2022

SD Advanced Engineering

SD e-NV200 features and drive-by-wire

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About StreetDrone and StreetDrone Advanced Engineering

Headquartered in Oxford, UK, StreetDrone is an autonomous technology business working on a full-stack solution for autonomy, from the conversion of vehicles to be 'autonomous-ready', through to the development of open-source self-driving software that helps those vehicles navigate their way around urban environments.

StreetDrone was the first business in Europe to run a public road autonomous trial using mainly open-source software. We continue to develop technology that lowers the cost of autonomy in order to make it faster and safer for cities to deploy autonomous vehicles at scale.

StreetDrone Advanced Engineering is a product of StreetDrone, selling its autonomous software, hardware and consultancy services to customers around the world.

Introducing the SD e-NV200

Introducing the SD e-NV200, offering a flexible approach to trialing autonomous shuttle, taxi and delivery services, fully supported by the StreetDrone engineering and field testing teams.

The SD e-NV200 is the perfect trials vehicle, and when combined with our enterprise open source software, Project Aslan, and Neousys PC computing power, provides our customers with an out-of-the box autonomous vehicle solution. Each vehicle comes complete with StreetDrone's proprietary XCU drive-by-wire, a system which has been specifically developed for autonomous applications, as well as an open CAN interface, open data network and built-in sensor and compute flexibility, to ensure that you and your team are making the most of your self-driving ambitions.

Highlights include

- SAE Level 2 Drive-By-Wire with extensive human-machine-interface
- Universal roof rack for flexible sensor integration
- Computation bay and power electronics included
- Data storage and 4G/Wi-Fi connectivity
- Additional power distribution system to support and individually power sensors
- Open source software compatible
- Remote and on-site engineering support available
- Fully bespoke set-up available, price on application

SD e-NV200 - the base vehicle

As standard, StreetDrone Advanced Engineering chooses the leading Nissan e-NV200 Evalia model, with 7 seats. Other variants include a taxi conversion and delivery van.

3 CHARGE METHODS

Rapid, wall box (7h30m), plug (21h30m)

40 kWh BATTERY

100% electric

RAPID CHARGE

From 20-80% in 40 to 60 minutes

TRANSMISSION TYPE

Automatic

EXTENDED RANGE

124 - 187 miles (with city cycle + eco)

PAYLOAD

Up to 658 KG (for 7 seats variant)

SD e-NV200 Specification

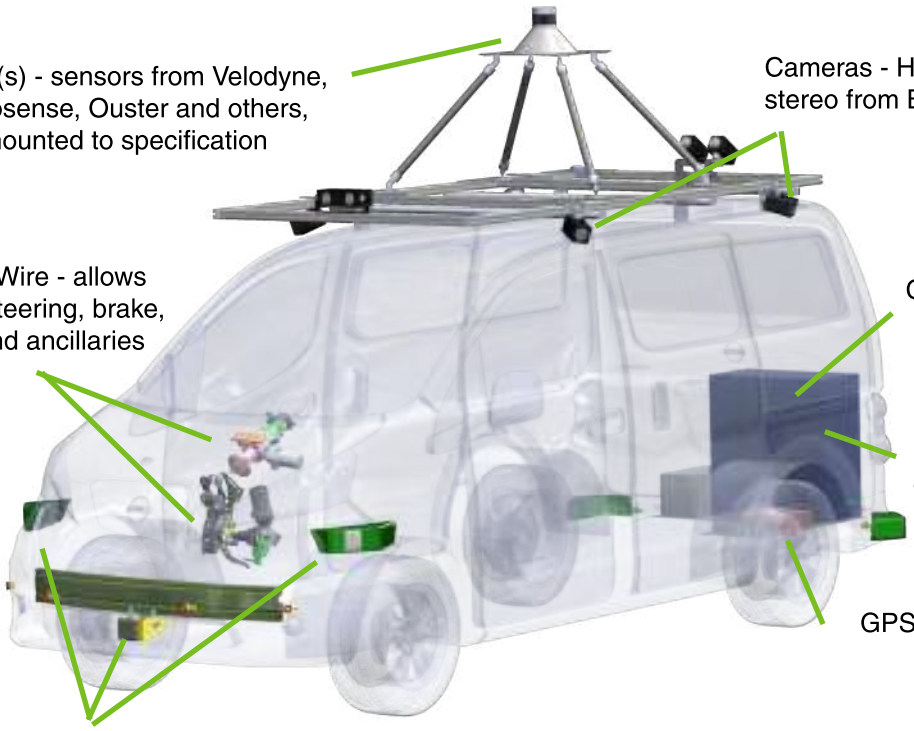
Whilst all of our Nissan e-NV200 vehicle packages are built according our customers specific needs, our "base package" has been tailored to meet the vast majority of autonomous vehicle use cases.

The SD e-NV200 base specification includes the following key features:

Category	Item
Platform	Drive-by-Wire control of steering, braking, throttle
	Control and Monitoring of Ancillaries
	CANbus Interface
Autonomous Ready	Compute Hardware Robust Mounting in bespoke bay
	Power supply for Compute Hardware
	Sensor, Data and Interface wiring for Compute Hardware
Functional Safety	Drive-By-Wire Power Cut-Off Button
	Arm and Initiate System
	Mode indication system
	Master cut-off
	Full time safety driver takeover system
	Removable Drive-By-Wire Isolator Switch
Data	On-board storage 2 x 2TB Samsung EVO III SSD
	4G/Wifi Connectivity
	USB/HDMI interfaces to chosen computation
Bodywork	Custom roof rack rails for sensor mounting
	Capability to move and adjust sensor positions
	Flexible wiring options into computation bay
	Personalised Livery- base colour and company branding
	Computation bay and mounting
Sensors / HMI	Peak Systems GPS/IMU unit (entry level)
	GEMS PM1/PM2 customised power management system
	Cockpit mounted touchscreen

SD e-NV200 flexible extras

The SD e-NV200 can accommodate a range of flexible sensors, depending upon research and deployment goals. The diagram below shows a typical sensor set.



You can contact our sales team directly to discuss any preferred configuration. In addition, the StreetDrone team can recommend set-ups for typical R&D vehicles, including ROS/Autoware compatible sensor configurations.

Base Vehicle Dimensions

A - Length - 4,560mm

B - Width - 1,755mm (without mirrors)

C - Wheelbase - 2,725mm

D - Unladen Height - 1,858mm

(Height with roof rack and cameras - approx 2,115mm)

(Height with full mapping height LiDAR - 2,750mm)

E - Unladen Ground Clearance - 153.4mm

Introducing the StreetDrone Drive-by-Wire System

StreetDrone build our own dive-by-wire installation, called XCU, into the Nissan e-NV200 vehicle, providing a safe way to control vehicle functions including brake, steering, throttle and ancillaries. ECU control units perform controller and supervisor roles, allowing for redundant monitoring and fulfillment of a SAE level 2 autonomous vehicle safety case. StreetDrone provides an interface to this drive-by-wire and safety system via an open CANbus.

Our drive-by-wire (DBW) technology is designed to operate at autonomy level 2 (as per SAE levels - https://www.sae.org/standards/content/j3016_201806/) meaning a trained safety driver is required to takeover in the event of a system failure, acting as system redundancy. The drive-by-wire installation includes functional safety design and an appropriate safety related HMI, to ensure that the system recognises driver intent to takeover control, and allows smooth transfer of control.

The XCU drive-by-wire system follows a best practice approach that avoids any kind of hacking, reverse engineering or spoofing of the base vehicles original control systems to achieve drive-by-wire control.

All of our products are designed around strict safety protocols, more details on our safety culture can be found on our 2020 Safety Report on the StreetDrone website.

StreetDrone Drive-by-Wire System Features

At its lowest interface level, communication with the car is achieved via StreetDrone's customer CANbus, and we provide a .dbc file for customers to establish a communications protocol correctly and safely.

Steer-By-Wire

StreetDrone ECU-controlled actuator and sensors built into the e-NV200 vehicle steering column provide a powered steering function with open CAN messaging as well as independent monitoring of key steering sensors through the DBW's functional safety system.

- Control - -100% to +100% of steering column angle over CAN interface
- Data rate - 200 Hz
- Component set includes: actuator, sensors, wiring to DBW controller, fuses, power supplies, all associated brackets and fixings

Brake-By-Wire

StreetDrone ECU-controlled actuator and sensors built into the e-NV200 vehicle braking system provide a powered braking function with open CAN messaging as well as independent monitoring of key braking sensors through the DBW's functional safety system.

- Control - 0 to 100% independently calibrated target over CAN interface. 100% braking is equivalent to 0.5g deceleration on dry tarmac.
- Data rate - 200 Hz
- Component set includes: actuator, sensors, wiring to DBW controller, fuses, power supplies, all associated brackets and fixings

Throttle-By-Wire

The DBW system interfaces with the vehicle throttle pedal electronically to allow torque control

- Control - positive 0 -> 100% of physical pedal request over CAN interface.
- Data rate - 200 Hz
- Component set includes: Pedal interface wiring, wiring to DBW controller, fuses, power supplies, all associated brackets and fixings

Ancillaries (indications, horn, lights)

StreetDrone provides control of main vehicle ancillaries as well as the means to log the status of each

- Control: On/off of headlights (main and side beam), rear lights, indicators / hazard lights, horn
- Data rate - 200 Hz
- Component set includes: ancillary wiring and controller, wiring to DBW controller, fuses, power supplies, all associated bracketry and fixings
- Note: Brake & reverse lights remain under control of the base vehicle function (pedal/PRNDL) whether or not the vehicle is in automated or manual modes.

Gear control (PRND)

Our standard drive-by-wire installation does not include selection / actuation of PRND. The StreetDrone safety analysis requires a driver to intentionally place the car into “Drive” or “Reverse” in order to enable autonomous mode for vehicle acceleration. “Neutral” selection is a legal safety requirement in most territories. Should this be an absolute requirement, StreetDrone will discuss safety requirements and implementation before adding this feature into the vehicle specification.

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Disclaimer

The content of this document is provided for information only and is correct at the time of writing (March 2020). Information provided is not to be interpreted as operating instructions nor recommendations.

To that regard, StreetDrone strongly recommend that you adhere to the following guidelines in conjunction with the documentation received alongside any StreetDrone vehicle deployment:

- A trained safety driver must always be present in the vehicle in order to provide critical redundancy
- Items such as the open source, publicly available ROS vehicle interface may not suitable for use on public roads, and should only be operated in a controlled 'concrete lake' environment

StreetDrone Advanced Engineering, a product of StreetDrone

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