

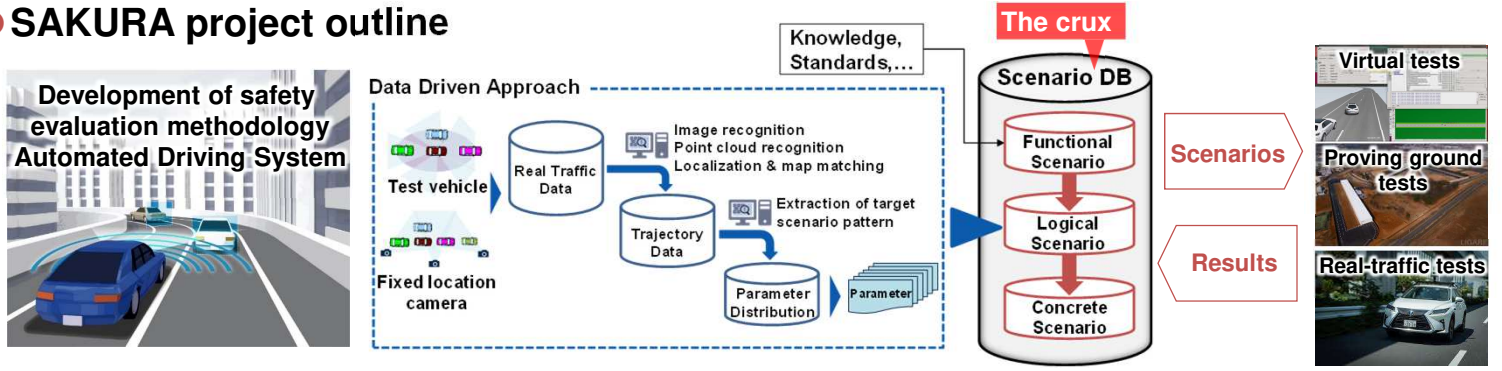


Summary

- For autonomous vehicles to become widespread, socially acceptable safety guarantees must be demonstrated.
- The SAKURA project aims to develop safety evaluation methods for autonomous vehicles and promote international standardization in collaboration with automobile manufacturers and research institutes. The national project is supported by the Ministry of Economy, Trade and Industry of Japan (METI).
- The project engages in many activities, such as building a scenario DB based on a comprehensive scenario system, collecting real traffic data, generating safety evaluation scenarios, and defining safety criteria.
- Through these activities, the range of accidents that can be reasonably foreseeable and preventable by autonomous vehicles are defined by scenarios. These definitions can be used in various tests to evaluate the necessary and sufficient safety performance in each scenario.


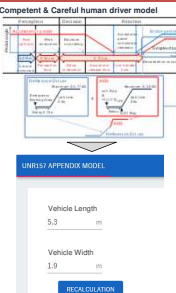
Scenario Based Safety Evaluation Framework

SAKURA project outline



Development of scenario database to realize safer Automated Driving System

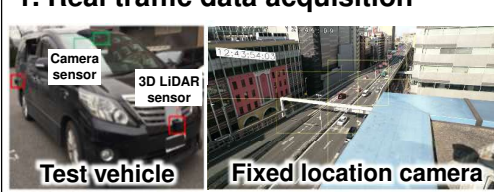
Scenario DB : the tool to support the safety evaluation of Automated Driving System

Main menu	Project	Scenario Library	Traffic Data	Pass/Fail Criteria	Test Specification	Test Plan	Test Result																		
<ul style="list-style-type: none"> Dashboard Project Scenario Library Traffic Data Pass/Fail Criteria Test Specification Test Plan Test Result 	<p>Project Create</p> <p>Name* HP_Demo_ALKS Cut-in edge cases</p> <p>Description ALKS Cut-in edge cases</p> <p>Project Manage</p> <p>Project List</p> <ul style="list-style-type: none"> PI002_AD_FMC DWP_ALPHARD SAKURA_autonomous_vehicle_2022_model HP_demo_SAKURA_autonomous_vehicle_2022_model 	<p>Scenario List</p> <table border="1"> <thead> <tr> <th>Scenario ID</th> <th>Description</th> <th>Case ID</th> </tr> </thead> <tbody> <tr> <td>LS-THC-G1-2-E1-10-01B-1120-02</td> <td></td> <td>No.01</td> </tr> <tr> <td>LS-THC-G1-2-E1-10-00B-3030</td> <td></td> <td>No.01</td> </tr> <tr> <td>LS-THC-G1-2-E1-10-00A-4030</td> <td></td> <td>No.01</td> </tr> <tr> <td>LS-THC-G1-2-E1-10-00B-5030</td> <td></td> <td>No.01</td> </tr> <tr> <td>LS-THC-G1-2-E1-10-00B-6030</td> <td></td> <td>No.01</td> </tr> </tbody> </table>	Scenario ID	Description	Case ID	LS-THC-G1-2-E1-10-01B-1120-02		No.01	LS-THC-G1-2-E1-10-00B-3030		No.01	LS-THC-G1-2-E1-10-00A-4030		No.01	LS-THC-G1-2-E1-10-00B-5030		No.01	LS-THC-G1-2-E1-10-00B-6030		No.01		<p>Competent & Careful human driver model</p>  <p>UNR157 APPENDIX MODEL</p> <p>Vehicle Length: 5.3 m</p> <p>Vehicle Width: 1.9 m</p> <p>RESOLUTION</p>	<p>Test Suite</p> <p>ALKS Cut-in edge cases</p> <p>Verify edge case</p> <p>Target Graph</p> <p>Ego Vehicle Speed: 60kph 10kph 40kph</p> <p>Opp. Vehicle Speed: 60kph 10kph 40kph</p> <p>Control resolution: 0.05 m/s</p> <p>Regulation Parameters</p> <p>Test specification function to adapt for each test object</p>	<p>TestPlan Create</p> <p>Name* HP_Demo_ALKS Cut-in edge cases</p> <p>Description ALKS Cut-in edge cases</p> <p>ALKS</p> <p>Cut-in ego speed -60kph</p> <p>Deceleration ego speed -60kph</p> <p>Cut-in</p> <p>ALKS Cut-in edge cases</p> <p>HP_Demo_ALKS Cut-in edge cases</p> <p>Process completed.</p> <p>817 scenarios generated and added to the test plan</p>	<p>Scenario ID: LS-THC-G1-2-E1-10-00B-3030</p> <p>Result: 19.6% Executed, 80.4% Not executed</p> <p>Collision: 38.2% Collision, 61.8% Non Collision</p> <p>CS ID: LS-THC-G1-2-E1-10-00B-3030-00000001</p> <p>Simulation: download</p> <p>OpenSCENARIO: download</p> <p>OpenDRIVE: download</p>
Scenario ID	Description	Case ID																							
LS-THC-G1-2-E1-10-01B-1120-02		No.01																							
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LS-THC-G1-2-E1-10-00B-6030		No.01																							
Manage the project which is a unit for managing evaluation scenarios	Define and register a project name that you will test in scenario DB	The systematized scenario catalogue for the safety evaluation of ADS	Flexible design of parameter range based on distribution in real traffic data	UNR157 C&C Driver Model recalculating according to the vehicle size	Parameter range to be tested for the scenario defined in the Scenario Library	Generation and management of Test Plan as a unit for safety evaluation	Function to display simulation result of test scenario created by Test Plan																		




Real Traffic DB with data quality and traceability

- ### 1. Real traffic data acquisition

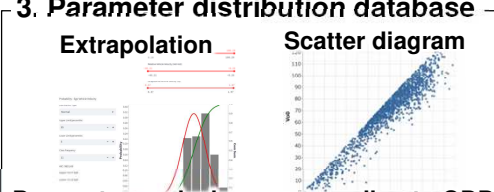


Camera sensor, 3D LiDAR sensor, Test vehicle, Fixed location camera
- ### 2. Real traffic data bank



Object recognition result, Estimated trajectory etc.
- ### 3. Parameter distribution database

Extrapolation, Scatter diagram



Parameter analysis corresponding to ODD
- ### 4. Traceability/quality assurance

 - ✓ Prior screening of raw data quality for storage

Parameter List

Scenario ID	Case ID	Parameter
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s
LS-THC-G1-2-E1-10-00B-3030	No.01	0.05m/s

time_series_data

 - ✓ Ensuring traceability of raw data and trajectory data