New sensor technologies are more and more present in our transit systems, with comprehensive connected sensor networks able to monitor and optimize many aspects of commuting in real time. Improving traffic flow, facilitating road law enforcement, and making life easier for vehicle owners and operators are just a few examples of where smart sensors contribute to making motorized transportation more efficient.

Leddar optical sensing technology is being used in many areas of intelligent transportation systems (ITS) to detect, locate and measure vehicles, pedestrians, or cyclists to accurately provide valuable information to various applications, such as traffic management, speed measurement, vehicle profiling and automated tolling, which improve transportation efficiency on a global scale.

**Leddar Benefits**
- Detection of cars, trucks, bikes, and pedestrians for several applications
- Multi-segment configurations for precise and simultaneous measurements
- Wide area coverage, various field-of-view options available
- Very easy to set up and integrate
- Few positioning constraints for greater freedom of placement
- Unaffected by vibrations, dust, lighting conditions, or temperature variations
- All-weather performance (snow, rain, fog)
Vehicle Detection for Advanced Traffic Management Systems (ATMS)

Leddar solid-state multi-segment sensors are used as part of above-ground pedestrian and vehicle detection systems, where they provide accurate and simultaneous monitoring of several traffic lanes, enabling stop-bar detection for efficient traffic flow management and red light enforcement, and vehicle counting for precise data on road usage statistics.

Leddar advanced target demerging and lateral discrimination capabilities allow it to simultaneously detect multiple cars, trucks, bikes or humans in each segment, resulting in nearly flawless detection of all objects in its field of view.

Already deployed in several cities around the world through the d-tec product line, Leddar sensors are affordable and can be mounted directly on existing traffic infrastructure with very few positioning constraints as well as easily integrated into a complete traffic management system. The advanced signal processing algorithms and robust solid-state design of Leddar provide reliable measurements in all weather conditions, 24/7, day or night, making for a long-term, low-maintenance solution.

Automated Tolling

As part of automated tolling systems, Leddar sensors detect the presence of incoming vehicles in every lane, triggering automatic number plate recognition systems (ANPR) which enable e-toll collection.

More sophisticated systems combining automated tolling with other ITS applications (e.g. speed enforcement, vehicle profiling) can be enabled by Leddar multi-segment sensors, resulting in a very cost-effective and robust multi-purpose installation.

Smart Occupancy Sensing

Leddar multi-segment sensors are ideal to detect the presence of vehicles and people in public spaces, resulting in cost-effective occupancy sensing that can contribute to better efficiency, security and economy.

Networks of sensors that detect parking space occupancy are providing the basic intelligence behind smart parking applications. Leddar sensors have the capability to monitor single or multiple parking spaces in indoor or outdoor settings. Leddar’s robust detection eliminate noise from the environment and mitigate false positive detections.

The benefits of Leddar for occupancy sensing is also leveraged for smart outdoor lighting, making our streets, walkways, bike lanes or parkings more secure as well as providing better energy efficiency. The small size of Leddar sensors allows them to be seamlessly integrated into existing infrastructures such as parking meters and light poles.
**Vehicle Profiling and Classification**

Data collected by Leddar sensor modules can be used to profile objects when they occupy several segments. This provides the capability to estimate the dimensions and shape of moving vehicles and then classify them or validate their characteristics against application-defined criteria.

Leddar sensors can therefore be used to design high-performance and cost-effective applications requiring vehicle classification systems by size and type.

**Speed Measurement**

LeddarTech's LiDAR solutions provide ranging capabilities for multiple targets, simultaneously measuring the speed of several vehicles within a wide detection area, while being virtually impossible to detect or evade.

Leddar-based speed control systems have successfully been deployed in several cities, providing almost infallible average velocity calculations of road vehicles. Such systems use the data collected by the Leddar sensor to send trigger signals to a camera acquisition module that takes pictures of each passing vehicle's license plate as it enters the detection zone, enabling the calculation of their average speed with a 3 km/h accuracy margin, for vehicles going from 0 to 250 km/h.

**Advanced Object Tracking with Leddar d-tec**

The Leddar d-tec is a powerful traffic monitoring sensor that can be used to track several objects simultaneously in its field of view. Compiling data thousands of times per second, the d-tec can accumulate enough information to estimate and predict an object's position, speed, acceleration, size and trajectory.

As seen on the side image, a Leddar d-tec placed to see the rear of traffic flow can monitor up to 3 traffic lanes to track several vehicles simultaneously, effectively calculating their speed with high accuracy.

The tracking capabilities of Leddar enable sophisticated systems with a very high degree of reliability, as required by applications where safety is key.
Leddar Technology: Optimized LiDAR Sensing

Developed by LeddarTech, Leddar is a high-performance, compact and affordable solid-state LiDAR technology that reliably detects the presence of objects, such as cars, cyclists and pedestrians in its field of view. It operates by emitting hundreds of invisible, infrared light pulses per second. The reflected pulses are detected by a multi-channel photodiode array, which are then processed through patented software algorithms that deliver an optimized, noise-free signal. This output signal is used to determine the presence, location, size and speed of passing objects, depending on the application.

Leddar is a proven technology with >20 million hours of year-round 24/7 operation in challenging environments. Its rugged, fixed-beam design and noise-filtering abilities makes Leddar perfectly suited for harsh weather conditions, such as rain, snow, fog, and a reliable choice for prolonged use outdoors. Relying on infrared light, it is immune to changing ambient light conditions, making it equally effective in direct sunlight or at night.

Leddar sensors have very few installation constraints compared to other technologies. They can be mounted in existing structures and have a greater angular freedom of placement than radar sensors.

<table>
<thead>
<tr>
<th></th>
<th>M16 Sensor Module</th>
<th>IS16 Industrial Sensor</th>
<th>LeddarVu Sensor Module</th>
<th>D-Tec Traffic Sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range</strong></td>
<td>100 m</td>
<td>50 m</td>
<td>215 m</td>
<td>75 m</td>
</tr>
<tr>
<td><strong>Data refresh rate</strong></td>
<td>Up to 100 Hz</td>
<td>Up to 50 Hz</td>
<td>Up to 100 Hz</td>
<td>12 Hz</td>
</tr>
<tr>
<td><strong>Number of detection segments</strong></td>
<td>16</td>
<td>16</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td><strong>Horizontal FOV</strong></td>
<td>9°, 18°, 24°, 34°, 45°, 95°</td>
<td>45°</td>
<td>20°, 48°, 100°</td>
<td>9°, 19°, 26.2°, 35.7°</td>
</tr>
<tr>
<td><strong>Vertical FOV</strong></td>
<td>7.5°</td>
<td>7.5°</td>
<td>0.3°, 3°</td>
<td>1.4°, 3°, 4.2°, 5.8°</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>104 mm x 66 mm x 48 mm*</td>
<td>136 mm x 86 mm x 70 mm</td>
<td>70 mm x 35.2 mm x 45.8 mm*</td>
<td>226 mm x 259 mm x 386 mm</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>180 g</td>
<td>430 g</td>
<td>75 g*</td>
<td>3 kg</td>
</tr>
<tr>
<td><strong>Operating temperature range</strong></td>
<td>-40°C to +85°C</td>
<td>-40°C to +50°C</td>
<td>-40°C to +85°C</td>
<td>-34°C to + 60°C</td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>4 W</td>
<td>5.6 W</td>
<td>2 W</td>
<td>15 W</td>
</tr>
</tbody>
</table>

* Depends on the configuration