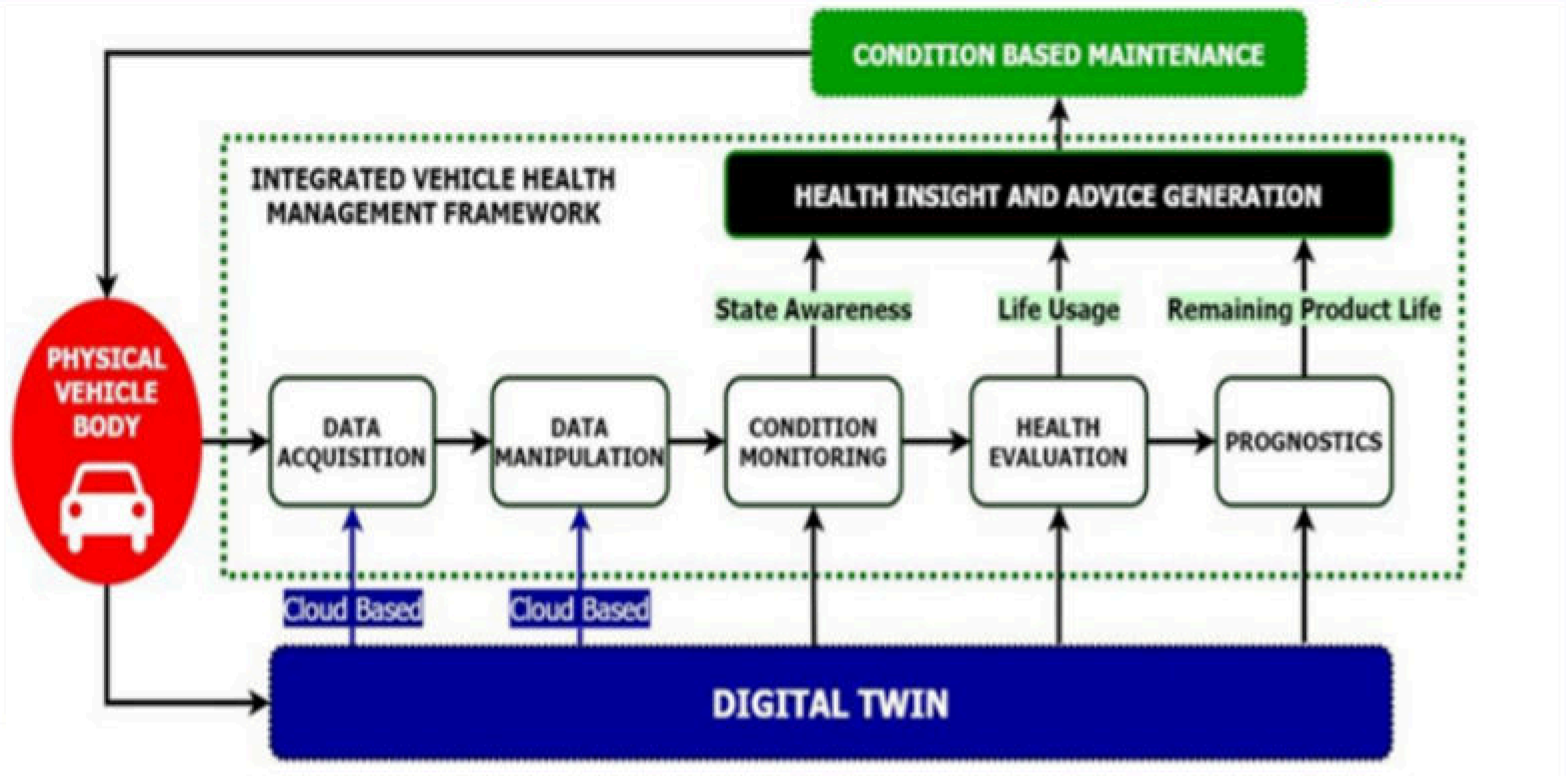
Autonomous Driving Sensors

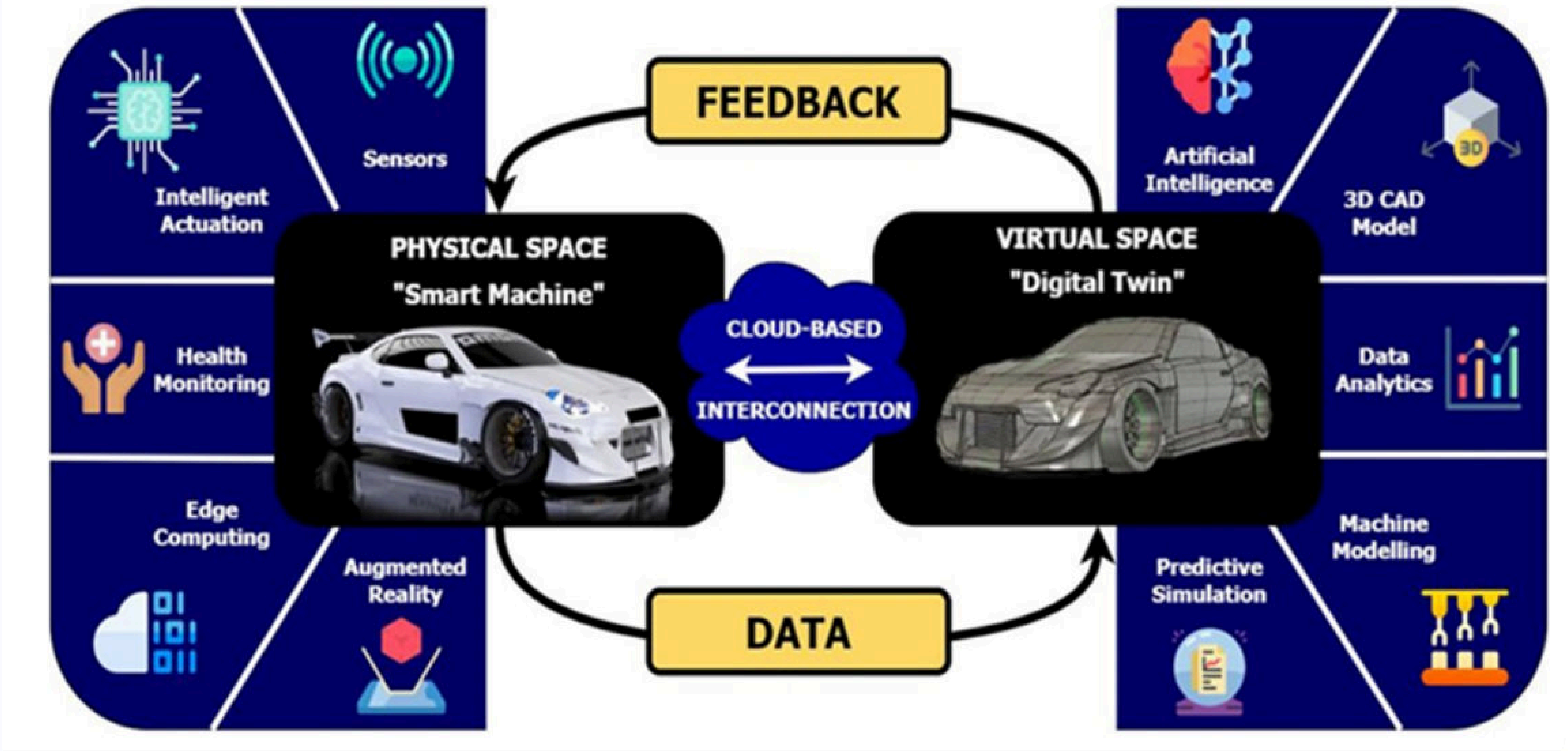
- Camera: provides realistic images that automatically detect objects, classify them.
- Radar: to determine distance between object and sensor.
- Lidar: more accuracy than radar and possible to build exact 3D models of objects surrounding vehicle.
- GNSS (GPS): used for navigation and positioning measurements.

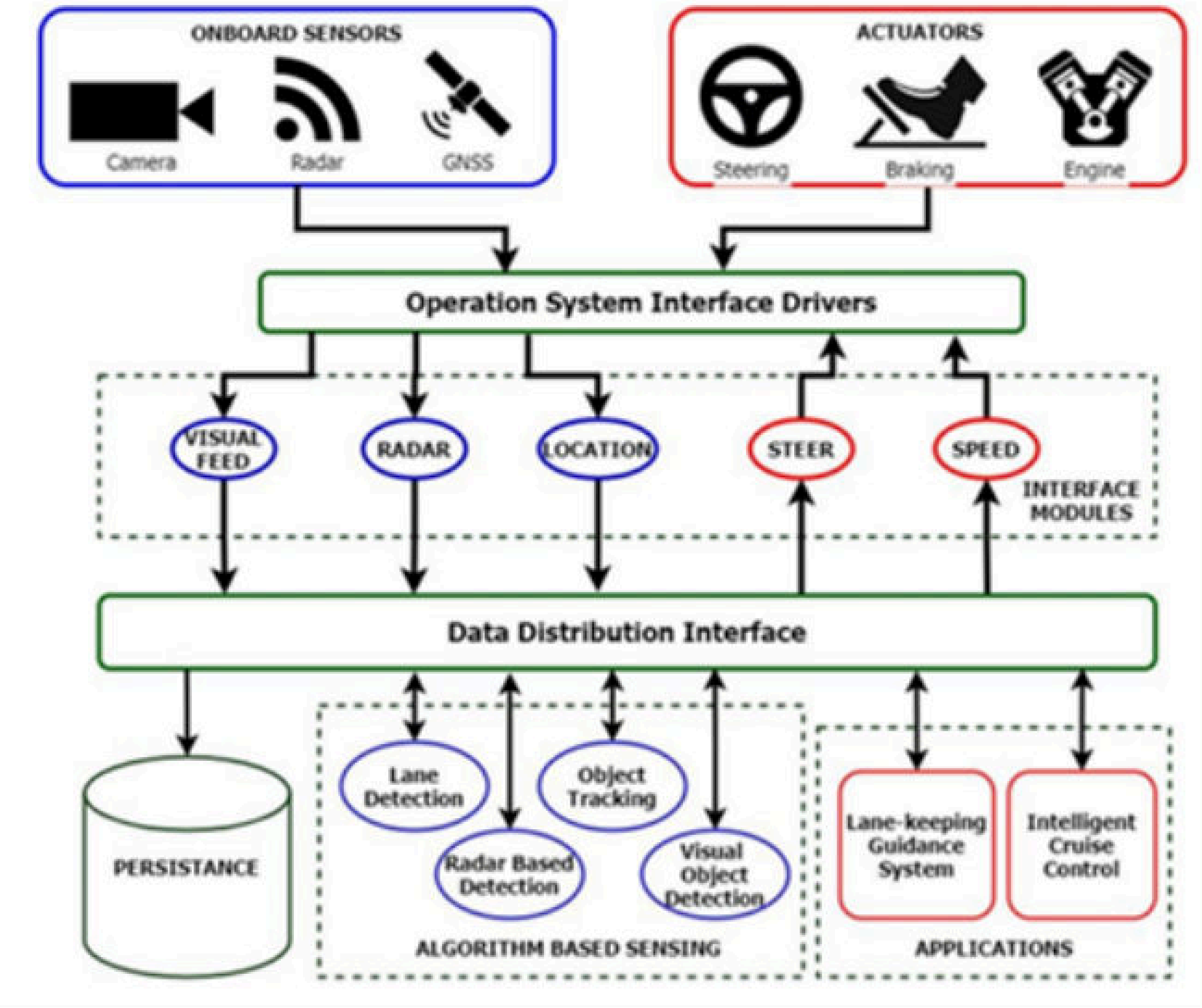


Digital Twins in Autonomous Driving

- A digital twin is a virtual representation of a physical or simulated system that is continuously updated using data.
- In automotive systems, data from cameras, LiDAR, radar, GNSS/IMU, and vehicle networks can be used to update the virtual model.
- The digital twin allows researchers to analyze vehicle behavior, test what-if scenarios, and evaluate system performance safely.
- For autonomous driving, digital twins help connect real-world driving conditions with simulation-based testing.
- This approach supports repeatable experiments before hardware-in-the-loop or real-world road testing.
- In this thesis, CARLA acts as a high-fidelity simulation environment for scenario-based autonomous vehicle decision-making analysis.



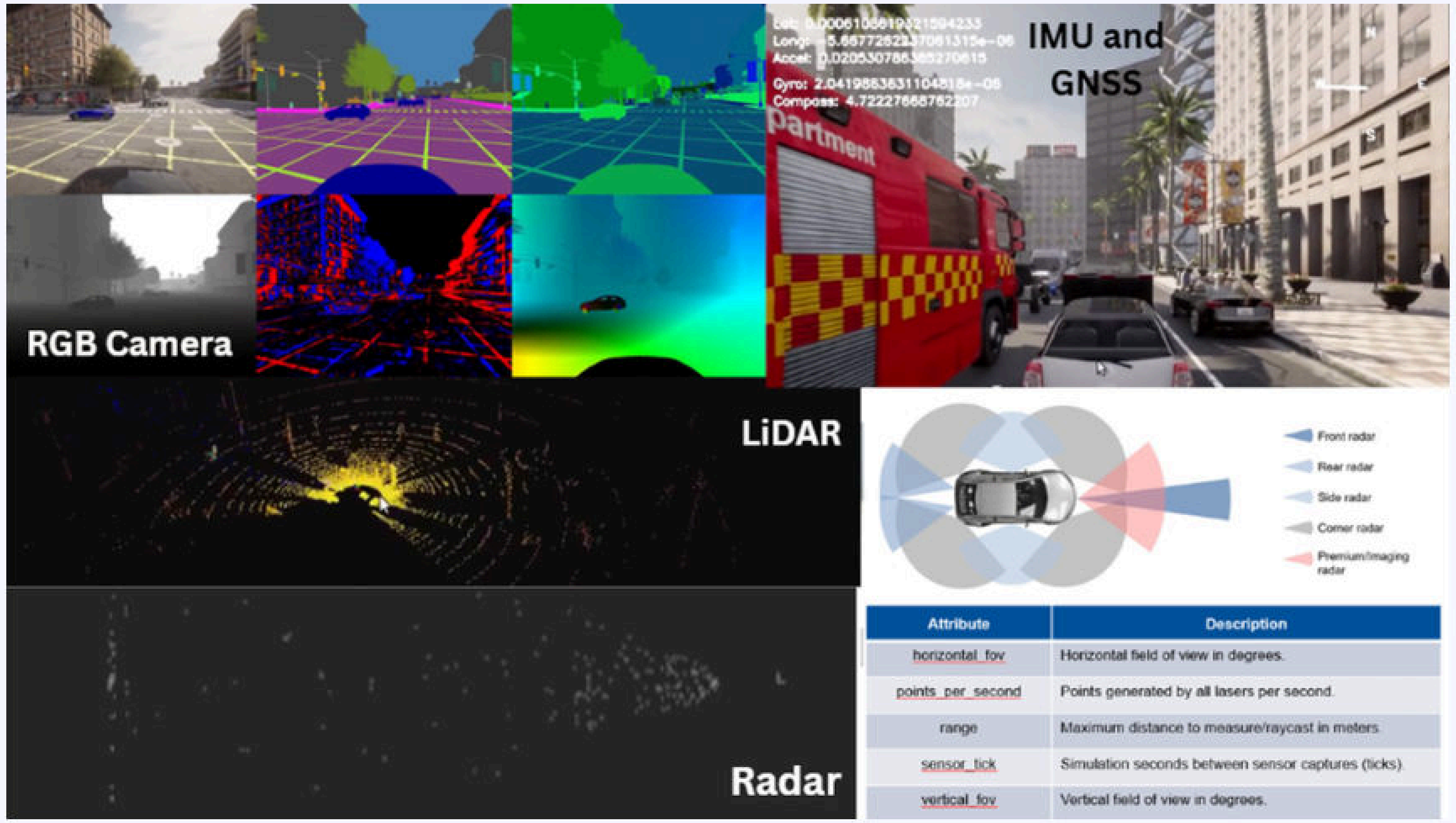




CARLA Simulation Framework

- CARLA is an open source simulator for autonomous driving research that provides open digital assets, flexible specification of sensor suites and environmental conditions to support development, training, and validation of autonomous driving systems.

- **In this methodology, we utilize CARLA simulator that is open-source program it's designed for autonomous driving research and realistic with Unreal Engine have a client-server architecture.**

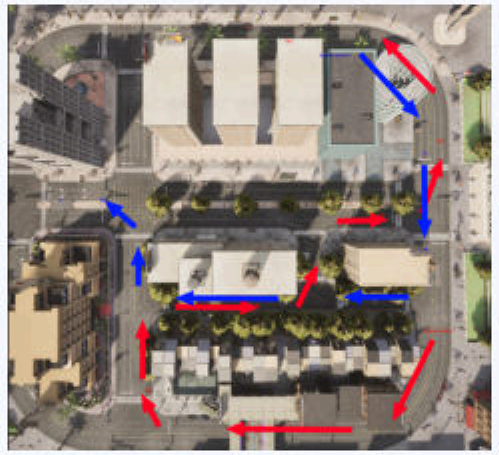


Attribute	Description
horizontal_fov	Horizontal field of view in degrees.
points_per_second	Points generated by all lasers per second.
range	Maximum distance to measure/raycast in meters.
sensor_tick	Simulation seconds between sensor captures (ticks).
vertical_fov	Vertical field of view in degrees.

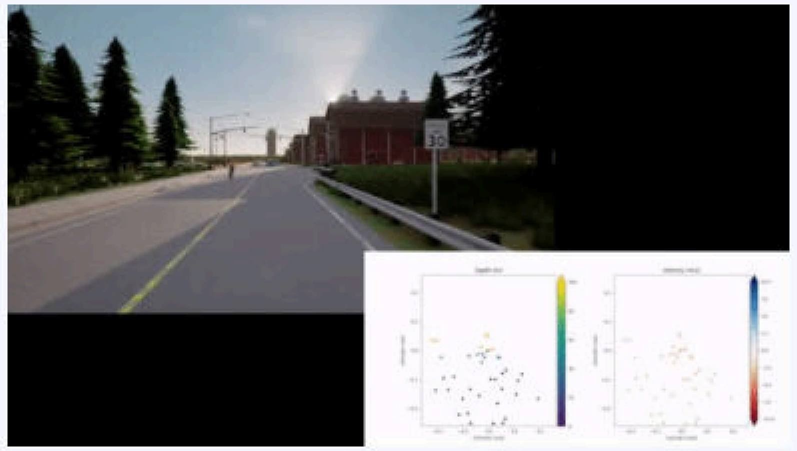
How does CARLA Work?

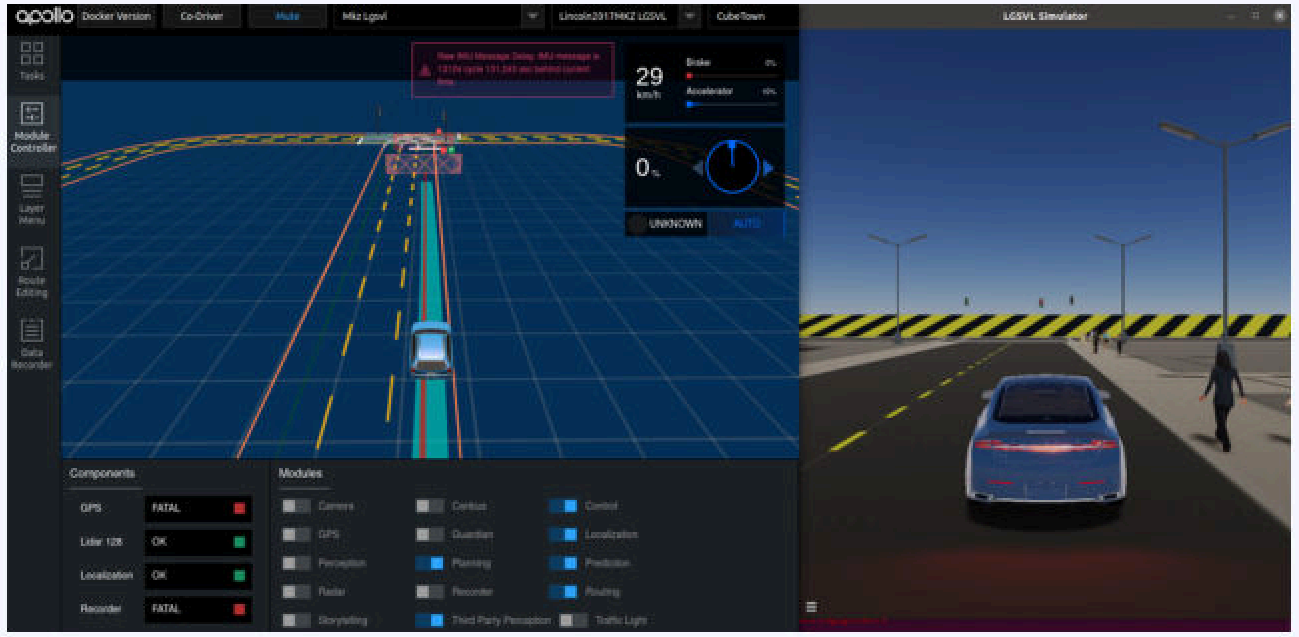
- The CARLA simulator consists of a scalable client server architecture.
- On the **server side**, CARLA manages core simulation processes such as sensor, physics computation, collision dynamics, and creating a simulation environment.
- And the **client side** to controlling and customizing world conditions, such as weather and NPC, using the API in Python and C++.

Traffic Manager



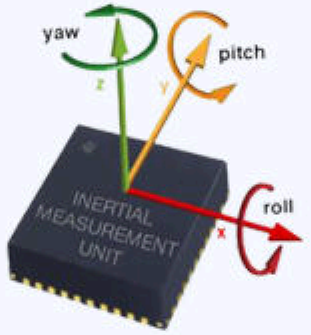
Traffic Scenario

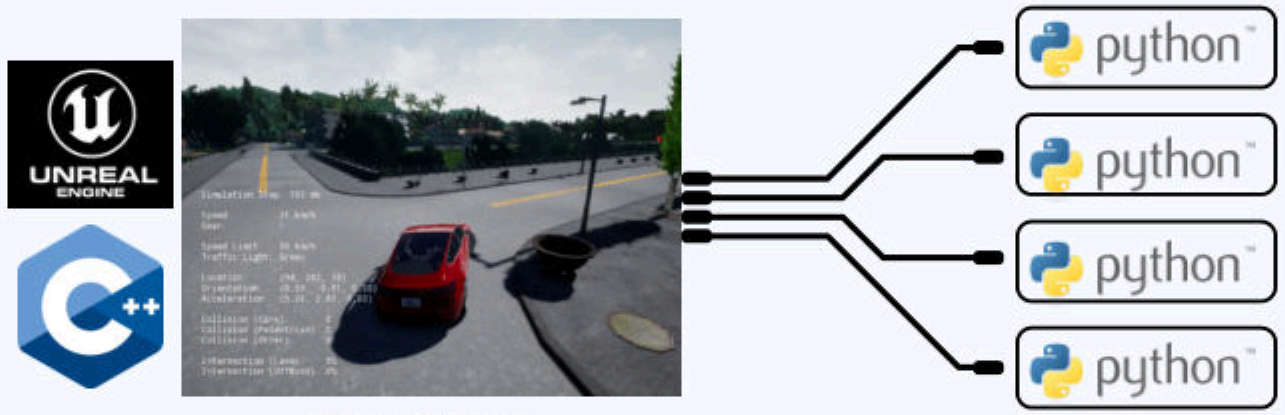




Sensors

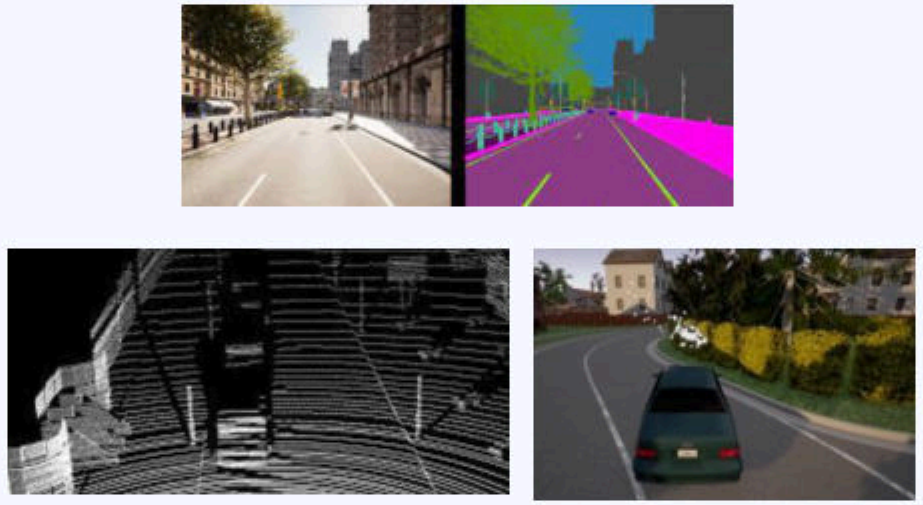
CARLA





simulator

User Scripts



Autonomous Driving Configuration

Camera

LIDAR

RADAR

Inertial Measurement Unit

Sattellite location

CARLA

Release 0.9.11

CARLA

Release 0.9.11


CARLA

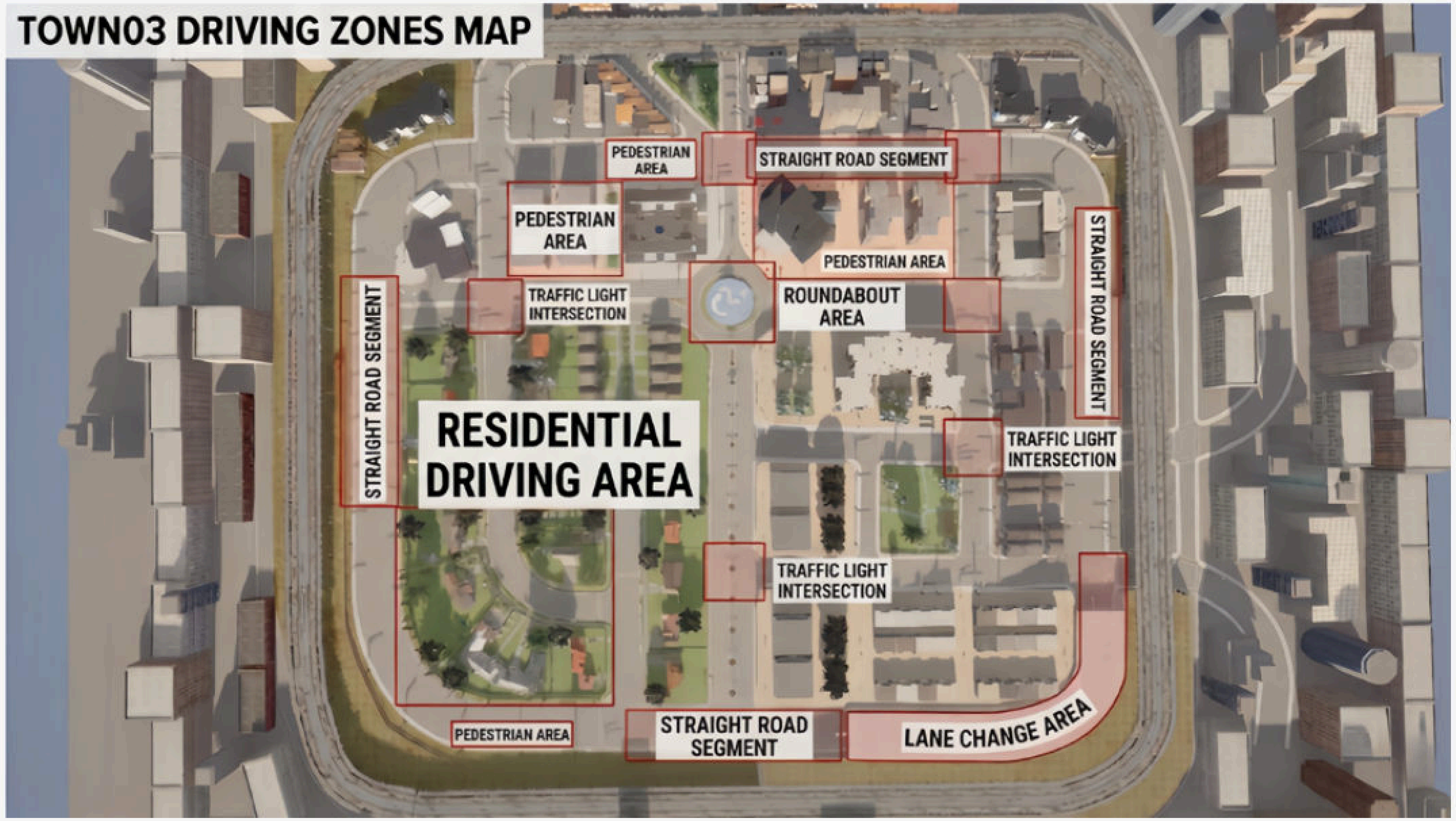
Add NPCs Spawned via Configuration

CARLA can addition of NPCs (non-player characters) via configuration include pedestrians, bicycles, motorcycles, and cars, controlled by the simulator's such as breaking traffic rules, creating obstacle on the road for the Ego car to make decisions.

Along with diverse traffic compositions that include up to 265 vehicles and 39 pedestrians, it provides the perfect setup for testing complex decision-making behaviors

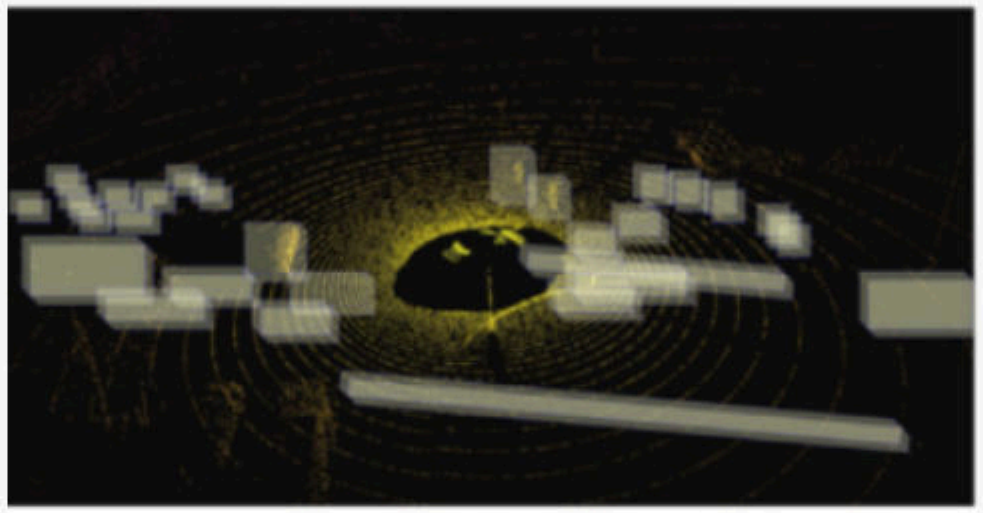
Full Map

Initial spawned setup amount 80 Vehicles and 39 walkers + 1 Ego car for System tests

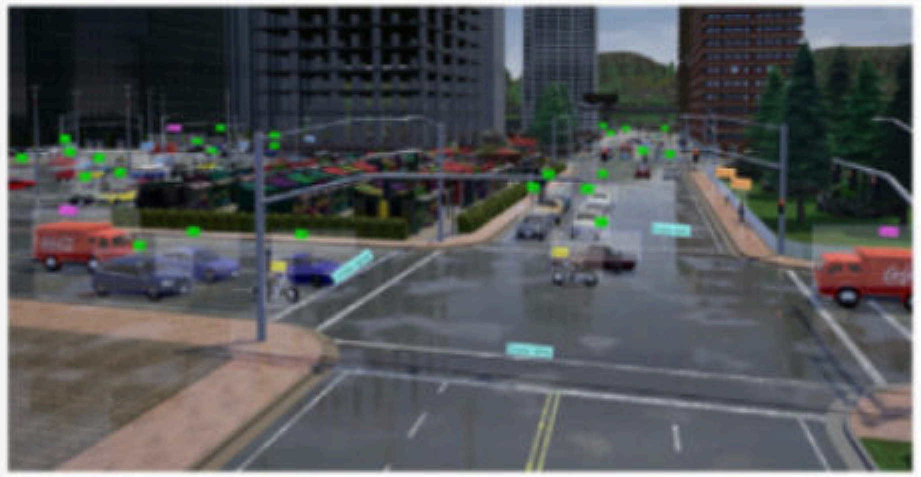


Maximum spawned are 265 vehicles + 39 walkers

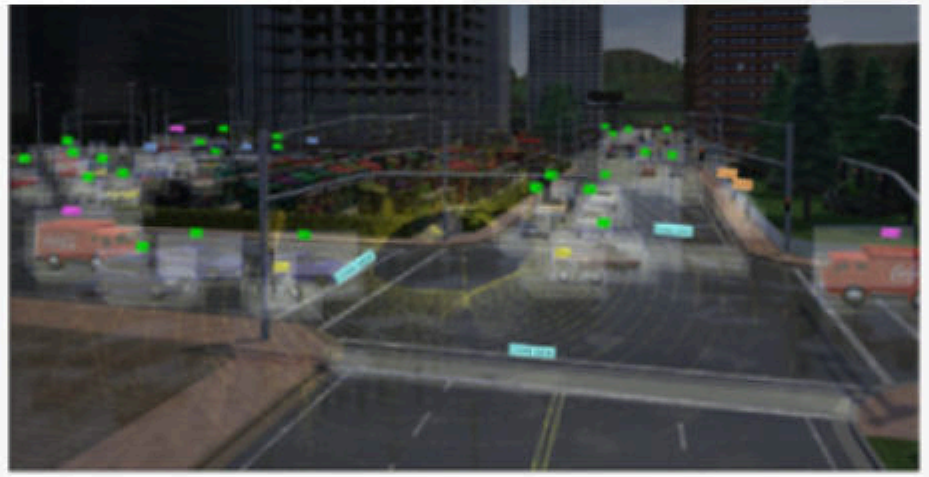
Sensor and Actor Simulation



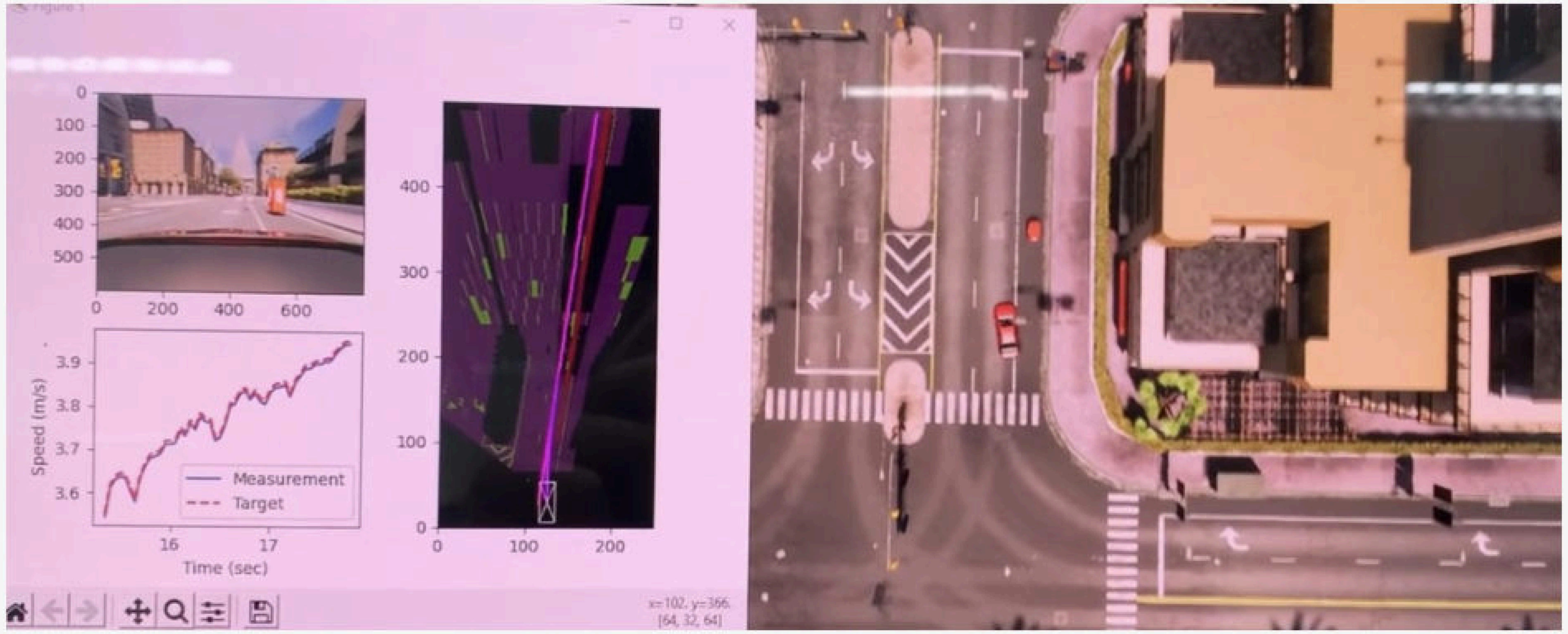
LiDAR Only



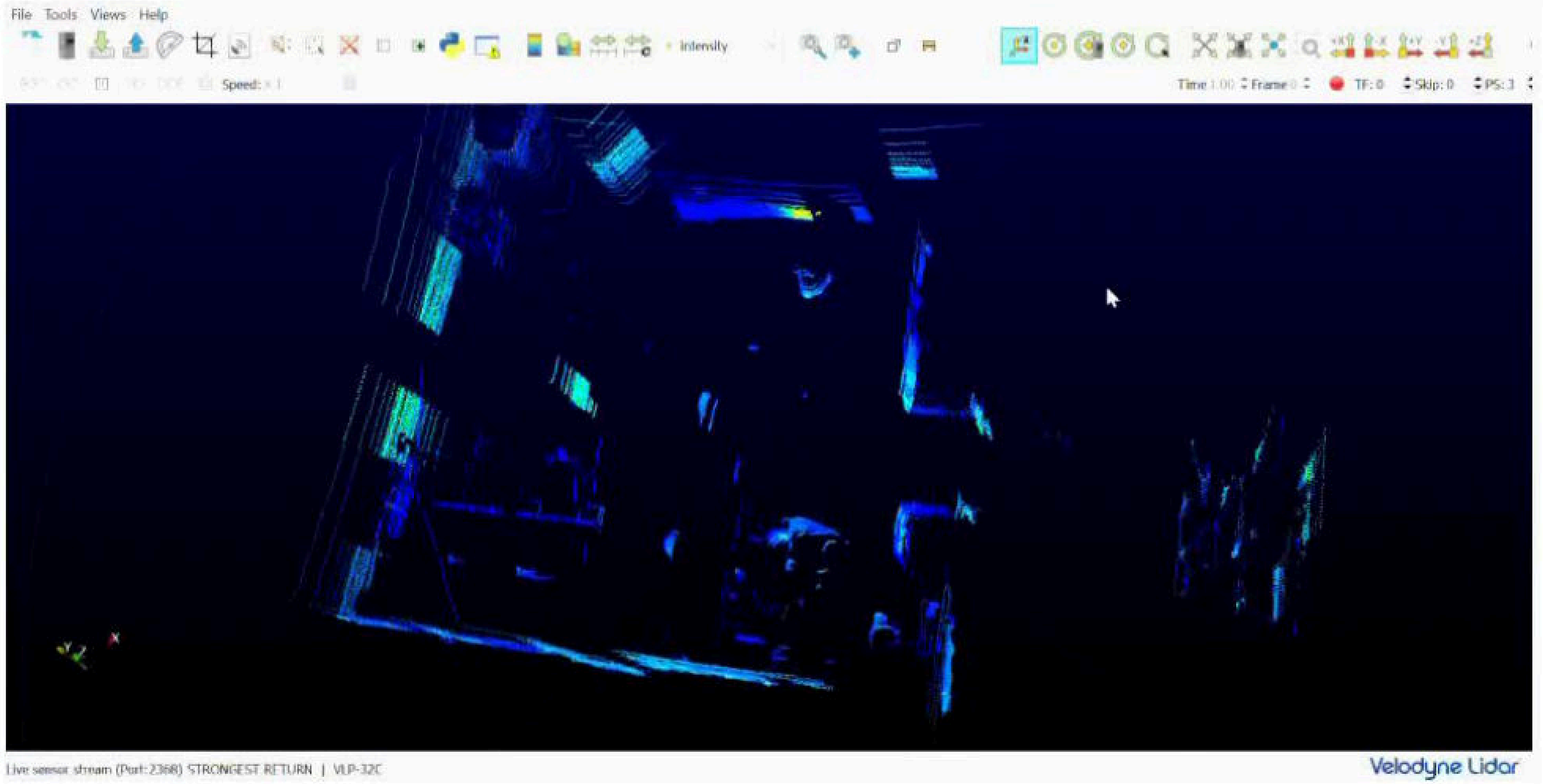
Camera Only

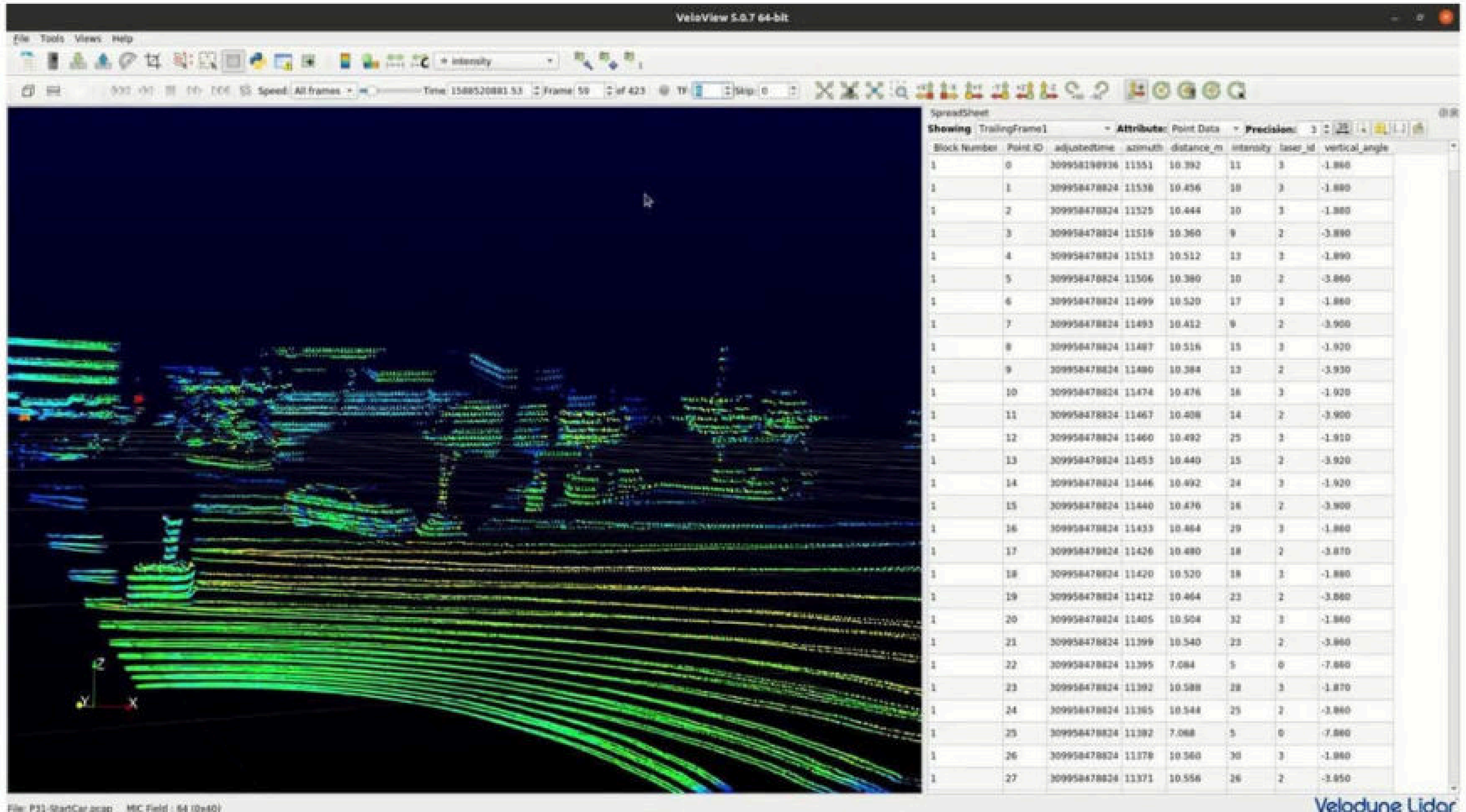


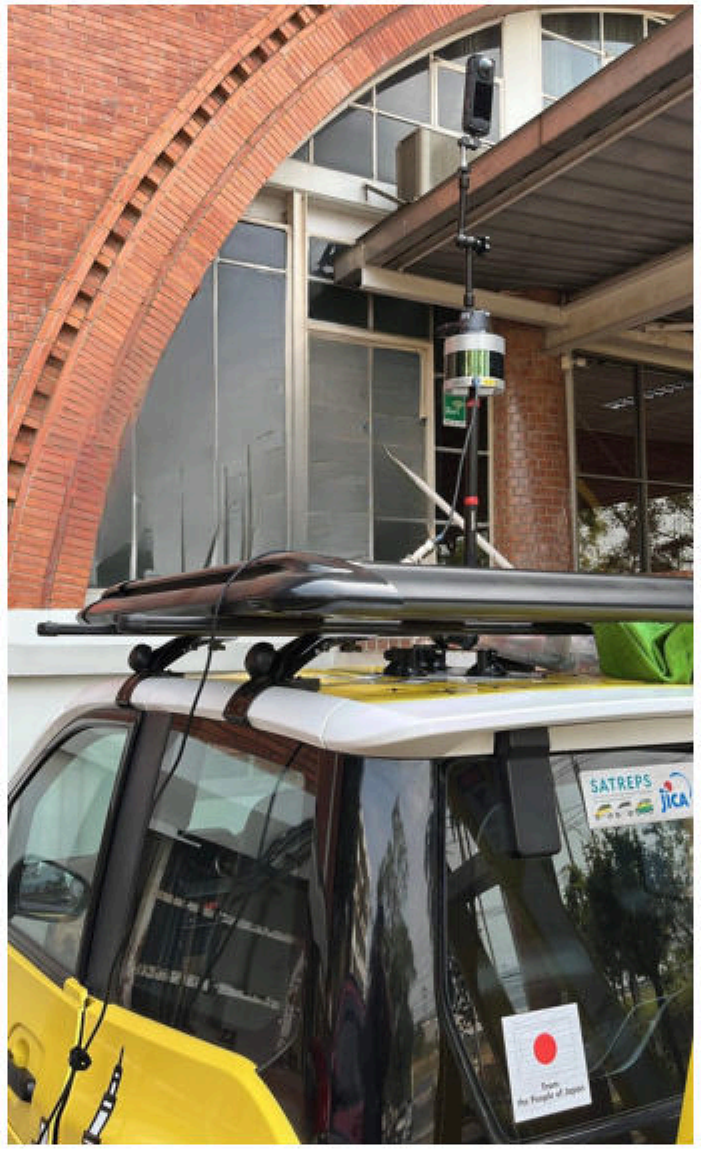
Fusion of Camera and LiDAR



Sensor Type	Description
LiDAR	Captures 3D point clouds for object detection and mapping.
Radar	Detects obstacles and calculates relative velocities for enhanced situational awareness.
Cameras	Provide front, rear, and surround views for visual recognition and perception tasks.
GPS	Delivers accurate localization data for navigation and route planning.
IMU	Measures acceleration and angular velocity for motion tracking and response calibration.


File Tools Views Help
Intensity
Live sensor stream (Port:2368) STRONGEST RETURN | VLP-32C
Velodyne Lidar


VeloView 5.0.7 64-bit
Velodyne Lidar


SATREPS
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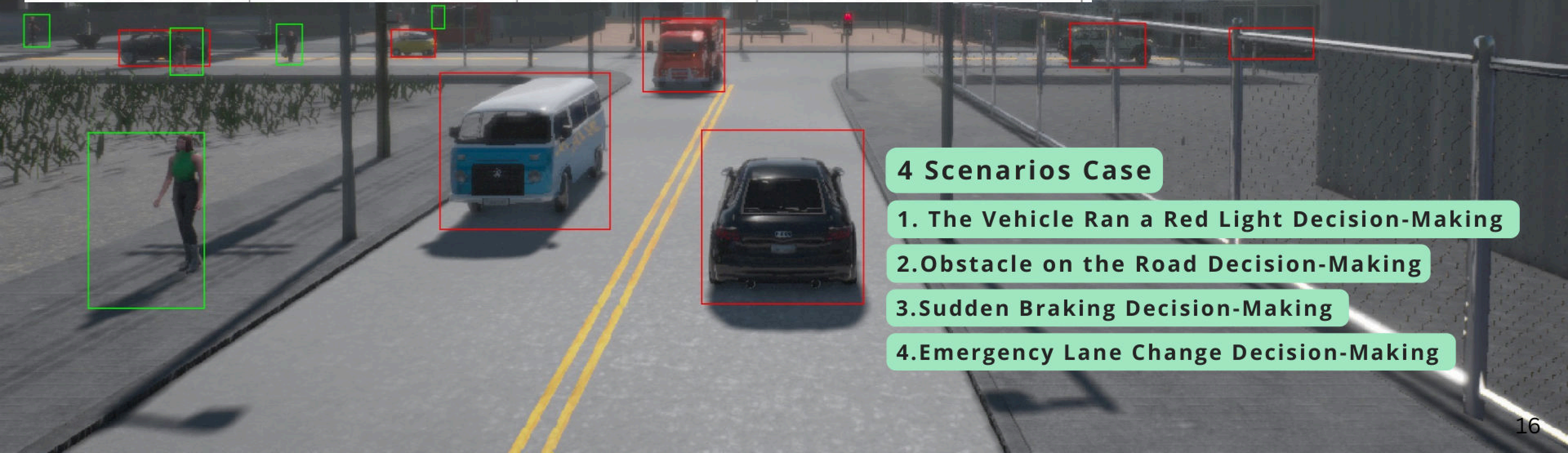
SIIT

Developments in self-driving cars and related research.

No.	Status	Type	Title / Topic	Core Research Focus	Method / Technology	Contribution / Output
1	Publication	IEEE Conference	A Random Forest-Based Approach for Autonomous Vehicle Decision-Making and Behavioral Modeling	การตัดสินใจของรถยนต์อัตโนมัติในสถานการณ์จราจรแบบไดนามิก โดยใช้การจำลองพฤติกรรมคนขับ	CARLA Simulator, Random Forest Classifier, Behavioral Modeling, Predictive Analytics	เสนอโมเดล Random Forest สำหรับทำนายพฤติกรรมการขับขี่ เช่น red-light violation, obstacle avoidance, sudden braking และ emergency lane changes โดยใช้ accuracy สูง เช่น sudden braking 90.2%, emergency lane changes 89.5%, obstacle avoidance 88.3%, red-light violation 83.6%
2	Publication	ScienceDirect Journal — Array	Context-aware Decision Making in Autonomous Vehicles: Integrating Social Behavior Modeling with Large Language Models	การทำให้ AV เข้าใจบริบททางสังคม เช่น pedestrian intent, social norms, ethical decision-making และ human-like interaction	Large Language Models, Social Behavior Modeling, Reinforcement Learning, Ontology, CARLA Simulation	เสนอ framework ที่รวม LLM กับ social behavior modeling เพื่อให้ AV ตัดสินใจแบบ context-aware และ socially responsible ในขนส่ง scene → text → reasoning → action control
3	Publication	ScienceDirect Journal — Array	Enhancing Autonomous Vehicle Resilience: Roadside Sensor Networks for Robust Perception and Decision-Making in Challenging Environments	เพิ่มความทนทานของ AV ในสภาพแวดล้อมยาก เช่น ฝนตกหนัก หมอก ฝุ่นละอองocclusion และ sensor degradation	Roadside Sensor Network, V2X, Sensor Fusion, Kalman Filtering, Foundation Models, CARLA	เสนอระบบ roadside sensor infrastructure ช่วยเสริม onboard sensors ของ AV โดยรายงานผล เช่น ลด occlusion errors ประมาณ 35%, object detection accuracy เพิ่มเป็น 74.7% และ collision rate ลดลง 28% ใน heavy rain
4	On Progress / Under Review	ScienceDirect Journal — Safety Science	LLM-Augmented Reinforcement Learning for Adaptive Emergency Vehicle Prioritization Under Urban Traffic Stress	การจัดลำดับความสำคัญให้รถฉุกเฉินในเมือง โดยใช้ LLM + RL เพื่อจัดการจราจรแบบ safety-critical	LLM Reasoning, Constrained Multi-Agent Reinforcement Learning, SUMO, CARLA, V2X, Emergency Vehicle Prioritization	เสนอ framework สำหรับ emergency vehicle prioritization ที่ลด EV travel time 16.6% เมื่อเทียบกับ RL baseline ในสภาพแออัด, 29.3% ใน peak-demand stress และลด safety-critical conflicts 33.3%
5	Idea / Future Research	New Research Idea	AIoAT Hallucination and Dynamic Scenarios	การศึกษา hallucination ของ AI Agents / AIoAT ในสถานการณ์ที่เปลี่ยนแปลงตลอดเวลา โดยเฉพาะ autonomous systems, traffic, healthcare หรือ smart city	AI Agents, LLM Hallucination Detection, Dynamic Scenario Simulation, Reliability Scoring, Human-in-the-loop, Safety Guardrails	Focus on hallucination detection, reliability assessment, and safe decision-making of AI agents in dynamic scenarios

A Random Forest-Based Approach for Autonomous Vehicle Decision-Making and Behavioral Modeling

Title / Topic	Core Research Focus	Method / Technology	Contribution / Output
A Random Forest-Based Approach for Autonomous Vehicle Decision-Making and Behavioral Modeling	การตัดสินใจของรถยนต์อัตโนมัติ ในสถานการณ์จราจรแบบไดนามิก โดยใช้การจำลองพฤติกรรมคนขับ	CARLA Simulator, Random Forest Classifier, Behavioral Modeling, Predictive Analytics	เสนอโมเดล Random Forest สำหรับทำนายพฤติกรรมการขับขี่ เช่น red-light violation, obstacle avoidance, sudden braking และ emergency lane changes โดยใช้ accuracy สูง เช่น sudden braking 90.2%, emergency lane changes 89.5%, obstacle avoidance 88.3%, red-light violation 83.6%



4 Scenarios Case

1. The Vehicle Ran a Red Light Decision-Making
2. Obstacle on the Road Decision-Making
3. Sudden Braking Decision-Making
4. Emergency Lane Change Decision-Making

Four Scenario Cases

1 Red-Light Violation Decision-Making

Objective:
Enhance safety at intersections by mitigating risks posed by red-light violations through predictive and adaptive strategies.

Key Inputs:
NPC speed profile; lane positioning near traffic lights.

Outputs:
Preemptive delayed start; dynamic stop zone.

2 Obstacle on the Road Decision-Making

Objective:
Enable autonomous vehicles to respond intelligently to road obstacles.

Key Inputs:
Obstacle characteristics; NPC behavior around obstacles; traffic density; road context.

Outputs:
Adaptive lane change; proactive deceleration.

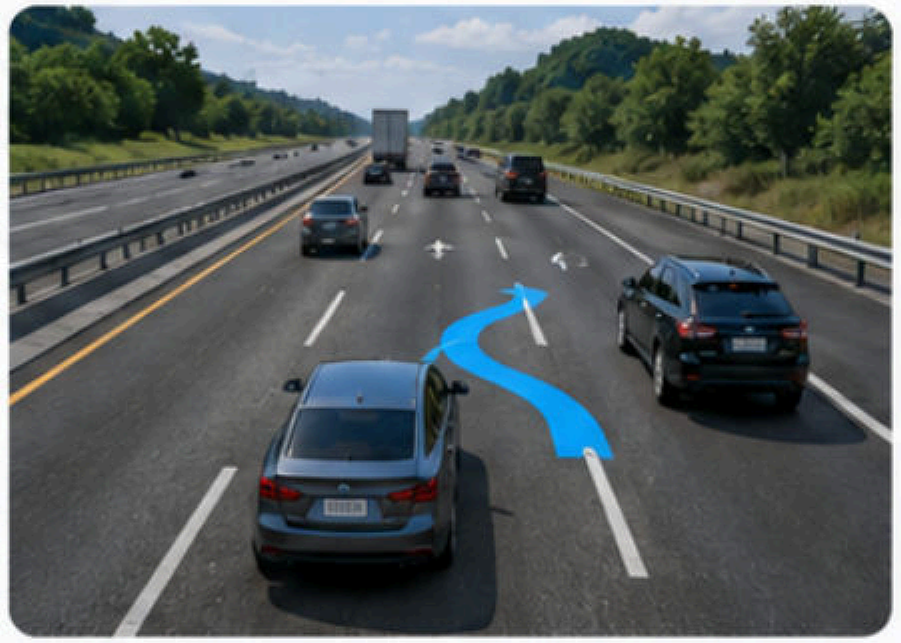
3 Sudden Braking Decision-Making

Objective:
Improve the ego vehicle's response to abrupt braking using behavioral and environmental context.

Key Inputs:
Preceding vehicle behavior; surrounding NPC dynamics; ego-car following distance.

Outputs:
Dynamic following-distance adjustment; early deceleration trigger.

4 Emergency Lane Change Decision-Making



Objective:
Equip the ego vehicle to handle sudden lane intrusions safely.

Key Inputs:
Lane-change indicators; lane occupancy dynamics; relative speed variations.

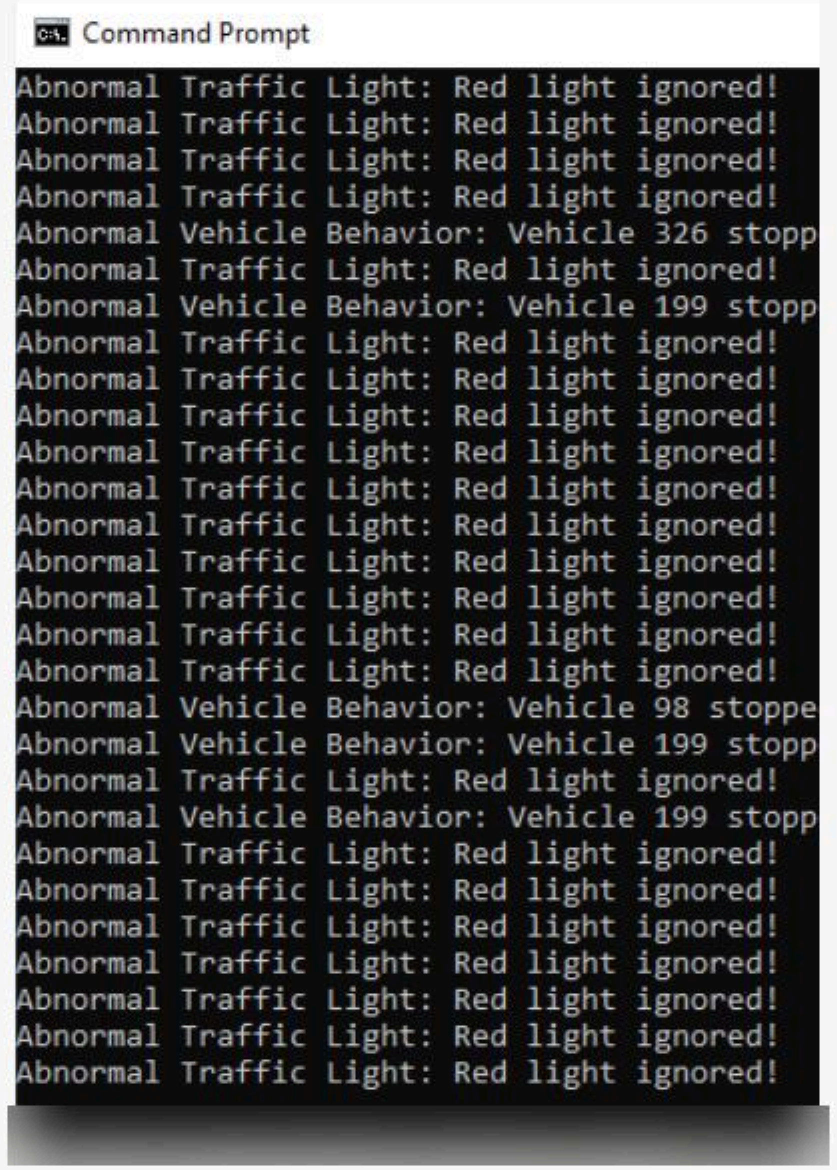
Outputs:
Proactive lane-occupancy check; gradual vs. abrupt lane-change mechanism.

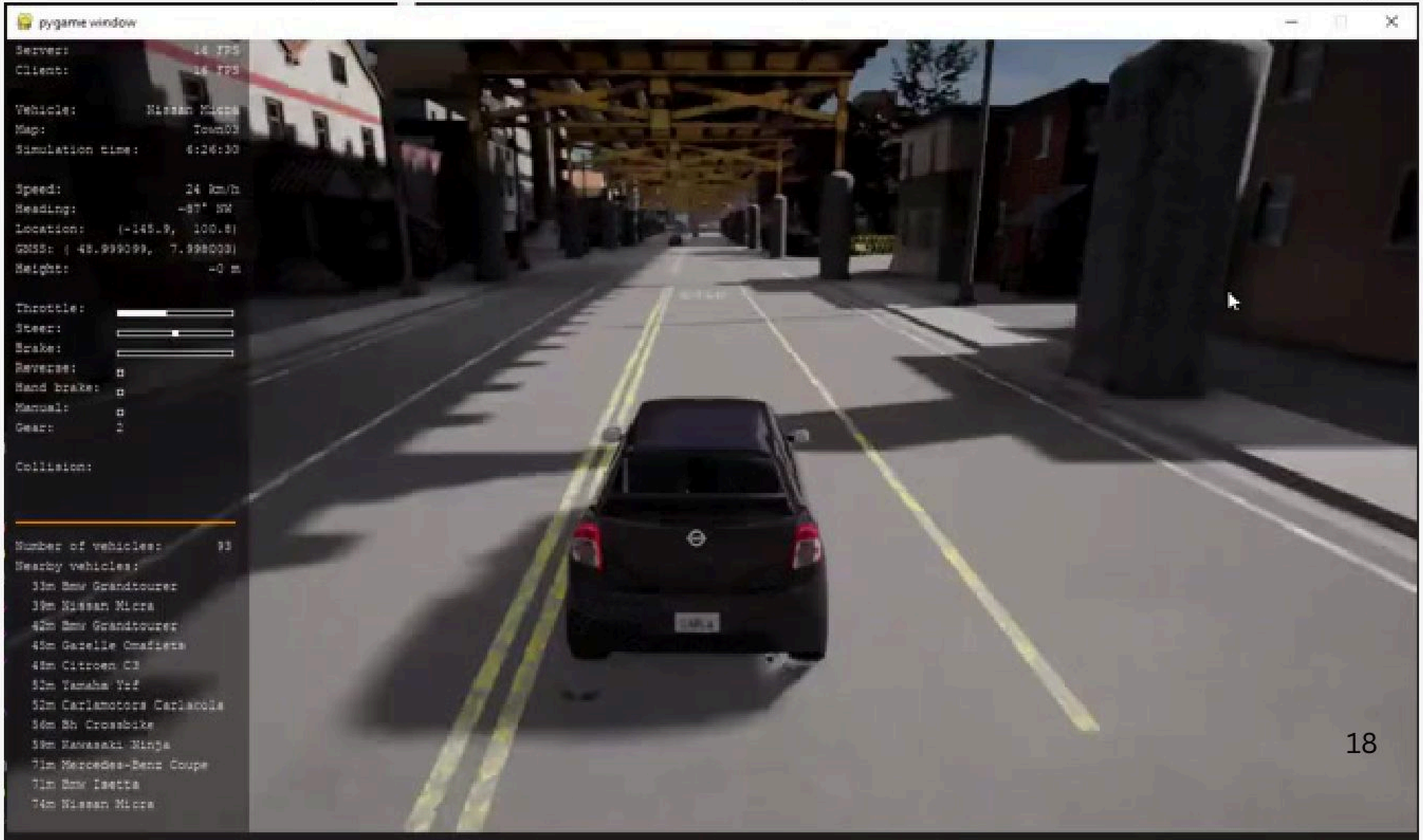
All scenarios are evaluated in the CARLA simulation environment.

1. The Vehicle Ran a Red Light Decision-Making

Checking result the Vehicle Ran a Red Light possibilities and decision-making

A motorcycle runs a red light and Ego car analyse a potential risk of continuing to drive or stopping. So, the system decides to stop because the possibility of a time to collision is high.



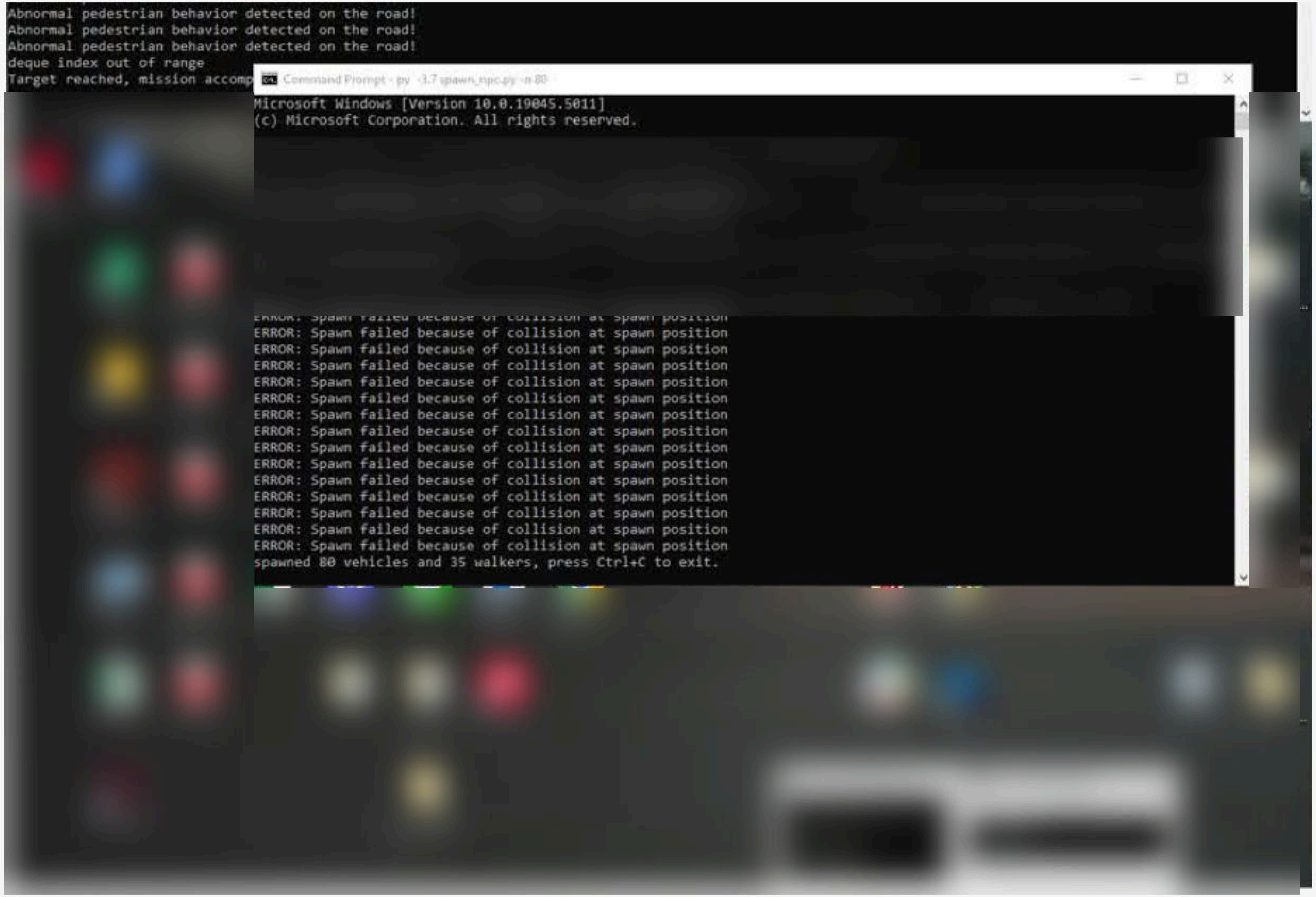


CARLA

PIE & AI

2.Obstacle on the Road Decision-Making

Checking result obstacle on the road detection possibilities and making a decision



Pedestrian Crossing model (Random forest) prediction: Case I

Pedestrian Crossing model (Random forest) prediction: Case II

3.Sudden Braking Decision-Making

Sudden braking detected: the ego vehicle checks collision risk and lane-change possibility before deciding to overtake, slow down, or stop.

Sudden Braking

Vehicle is abnormal
Checking lane change possibilities

Initiating overtake

04 Methodology

Obstacle detected at distance 4.89m
Checking lane change possibilities

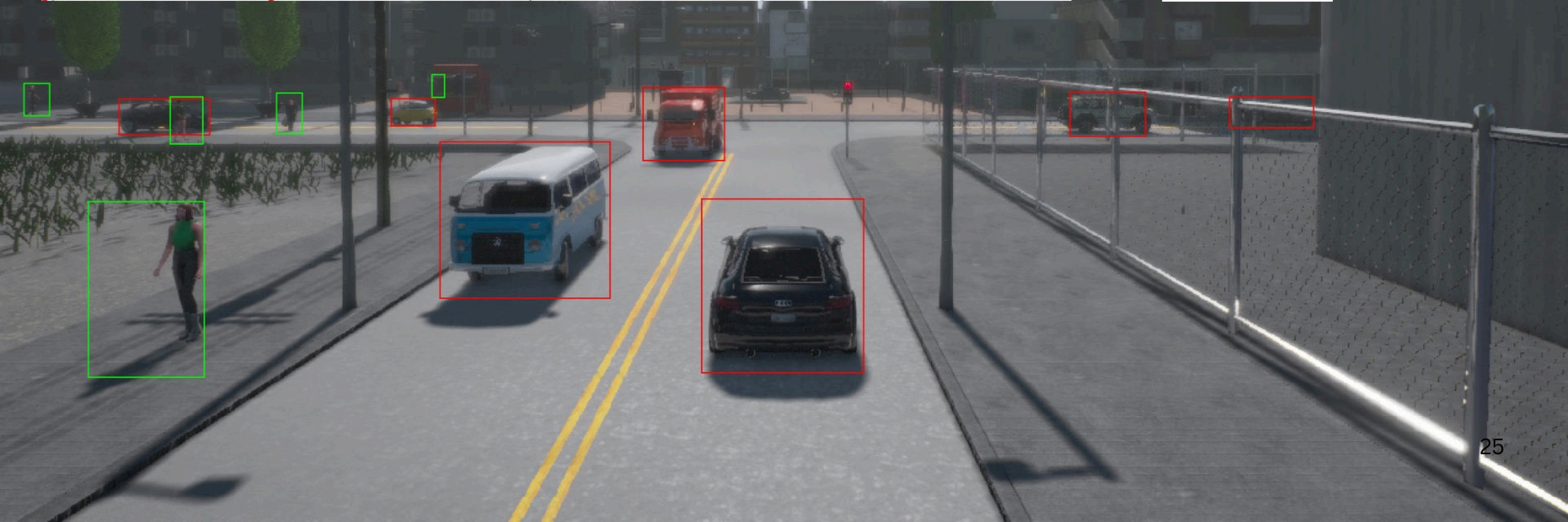
Command Prompt

```
Vehicle 168 has been stopped.
Vehicle 322 has been stopped.
Vehicle 211 has been stopped.
Vehicle 240 has been stopped.
Obstacle detected at distance 4.897009136254757. Checking lane change possibilities...
Changing to the left lane.
Vehicle 87 has been stopped.
Vehicle 168 has been stopped.
Vehicle 322 has been stopped.
Vehicle 211 has been stopped.
Vehicle 240 has been stopped.
Obstacle detected at distance 4.897226585121588. Checking lane change possibilities...
Changing to the left lane.
Vehicle 87 has been stopped.
Vehicle 168 has been stopped.
Vehicle 322 has been stopped.
Vehicle 211 has been stopped.
Vehicle 240 has been stopped.
Obstacle detected at distance 4.899381387837509. Checking lane change possibilities...
Changing to the left lane.
Vehicle 87 has been stopped.
Vehicle 168 has been stopped.
Vehicle 322 has been stopped.
Vehicle 211 has been stopped.
Vehicle 240 has been stopped.
Obstacle detected at distance 4.896898884001612. Checking lane change possibilities...
Changing to the left lane.
Vehicle 87 has been stopped.
Vehicle 168 has been stopped.
Vehicle 322 has been stopped.
```

4.Emergency Lane Change Decision-Making

Context-aware Decision Making in Autonomous Vehicles: Integrating Social Behavior Modeling with Large Language Models

Context-aware Decision Making in Autonomous Vehicles: Integrating Social Behavior Modeling with Large Language Models	การทำให้ AV เข้าใจบริบททางสังคม เช่น pedestrian intent, social norms, ethical decision-making และ human-like interaction	Large Language Models, Social Behavior Modeling, Reinforcement Learning, Ontology, CARLA Simulation	เสนอ framework ที่รวม LLM กับ social behavior modeling เพื่อให้ AV ตัดสินใจแบบ context-aware และ socially responsible ในขนส่ง scene → text → reasoning → action control

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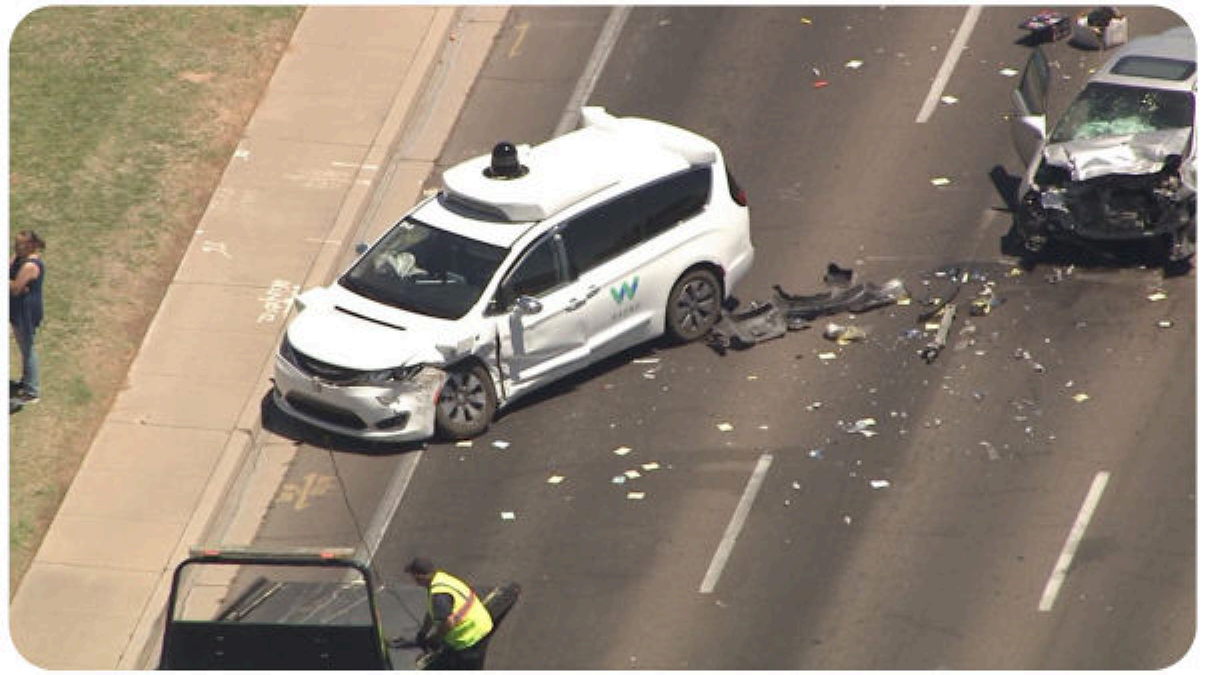
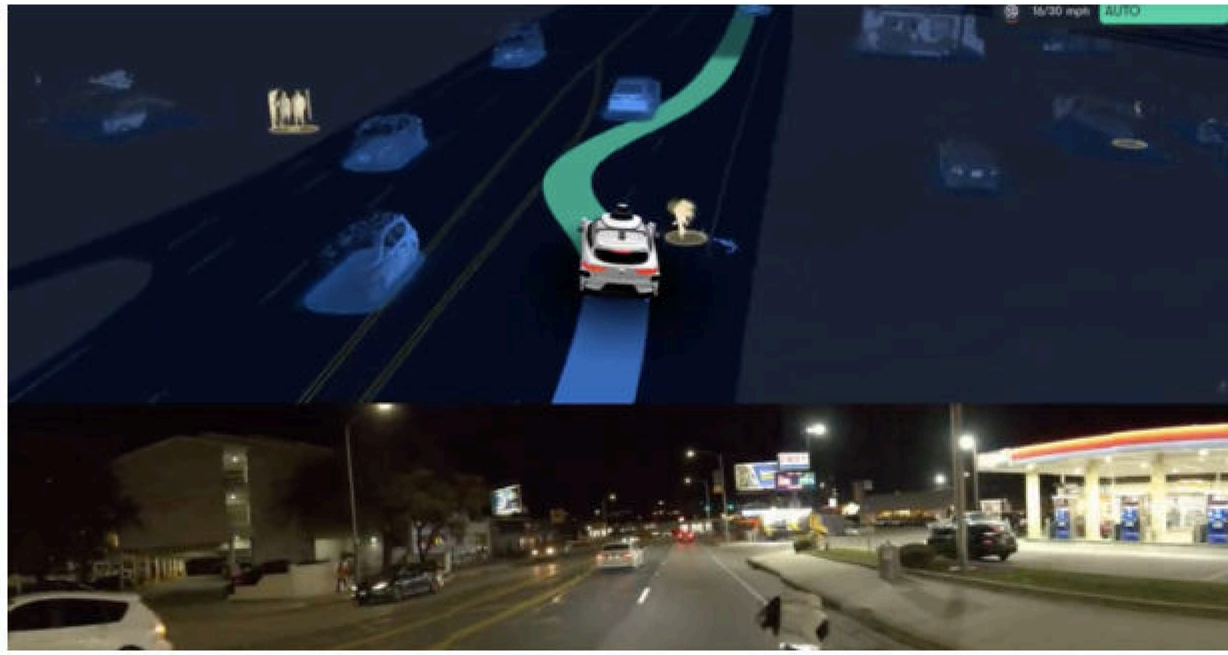
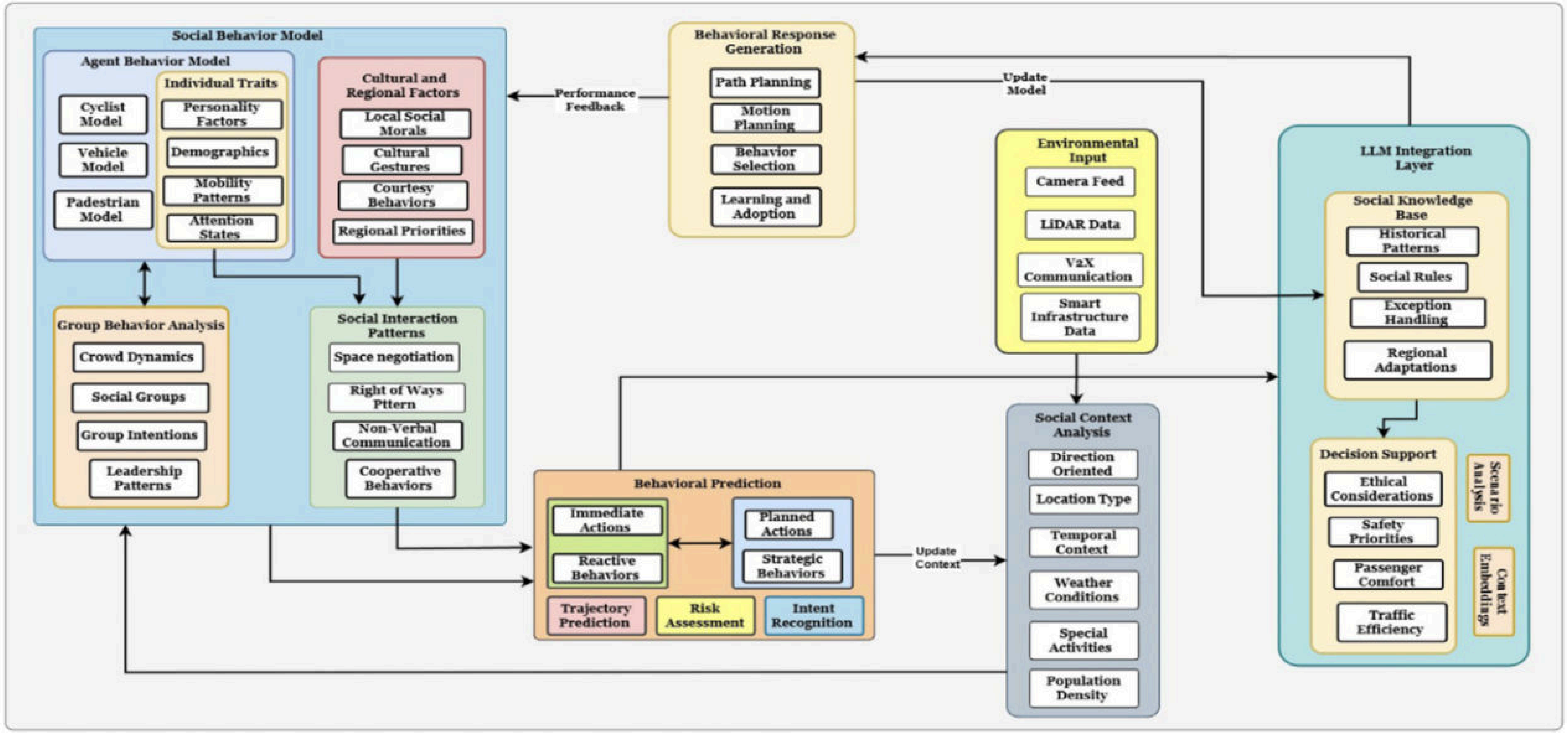
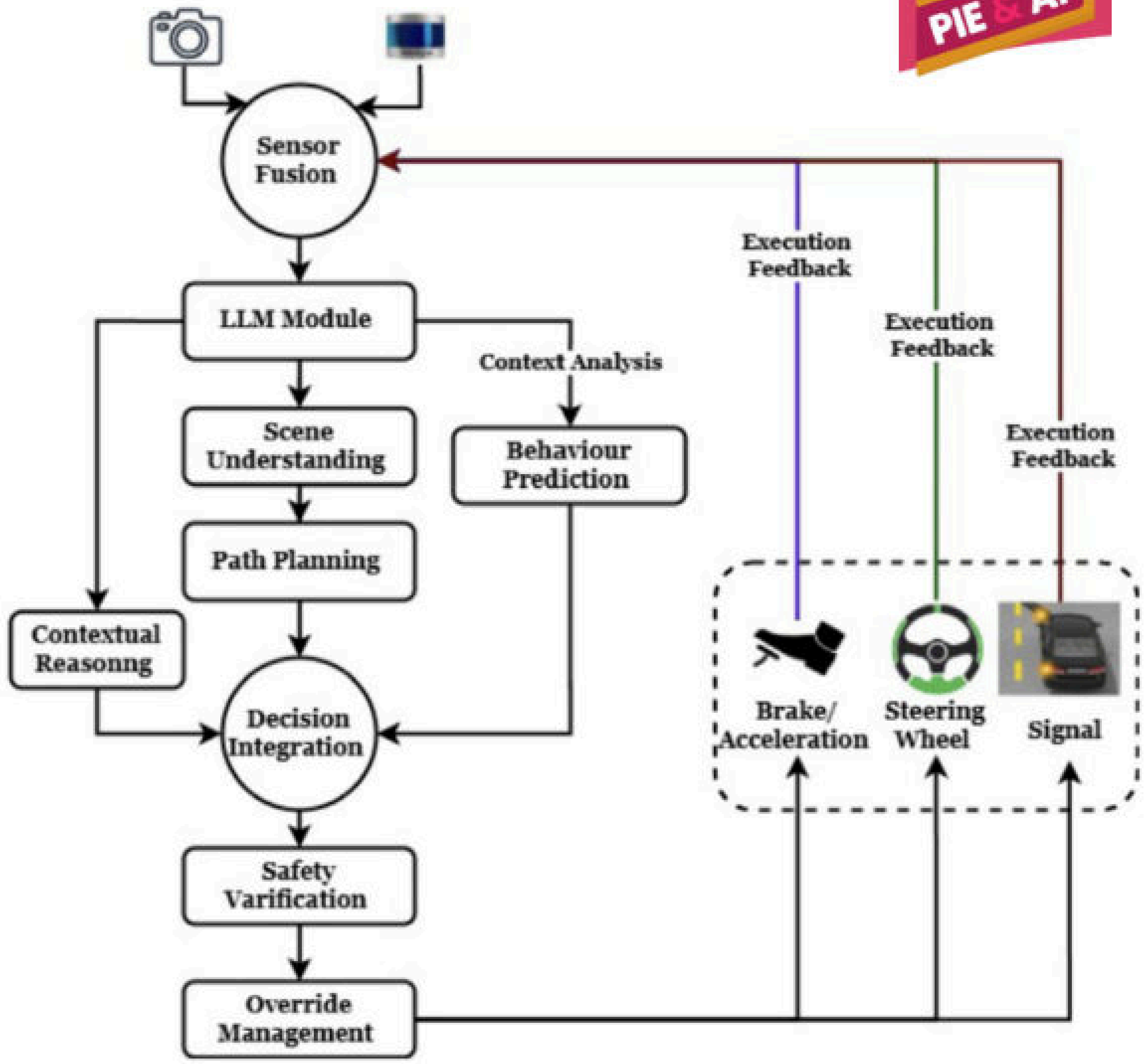








Scenario-to-Text Conversion

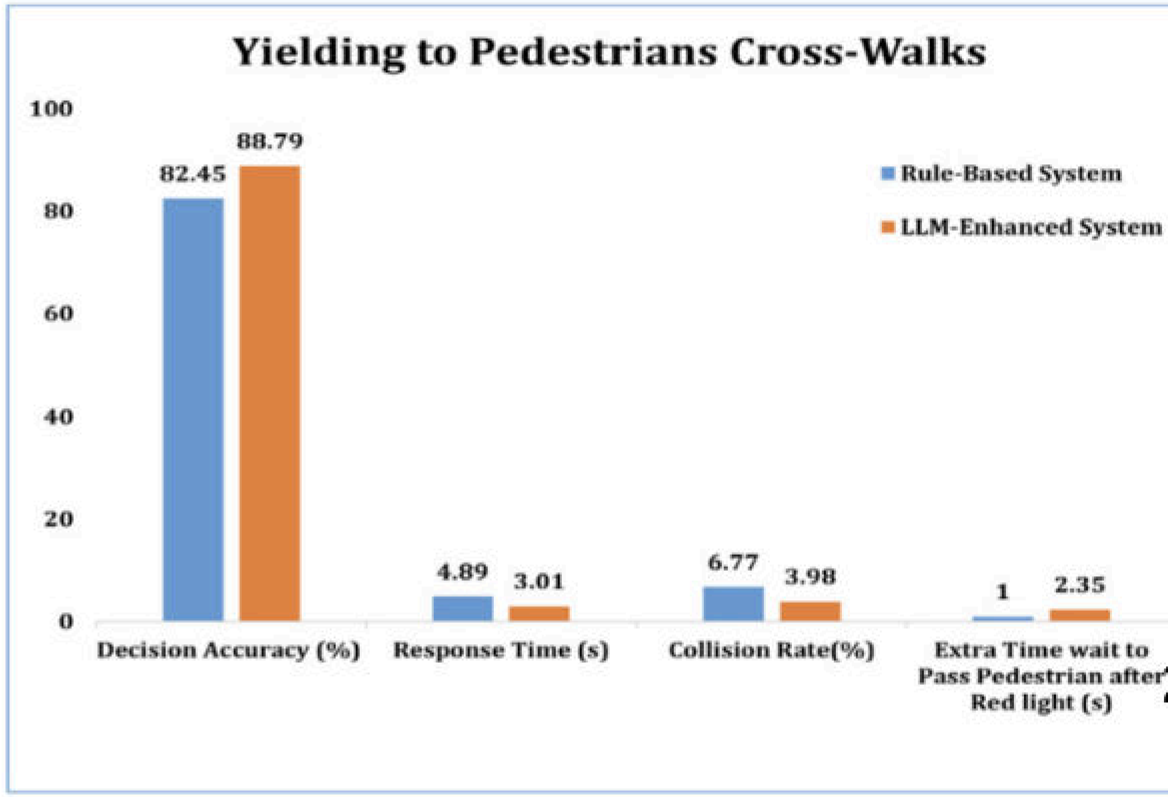
Ego vehicle speed: 40 km/h.
Leading vehicle: 20 m ahead, decelerating at 4 m/s².
Pedestrian: Crossing road 15m ahead, moving at 1.5 m/s.
Traffic light: Red.
Road conditions: Normal

Output Generation

1. Immediate action: "Decelerate at 4 m/s² to match leading vehicle's speed"
2. Contingency plan: "Prepare emergency braking if pedestrian enters 5-meter zone"
3. Regulatory compliance: "Maintain full stop until traffic light turns green"

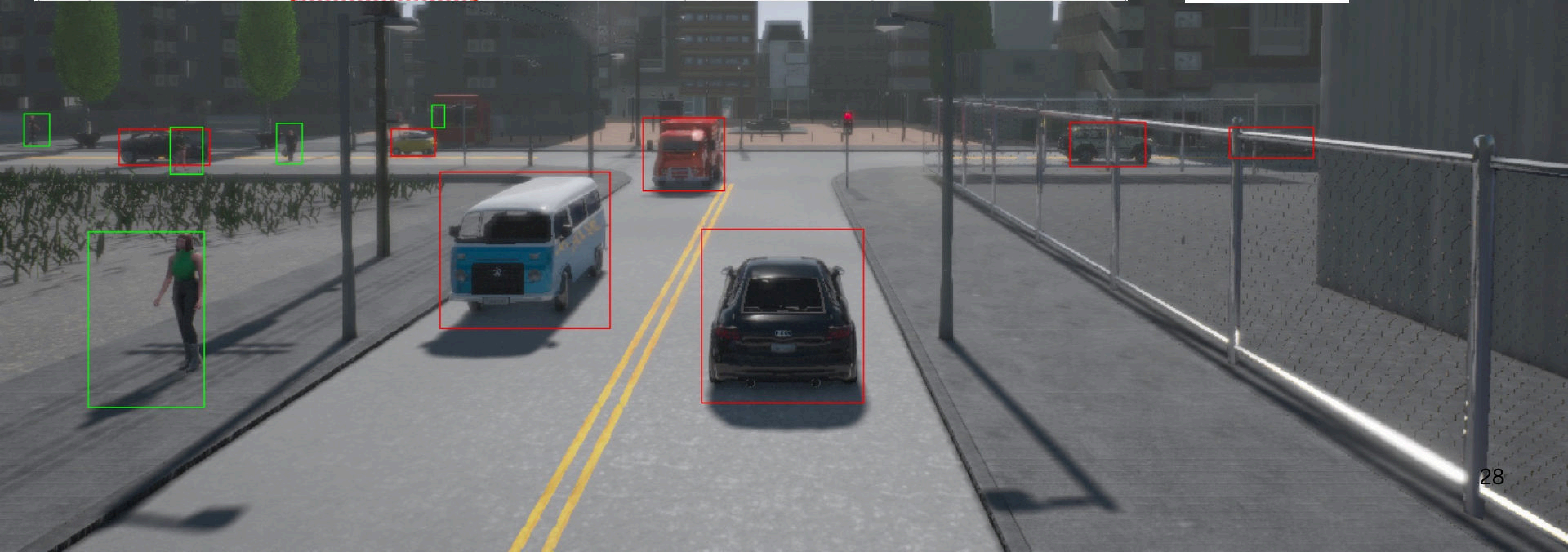
Outputs to control parameters

Target speed: 20 km/h
Braking pressure: 45%
Steering adjustment: +2.5° for lane centering



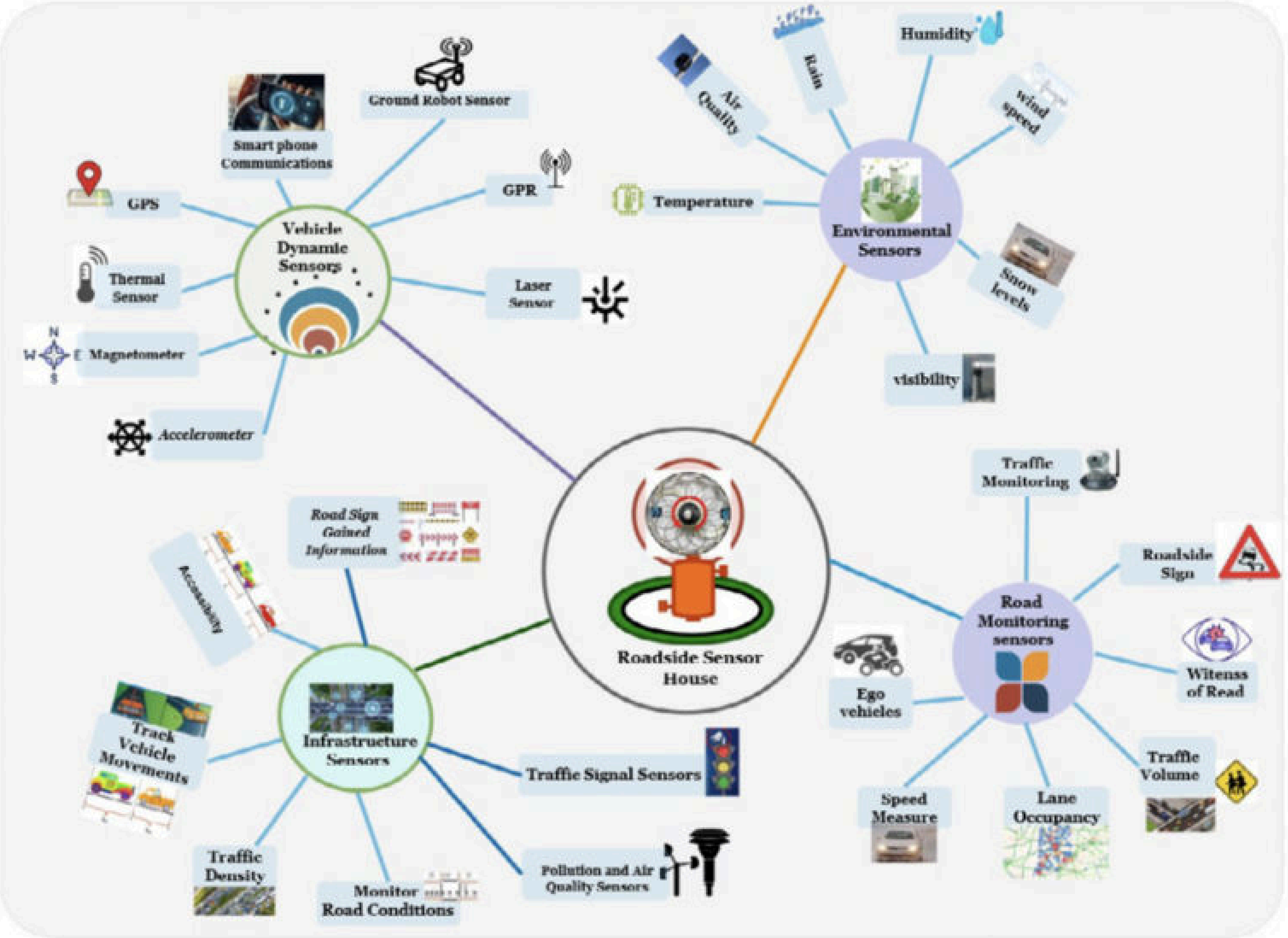
Enhancing Autonomous Vehicle Resilience: Roadside Sensor Networks for Robust Perception and Decision-Making in Challenging Environments

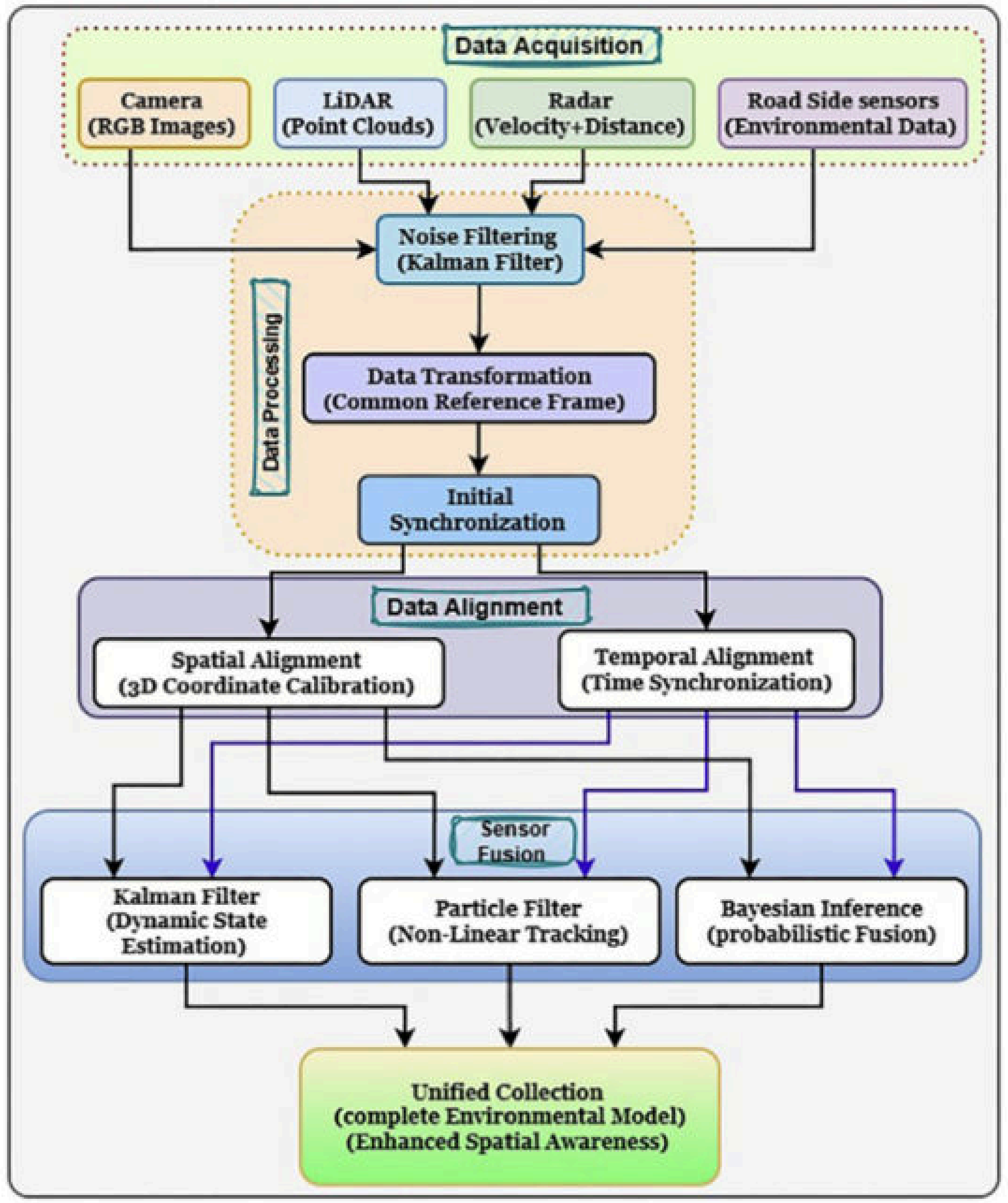
3	Publication	ScienceDirect Journal — Array	Enhancing Autonomous Vehicle Resilience: Roadside Sensor Networks for Robust Perception and Decision-Making in Challenging Environments	เพิ่มความทนทานของ AV ในสภาพแวดล้อมยาก เช่น ฝนตกหนัก หมอก ฝุ่นละอ่อง occlusion และ sensor degradation	Roadside Sensor Network, V2X, Sensor Fusion, Kalman Filtering, Foundation Models, CARLA	เสนอระบบ roadside sensor infrastructure ช่วยเสริม onboard sensors ของ AV โดยรายงานผล เช่น ลด occlusion errors ประมาณ 35%, object detection accuracy เพิ่มเป็น 74.7% และ collision rate ลดลง 28% ใน heavy rain



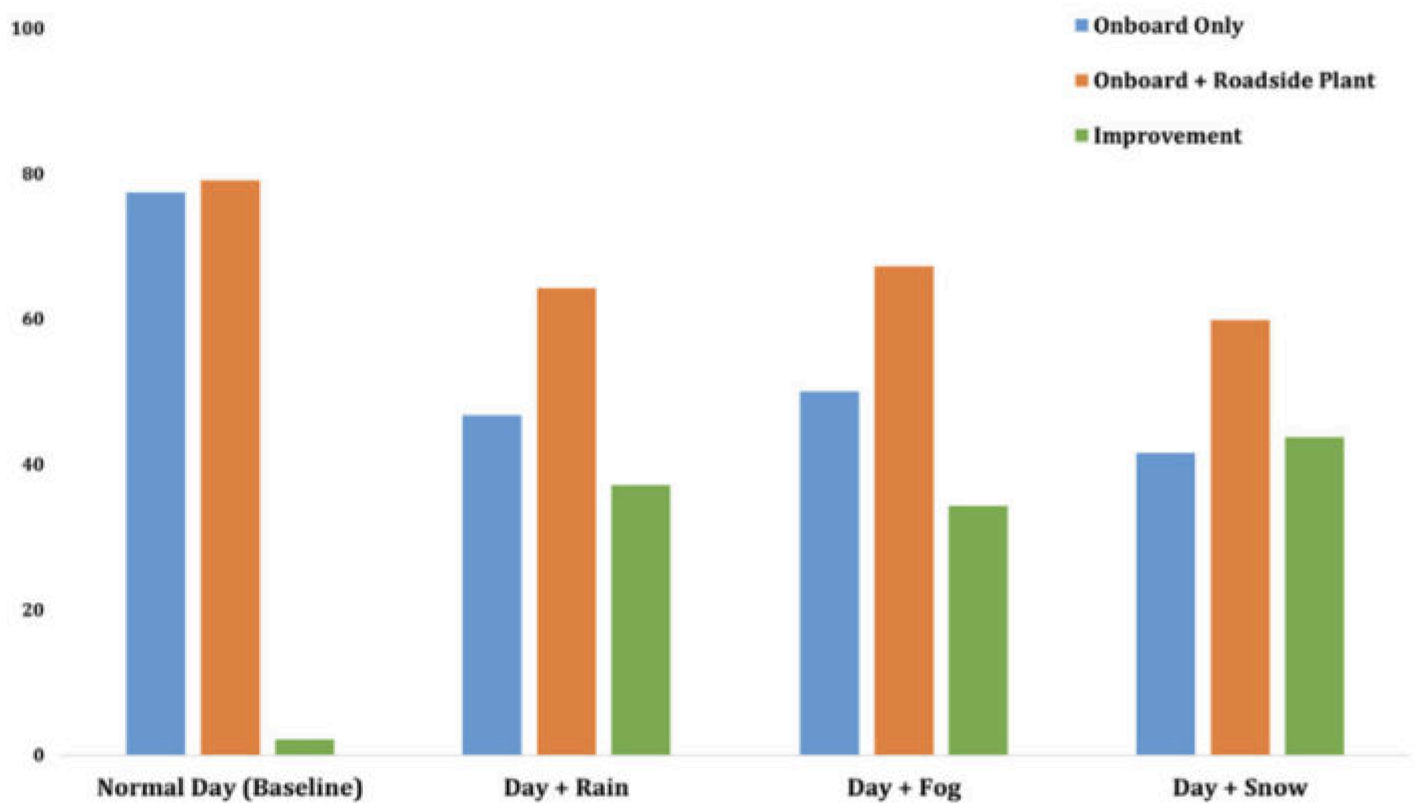
CARLA

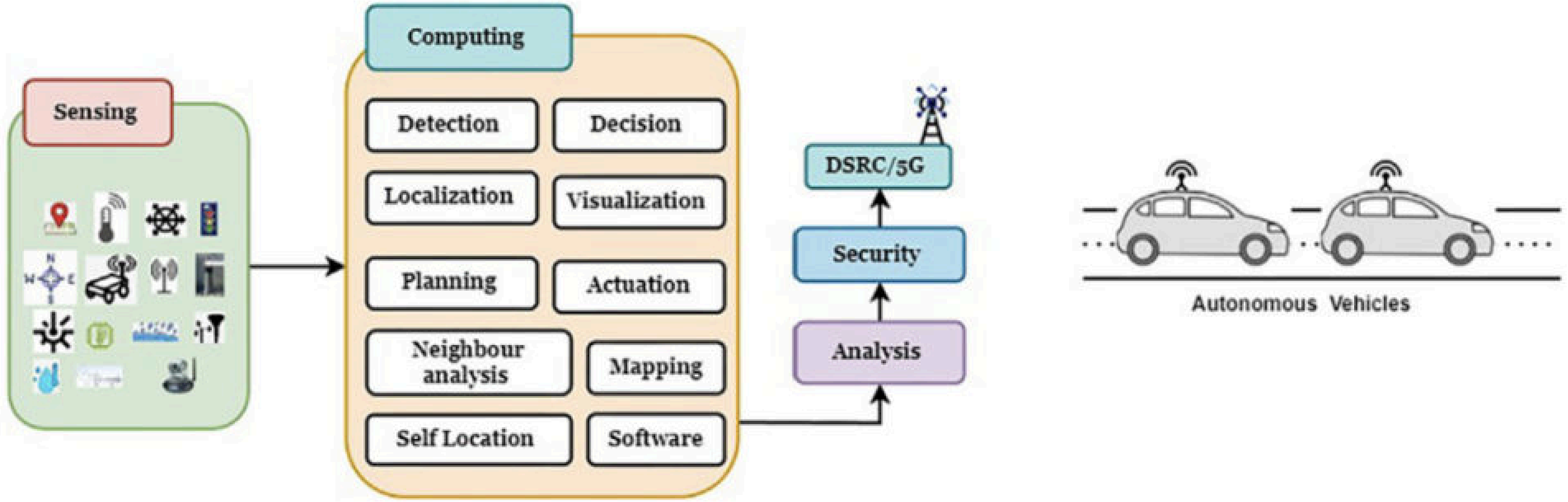
Release 0.9.11





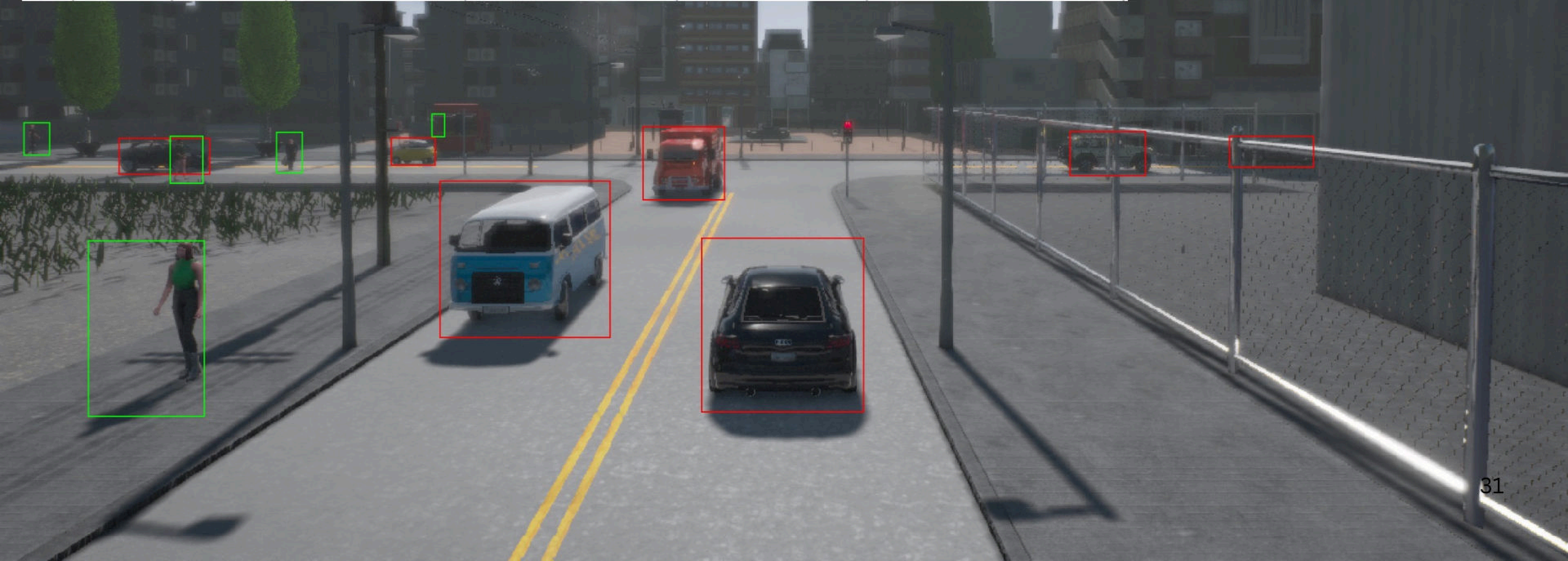
Improvement in Object Detection Accuracy (%) with Roadside Sensor Integration Under Adverse Weather Conditions





LLM-Augmented Reinforcement Learning for Adaptive Emergency Vehicle Prioritization Under Urban Traffic Stress

4	On Progress / Under Review	ScienceDirect Journal — Safety Science	LLM-Augmented Reinforcement Learning for Adaptive Emergency Vehicle Prioritization Under Urban Traffic Stress	การจัดลำดับความสำคัญให้รถฉุกเฉินในเมือง โดยใช้ LLM + RL เพื่อจัดการจราจรแบบ safety-critical	LLM Reasoning, Constrained Multi-Agent Reinforcement Learning, SUMO, CARLA, V2X, Emergency Vehicle Prioritization	เสนอ framework สำหรับ emergency vehicle prioritization ที่ลด EV travel time 16.6% เมื่อเทียบกับ RL baseline ในสภาพแออัด, 29.3% ใน peak-demand stress และลด safety-critical conflicts 33.3%



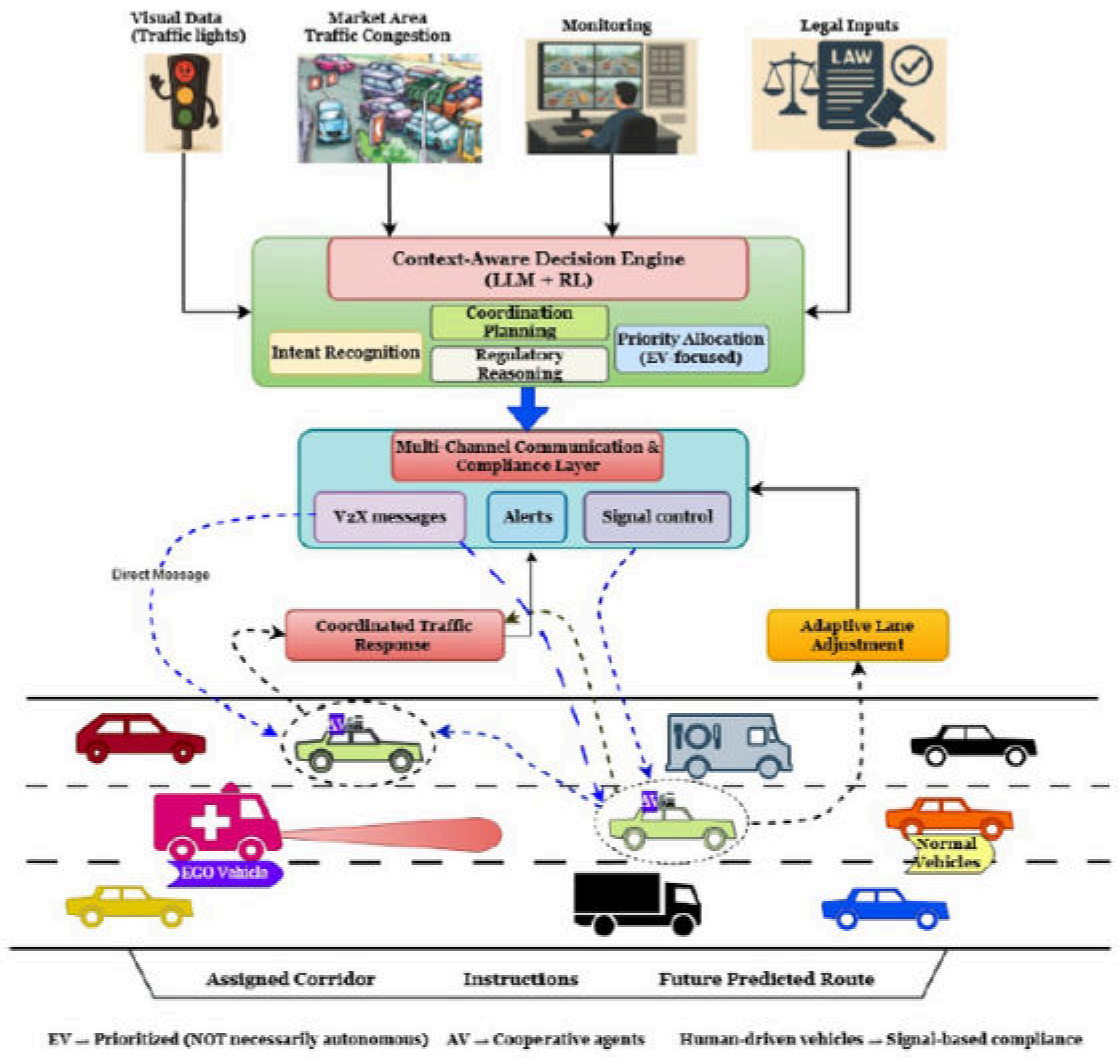
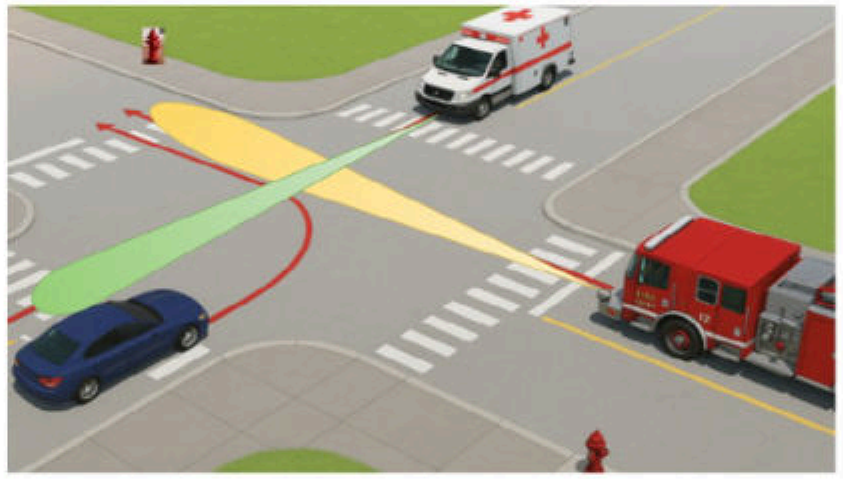
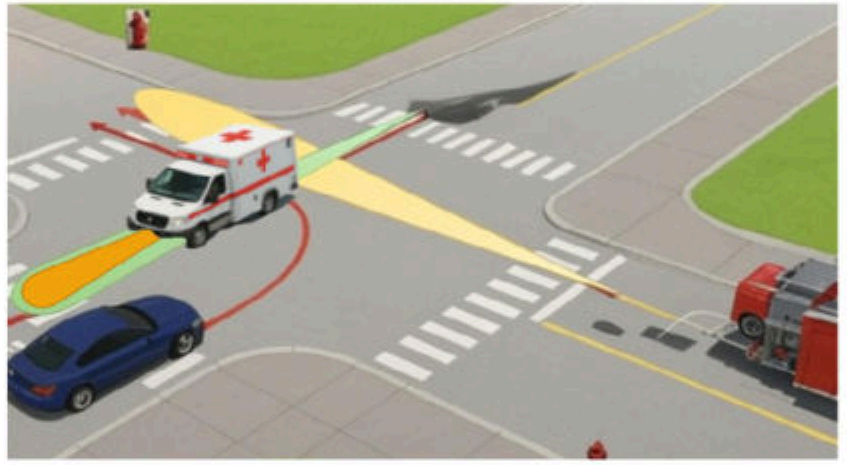


Figure 3: Context-aware LLM-augmented reinforcement learning architecture for coordinated emergency vehicle prioritization in heterogeneous mixed-traffic environments.



(a)Priority conflict scenario: Ambulance, fire truck, and civilian vehicle simultaneously request intersection access, creating scheduling conflict.



(b) LLM-based resolution: Ambulance with cardiac patient prioritized to cross first; fire truck held temporarily despite emergency status.

Figure 11: LLM-based emergency vehicle priority resolution at signalised intersection: (a) conflict scenario and (b) intelligent priority assignment.


Server: 72 FPS
Client: 71 FPS
Vehicle: Ford Ambulance
Map: Town10HD_Opt
Simulation time: 0:18:34
Speed: 8 km/h
Heading: 86° NE
Location: (40.3, 46.1)
GNSS: (-0.000423, 0.000362)
Height: -0 m
Throttle:
Steer:
Brake:
Reverse:
Hand brake:
Manual:
Gear: 1
Collision:
Number of vehicles: 31
Nearby vehicles:
21m Vespa Zx125
37m Gazelle Omafiets
42m Dodge Charger Police
63m Nissan Patrol
64m Bmw Grandtourer
74m Yamaha Yzf
77m Micro Microlino
78m Carlamotors European ...
81m Seat Leon
82m Harley-Davidson Low R...
83m Carlamotors Firetruck
89m Dodge Charger Police ...
STOP
AMBULANCE
CMR
CARLA
PIE & AI

5	Idea / Future Research	New Research Idea	AIoAT Hallucination and Dynamic Scenarios	การศึกษา hallucination ของ AI Agents / AIoAT ในสถานการณ์ที่เปลี่ยนแปลงตลอดเวลา โดยเฉพาะ autonomous systems, traffic, healthcare หรือ smart city	AI Agents, LLM Hallucination Detection, Dynamic Scenario Simulation, Reliability Scoring, Human-in-the-loop, Safety Guardrails	Focus on hallucination detection, reliability assessment, and safe decision-making of AI agents in dynamic scenarios

A DeepLearning.AI community meetup hosted by <<AGICAFET>>

CARLA
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Local AI for Autonomous Vehicles:

From CARLA Decision-Making to Context-Aware and Resilient Urban Mobility.

27 June 2026
1:00 – 6:00 p.m.

Cleverse Rama9

Aueaphum Aueawatthanaphisut
Founder & CEO,
Tensai Thaizen Co., Ltd.

- CARLA Simulation & Decision-Making
- AI & Machine Learning on the Edge
- Context-Aware Perception
- Resilient & Safe Urban Mobility

Special thanks to: DeepLearning.AI, SCG PACKAGING, IBM, true together