Environment Sensor Interface Unit

Feeding digital data into camera, radar, and lidar ECUs

Highlights

- High-performance FPGA for feeding raw sensor data to sensor ECUs in a synchronized manner
- Flexible adaption of long- and short-range raw data interfaces, including FPGA-based sensor models
- Support for ADI/Maxim GMSL1/2/3, TI FPD-Link III/IV, Sony GVIF2/3, and MIPI CSI-2 D-PHY
- Simulation of up to 12 sensors with 50 Gbit/s of aggregated bandwidth

Application Areas

For the development and validation of environment sensors, e.g., radar, camera and lidar, and more generally the validation of ADAS/AD functions, support for a range of ECU interfaces for data insertion is essential. In addition to testing based on over-the-air methods and object lists, the insertion of raw data or target lists is of utmost importance for the validation of perception and fusion algorithms that are based on raw data. The Environment Sensor Interface (ESI) Unit supports all relevant sensor interfaces and is important for closed-loop and open-loop testing. Advanced sensor simulation in combination with the ESI Unit makes it easy to provide synthetic sensor data under realistic conditions and with low latencies. This is useful for validating functions for autonomous driving in HIL simulation (closed- and open-loop). If RTMaps is used as well, recorded sensor data can be replayed conveniently. A major advantage of the ESI Unit is that it can be used to process both data replay and sensor simulation simultaneously or sequentially and on the same HIL simulator.

Key Benefits

The ESI supports the injection of raw data and target lists for HIL tests of camera, radar, and lidar ECUs as well as central processing units for autonomous driving. Thanks to its flexible and scalable architecture, the ESI Unit supports tasks such as lidar point cloud data injection via 10 Gigabit Ethernet, radar raw data injection via MIPI CSI-2 D-PHY, and camera raw data injection via ADI/Maxim GMSL1/2/3, TI FPD-Link III/IV, Sony GVIF2/3, or MIPI A-PHY. To meet the requirements of next-generation ECUs, the ESI Unit can be configured to simulate the latest sensors, including FPGA-based sensor models. A single ESI Unit simulates up to twelve sensors synchronously and supports more than 50 Gbit/s of aggregated bandwidth. Multiple combined ESI Units let you test functions for autonomous driving with dozens of different sensors. Special customer requirements and functions can be implemented directly on the ESI Unit thanks to the powerful Xilinx® UltraScale+™ FPGA.

Preconfigured Environment Sensor Interface Units

dSPACE offers preconfigured ESI Units for specific, widely used application scenarios. All kits handle the simulation of 4 cameras using synthetic sensor data (with AURELION) and recorded sensor data (with RTMaps):

- ESI Kit YUV: Preconfigured Environment Sensor Interface Unit for YUV camera simulation (GMSL2 or FPD-Link III)
- ESI Kit DRIVE: Preconfigured Environment Sensor Interface Unit for NVIDIA® DRIVE AGX

YOUR PARTNER IN SIMULATION AND VALIDATION

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Technical Details

| Parameter	Specification
FPGA	■ Xilinx® Zynq® UltraScale+™ FPGA with an aggregated data rate of up to 50 Gbit/s
Memory	■ 8 GB RAM, 4 GByte flash memory
Sensor interfaces	■ ADI/Maxim GMSL1/2/3, TI FPD-Link III/IV, Sony GVIF2/3, MIPI A-PHY, MIPI CSI-2 D-PHY, HiSPI, LVDS, Parallel ■ 1G/10G Ethernet, GigE Vision (available on request), Ethernet AVB (available on request) ■ Simulation of control interface to sensor ECU (e.g., I2C, SPI), including full I2C imager simulation ■ Customer-specific interfaces on request
Input interfaces	■ Up to four DisplayPort or HDMI inputs (up to 17 Gbit/s, 4k resolution, and 120 Hz per input), 10G Ethernet
Power supply	■ 24 V DC
Weight	■ 3.8 kg (8.4 lb)
Size	■ 448.9 x 255.5 x 88.1 mm (17.7 x 10.1 x 3.5 in)
Camera	■ High dynamic range (HDR) with up to 24 bits, resolution of up to 4k, high frame rates, stereo or multiple camera setups, imager sensor models, dynamic exposure control, embedded data & statistics
Radar	■ Detection list (point cloud), raw data (ADC data) injection including multipath propagation, reflection, and scattering
Lidar	■ Extended point cloud injection including information like distance, reflectivity, azimuth, and elevation angle

Order Information

Product	Order Number
Environment Sensor Interface Unit (ESI Unit)	■ Please inquire

Relevant Software and Hardware

Software		Order Number
Optional	■ AURELION ■ RTMaps	■ Please inquire ■ Please inquire

Hardware		Order Number
Optional	■ ESI KIT DRIVE for AGX ■ ESI Kit for YUV and GMSL2 MAX9295 simulation ■ ESI Kit for YUV and FPD-Link III TI953 simulation	■ ESI_KIT_DRIVE_AGX ■ ESI_KIT_YUV_SIF1 ■ ESI_KIT_YUV_SIF5
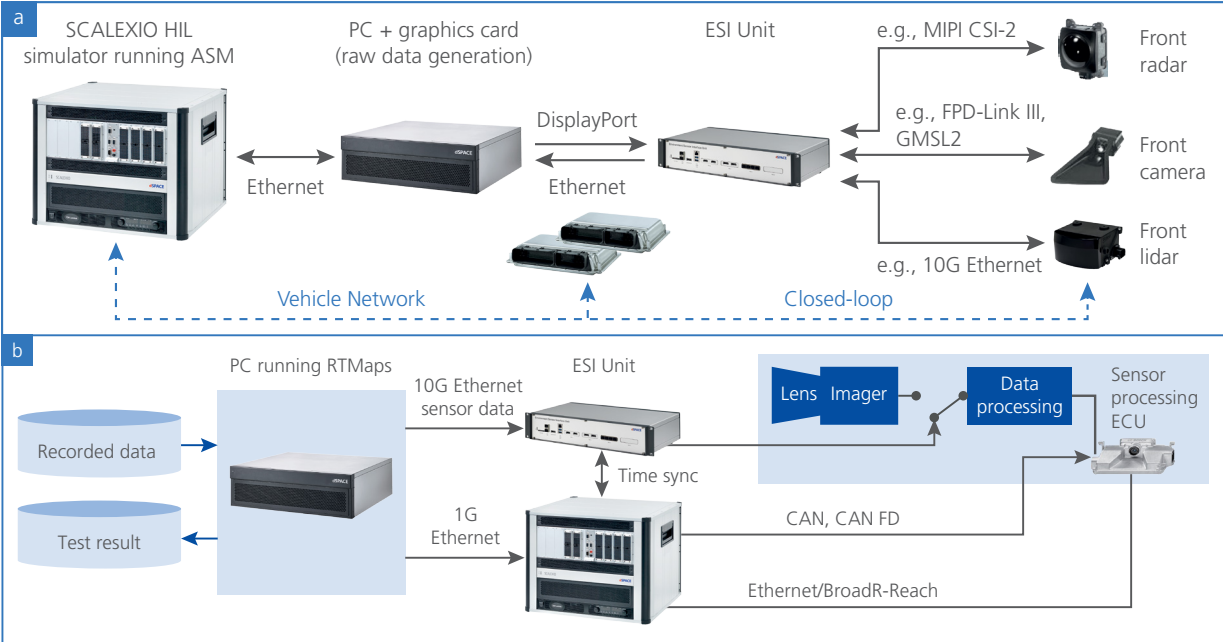
Two typical use cases: (a) Insertion of raw sensor data into the digital interface behind the respective sensor front end.
(b) Replay of pre-recorded sensor and bus data with RTMaps.

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