Integration and Control of Agent Models

Daniel Becker (ika), Thomas Bleher (BMW), Heinz Sachsenweger (ZF)

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Agenda

• Osi Sensor Model Packaging for Agents (OSMP)
  Daniel Becker

• ika-Driver
  Daniel Becker

• BMW-Pedestrian
  Thomas Bleher

• Abstract Behavior of Traffic Agents
  Heinz Sachsenweger
OSI Sensor Model Packaging

General

• Name origins from sensor model development

• Goal: Generate FMU with OSI interfaces

• Adapted from ASAM OSI GitHub project

• Concept for extension for agent models in SET Level

• Proof of concept in MS1

• Contribute result to ASAM OSI project

Image sources:
https://www.asam.net/
https://github.com/
OSI Sensor Model Packaging

OSMP for Traffic Agents

Environment Simulation Tool, e.g. openPASS

Initialization

- OSMPGroundTruthInit
- OSMSensorViewInConfigRequest
- OSMSensorViewInConfig

Runtime

- OSMSensorViewIn
- OSMPTrafficCommandIn
- OSMPTrafficUpdateOut

OSMP FMU

- Framework generates FMU
- Wrapper transforms FMU integer variables to OSI Objects

Agent Model

C++ Object/Class

- In-/Output are OSI Protobuf objects
Integration of ika Driver Model
**ika Driver Model Integration (1)**

**Environment Simulation Tool, e.g. openPASS**

**OSI - Adapter**

**ika Agent Model**

**ika controller + vehicle model**

**OSMP Agent Model (FMU)**

- `osi3::SensorView`
- `osi3::TrafficCommand`
- `agent_model::input`
- `sl4to5::DynamicsRequest`
- `osi3::TrafficUpdate`

**Osi Interface**

**Internal Interface**
**ika Driver Model**

Integration (2)

- **OSI - Adapter**
  - **Interpretation of OSI**
    - Transformation of signals, moving objects, lanes in internal format
    - Centerlines are the basis for driving path
    - Interpretation of Traffic commands

- **ika Agent Model**
  - **Behavior model**
    - Implementation of a prototypical driver model
    - Modules in different stages:
      - Decision
      - Conscious
      - Subconscious
    - Set of capabilities/maneuvers implemented (outtake):
      - Following
      - Give right of way (very simplified)
      - Consider speed limits + comfortable curve speed
**ika Driver Model**

**Capabilities**

### Longitudinal

1. Stop
2. Speed Up
3. Change Speed
4. Approach (Max. Speed)
5. Avoid Temp. Conflicts

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### Lateral

11. Pull Out
12. Pull In

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ika Driver Model

Demo Video
Integration of BMW Pedestrian Model
Goal – what are we aiming for?

Simulate human behaviour for different types of simulation using standard interfaces and vehicle interaction.
Current state

Environment Simulation Tool, e.g. openPASS

Initialization

- OSMPGroundTruthInit
- OSMSensorViewInConfigRequest
- OSMSensorViewInConfig

Runtime

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- OSMSensorViewIn
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OSMP OSI Pedestrian Model (FMU)

Osi Pedestrian Model

Current functionality:
- Path-finding via Theta*
- Avoiding other pedestrians via Social Force model
- Reacting to vehicles

- packaged as FMU shared library
- Shared library loaded once
- Multi-instantiation possible via FMU instantiation mechanism
- Expensive map data can be shared between instances (via OSMPGroundTruthInit message)
<table>
<thead>
<tr>
<th>Topic</th>
<th>Status</th>
</tr>
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<tbody>
<tr>
<td>Representing the walkable space</td>
<td>Open: probably ASAM OpenDRIVE 2.0</td>
</tr>
<tr>
<td>Efficiently handling the map for realtime simulation</td>
<td>Partially solved: introduction of OSMP GroundTruthInit. Further improvements needed: e.g. FlatBuffer instead of ProtoBuf.</td>
</tr>
<tr>
<td>Representation of junctions</td>
<td>In Progress: either OSI 3.4 or OSI 4.0</td>
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<tr>
<td>Representation of sidewalks</td>
<td>Solved in OSI 3.3</td>
</tr>
<tr>
<td>Pedestrian movement (head movement, gestures, etc.)</td>
<td>In Progress: either OSI 3.4 or OSI 4.0</td>
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</table>
Demo Time 😊
Abstract Behavior of Traffic Agents
Motivations and Goals

• Decentralizing of agent functionality and intelligent behavior:
  • Abstract agent behavior can be formulated and passed as command to agent
  • Decentralization of intelligent behavior
• Proposal for OpenSCENARIO or/and Open Simulation Interface (OSI)
Simulation Environment

- OpenSCENARIO 1.0
- OpenDRIVE 1.6

ASAM

BMW / SET Level
- Simulation platform openPASS

ASAM / SET Level
- Open Simulation Interface (OSI) with custom adjustments

SET Level
- Driver model (RWTH Aachen)
- Pedestrian agent (BMW)
Proof of Concept

```
<UserDefinedAction>
  <CustomCommandAction type="setlevel">
    {
      "Ignore_AllTrafficParticipants" : true
    }
  </CustomCommandAction>
</UserDefinedAction>
```

```
message CustomAction {
  // The Action Header
  //
  optional ActionHeader action_header = 1;
  // The custom command given to the traffic participant.
  //
  optional string command = 2;
}
```

```
command = "{"Ignore_AllTrafficParticipants": true}"
```
Simulation Video

Ignore_AllTrafficParticipants = false
Simulation Video

Ignore_AllTrafficParticipants = true
Thank you!