DATASPEED INC.
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21.5 mph

DATASPEED NAVROUTE™

PATH FOLLOWING SOFTWARE

DATASPEED NAVROUTE™

Dataspeed NavRoute™ is a comprehensive, full-stack path following system for autonomous vehicle research and development. It's designed for easy control of the entire processing pipeline from inputting raw odometry data to performing longitudinal and lateral control. The system's intuitive and user-friendly interface simplifies trajectory programming, enabling accurate vehicle tracking with ease. The software is highly customizable, making it effortless for customers to run a subset of the system independently, and mix and match modules to create the perfect setup for their individual needs. Figure 1 demonstrates how the system is partitioned into individual ROS 2 nodes, and how they interact with each other using ROS topics and services.

System Requirements

- Dual-antenna GNSS/INS with RTK capability and a minimum of 100 Hz output rate
    - Novatel and OxTS GPS systems are recommended
- Drive-by-Wire System

Figure 1: Block diagram of Dataspeed NavRoute™ modules.
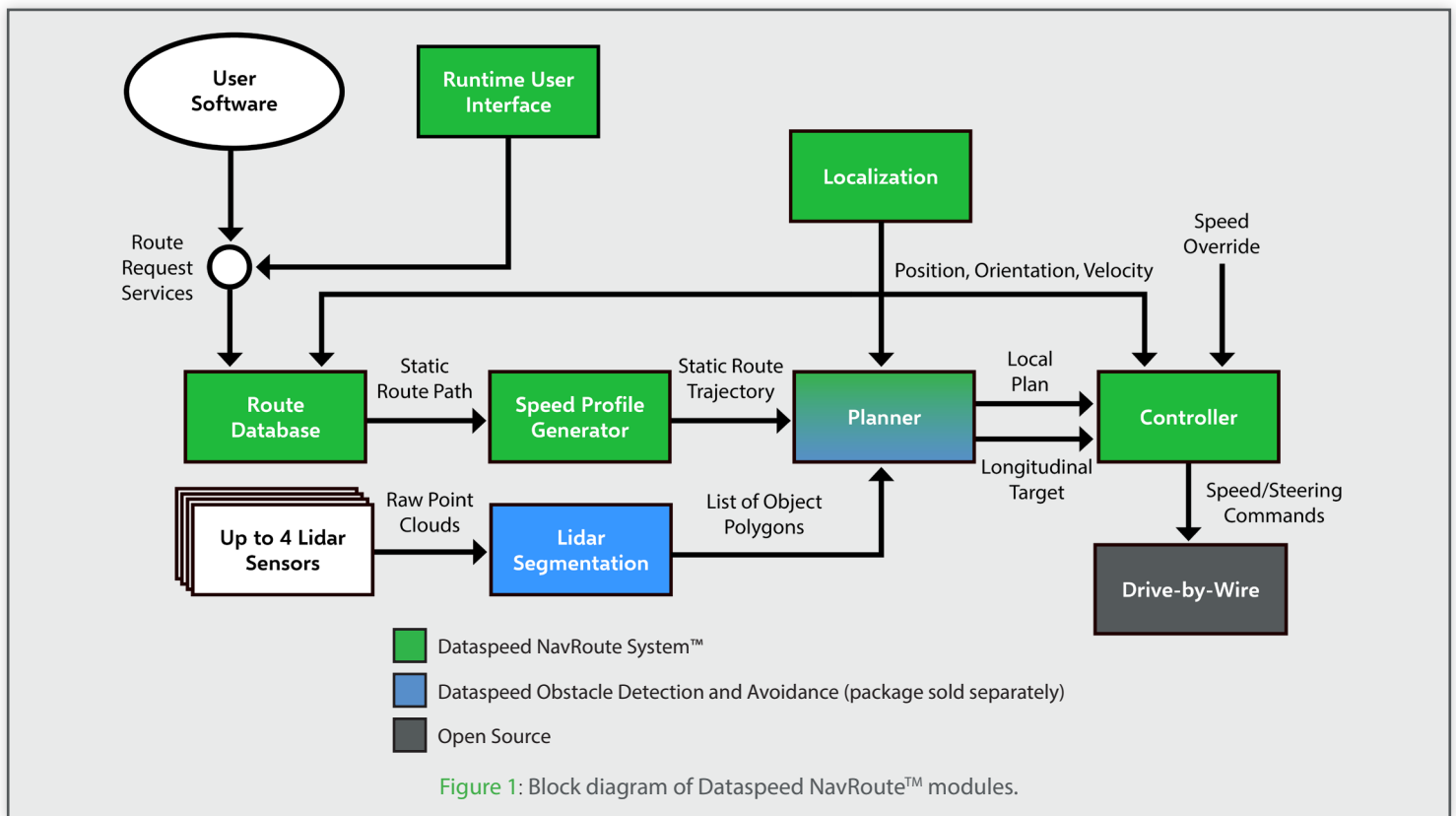
Route Editor

The route network editor is an offline tool for defining route networks used by the runtime system with the following features:

- Graphical interface to load and automatically process raw position data into route network segments
- Rviz interface to manually modify route network elements
- Rviz interface to quickly program specific routes through the network
- Ability to export KML files to visualize the route network in Google Earth
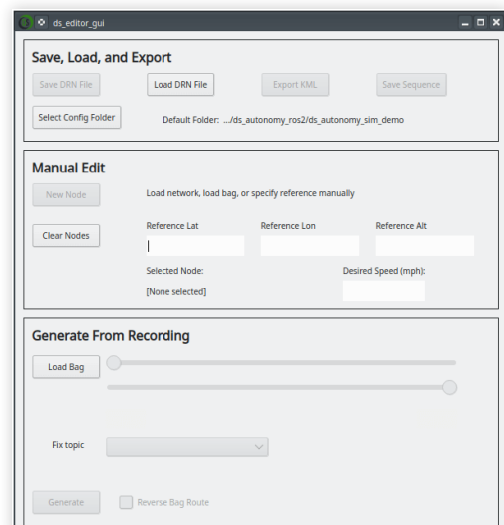
Initial State of Route Editor Interface

Runtime User Interface

Path Record Mode

The path record mode of the runtime interface helps the user record ROS 2 bag files of manual driving that can be used for two purposes:

- Automatically generate route segments using the offline route network editor
- Autonomously follow the recorded path using Quick Route Mode
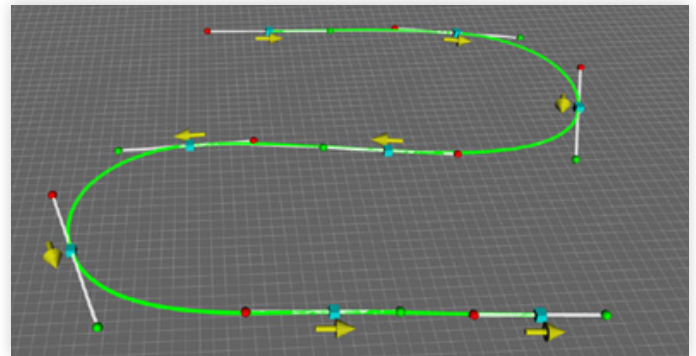
Example of automatically generating route nodes and segments from recorded data

Quick Route Mode

The quick route mode of the runtime interface provides an easy way to autonomously replay a recorded route. By simply loading a bag file containing raw position data recorded during a manual drive, the vehicle can follow that path without having to first create a full route network definition using the offline route network editor.

Route Network Mode

The route network mode of the runtime interface allows the user to load a pre-configured route network and issue commands to follow specific routes through the network.

Runtime Speed Constraints

Speed (mph):	10.0	Lat Accel (m/s2):	2.5
Lin Accel (m/s2):	1.0	Lin Decel (m/s2):	1.5
Jerk (m/s3):	0.25		

Speed constraints settings section of the runtime UI

Vehicle Speed Constraints

The vehicle speed profile used to follow routes can be adjusted using kinematics constraint parameters consisting of maximum speed, lateral acceleration, longitudinal acceleration and deceleration, and longitudinal jerk. These parameters can be changed on the fly with the user interface or a ROS service call.

| Drive-by-wire | | Waiting for enable |
Autonomy		Enabled
Control		Ready
Localization		Good (0.02 m) (100.0 Hz)
Planner		Ready

Subsystem status section of the runtime UI

Subsystem Statuses

The user interface provides a visual indication of the subsystem health to quickly verify the system is working properly before recording path data or executing autonomous path following.

Simulation Demo

To demonstrate the function of Dataspeed NavRoute™, an example simulation ROS 2 package is provided along with the main system binaries. This package helps the user get familiar with both the ROS software interfaces and the user interface. The package also contains example configuration and launch files that can be modified to adapt to a real vehicle.
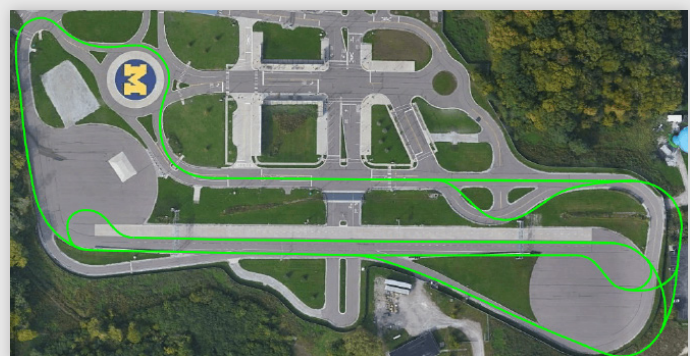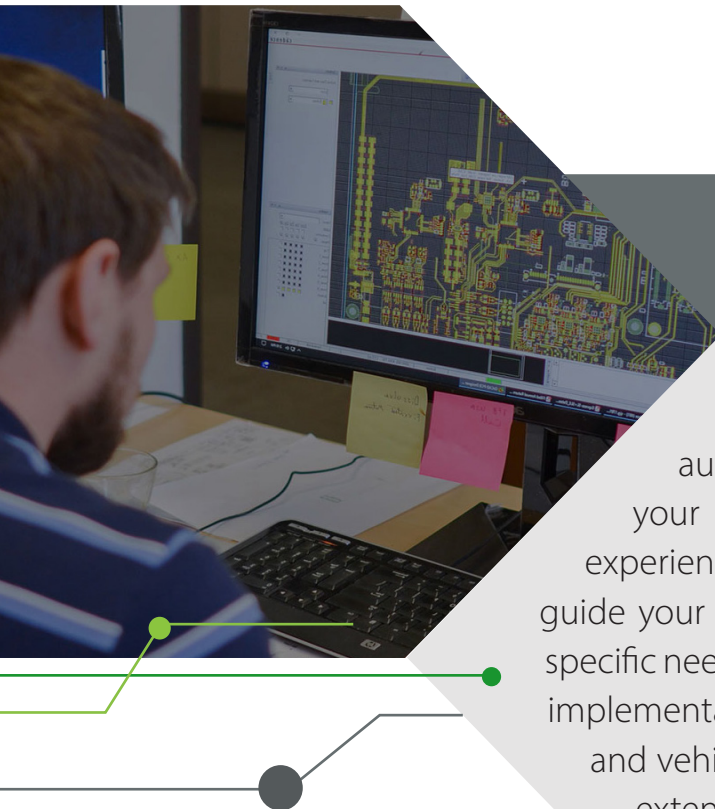

Route network overlaid on real Mcity in Google Earth

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Partner with Dataspeed

Whether your company is just getting started in the autonomous vehicle (AV) industry or is looking to scale your vehicle fleet, Dataspeed has the solution for you. Our experienced team of engineers and business professionals can guide your organization in developing an action plan to meet your specific needs. We're skilled in full vehicle integration including by-wire implementation, sensor and computer installation, data acquisition, and vehicle communications. Our vehicle systems engineers have extensive experience creating custom hardware and software solutions. Contact us today to discuss how Dataspeed can accelerate your AV research and development.