

Self-driving car

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Key Concepts

- Autonomous automobiles, also known as self-driving cars, navigate independently by sensing traffic and obstacles using sensors, microprocessors, software, algorithms, and programmable controllers.
- Sensors for driverless cars include differential GPS, infrared cameras, laser scanners (rangefinders), lidar (light detection and ranging), radar, and video cameras.
- On public roads, self-driving cars are required to have a human driver to take over in case of technical failure.
- Currently there are no federal laws in the United States for allowing the use of self-driving cars.
- Experts anticipate that a major advantage of self-driving cars will be improved traffic safety.

Driverless cars operated via sensors, microprocessors, software, algorithms, and controllers; also known as autonomous cars and robotic cars. Most of the major automotive companies and some research organizations have developed working prototypes (see **illustration**). However, these self-driving cars are required to have a driver who can take control of the car when driving on public roads. Sensors for driverless cars include differential GPS, infrared cameras, laser scanners (rangefinders), lidar (light detection and ranging), short- and long-range radar, ultrasonic sensors (which send a high-frequency sound wave and receive an echo), and video cameras, with most cars using three or more types of sensors to probe their environment. Lidar sensors, for example, can be used to generate 3D maps showing everything within about 100 meters of the vehicle. Complex projects for advancing the future of driverless cars include developing extremely reliable computers as well as software and algorithms capable of processing all the information from the sensors. *See also:* ALGORITHM; AUTOMOBILE; INFRARED RADIATION; LIDAR; MICROPROCESSOR; PROGRAMMABLE CONTROLLERS; RADAR; RANGEFINDER; SATELLITE NAVIGATION SYSTEMS; SOFTWARE; ULTRASONICS.

It is projected that commercial sales of self-driving cars—without steering wheels or gas and brake pedals—could start in the early 2020s. However, the legal and legislative issues surrounding their use have yet to be sorted out. In the United States, there are currently no federal laws for self-driving cars. There also are many unanswered questions, such as how to define what constitutes a safe self-driving car and how to prevent a self-driving car from being hacked, since it will be connected to the internet. Even the question of who is liable in an accident of



Waymo self-driving car on the road in Mountain View, California, USA. [Credit: Grendelkhan (CC BY-SA 4.0)]

a car parking itself (the manufacturer, the software developer, the owner, and so on) is far from clear at present.
See also: POTENTIAL IMPACTS OF SELF-DRIVING CARS.

A major advantage of autonomous driving technology is hoped to be improved safety: The World Health Organization reports that every year 1.24 million people are killed in road traffic accidents and as many as 50 million are injured. Even before self-driving cars become viable, automakers have begun rolling out autonomous technology for reducing accidents, such as automatic braking, collision-avoidance systems, blind-spot detection, and adaptive cruise control. Mercedes's latest version of adaptive cruise control is nearly autonomous, because it operates in stop-and-go traffic up to about 35 mi/h (55 km/h). In addition, the U.S. National Highway Traffic Safety Administration has proposed rules for vehicle-to-vehicle (connected-vehicle) communications.

Vehicle-to-vehicle communication and ubiquitous wireless sensor networks will be important components for preventing collisions and alerting the piloting and navigational systems of driverless cars to roadway conditions.

See also: CONNECTED VEHICLES; DATA COMMUNICATIONS; HIGHWAY ENGINEERING; MOBILE COMMUNICATIONS; TRAFFIC-CONTROL SYSTEMS; TRANSPORTATION ENGINEERING; UBIQUITOUS TRANSPORTATION NETWORK SENSORS; WIRELESS FIDELITY (WI-FI).

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Keywords

self-driving car; autonomous car; driverless car; sensors; lidar; transportation

Test Your Understanding

1. What kinds of innovations are needed to advance self-driving-car technology?

2. What legal and legislative issues will arise as true self-driving cars become commercially available in the United States?
3. Critical Thinking: You are designing a self-driving car. What three types of automotive technology would you include in your design, and why?

Bibliography

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Additional Readings

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MIT Technology Review: What to Know Before You Get In a Self-driving Car

Scientific American: When It Comes to Safety, Autonomous Cars Are Still "Teen Drivers"

Wired: A Brief History of Autonomous Vehicle Technology

Wired: Detroit Is Stomping Silicon Valley in the Self-Driving Car Race