VOICES Overview

October 28, 2021
AGENDA

- Introduction to VOICES.
- VOICES technical overview.
- VOICES schedule.
- Question and answer.

VOICES = Virtual Open Innovation Collaborative Environment for Safety.
MEETING OBJECTIVES

- Describe background and motivation for VOICES.
- Provide high-level technical overview of VOICES platform.
- Lay out VOICES schedule and future webinar topics.
- Receive feedback and questions from attendees.
INTRODUCTION TO VOICES
THE TRANSPORTATION SYSTEM OF THE FUTURE

An integrated, ubiquitously connected, and intelligent system of systems.

Source: USDOT.
THE CHALLENGE OF COLLABORATION

- Lack of a simple, effective, and efficient mechanism to perform collaborative research and testing.
- Multiplicity of stakeholders.
- Natural silos.
- Trust deficit.
- Intellectual property and competitive pressures.
- Cost and resource barriers.
- Lack of interoperable test tools and environment.

Source: USDOT.

OEM = original equipment manufacturer; ITS = intelligent transportation systems; IoT = internet of things; IOO = infrastructure owner operator.
WHAT VOICES IS

- Distributed virtual platform that enables stakeholder virtual collaboration for research and interoperability testing of cooperative driving automation (CDA) applications.
- Intellectual property-protected environment.
- Collaboration tool for participating entities.
  - Public sector.
  - Private sector.
  - Academic institutions.

Source: USDOT.*

HOW VOICES WORKS

- Safe
- Secure
- Efficient
- Realistic

Source: USDOT.
The United States Department of Transportation (USDOT) leadership is advancing progress toward its vision of an integrated, seamless, efficient, clean, and equitable transportation system of the future.

VOICES is:

- A pathway to prepare for the transportation system of the future.
- An opportunity to advance equity, innovation, climate, and safety priorities.
- A way to harness convening power of government to enable collaboration.
- A platform to test for today and explore for tomorrow.

Source: USDOT.
VOICES TECHNICAL OVERVIEW
HIGH-LEVEL ARCHITECTURE

MANAGEMENT DOMAIN

High-Level Scenario Database

Functional Scenario Database

TEST DOMAIN

Environmental Definition

Synthetic Environment

Roads
Signs/Signals
Buildings

SUMO

TENA = test and training enabling architecture; CARLA = cars learning to act; SUMO = simulation of urban mobility; CARMA = cooperative automation research mobility applications; RADAR = radio detection and ranging; LiDAR = light detection and ranging.

Figure created using Microsoft Visio. CARMA® is a registered trademark of the Federal Highway Administration. SUMO is an open-source traffic simulation package developed by German Aerospace Center (DLR) and licensed under EPL 2.0. SUMO logo used with permission from DLR. CARLA® logo used with permissions from the Computer Vision Center (CVC). CARLA is an open-source simulator developed by CVC and trademarked by the CARLA Team 2021.
SCENARIO DATABASE OVERVIEW

- Develop a set of functional and definitive scenarios for each use case.
  - Define parameters necessary for actors of a given scenario.
  - Describe file formats and structures for scenario descriptions and scenario files.
- Allow ingest of a concrete scenario using application programming interfaces to CARLA® or SUMO.
- Define labels for test parameters and applicable values.
- Allow scenario filtering to quickly identify scenarios.
- Match scenarios to a real-world operating environment.
- Develop pass criteria for each scenario.

Source: USDOT.
VOICES IMPLEMENTATION

Process for users looking to run a cooperative distributed test in VOICES:

1. User logs into VOICES portal.
2. User browses VOICES scenario database.
3. User chooses test scenario and coordinates with other stakeholders.
4. Scenario manager launches container.*
5. Scenario manager sends:
   a) Maneuver plan to system under test.
   b) Vehicle configuration to adapter.
   c) Traffic signal configuration to adapter.
   d) Simulator configuration to adapter.
6. Scenario is executed once all members select to join the test.
7. Results are collected and distributed.

*A container is a standard unit of software that packages code and its dependencies.
VOICES ENGAGEMENT

Source: USDOT.

ADS = automated driving system; Eco = economic; ConOps = concept of operations; WG = working group.
SAMPLE USE CASE: PLATOONING

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>CLASS OF CDA</th>
<th>CDA DEVICE TRANSMISSION MODE AND DIRECTIONALITY</th>
<th>INFORMATION EXchanged</th>
<th>LEVEL OF FUNCTIONALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platooning Awareness and CACC* vehicle control**</td>
<td>**CLASS A STATUS SHARING</td>
<td>Two-way: CDA Vehicle 1 ↔ CDA Vehicle 2, 4 CDA Vehicles 1 ↔ CDA Vehicle 3</td>
<td>Platooning/CACC activation status; speed, trajectory, and location of vehicles in platoon</td>
<td>Supporting: Followeer vehicles in platoon can follow more closely and stably than they could otherwise</td>
</tr>
<tr>
<td>Advance notice of braking maneuver</td>
<td>**CLASS B INTENT SHARING</td>
<td>One-way: C-ADS 1 ↔ C-ADS 2, 4</td>
<td>Planned speed reduction</td>
<td>Supporting: C-ADS 1 detects forward hazard that may require deceleration of platoon, enabling smoother deceleration of all vehicles</td>
</tr>
<tr>
<td>Platoon Joining</td>
<td>**CLASS C AGREEMENT SEEKING</td>
<td>One-/Two-way: C-ADS 1 ↔ C-ADS 2, 4 C-ADS 3 ↔ C-ADS 1</td>
<td>Seeking to join platoon; allow to join platoon in the middle; inform other platooners</td>
<td>Enabling: C-ADS 3 can join the platoon in the middle (otherwise it would have had to join at the end)</td>
</tr>
</tbody>
</table>

C-ADS = cooperative–automated driving system.

*SACC: Cooperative Adaptive Cruise Control
**Note example A has been defined using CDA vehicles (i.e., SAE Levels 1 to 5 automation), and the B and C examples have been defined for C-ADS (i.e., SAE Levels 3 to 5 automation).

NOTE: In practice, one-way transmission will typically send the message to multiple CDA devices in the vicinity.

VOICES SCHEDULE
SCHEDULE AND MILESTONES

2020
- Kickoff
- DOT/DoD MOU
- Form DOT/DoD Dev Teams
- Est. DOT/DoD Dev Process
- Est. PM & SE Processes
- Form Stakeholder Engagement Team

2021
- Est. Community of Practice (CoP)
- Establish/Conduct Working Groups
- Select VOICES Nodes

2022
- TRL 8 Initial External Nodes Initial Use Case
- TRL 9 MVP External Nodes MVP Use Case

Build VOICES Prototype
- TRL 3 Garage Proof of Concept

Build VOICES Core System
- TRL 4 Individual Component Validation
- TRL 5 Local Component Testing
- TRL 6 Distributed Testing

Additional Use Cases
- TRL 7 Additional DOT Nodes

Source: USDOT.
UPCOMING WEBINARS

- VOICES updates and material will be presented at webinars, and attendees are encouraged to provide written feedback or questions after each webinar.

- Webinars on the following topics are planned for every 3–4 mo:
  - VOICES overview.
  - Use case development.
  - TENA-CARMA<sup>SM</sup> integration.
  - Technology transfer.
  - Use case testing and reporting.
Please submit questions via the chat pod.
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