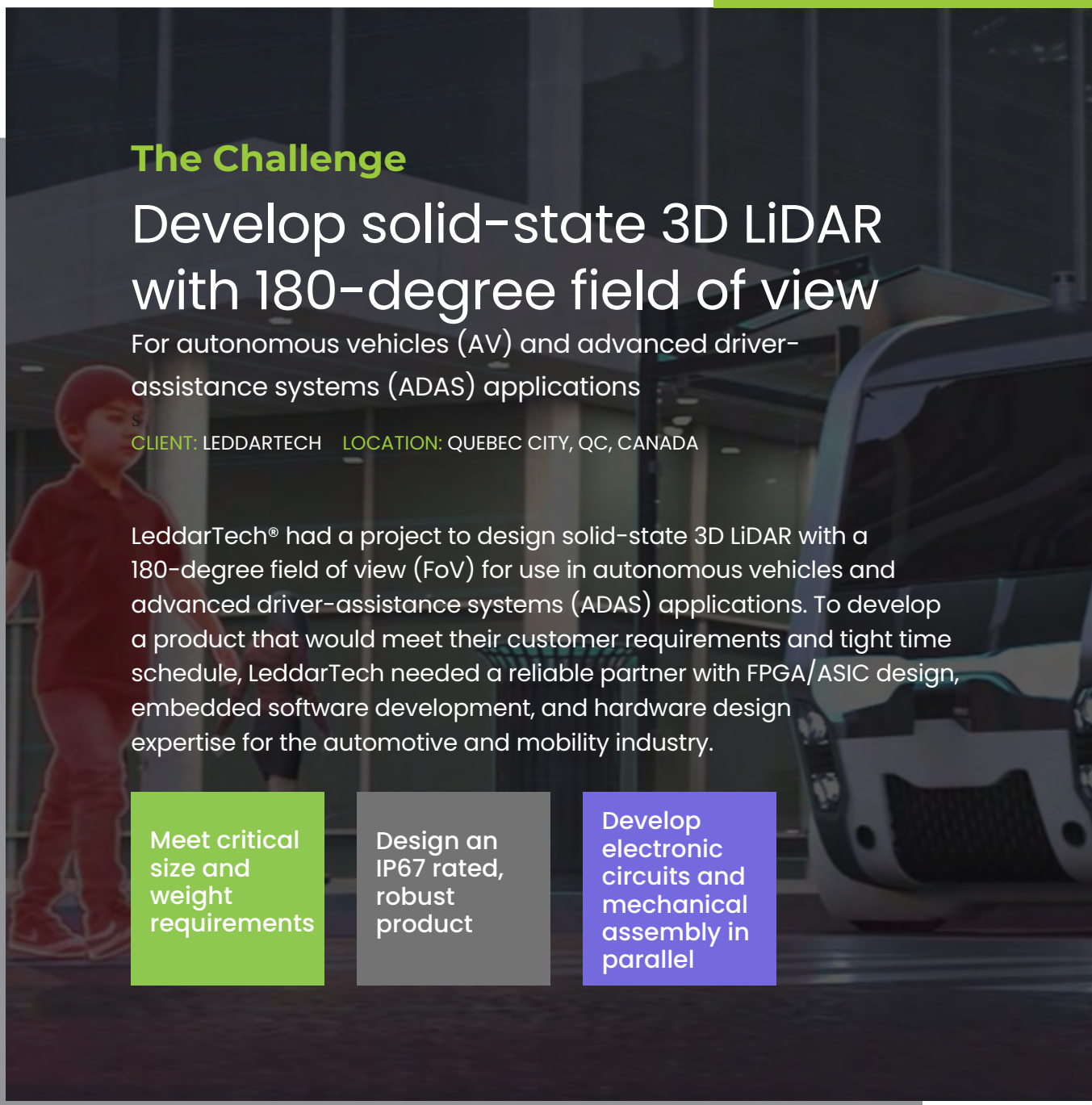
Orthogone
Developers of the
Seemingly Impossible

AUTOMOTIVE SOLUTION



The Challenge

Develop solid-state 3D LiDAR with 180-degree field of view

For autonomous vehicles (AV) and advanced driver-assistance systems (ADAS) applications

CLIENT: LEDDARTECH LOCATION: QUEBEC CITY, QC, CANADA

LeddarTech® had a project to design solid-state 3D LiDAR with a 180-degree field of view (FoV) for use in autonomous vehicles and advanced driver-assistance systems (ADAS) applications. To develop a product that would meet their customer requirements and tight time schedule, LeddarTech needed a reliable partner with FPGA/ASIC design, embedded software development, and hardware design expertise for the automotive and mobility industry.

Meet critical size and weight requirements

Design an IP67 rated, robust product

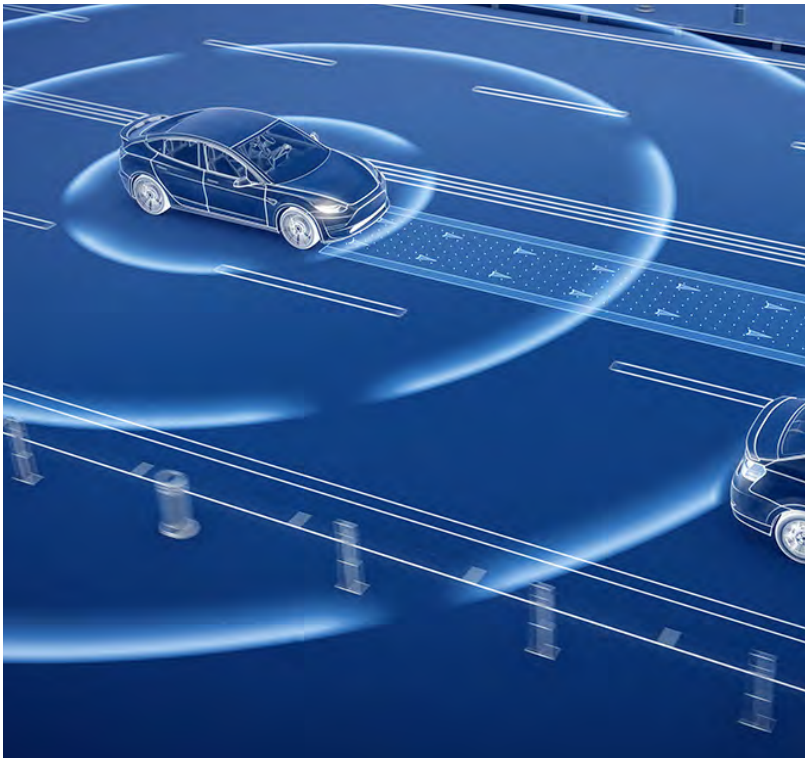
Develop electronic circuits and mechanical assembly in parallel

Highly reliable detection of vehicles, pedestrians, cyclists, and other obstacles in the vehicle's vicinity.

The client

LeddarTech®
is a leading provider of integrated end-to-end environmental sensing solutions.

They provide **Tier-1 automotive suppliers** and **AD system integrators** with the efficient, scalable, and versatile **LeddarEngine™** LiDAR platform, enabling them to design automotive-grade solid-state LiDAR solutions. With the powerful **LeddarEngine platform,** a variety of highly optimized LiDAR sensors can be built and manufactured in high volumes to meet OEM requirements.



"Since we worked with Orthogone before, we knew we could count on them to collaborate with our team and deliver high-quality, critical work on time, and they did exactly that. Partnering with Orthogone helps us meet extremely aggressive timelines with exceptional results."

David Bourget,
Hardware Manager, LeddarTech

The challenge

CPU design and electronic components development on on a tight schedule

For the 180-degree field of view solid-state 3D LiDAR project, customer feedback revealed that **size** and **weight** can be critical, so the final product needed to be small and lightweight. The final product also needed to be **IP67-rated**, **robust**, and have a **wide operating temperature range**.

Due to the **tight project schedul**e, the electronic circuits and mechanical assembly had to be developed in parallel in order to meet the deadline. **Cost** was another key factor in the design as well as the **interconnection** between the internal modules. And, to get the best detection accuracy, noise and crosstalk had to be minimized.

After successfully partnering with Orthogone previously for the electronic design of multiple high-speed digital and analog printed circuit boards, LeddarTech again turned to Orthogone to provide needed technical expertise and speed development time.

The Solution

Orthogone designed the CPU card and developed an ASIC card.

For the 180-degree field of view solid-state 3D LiDAR project, Orthogone designed the CPU card used to **control, monitor, and communicate** with the internal modules and the LiDAR module, and be the main power supply interface of the system.

Orthogone also developed an ASIC card that has the **LeddarCore® LCA2 SoC** and **the photodiode detector** on it.

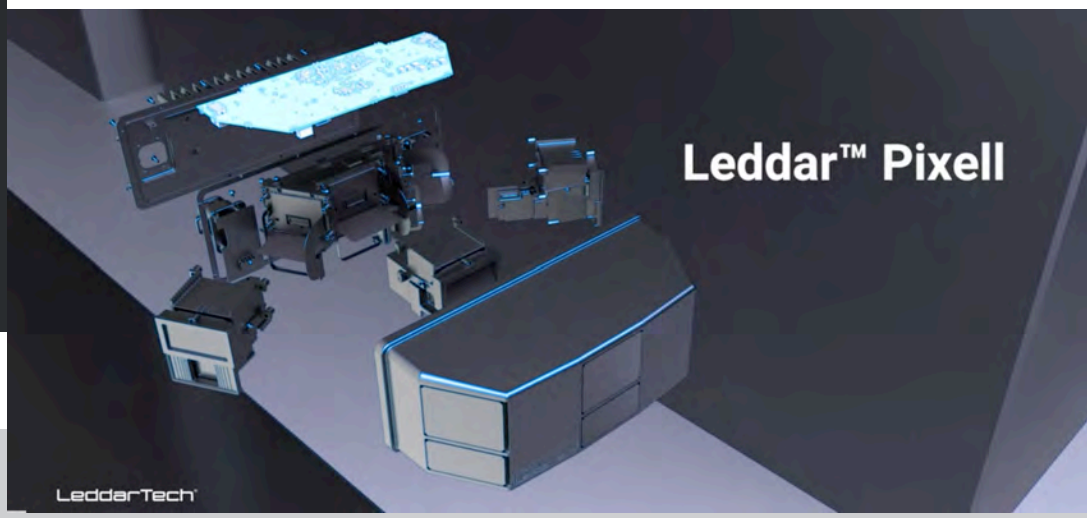
In addition to the CPU and ASIC cards, Orthogone designed custom flex cables to help reduce the interference between inside modules. The flex cable design uses a 2-layer architecture including a ground to keep better trace impedances and have better interference immunity.

CPU card design key features:

- Power supply interface meeting EMC and voltage transient requirements of automotive applications
- High-density processor based on Renesas R-CARv3M system-on-chip (SoC) with DDR3L memory that controls and monitors the whole system
- Automotive ethernet interface between the R-CARv3M SoC and the external interface connector, using an automotive ethernet qualified PHY, for robust communication with external equipment
- Simulation of low noise power supplies and filters to minimize noise added to the system due to power supplies switching. High-efficiency converters were used to minimize power dissipation and increase temperature range
- Pulse per second (PPS) in and out interface between the external connector and the controller used for system synchronization
- Highly sensitive clock synchronization between the CPU card and the ASIC cards for synchronization and alignment
- Sensitive power-up sequence considering the CPU, the ASICs and the laser boards' requirements
- Extremely low noise power supplies using LDO with high power supply ripple rejection

ASIC Card design key features:

- Simulation and calculation based on the spectral noise density of the LDO to meet the stringent noise requirement of the LeddarCore LCA2 SoC
- Optimization of the photodiode interface circuits based on post-layout crosstalk simulation performed using Keysight ADS 2020 (using SiPro 3D EM simulation)
- Front-end analog signal conditioning to maximize signal bandwidth, limit noise and crosstalk, and provide adequate protection against strong feedback signals
- Delocalization of some supplies from the ASIC to the CPU card to help reduce the height of the Leddar™ Pixell 3D flash LiDAR and reduce system cost



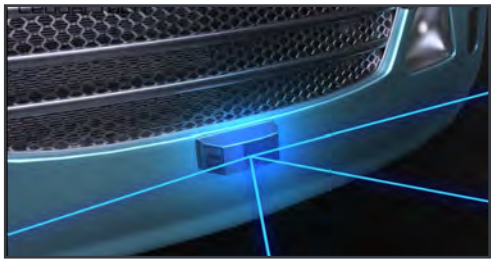
"From a technical standpoint, one of the critical interfaces for this project was the one between the LeddarCore LCA2 SoC and the photodiode. Orthogone was able to design the interface, do a post-layout simulation, optimize the layout based on the simulation, reperform the simulation and release a PCB that worked the first time."

Alex Ouellet-Belanger,
Director of System Architecture, LeddarTech

The Results

As a result of the project, LeddarTech now has an award-winning product: the Leddar™ Pixell 3D flash LiDAR.

In 2020, the Leddar Pixell was recognized as a **CES Innovation Award Honoree** and has received the **"Outstanding & Innovative Product Award"** by the Shenzhen Automotive Electronics Industry Association.



The finished Leddar Pixell LiDAR

THE MOST ROBUST 3D LIDAR ON THE MARKET!

The Leddar Pixell is a 3D flash LiDAR with 180-degree field of view designed for advanced driver-assistance systems (ADAS) and autonomous driving (AD) applications. The Leddar Pixell provides highly reliable detection of pedestrians and other obstacles in the vehicle's vicinity and is ideal for use in perception platforms that help ensure safety and protection.

This robust solid-state LiDAR design makes it ideally suited for ADAS and AD deployments in any operating domain, including public transit, commercial delivery, long-haul trucking, off-road vehicles and robotaxis.

Leddar Pixell has been adopted by leading autonomous vehicle providers in North America and Europe.

Learn more about Leddar Pixell.

Leddar Pixell LiDAR key features:

100% solid-state design

Fanless IP67 enclosure

Best-in-class shock and vibration resistance

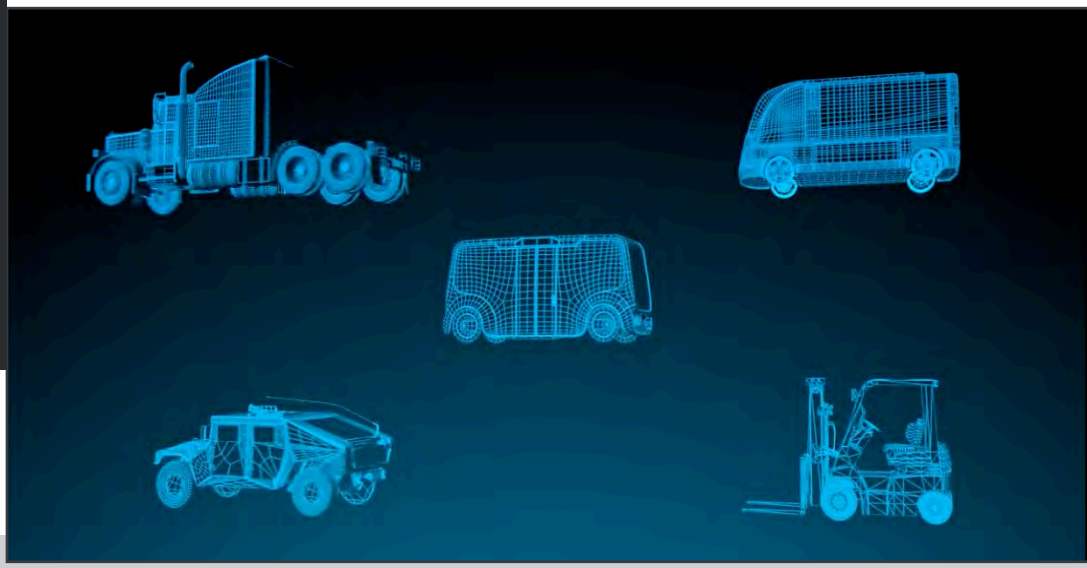
Wide operating temperature range

Impact-resistant windows

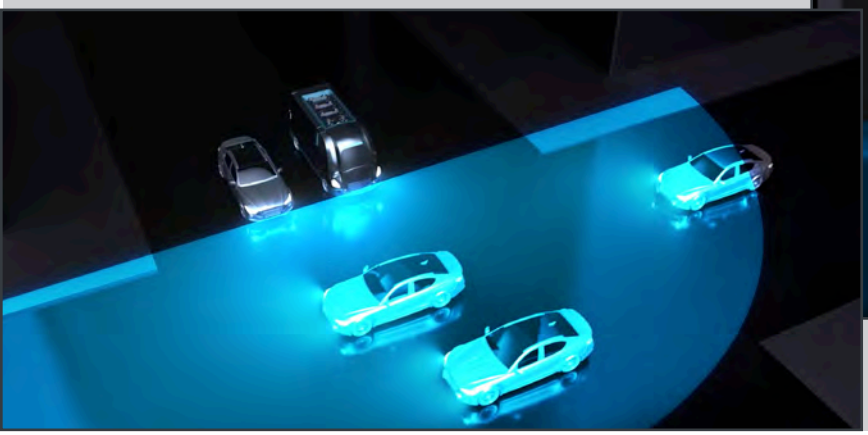
Automotive-grade connectors

"Orthogone designed the CPU and developed the ASIC cards in-house, which allowed them to complete the work quickly. Once again, we were impressed with the quality and speed of Orthogone's work."

Alex Ouellet-Belanger,
Director of System Architecture, LeddarTech

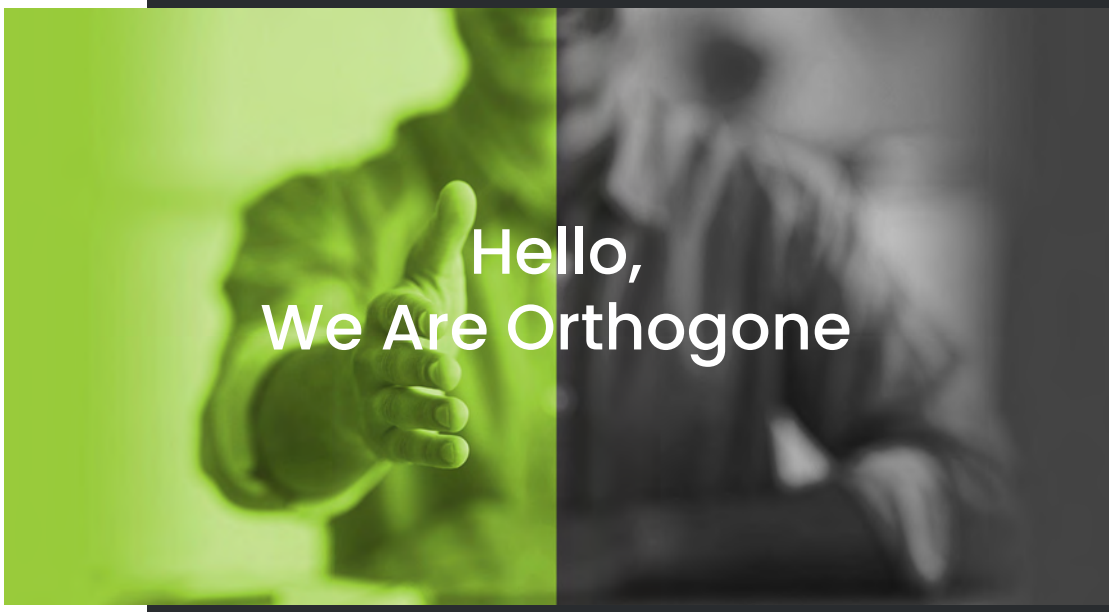


Ideally suited for ADAS and autonomous vehicle deployments in any operating domain, including public transit, commercial delivery, long-haul trucking, construction, mining, and military.



Orthogone Technologies is a design house that solves tough engineering challenges by providing electronics product development and design services including embedded software development, FPGA / ASIC design & verification and hardware design.

To learn more about partnering with Orthogone to drive innovation, contact us.



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