



Real-time vehicle acoustics for industrial driving simulators.

Overview

- ✓ **HacoustiCAR** generates dynamic and realistic sound environments for immersive and accurate simulations. The synthesis is driven by vehicle dynamics signals, ensuring physically consistent sound behavior. It synthesizes:
 - Engine sound
 - Rolling noise
 - Aerodynamic noise
 - Traffic sounds
 - Environmental sounds
 ...and more, all synthesized in real time with high physical and perceptual realism.
- ✓ It supports:
 - Internal combustion engine (ICE) vehicles
 - Electric vehicles (EVs)
 - Hybrid vehicles
 and can reproduce the acoustic signature of specific vehicles.
- ✓ **HacoustiCAR** supports multi-speaker systems or headphones for accurate 3D sound rendering.
- ✓ It combines precision, flexibility, and ease of use for professional driving simulator environments.





Core capabilities

Vehicle synthesis

- ✓ State-of-the-art synthesis techniques driven by vehicle dynamics.
- ✓ Independent control of engine, rolling, and aerodynamic components.
- ✓ High-performance aerodynamic and rolling noise separation model.
- ✓ Configurable sound rendering.

Traffic realism

- ✓ Cars, EVs, motorcycles, and trucks, each with their own acoustic signatures.
- ✓ Accurate Doppler-aware pass-bys.

Road, weather and tunnel

- ✓ Surface-dependent rolling noise.
- ✓ Rain, wet-road, wind, and snow acoustic effects.
- ✓ Accurate tunnel environments with fine-tuned reverberation.

Spatial acoustics

- ✓ High-fidelity 3D sound rendering for any number of speakers or headphones.
- ✓ State-of-the-art binaural rendering.
- ✓ Optional head tracking for head movement compensation.

Custom integration and on-site acoustic tuning

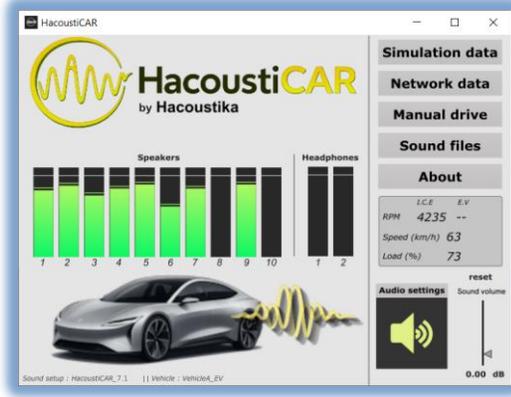
- ✓ Frequency equalization and delay compensation for each speaker.
- ✓ Sound level calibration.
- ✓ Audio architecture design.
- ✓ Hardware specification.

Network communication

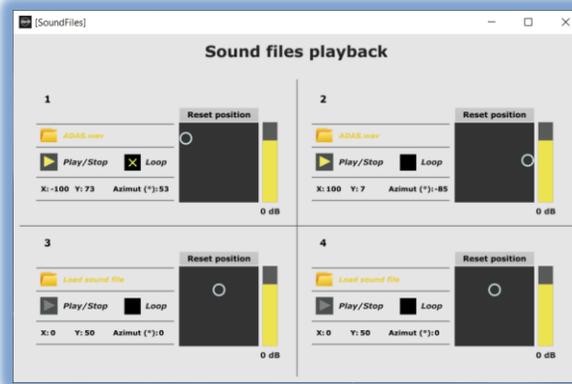
- ✓ Low-latency real-time communication with simulation engines.
- ✓ Native compatibility with SCANeR™ by AVSimulation.
- ✓ Dedicated UDP (OSC) API for real-time control of synthesis parameters.
- ✓ Seamless integration with third-party simulation environments.

A practical sound platform for immersive, accurate, and repeatable driving simulation experiments.

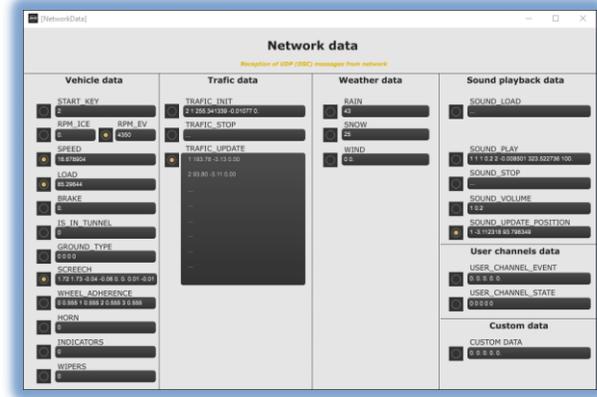
Software interface and integration



HacoustiCAR main interface.



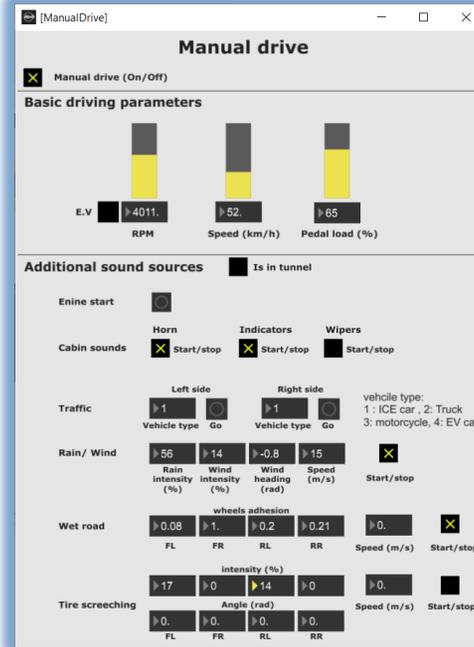
Additional sound files with real-time spatialization.



Real-time monitoring of synthesis parameters.

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  <VehicleData>
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    <RollingNoiseFile>VehicleA_Rolling.hacnoise</RollingNoiseFile>
  </VehicleData>
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    <RollingNoiseLevel>0</RollingNoiseLevel>
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    <SpeedRollingStartFadeInKmh>5</SpeedRollingStartFadeInKmh>
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Vehicle configuration file.



Manual driving and triggering of sound sources.

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<?xml Hacoustika - HacoustiCAR sound output config file?>
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    <ChannelBinauralR>2</ChannelBinauralR>
    <ChannelShaker>7</ChannelShaker>
    <ChannelSub>8</ChannelSub>
  </ChannelsMatrix>
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  <ShakerOffsetGain>
    <ShakerOffsetGain_db>-70</ShakerOffsetGain_db>
  </ShakerOffsetGain>
  <Calibration>
    <CalibrationGainB>-3</CalibrationGainB>
  </Calibration>
</HacoustiCARSoundOutputdata>
```

Sound output configuration file.

Easy to use – Flexible – High-performance.



What HacoustiCAR brings

- ✓ Fine-grained control over multiple sound sources during simulations.
- ✓ Acoustic realism from vehicle dynamics to environmental effects.
- ✓ Flexible integration into industrial driving simulator infrastructures.
- ✓ An immersive and realistic sound layer for demonstration and evaluation workflows.

Applications

- ✓ Driving simulators for vehicle NVH development and evaluation.
- ✓ Vehicle sound quality evaluation and sound design.
- ✓ Vehicle noise perception and psychoacoustic studies.

HacoustiCAR - Driving your simulations further.