Velodyne LiDAR®

Velodyne LiDAR Sensors – The Future of Port Automation

Velodyne LiDAR's Puck 3D LiDAR sensors are utilized in automotive vehicles to generate 3D maps/images in real-time traffic environments. These same sensors provide wide area coverage and may be utilized to automate ports to load and unload containers from ships to trucks. Three-dimensional LiDAR sensors provide better, faster measurement data which is easier to model in a more productive way.

PORT AUTOMATION
MATERIAL HANDLING
& LOGISTICS

Current Solution

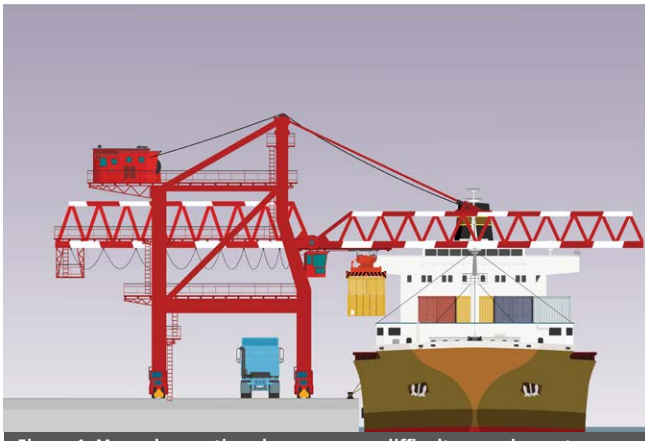

Figure 1. Manual operations become more difficult as equipment becomes taller and wider.

Future Solution

Figure 2. 16-channel 3D LiDAR sensor scans a wide spatial area with single sensing technology with the off-the-shelf controller system.

Required Sensor Types	2D LiDAR Scanners	3D LiDAR Sensor
Data Measurement	ON/OFF (2D LiDAR)	Distance, Calibrated Reflectivity Values, Rotation Angles and Timestamps
Data Output	Several Communication Protocols (Ethernet, RS232, etc.)	UDP Packets (with timestamps) via Ethernet Protocol
Sensor Coverage Area	Multiple Sensor Technologies Required; Specific Sensors Perform Individual Tasks Over a Limited Area.	One 3D LiDAR Sensor Performs Multiple Functions and Covers Greater Spatial Area
System Integration	Difficult to Implement and Modify for Future Systems	Easy Modification and Implementation Process for Future Product Upgrades.

Figure 3. Concept drawing of LiDAR sensor's scan lines with PUCK VLP-16.

Velodyne LiDAR® Sensor Advantage:

- **Lowers Total Cost of Ownership**
  - Reduced Sensor Count
  - Shortens/Simplifies Design and Implementation Time
- **Detailed 3D Images for Vehicle/Object/Container Profiling**
  - Full Surround View in both Horizontal and Vertical Fields
  - Fast Identification of Vehicles, Objects and Containers
  - Object Detection and Identification
  - Identify Port Workers Wearing Retro-reflective Safety Vests
- **Fast On-site Commissioning Time**
- **Flexibility in Use of Pure Measurement Data**

Real-Time 3D LiDAR Sensors

The Puck™ and HDL-32E provide high definition 3-dimensional information about the surrounding environment.

Parameters	VLP-16 	HDL-32E 	Benefit
Range	100 m (>300 feet)	100 m (>300 feet)	Detects objects at farther distances.
# of Channels	16	32	Visualize actual scanned objects.
Horizontal Field of View	360°	360°	Detect and maintain visibility continuously.
Horizontal Resolution (Azimuth)	0.1° to 0.4°	0.1° to 0.4°	No laser beam gaps for accurate measurements.
Vertical Field of View	30° (-15° to +15°)	40° (-30.67° to +10.67°)	Follow objects as they move.
Vertical Resolution	2.0°	1.33°	Determine potential hazards before they enter critical scan line.
Rotation Rate	5 Hz to 20 Hz	5 Hz to 20 Hz	Reliable Time-of-Flight Measurement Techniques.
Accuracy	±3.0 cm (±1.2")	±2.0 cm (±0.8")	Measure stationary and moving objects accurately.
Data Output Information	UDP Packets • Distance Measurements • Calibrated Reflectivities • Rotation Angles • Time Stamps (µs resolution)	UDP Packets • Distance Measurements • Calibrated Reflectivities • Rotation Angles • Time Stamps (µs resolution)	Provides a wealth of information to distinguish different types of vehicles and objects.
Data Output	Single Return Mode: 300k points/s Dual Return Mode: 700k points/s	Single Return Mode: 695k points/s Dual Return Mode: 1,390k points/s	More than 4x data output from competing solutions.
Operating Voltage	9 V to 18 V (Directly to Sensor) 9 V to 32 V (Thru Interface Box)	9 V to 18 V (Directly to Sensor) 9 V to 32 V (Thru Interface Box)	Standard operating voltage range.
Power Consumption	8 W	12 W	Low energy consumption, decreases operating expenses.
Enclosure Rating	IP67	IP67	Operates in wet and cold environments.
Operating Temperature	-10°C to +60°C	-10°C to +60°C	Works in hot and cold weather conditions.
Size	Ø103 mm x 72 mm (Ø4.1" x 2.8")	Ø85 mm x 144 mm (Ø3.6" x 5.68")	Smaller size allows for smaller mast size.
Weight	830 g (1.8 lbs)	1 kg (2.2 lbs)	Lower weight decreases need for larger mast.

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Contact us for a video or onsite product demonstration. **Email:** sales@velodyne.com **Phone:** +1-408-465-2899

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