

자유와 활력이 넘치는
파워풀 대구



FIX All on AI

Future Innovation tech eXpo Conference 2025

Tailored Autonomy
Leveraging Open-Source Ecosystems
for Special Purpose Vehicle



TREEZE Co., Ltd.

TREEZE



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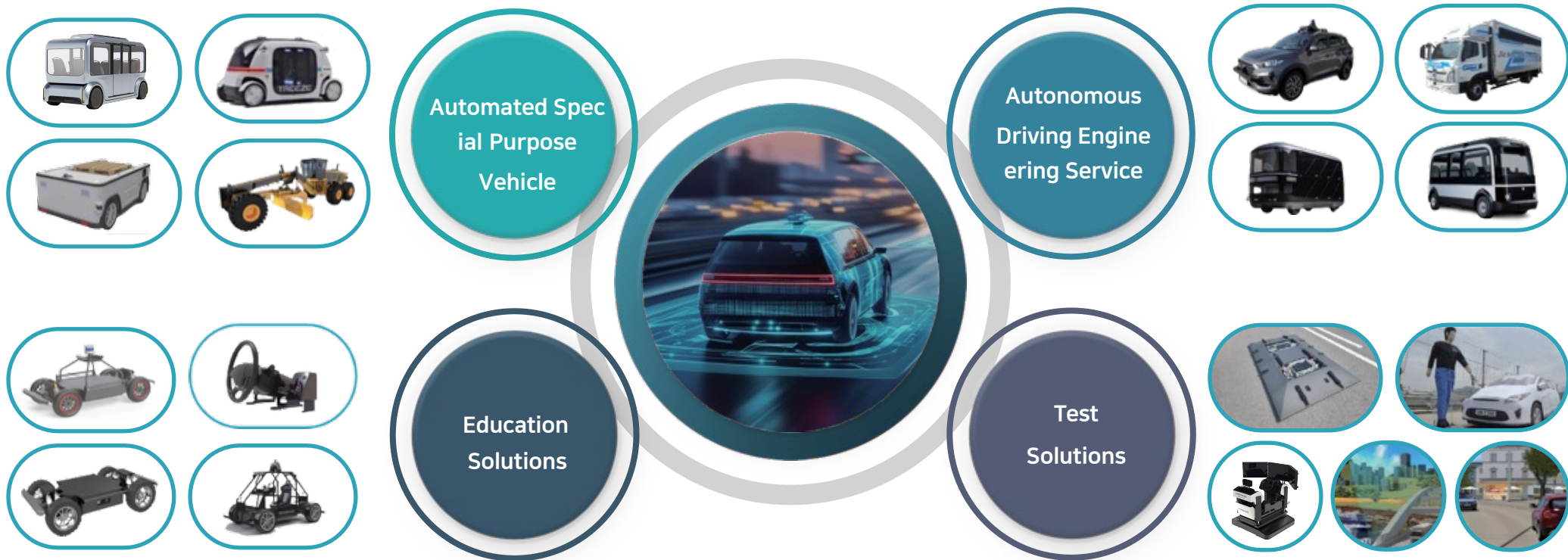
I. Treeze Overview



TREEZE

1-1 Who we are

TREEZE has established itself as a trusted partner in advancing autonomous driving technologies, collaborating with leading companies, research institutions, and educational organizations. Our expertise encompasses a diverse range of mobility platforms, including ICVs, EVs, compact vehicles, buses, snowplows, construction machinery, and Automated Special purpose vehicles(A-SPV). By driving innovation through extensive development and testing of autonomous mobility solutions, we continue to push the boundaries of engineering excellence in this dynamic field



1-2 Diverse Experience in AD

Over 120 projects

(Feb 2025)

Secured technologies for autonomous vehicle development and retrofit through various projects with leading domestic autonomous driving companies and institutions.

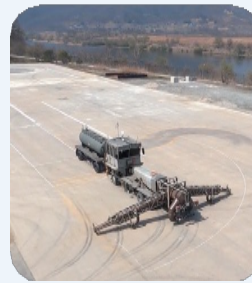
Retrofit based AD Vehicle Development



42dot, RideFlux, KATECH, Korea National Police Agency
[2018 ~ Dec. 2024]



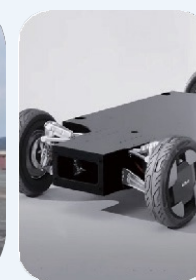
AD Cargo Vehicle



AD Runway Snow
Removal Vehicle
[Nov. 2021]



AVAS
(AV Auto Shipment)
[Nov. 2024]



Execution of Various
Special-Purpose Vehicle Projects
[2018 ~ present]



AD Yard Tractor
Planned for Aug.2025



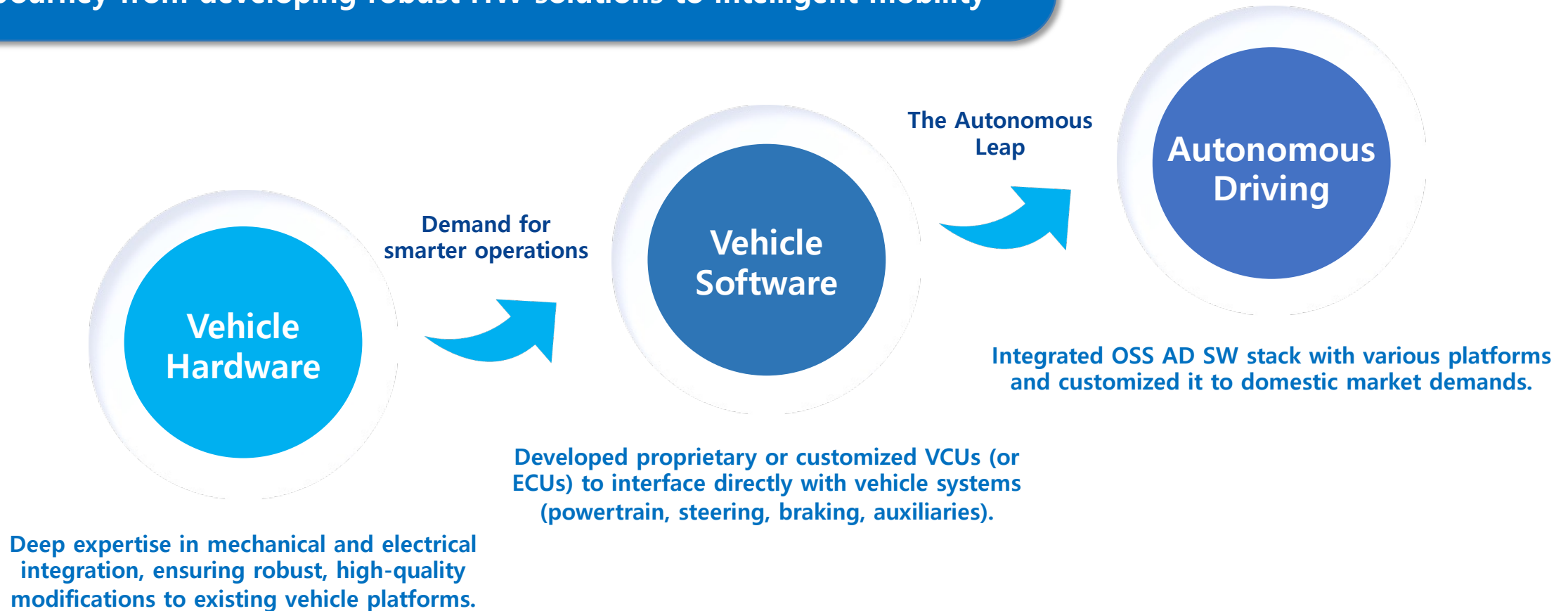
II. Covering HW to AI



2-1 Combining HW, SW & Autonomy



Journey from developing robust HW solutions to intelligent mobility





III. A-SPV Introduction



3-1 Role of TREEZE in AD market

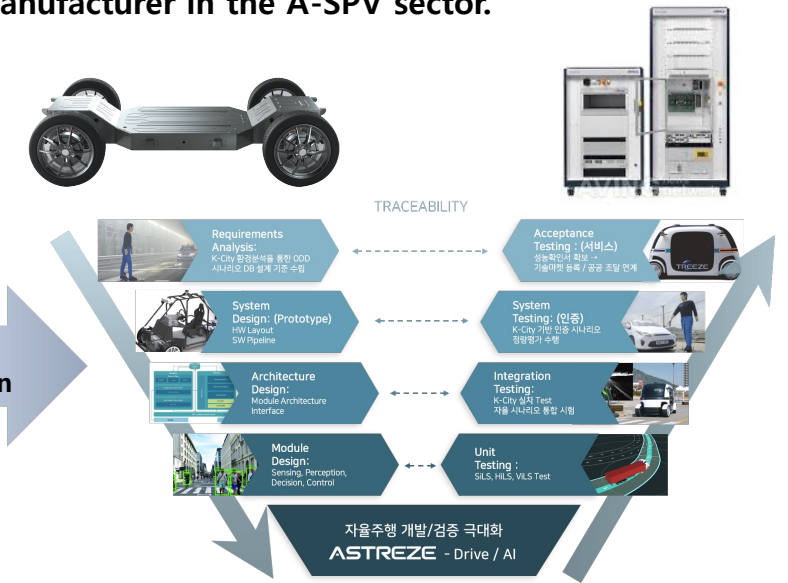
TREEZE is a full-stack autonomous driving solutions provider, covering the entire development pipeline from software R&D and simulation to vehicle prototyping and mass production.

By standardizing and securing IP for Level 4 autonomous driving software, TREEZE strengthens its technological edge.

The company develops and manufactures a range of **Autonomous Special-Purpose Vehicles (A-SPVs)**, including shuttles, yard tractors, and logistics robots, positioning itself as a leading manufacturer in the A-SPV sector.



Expanding VV&A business through XIL-based solutions



Evolving into a full-spectrum solution provider from autonomous driving development to mass production.

3-2 Product Line-up



Leo™

Autonomous shuttle

Leo is an autonomous shuttle optimized for mobility services in smart cities, campuses, and leisure spaces.



Taurus™

Autonomous yard tractor

Taurus is an autonomous tractor for ports and logistics centers, built to transport heavy cargo safely and efficiently.



Vega™

Open Mobility Platform (OMP)

Vega is a platform optimized for development and education, compatible with various autonomous systems.



Chameleon™

Mobile Robot Platform (MRP)

Chameleon is a compact EV robot platform with 4 WD and 4WS, supporting various driving modes and open communication for multi-purpose robotic development.



Scorpius™

Overrunnable Flat Robot

Scorpius is a testing platform for ADAS and autonomous driving, focused on evaluating obstacle detection and avoidance in real-world scenarios.



Sim™

Driving Simulator

Sim is a motion simulator for AD and ADAS testing, enabling real-time validation in virtual driving environments.



IV. Open-source advantage for SPV

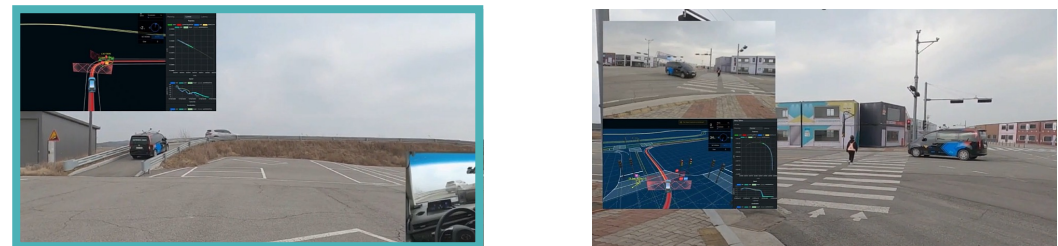


TREEZE

4-1 Experience with AD OSS



Urban ODD



4-2 Why Autoware

COMMUNITY

- Leverages global community for **diverse contributions**
- Longevity, promotes standardization, and enhances **widespread industry adoption**.
- **Active participation** accelerating feature integration and SW maintenance

TRANSPARENCY

- Allows for **public scrutiny**, enhancing security through rapid vulnerability identification
- Transparency builds trust and accountability, as users can **verify functionality**
- Open access to the code **accelerates research** and fosters innovation

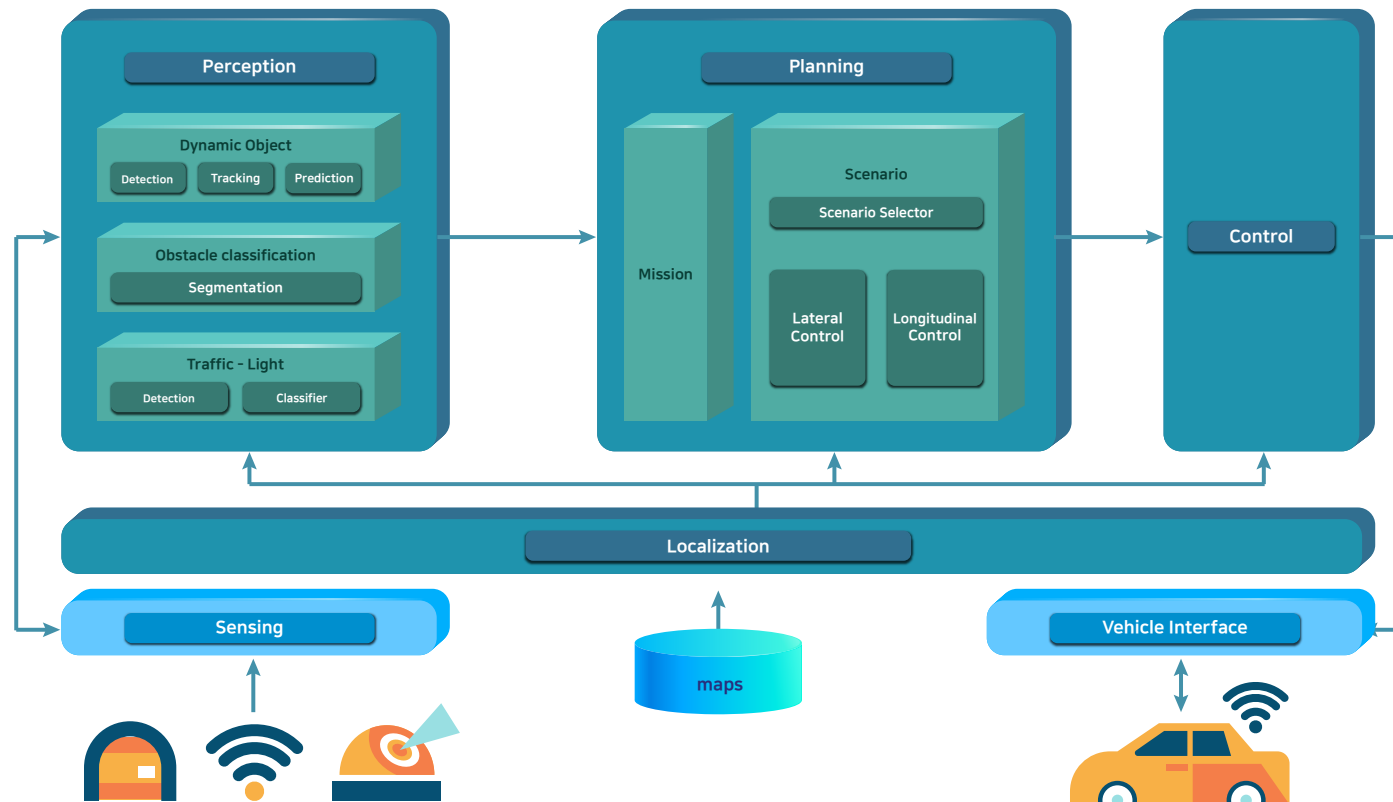
STATE OF THE ART

- **Active integration** of state-of-the-art technology on period basis
- **Open discussion forums** to understand and check the feasibility of SOTA functions.

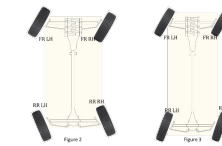
4-3 Current limitation with Autoware

Hurdles with current version of SW for diverse ODD/vehicle deployments

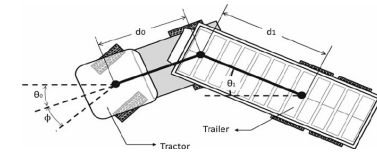
- The software relies on outdated, lidar-dependent perception models and lacks support for advanced vehicle types like 4-wheel steering or articulated vehicles.
- Key functions like localization, dynamic map handling, and V2X integration are underdeveloped, limiting real-world performance.



Some of the limitations



Non-availability of diverse vehicle models



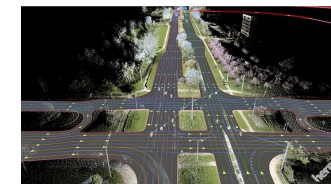
Non-availability of articulated models



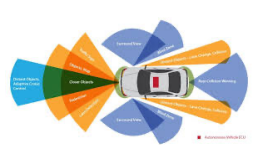
Lacks V2X integration with latest standard



Mainly lidar dependent perception model



Heavily reliant on static semantic maps for planning

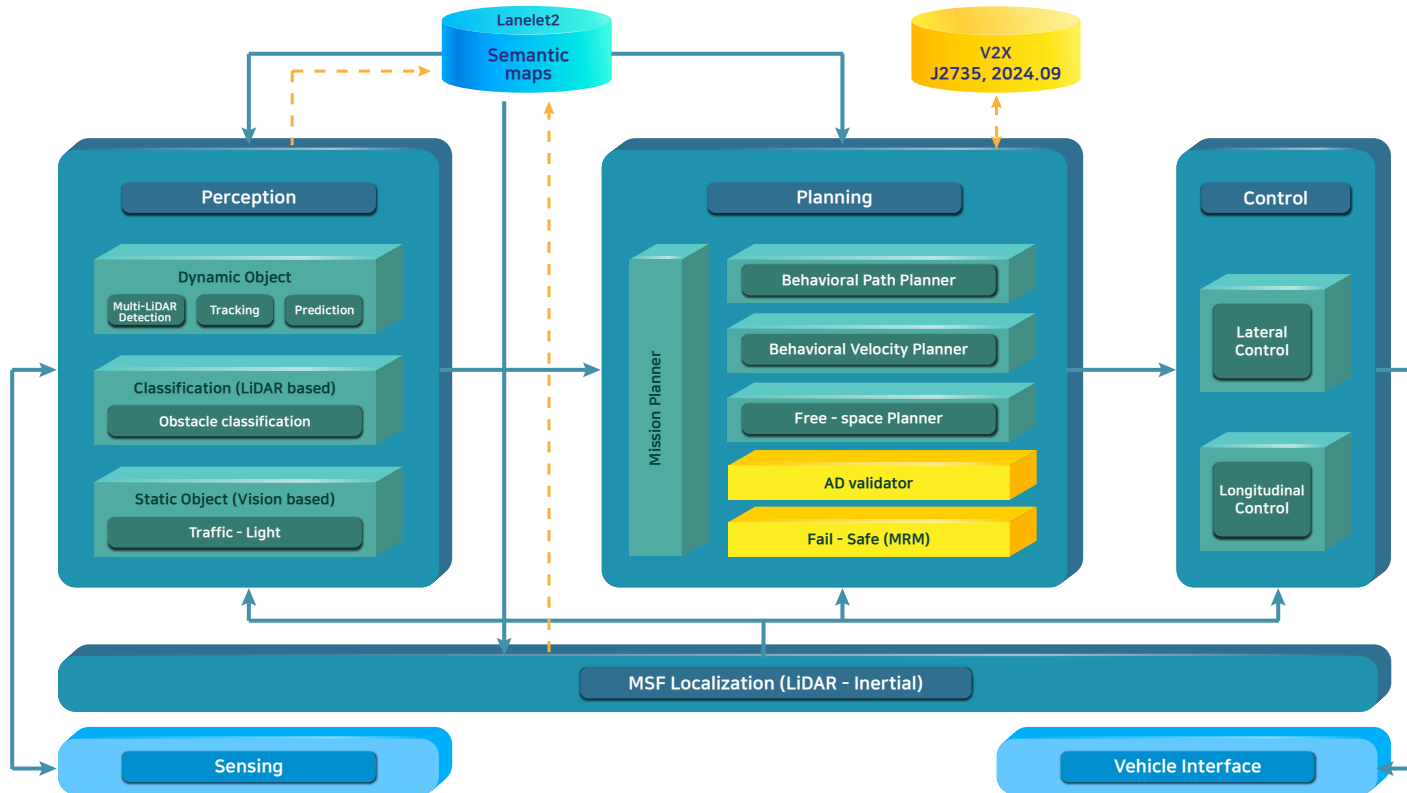


Outdated perception models

4-4 Adapting OSS to specific ODD

V2X SW module integration

- Developed ETraffic light adapter module to convert the decoded SPaT (Map) messages to Autoware messages.
- Encoding and Decoding packages for J2735 (2024.09) V2X data packets.
- BSM/PVD generator from vehicle data



Latest V2X standard J2735
(v2024.09) integrated

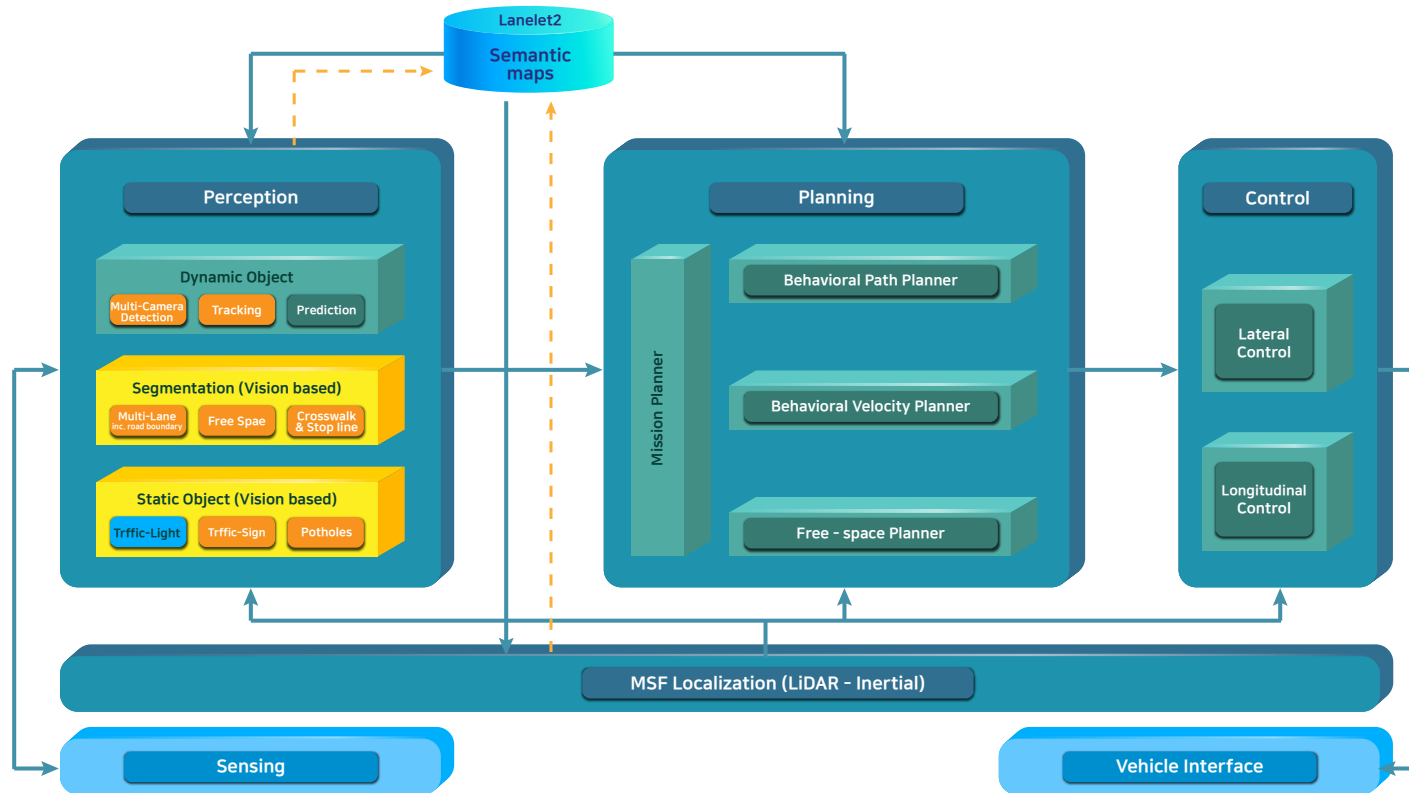
[▶ Demo Video](#)



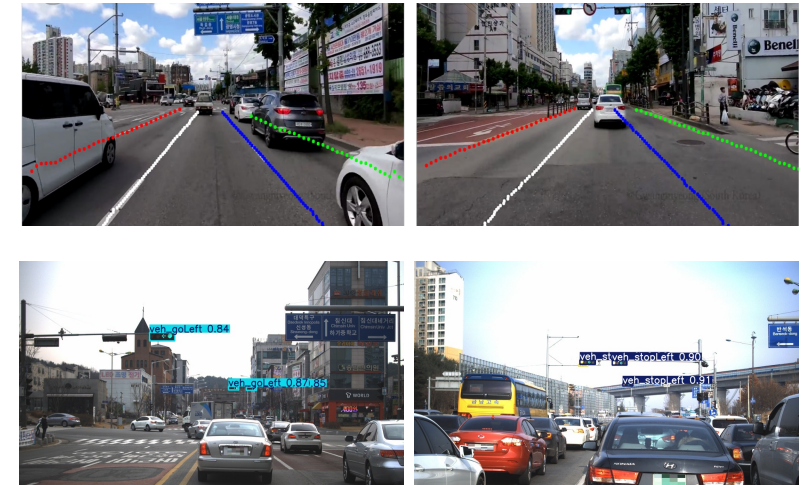
4-4 Adapting OSS to specific ODD

Customized Perception models

- Inclusion of vision based traffic light detection model based on domestic custom and open dataset.
- Updated model and relevant weights for lidar, camera detection & segmentation module based on custom dataset.



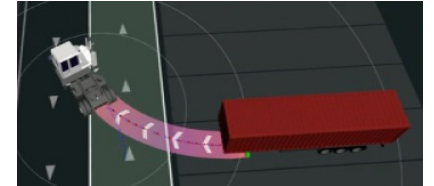
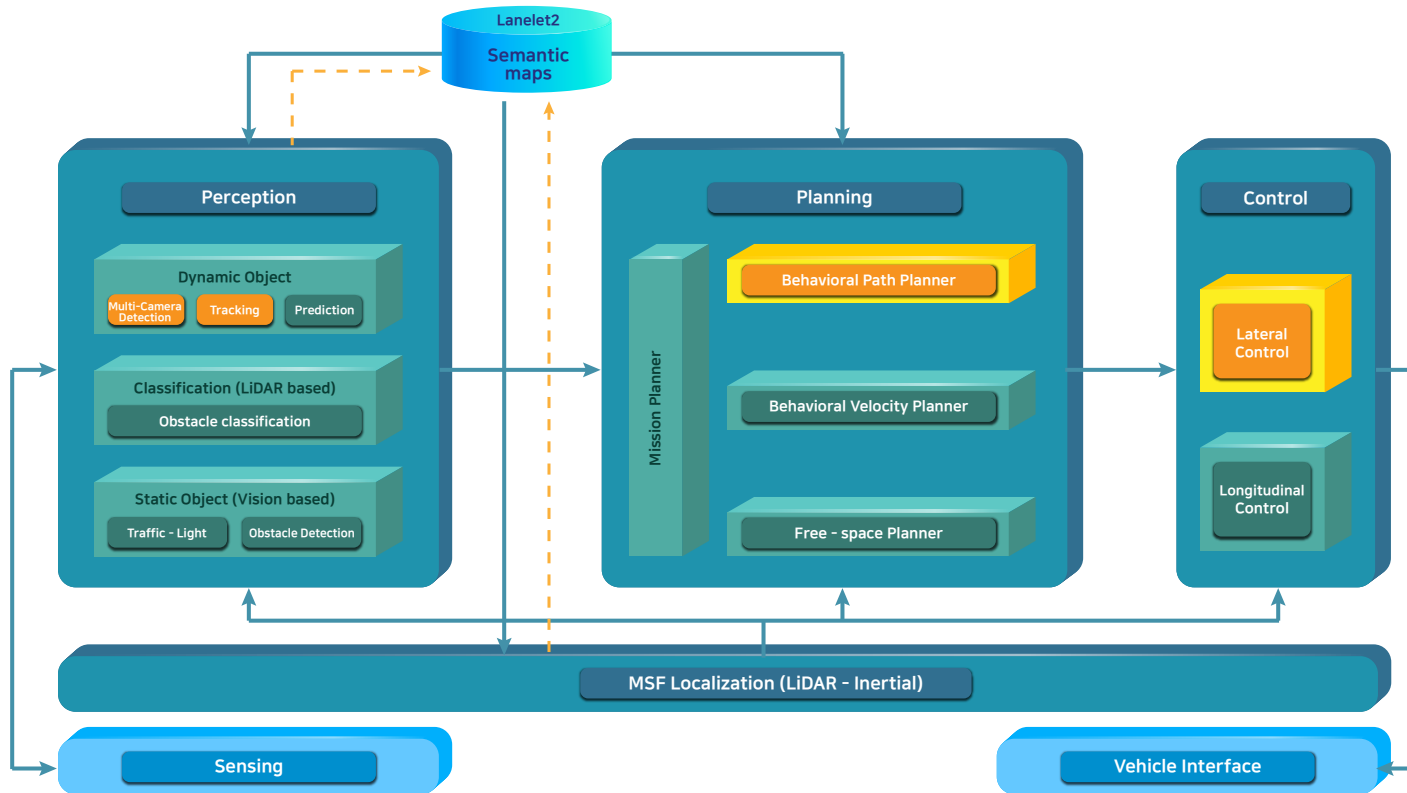
Updated perception models for domestic adaptations



4-4 Adapting OSS to specific ODD

Inclusion of Specialized Vehicles

- Path planner update to generate optimized trajectory for a articulated vehicle and 4W steering vehicle models.
- Enhanced Lateral control module to include tractor-trailer, 4W steering vehicle model safe maneuvering .

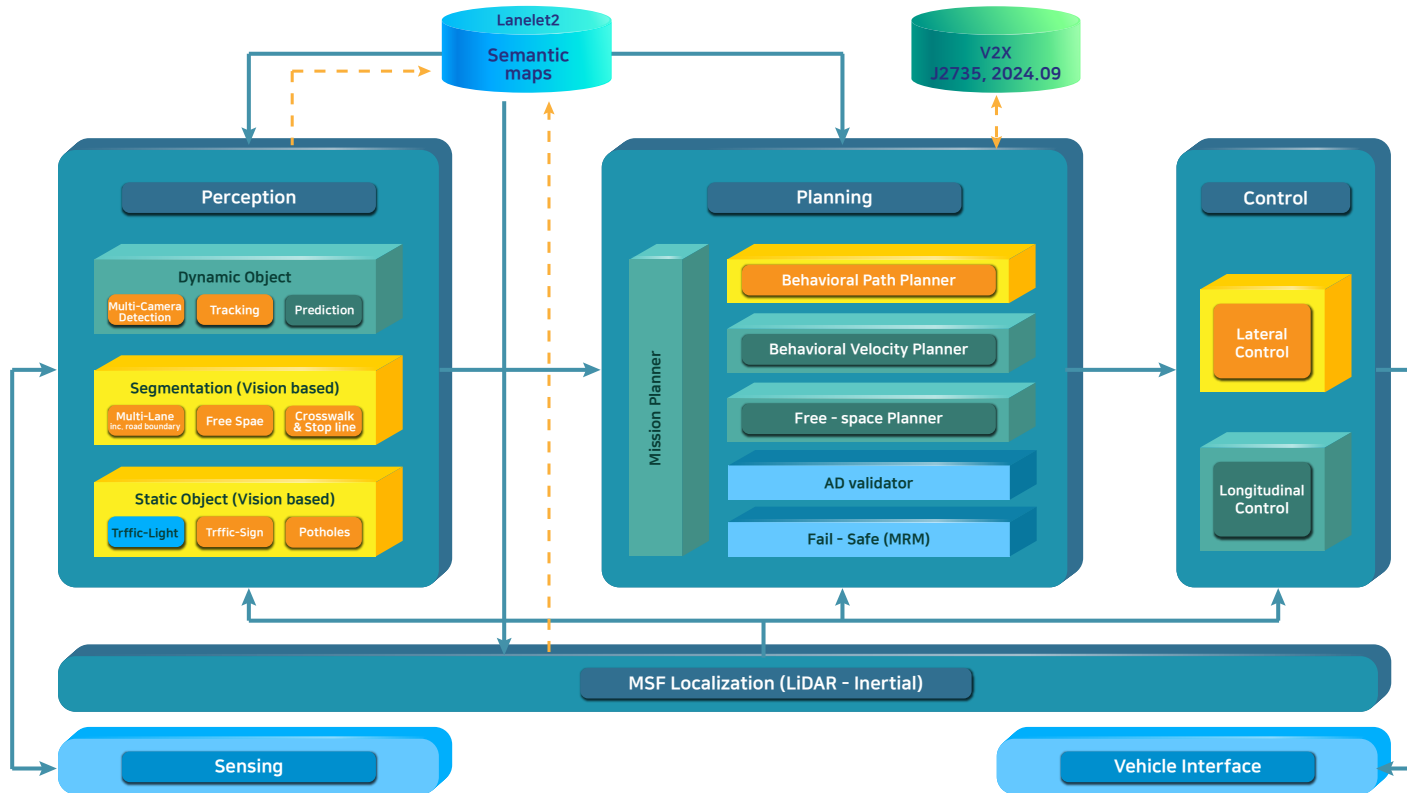


Articulated vehicle model integration
ex. Tractor – trailer model

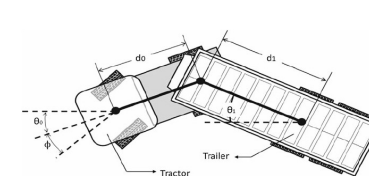


4-4 Adapting OSS to specific ODD

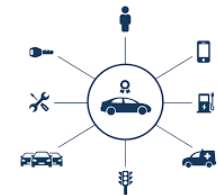
- Extended Autoware to deliver high-performance, safe, and efficient autonomous solutions customized for these specific ODDs.
- Integrated functions include latest V2X standard, diverse vehicle models and updated lidar and camera perception models.



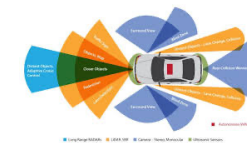
Some of the new built modules to Autoware



Articulated vehicle model integration ex. Tractor - trailer model



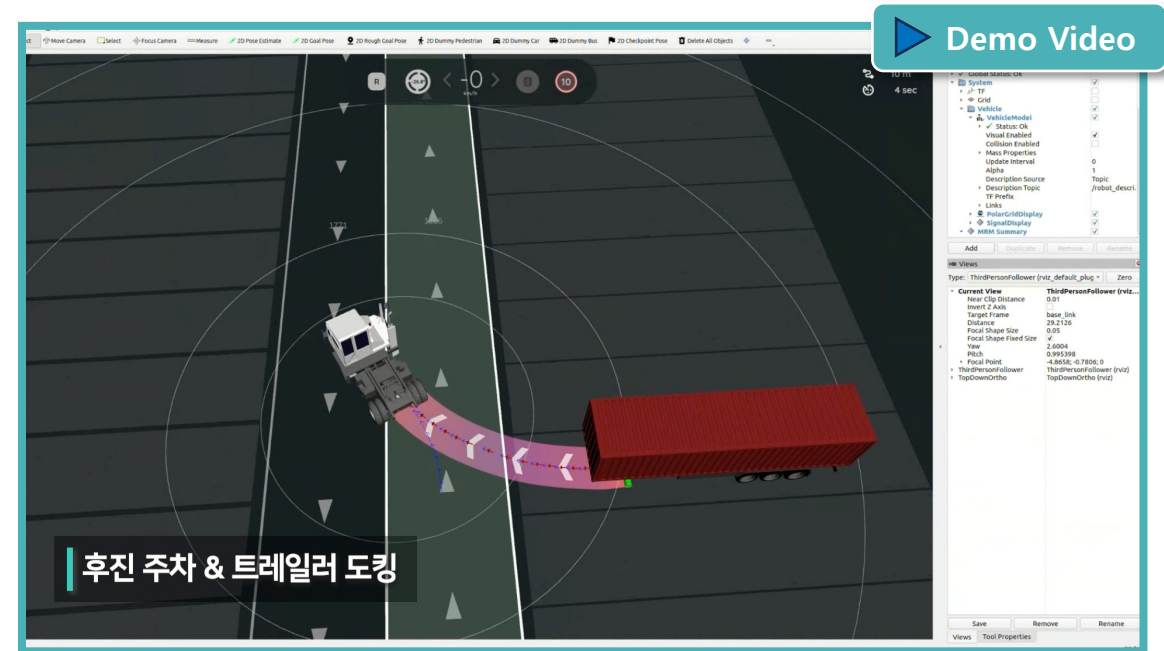
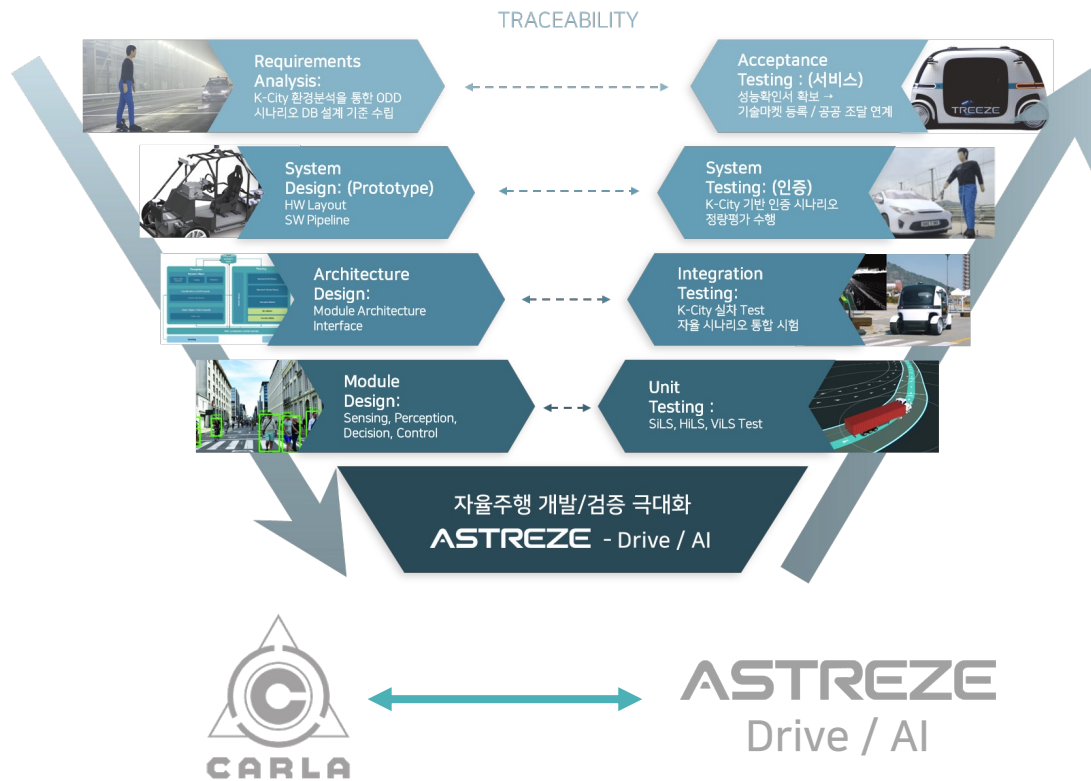
Latest V2X standard J2735 (v2024.09) integrated



Updated perception models for domestic adaptations

4-5 Validating AD OSS

- Complete integration of Astreeze Drive/AI with Carla simulator to verify and validate autonomous driving functionalities.
- For each of the custom ODD & vehicle relevant virtual environment including vehicle is built, rendered and imported to simulation platforms like Carla.





V. Real-world impact : AD deployment use cases for SPVs



5-1 Autonomous Deployments



- ◆ Development of Lvl. 4 AD SW involves utilizing open-source Autoware universe branch which is based on ROS2 middleware.
- ◆ Customizations mainly on Planning modules to satisfy custom Urban & Highway ODD and AD licensing requirements.
- ◆ Additional SW packages (HMI-Failsafe) developed for Korean AD Licensing.
- ◆ Customizations mainly on Perception and Planning modules to satisfy custom ODD and AD licensing requirements..
 - LiDAR perception: Customized Center-point model trained on custom data for 3D obstacle detections.
 - Camera perception: Customized YOLOv8 model trained on custom data for traffic light detection and obstacle detection.
 - V2X (J2735, 2024.09) integration

Clients



▶ Demo Video



Clients



▶ Demo Video



5-2 A-SPV Deployments

- ◆ Development of confined ODD based AD SW for vehicle platforms like Motor grader, Wheel Loader, Wheel roller, Snow removal vehicle, etc.
- ◆ AD SW comprises of mainly
 - Waypoint based autonomous maneuvering
 - Integrated with tele-operation system
 - Integrated with monitoring software for route/waypoints editing and real-time status monitoring

Clients



▶ Demo Video



Clients



▶ Demo Video



5-3 A-SPV Deployments

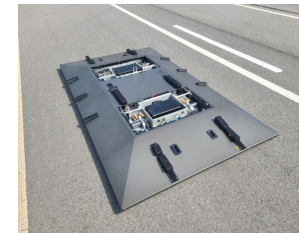
◆ OFR: Test platform utilized for testing performance and reliability of AD/ADAS systems.

◆ Platform Highlights:

- Vehicle Platform: Max. speed of 60kph with max. acceleration of 0.6G
- Pedestrian Platform: Max. speed of 20kph
- Max. turn angle of $\pm 35^{\circ}$
- Localization accuracy of $\leq 0.2\text{m}$
- Supports Euro-NCAP test scenarios like ACC, AEB, etc.

◆ Three main software components:

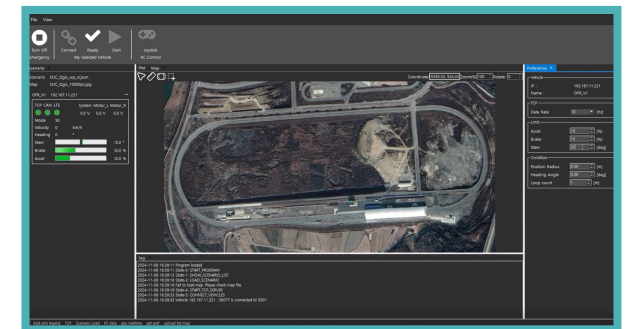
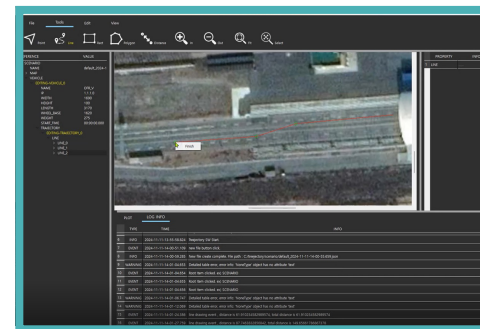
- Scenario Editor SW: Author/Edit NCAP scenarios that are to be tested.
- AD SW: Waypoints based vehicle maneuver.
- Monitoring SW: Tele-operation with real-time status monitoring.



▶ Demo Video



▶ Demo Video



5-4 A-SPV Deployments

- ◆ Deployment scenario: Vehicle to maneuver autonomously from the yard to the shipping container and park autonomously.
- ◆ Perception:
 - Lidar based obstacle and traversable area detection.
 - Camera based custom line detection
- ◆ Localization: INS and QR marker (placed on the internal roof of the container) fusion-based localization
- ◆ Localization accuracy $\leq 0.2\text{m}$ (including indoor localization)

Clients



해양수산부



한국교통연구원



Key Development Details

TR
EEZE

AVAS TEST



AVAS
Autonomous Driving
Development Goals
and Key Features

- **Autonomous valet parking ODD**
- **Current Technology**
Most companies rely on heavy installation of infrastructure that incurs massive cost for deployment, maintenance and service
- **Our Solution**
Autonomous solution with free space, parking lot detection and indoor localization using multi-sensor fusion with marker tags that are cost efficient and reliable.

▶ Demo Video

AVAS TEST



AVAS

**Autonomous
Vehicle
Auto
Shipment**

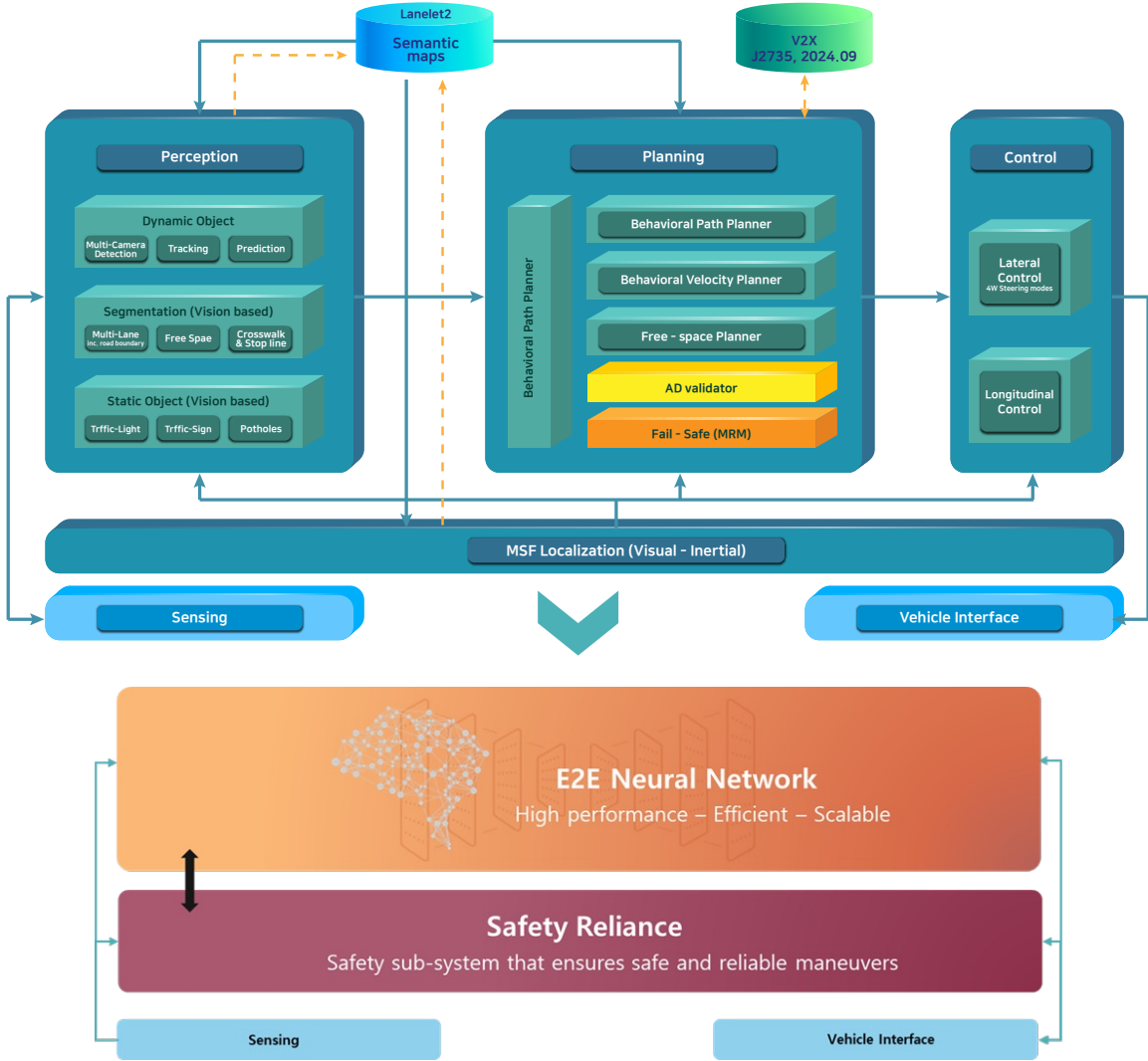


VI. The road ahead: Treeze's end-to-end AD SW roadmap



TREEZE

6-1 AD Roadmap: Vision



Mapless Autonomy



Real-time semantic segmentation and 3D obstacle detection, removing the need for costly HD maps

Optimized Inference



Model uses multi-modal deep teaching for real-time use on low-power devices.

ASTREZE AI™

Vision Priority



Multi-modal perception software optimized for multi-camera sensor setup, cutting costs while maintaining performance.

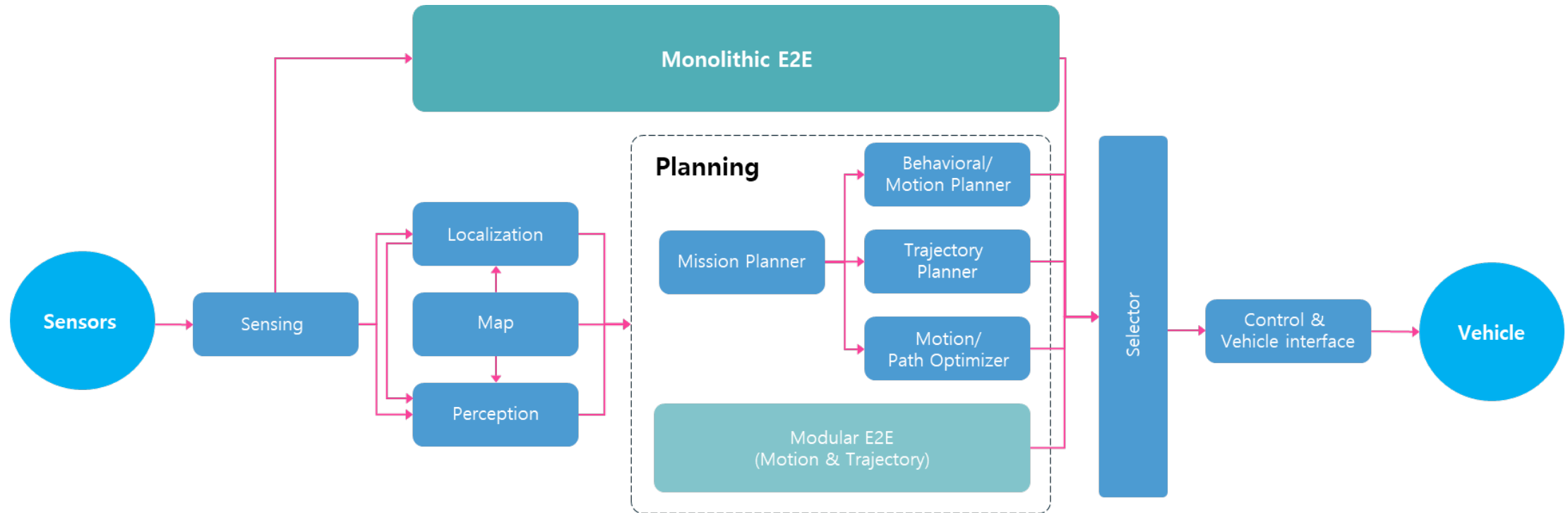
X - AgnostiΩ



Supports diverse vehicles, low-power platforms, and sensor setups, ensuring broad flexibility.

6-2 AD Roadmap: Next Steps

- ◆ Development of Modular E2E (Hybrid approach) and scaling to Monolithic E2E with supervisory module.
- ◆ Multi-teacher, student-teacher knowledge distillation architecture approach.
- ◆ Main objective to generalize across diverse driving environments and conditions.



6-3 SW Roadmap

Development Roadmap

2025

**Secure Autoware
deployment use case**



Our goal is to enable the
integration
Of Autoware across diverse ODDs,
Independent of HW limitations

2026

**SW optimization (HW)
& Secure IP SW**



In-house software development
Related to Autoware Lite,
Including **perception and
Localization modules**

2027

**Automotive Process
Standardization**



Successfully developed
standardized software aimed at
unifying HW & SW interfaces
and ensuring vehicle safety
compliance.

자유와 활력이 넘치는
파워를 대구



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Thank you

for taking the time to attend my presentation



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