



METROLLA

The Power of LiDAR in an Automation Driven World.

WHITE PAPER: ENHANCING AUTOMATION WITH NEAR REAL-TIME DATA
OVERSIGHT



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Introduction to LiDAR Technology

Automation is paving the future for mobility, infrastructure, robotics, logistics and manufacturing at a rapid pace. At the forefront of the automation evolution is laser imaging, detection and ranging (LiDAR) sensors. The use of LiDAR is a method for measuring distances using laser based sensors. Differences in laser return times and wavelengths enable digital 3-D representations of the world around the sensor. The use of LiDAR technology is influencing technology decisions of companies, smart cities and governments, due to the breadth and accuracy of information it provides.

The LiDAR systems considered in this document operate on the same principle: emitted laser pulses which intercept a target and where a portion of that energy is detected and reflected back to the emitting instrument. The systems discussed in this whitepaper can apply to airborne laser scanning (ALS), terrestrial laser scanning (TLS), and portable canopy LiDAR (PCL).

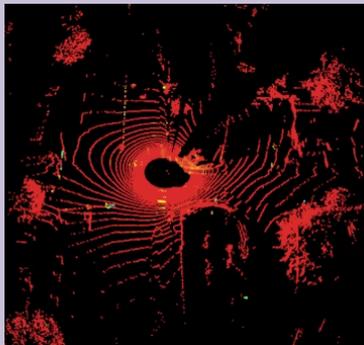


Figure 1.1: Metrolla LiDAR Data processed in near-real time

As automation continues to advance, the data produced from LiDAR will be paramount for machine vision and automated decision making. Improving data oversight will help solve anomalies and software bugs with quicker advances. Due to the uncertainty of automation across a range of industries (autonomous vehicles, smarter cities, defense and more) it is paramount that random, explicit and event based data sampling occur to keep governance and integrity at it's the highest level.

By enabling remote access to data streams and data payloads in near real time, companies and governments can iterate on LiDAR technology on the fly and act on any event or potentially dangerous situation. This creates a distributed data pipeline that will enhance artificial intelligence, machine-learning and software development to take advantage of the capabilities of automation across a range of industries using LiDAR.



LiDAR Data Acquisition and Processing

LiDAR sensors provide rapid measurements at sampling rates greater than 150 kilohertz (i.e., 150,000 pulses per second). This results in a densely spaced network of highly accurate georeferenced elevation points coined as "point clouds" that can be used to generate three-dimensional representations for a range of use cases. The range of information collected using LiDAR sensors can quickly amount to terabytes of data on a single machine. The amount and accuracy of LiDAR data is necessary for automation benefits, leaving practical data off-load an anomaly until Metrolla created the AutoComm solution.

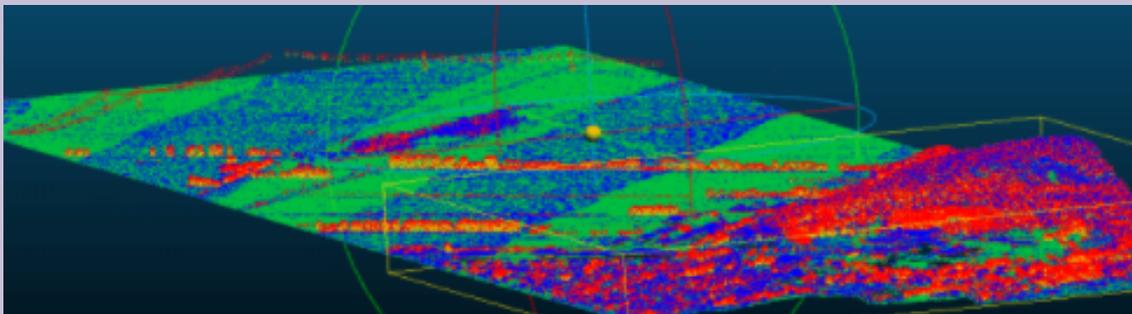


Figure 1.2: A snapshot of LiDAR Data

Post-processed and spatially organized LiDAR data is known as point cloud data. This data is processed with highly accurate georeferenced x,y,z coordinates by analyzing the laser time range, laser scan angle, GPS position, and INS information. Elevations for the ground, buildings, forest canopy, highway overpasses, and anything else that the laser beam encounters during the survey constitutes point cloud data. In real-world applications, data size in LiDAR processing can typically range from tens to hundreds of millions of points.

Metadata is imperative to maximize the use of LiDAR, since metadata typically provides a range of information including collection parameters, accuracy, and additional context for decision-making, which may include full collection and quality control reports. The primary aspects of metadata can include intensity, scan angle, reflectivity, data quality, spatial reference information and context along with other variables.

Processing the data is critical for visualization, and critical to merge and query multiple datasets and subsequent processing for segmentation, as well as computational modelling, machine learning and artificial intelligence. Due to the high-volumes of data quickly produced by LiDAR, streaming the data in near real time to a centralized or distributed data repository has been a challenge for a range of industries.

Implementation

Metrolla AutoComm

To enable data collection and communication with the vehicle, a hardened micro-computer running Metrolla's node software needs to be installed on the local sensor's network. The Metrolla Autocomm node can include auxiliary sensors such as GPS/RTK sensors, Video cameras and more, including an optional cellular gateway. These sensors allow the node to act as redundant onboard networking solution such as a GPS server, NTP server and primary or backup cellular gateway.



Figure 1.3: Metrolla AutoComm

The Server

To enable delivery of data and communication from the Autocomm node, a server is required. This server can be in the form of the Metrolla SaaS, a cloud based server, or an on-premise server. The server(s) can be provided allowing for distributed data handling via network load balancers and can allow easy organization of data, fleet and internal device communication, along with web based viewing of static payloads and streaming data.

Data Off-load

Metrolla delivers a standard payload of .bag and .pcd files that are retrieved and then bundled from the local file storage on each LiDAR sensor. These can include LiDAR, GPS, and/or video data. Metrolla includes a streamable payload solution for LiDAR data points and video in the event that an administrator wants to process the data in near-real time. By pipelining streamed data and automating data payloads, engineers and scientists can create projections and algorithmic optimizations for their test / prod environments providing greater efficiency and increasing safety and operational effectiveness of sensor devices.

Communication

As a byproduct of connecting the AutoComm to the server using Metrolla's process, the AutoComm can communicate across devices in groups or by individual device ID. This allows companies to enable devices utilizing LiDAR to talk to each other over a distributed and centralized solution. This channel of communication enables route optimization, autonomous delivery negotiation, real time traffic updates and allows administrators to send commands to large groups of remote devices. The Autocomm also has a relay subroutine that allows for commands to be sent to OEM logic controllers if the administrator is required to send a new instruction to the technology itself. Furthermore the Autocomm provides a network multiplexer for streamlining more complicated networking from LiDAR sensors to services needing to consume the data.

Applications:

Distributed Data Pipelines, Machine Learning & Artificial Intelligence:

The ability to track, log, and aggregate data across multiple sensors can help manipulate and enhance machine vision and artificial intelligence for devices utilizing LiDAR sensors. Metrolla allows for smarter more real time automated decisions with increased quality assurance built into the process



Mapping, Defense, and Smart Cities: From oceanography, typography, or LiDAR's ability to see through objects, many industries are using LiDAR to make smarter - and safer - decisions. While defense use cases are highly classified, A NATO report (RTO-TR-SET-098) evaluated LiDAR to do stand-off detection for the discrimination of biological warfare agents.

Autonomous Vehicles and Robotics: Both autonomous vehicles and robotics utilize LiDAR for object detection and classification. LiDAR is also widely used in robotics for simultaneous localization and mapping and well integrated into robot simulators across a range of industries. The Metrolla Autocomm is designed to operate in these environments allowing near real time data access.

Reporting and Governance: Metrolla's ability to access LiDAR data in near real-time increases oversight and reporting for random sampling and quality assurance. Metrolla foresees this also helping fulfill legal requirements for real applications across a range of industries, including autonomous vehicles, smarter cities, defense and robotics applications utilizing LiDAR.

Ready to take full advantage of data-offload for automation purposes?

For more information head to [Metrolla.com](https://metrolla.com) or send inquiries to contact@metrolla.com

