LIDAR: how self-driving cars ‘see’ where they’re going

Those spinning units atop autonomous vehicles use laser light to map their surroundings in 3-D.



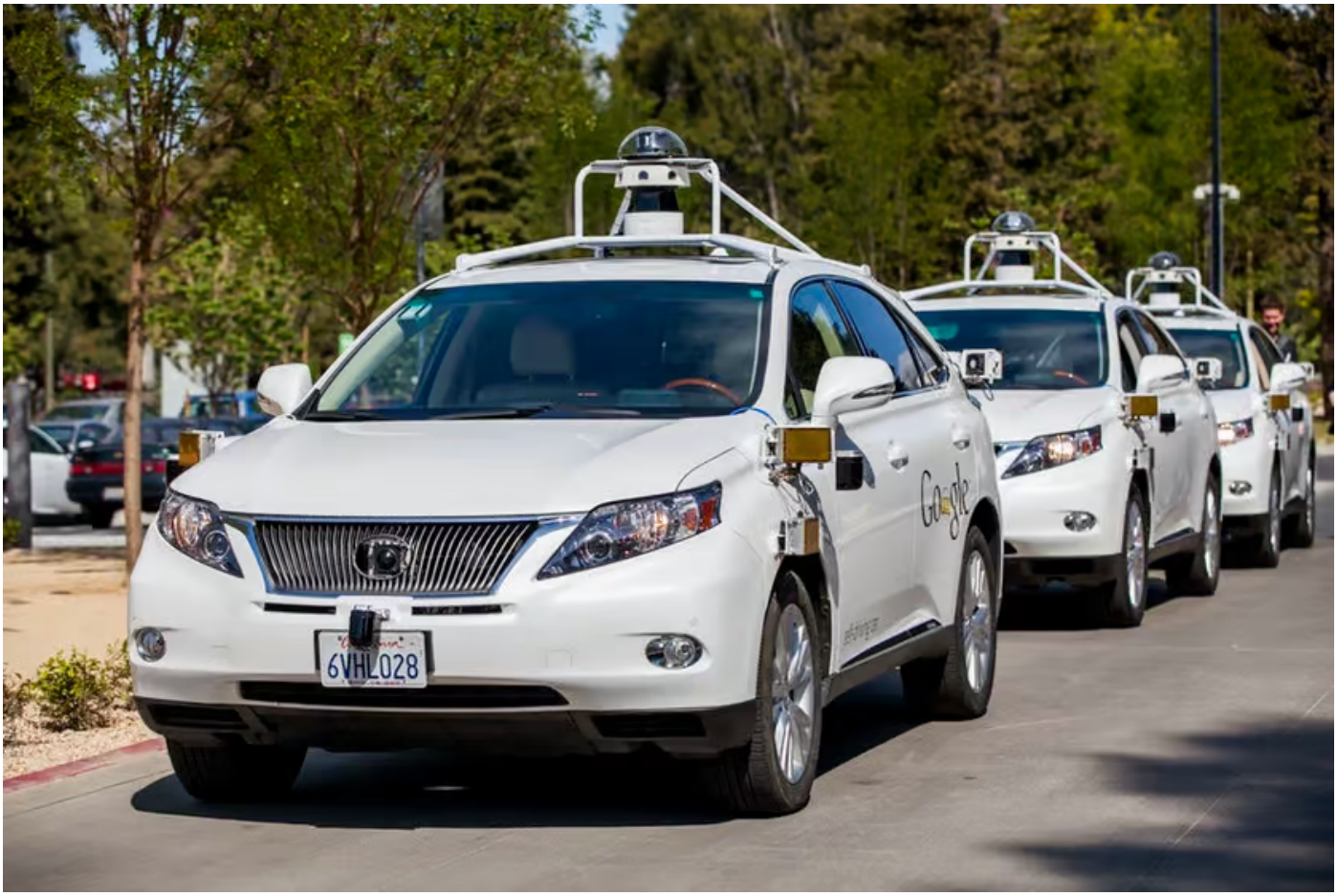
Fully autonomous cars are edging closer to reality, driven by advanced sensors that can avoid a crash before it happens. Leading the charge in this area is LIDAR, a light sensing technology that creates a 3-D map of a car’s surroundings using a laser and receiver. But how does it work?

What is LIDAR?

If you’ve ever seen an autonomous vehicle, you may have noticed a rapidly-spinning tube mounted on its roof. This is a LIDAR unit. Its role is to measure the distance of objects relative to the position of the car in 3-D.

(LIDAR isn’t just used in self-driving cars. It’s also used extensively by

aircraft to map large areas of inaccessible terrain in great detail, even detecting the shape of individual trees.)

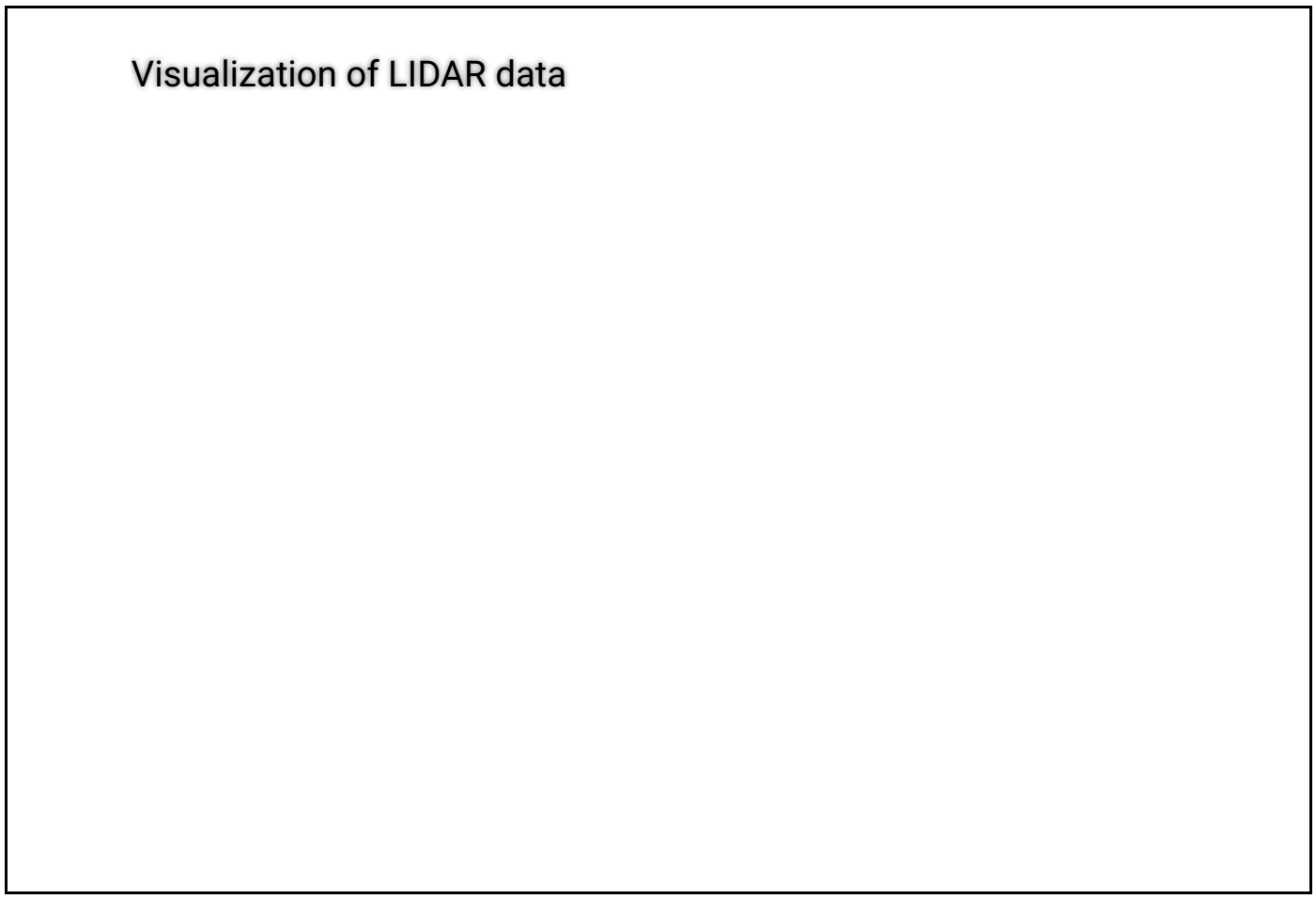


Google's self-driving cars are topped with a spinning LIDAR scanner. So what is it and how does it work? Credit: Kim Kulish / Corbis / Getty.

How LIDAR works

First, a laser unit fires a short pulse of light. The pulse rebounds off a point, such as the rear of the car in front, and is detected by a sensor in the laser unit.

A computer connected to the unit measures the time between the initial pulse and the light return and, using the speed of light, calculates the distance the light has travelled.



How cars use LIDAR to ‘see’ what’s around them

This isn’t the full story, though. Knowing the distance between two objects is not just about measuring point-to-point distance, but also the angle of the LIDAR unit and the angle on which the pulse was fired.

Roads aren’t completely smooth. When a car is on the move, it rocks from side to side. So a laser pulse fired horizontally from the top of the car may not be horizontal to the road.

Taking this into account is vitally important when measuring a car’s surroundings. A slight angle change could mean the difference between two cars colliding or stopping in time, because it changes light’s travel time between the two points.

Keeping track of these angle changes and feeding this data to the computer

is the role of what's called the Inertial Measurement Unit. This unit, the laser unit and computer work together to track the distance of thousands of points each second around the entire vehicle. This helps to build a digital image that allows the car to 'see' what's around it, and it works in pitch black.

Google's LIDAR technology can see road works, parked cars, and even hand signs from a cyclist. See it in action below.

