

A linked scenario database and virtual environment to enhance automated driving safety and development speed

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Key challenges on safety assurance

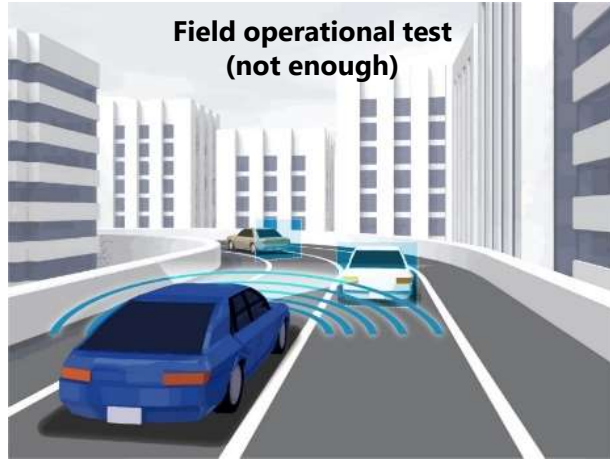
- (Common issue)

AD safety cannot be ensured through long-distance endurance driving tests alone.

- (Key challenges)

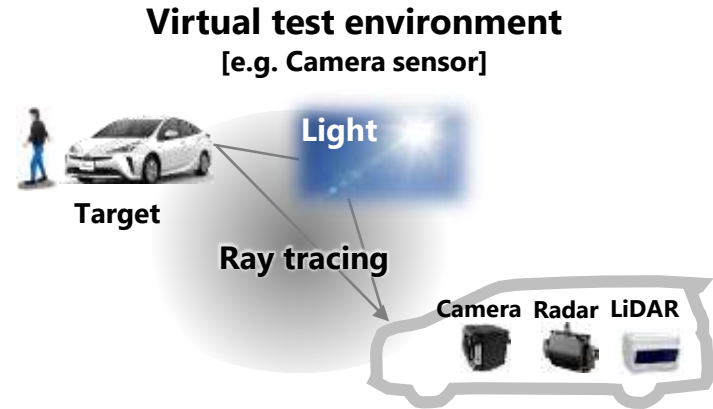
Challenge 1

To define validation scope for the multiple safety-related phenomena that may occur



Challenge 2

To prove consistency between virtual evaluation and reality



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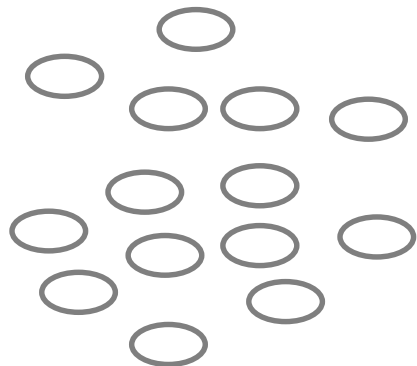


Our approach to overcome the challenges

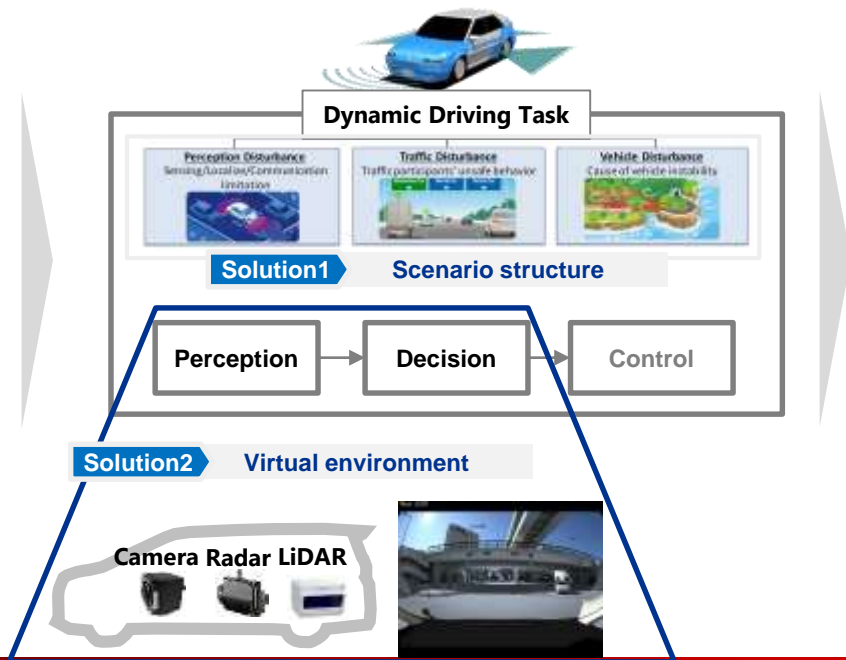
- (Solutions)

1. A scenario structure that addresses the 3 fundamental subtasks of the dynamic driving task
2. A qualified virtual environment capable of simulating sensor weaknesses

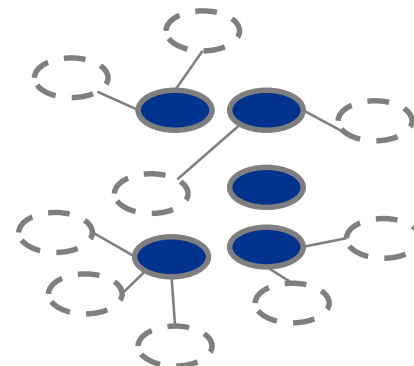
Due to complicated causality of traffic and natural phenomena, the verification scope is “**uncertain**”



Non-deterministic system



Identifying root causes enables the verification scope as “**certain**”



Deterministic system

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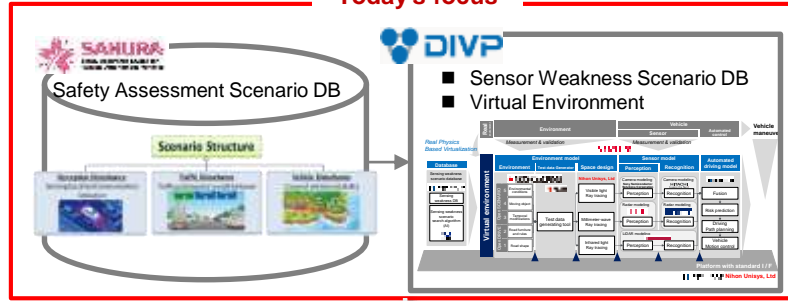


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Safety assurance strategic activities in Japan

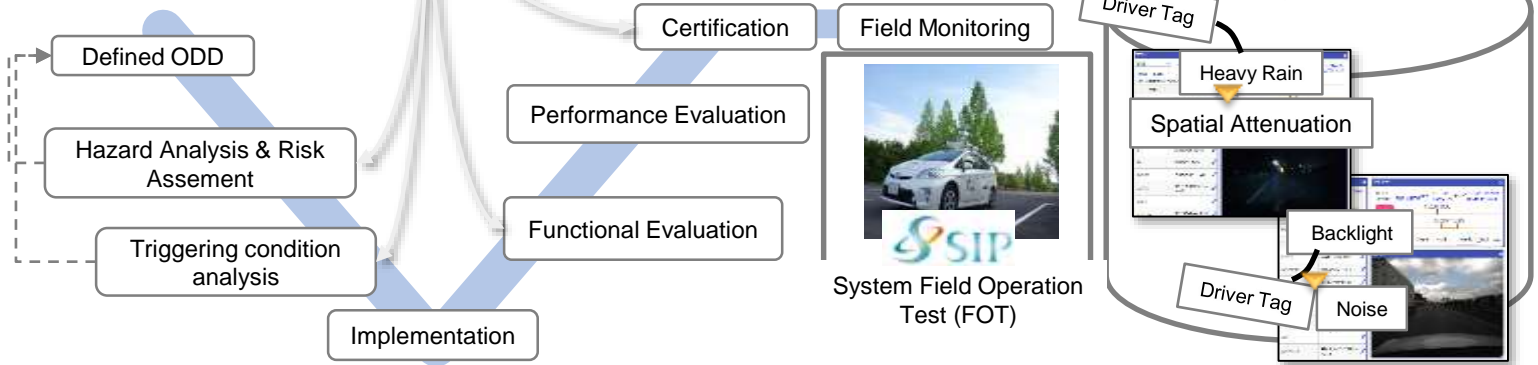
Today's focus



Aim: To build a scalable simulation platform to support safety planning, design and evaluation of AD systems

Scalable simulation platform in accordance with the evaluation purpose

- Linked scenario database and virtual environments for safety assessment



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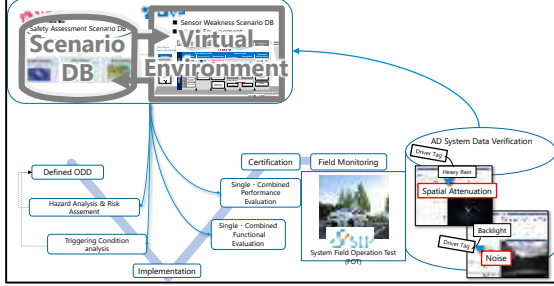


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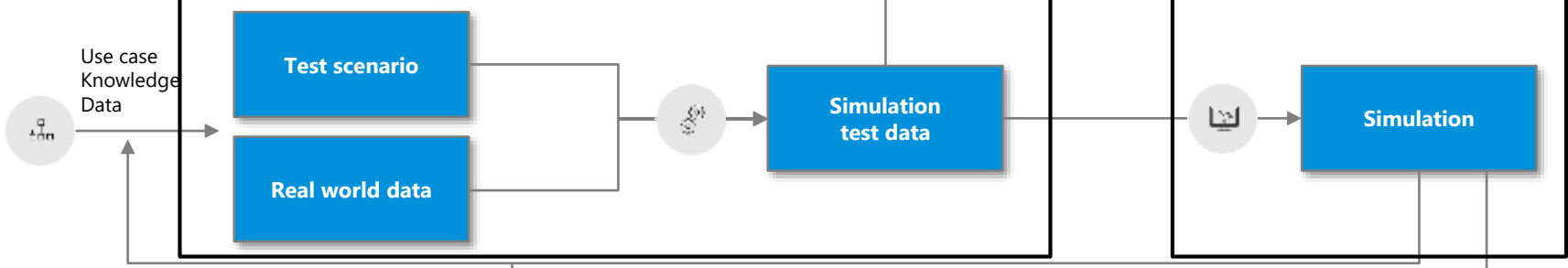
Linked scenario database & virtual environment

Scenario modeling
Test data generation



Scenario database

Virtual environment



Visualize results



Evaluation

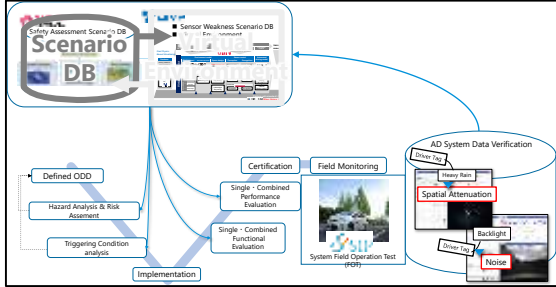


Scenario database

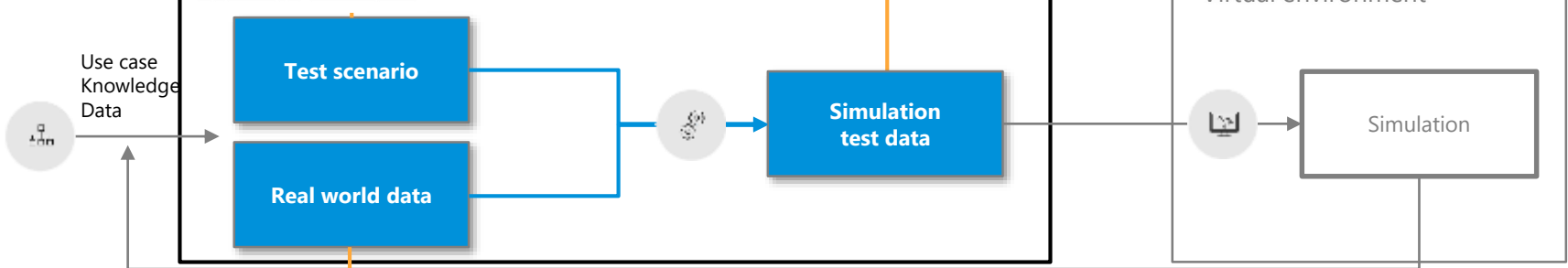
ISO 34502 Scenario based safety evaluation (Annex A to D)



Standard format



Scenario database

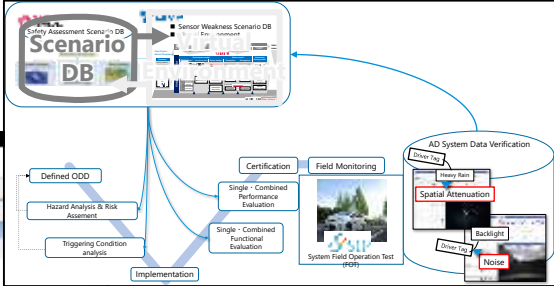
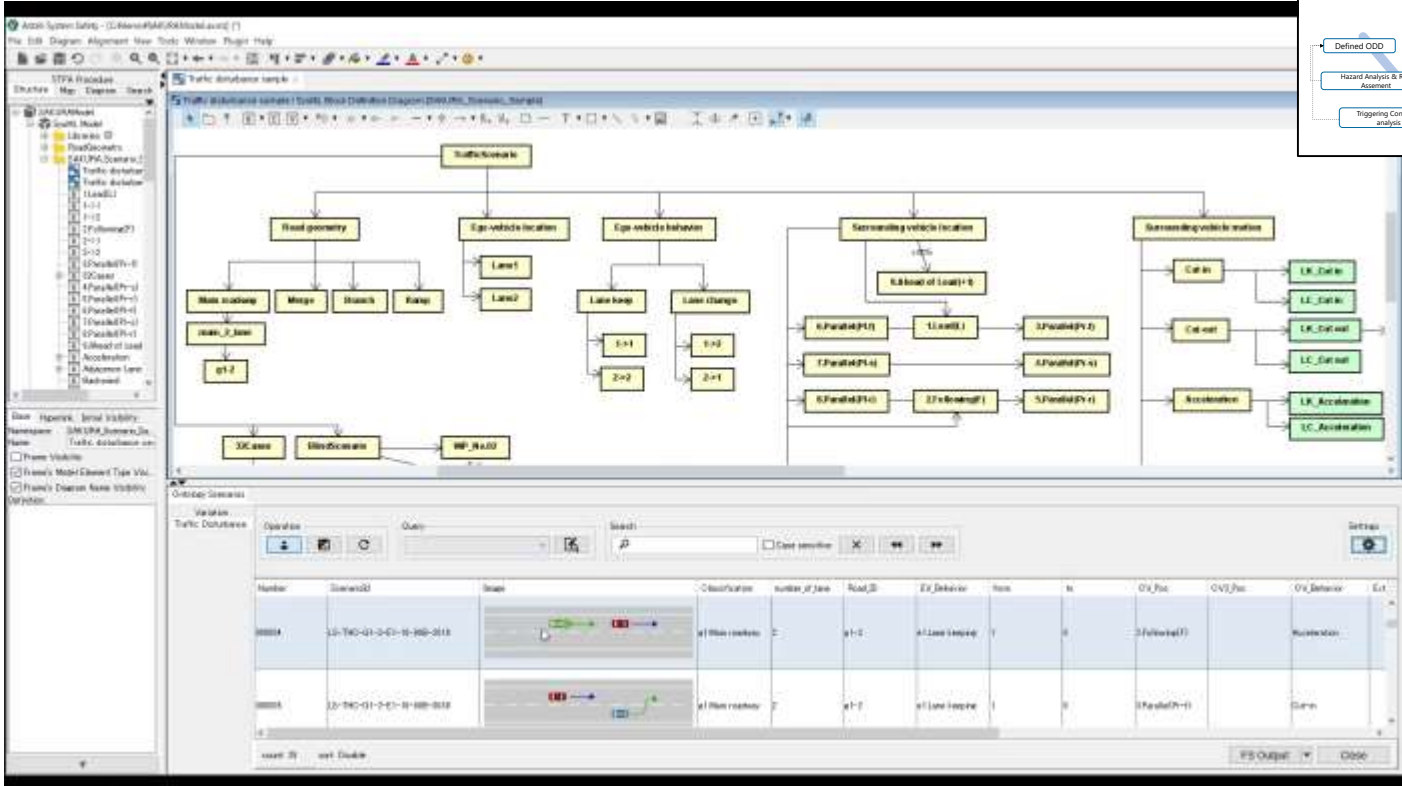


Accident data - Traffic flow data

Parameter distributions



Scenario database



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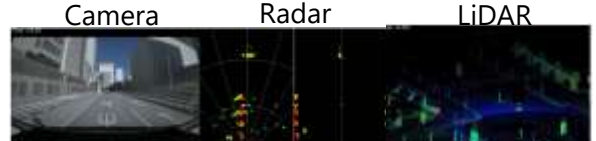
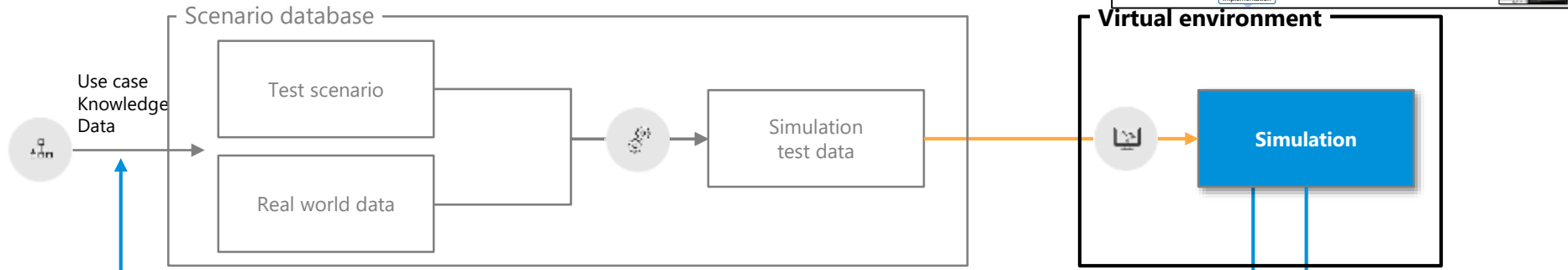
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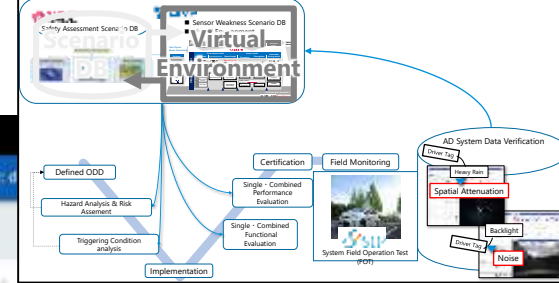
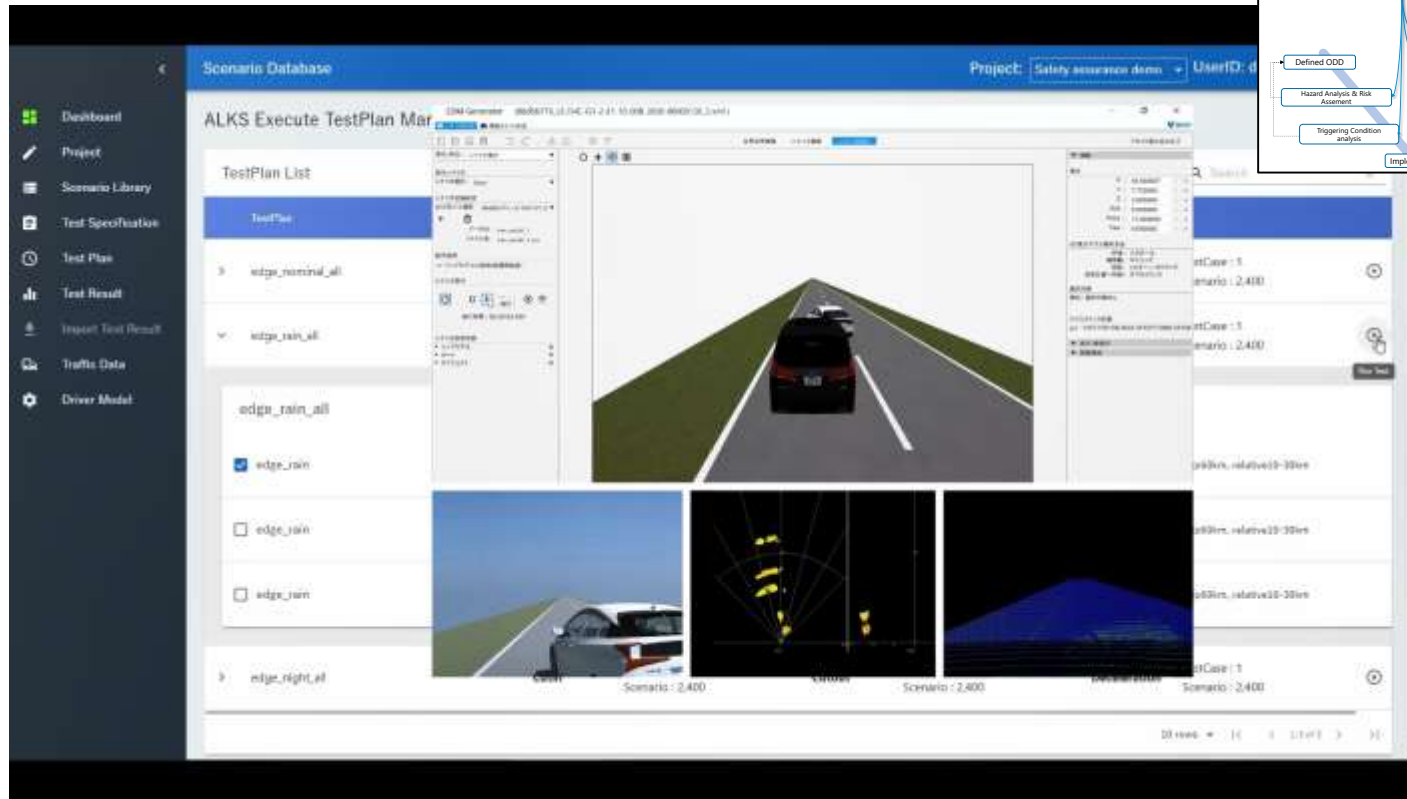
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Virtual environment



Virtual environment



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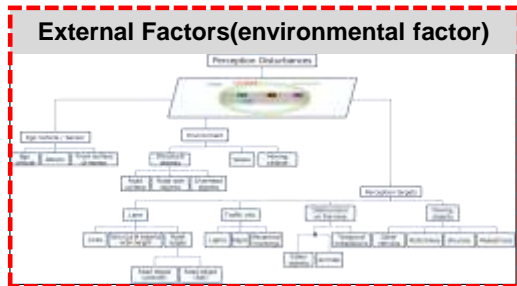
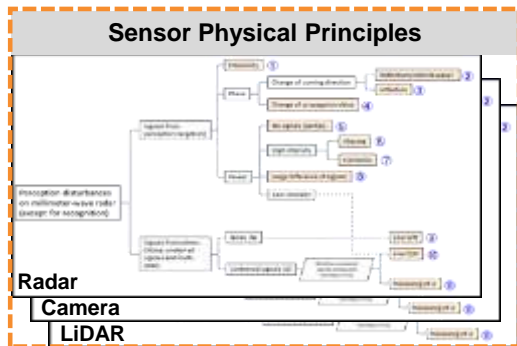
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Virtual environment qualification

The whole aspect of validation items

Validation result of each item



Sensor Physical Principles

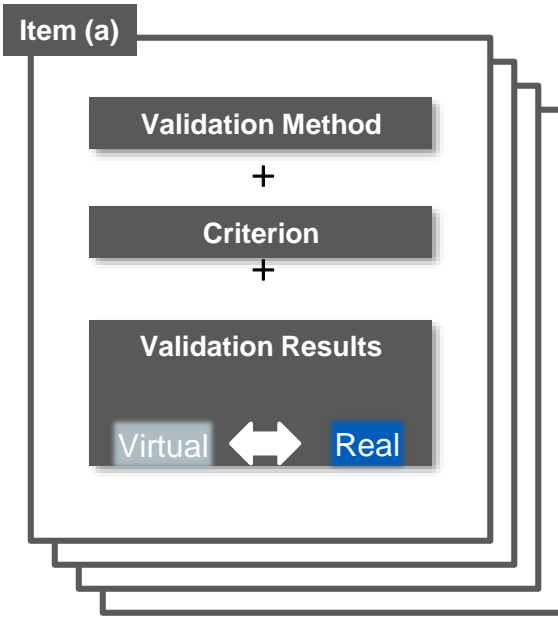
Radar

External Factors (environmental factor)

Traceable & Explainable

(a)

The table is a large grid with multiple columns and rows. The columns represent different sensor physical principles and external factors. The rows represent specific validation items. A blue box labeled 'Traceable & Explainable' is overlaid on the table, with an arrow pointing to a specific cell labeled '(a)'. The table is divided into sections for Radar and External Factors (environmental factor).



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Virtual environment qualification

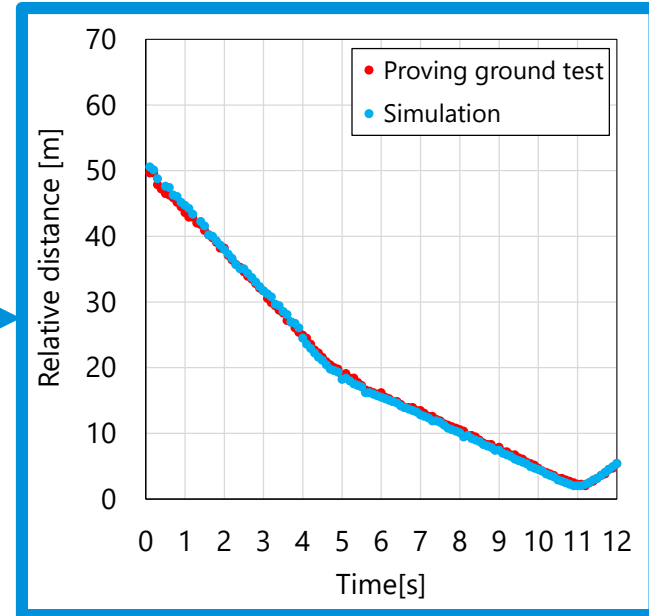
Proving ground test



Simulation



Validation result (e.g. Radar)



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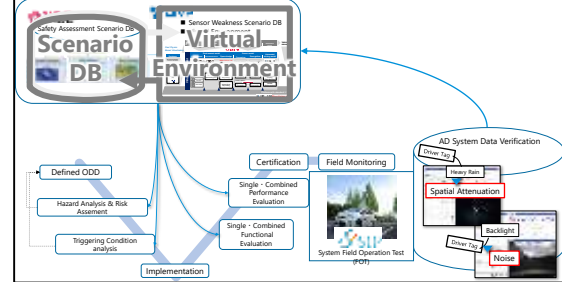
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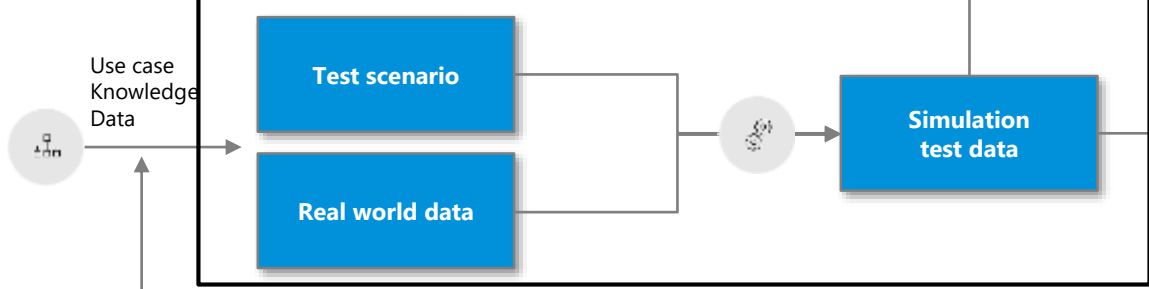
Summary

A scalable simulation platform to support safety planning, design and evaluation of AD systems ✓

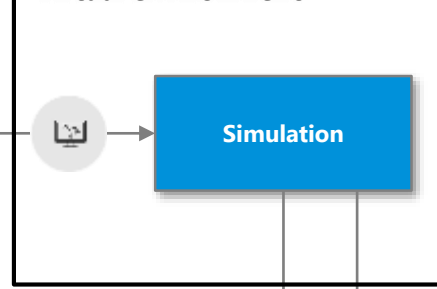
Scenario modeling
Test data generation



Scenario database



Virtual environment



Visualize results

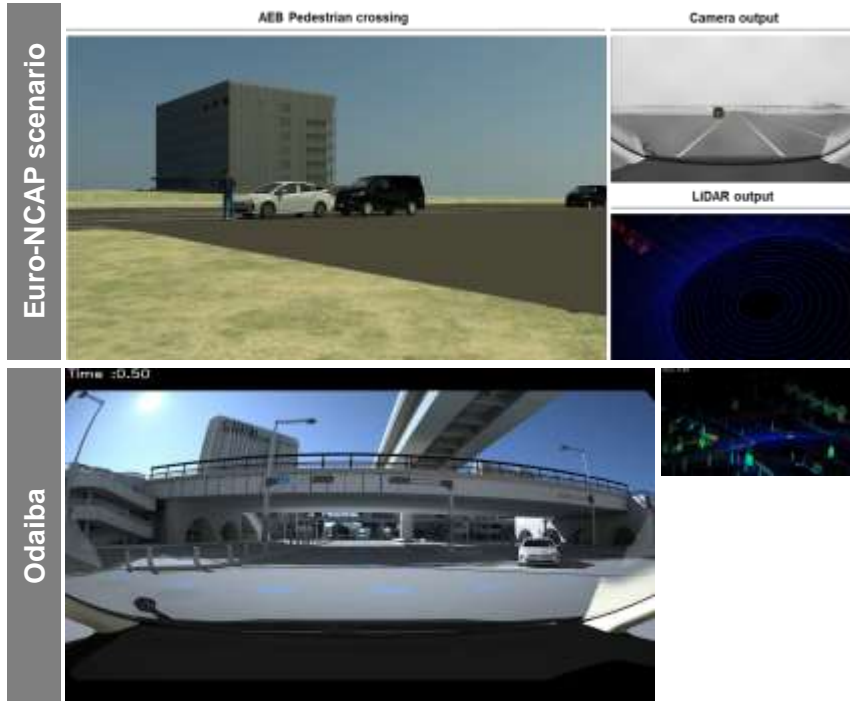


Evaluation

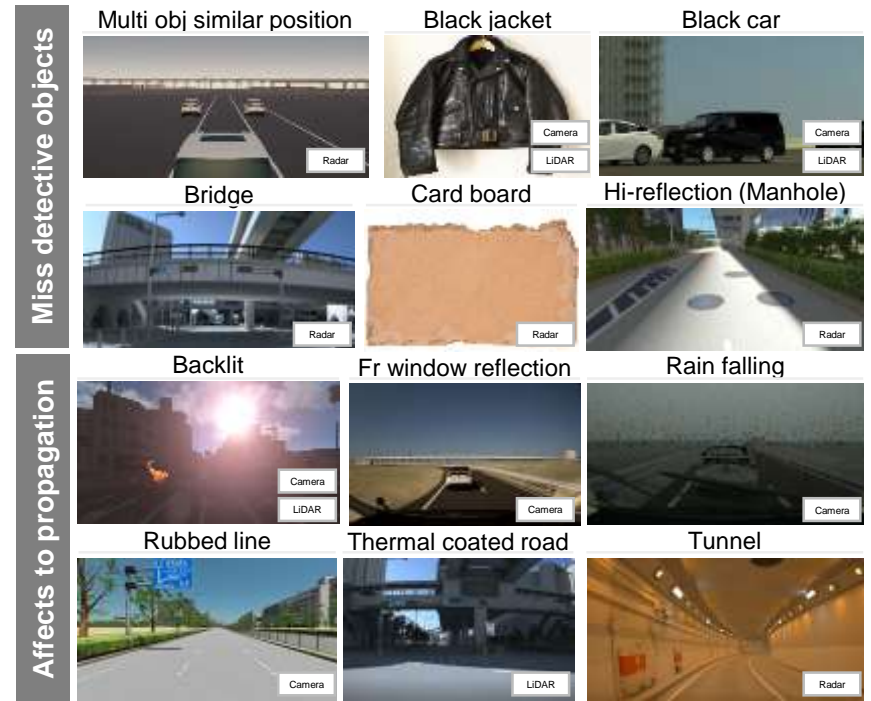


Next steps

Expanded scenario packages



Expanded sensing weakness conditions



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Project information

AD safety evaluation framework

http://www.jama-english.jp/publications/Automated_Driving_Safety_Evaluation_Framework_Ver1.0.pdf

Scenario database

https://www.sakura-prj.go.jp/project_info/

Safety evaluation

https://en.sip-adus.go.jp/evt/theme/safety_assurance.html

DIVP (Driving Intelligence Validation Platform)

<https://divp.net/>

Thank you!

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