2022

SD Advanced Engineering

SD Twizy features and drive-by-wire

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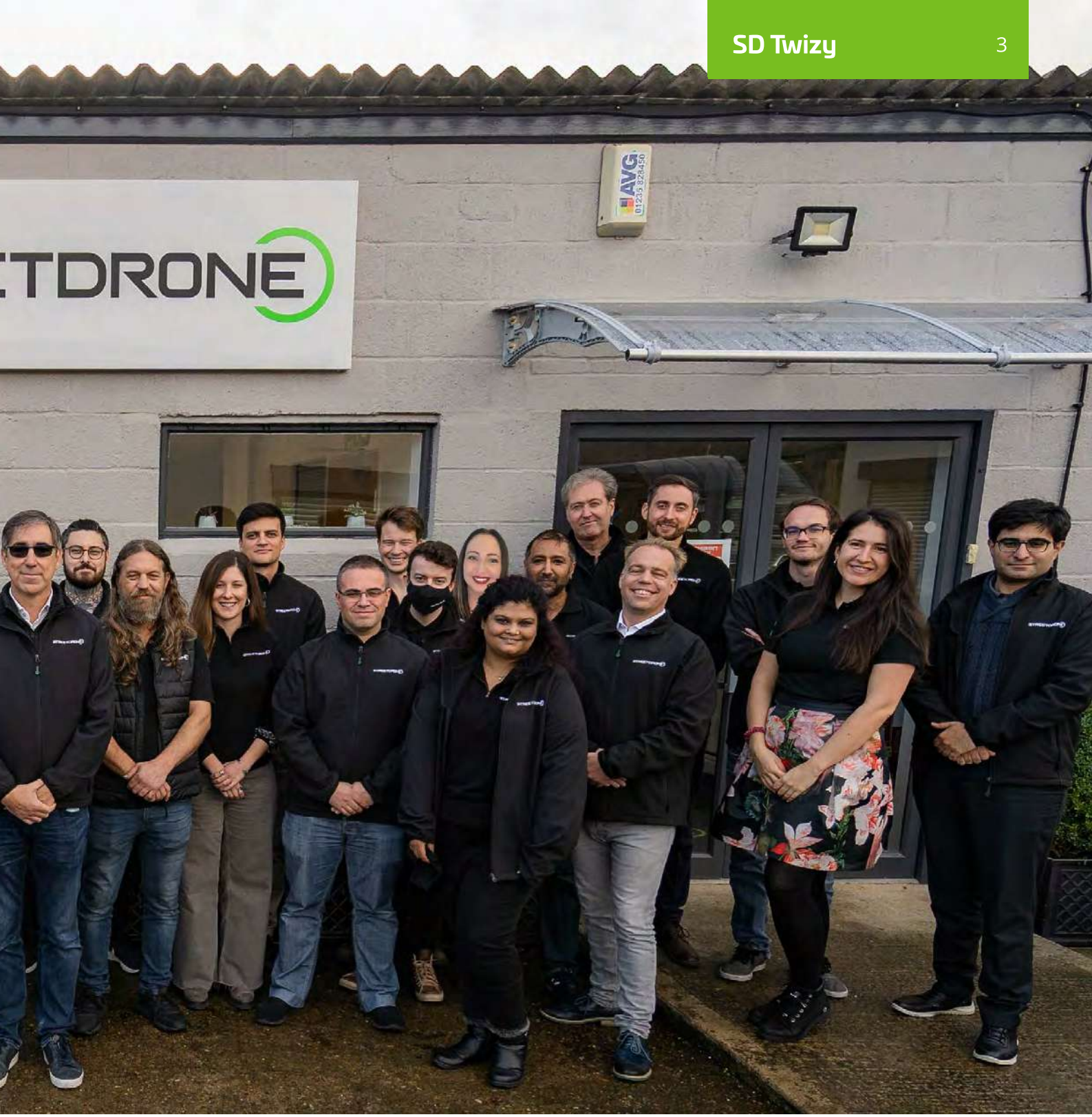


About StreetDrone and StreetDrone Advanced Engineering

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.

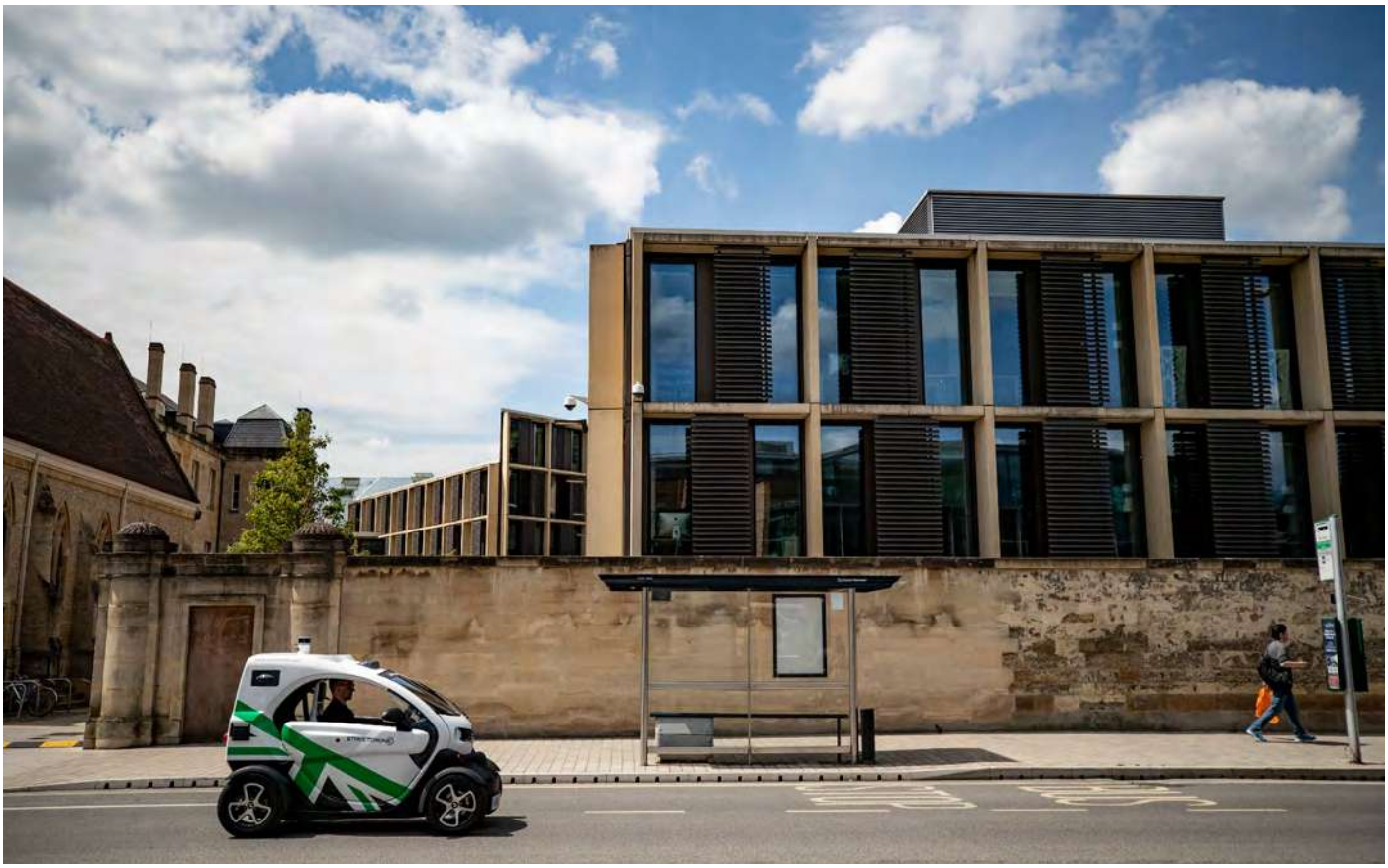
Introducing the SD Twizy

Introducing the SD Twizy, an integrated autonomous-ready vehicle for testing and R&D; ideal for universities, start-ups and anyone looking at future connected and autonomous vehicles, fully supported by the StreetDrone engineering and field testing teams.

The SD Twizy 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 functional safety system
- Power electronics and wiring included
- Data storage and 4G/Wifi connectivity
- CAN / ROS open interface
- Flexible sensor mounting
- Open source software compatible
- Remote and on-site engineering support available
- Fully bespoke set-up available, price on application



SD Twizy - the base vehicle

As standard, StreetDrone Advanced Engineering chooses the Renault Twizy 80 model with 2 seats and a top speed of 50mph:

CHARGING

0 - 100% in 3.5 hours using Standard plug

6.1 kWh BATTERY

100% electric

RANGE

up to 54km (payload dependent)

PAYLOAD

2 seats + all sensor equipment

SD Twizy Specification

Whilst all of our Renault Twizy 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 Twizy 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
	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 and actuator limits
	Removable Drive-By-Wire Isolator Switch
Data	On-board storage 2 x 2TB Samsung EVO III SSD
	4G/Wifi Connectivity
	Cockpit mounted ethernet connection and USB
Bodywork	Front, roof, side and rear sensor mounting points
	Flexible points sensor mountings
	Flexible wiring options
	Personalised Livery- base colour and company branding
	Rear door computation bay
Sensors / HMI	Peak Systems GPS/IMU unit
	8 x Cameras - Ethernet (Pointgrey Blackfly S - ROS node available)
	Cockpit mounted touchscreen

SD Twizy flexible extras

The SD Twizy 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 - 2,369 mm

B - Width (incl. mirrors) - 1,381 mm

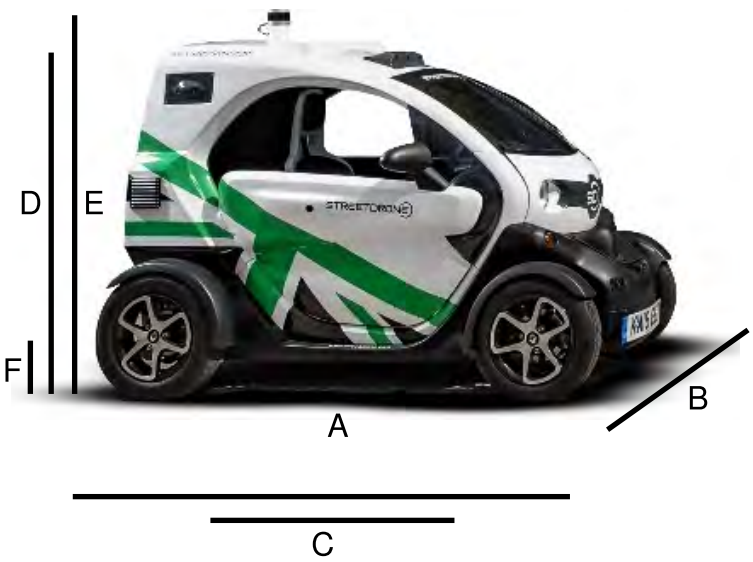
(Width without mirrors - 1,232 mm)

C - Wheelbase - 1,686 mm

D - Height - 1,522 mm

E - Height (with lidar) - 1,686 mm

F - Ground clearance - 120 mm



Introducing the StreetDrone Drive-by-Wire System

StreetDrone build our own dive-by-wire installation, called XCU, into the Renault Twizy 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 Twizy 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 Twizy 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 Twizy 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 (September 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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