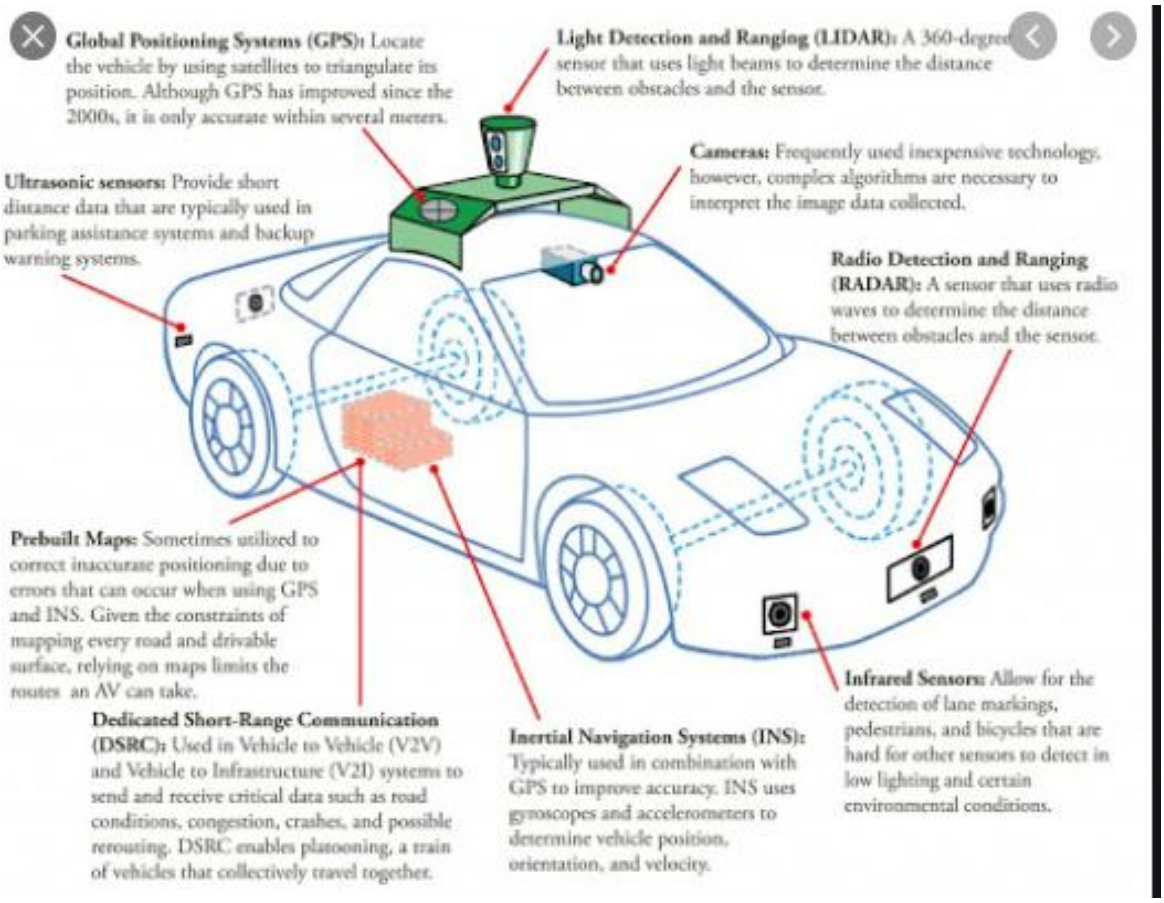
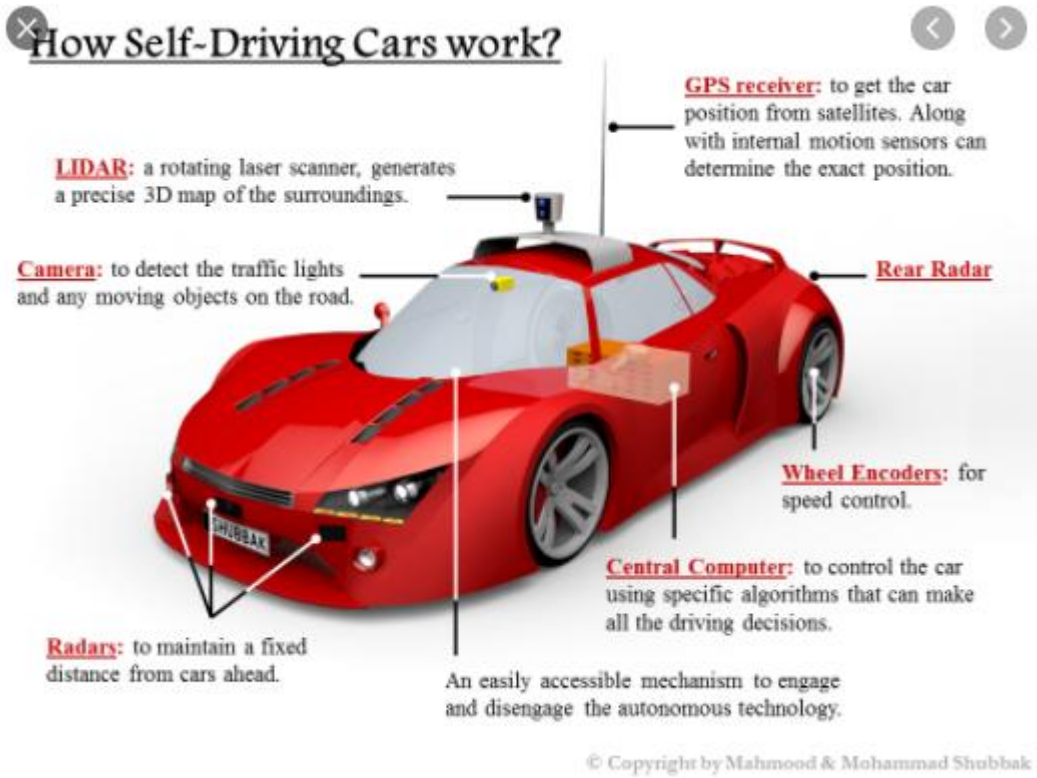
Self driving cars

How do autonomous **cars work**? Autonomous **cars** rely on sensors, actuators, complex algorithms, machine learning systems, and powerful processors to execute software. Autonomous **cars** create and maintain a map of their surroundings based on a variety of sensors situated in different parts of the vehicle.




How Self-Driving Cars work?
GPS receiver: to get the car position from satellites. Along with internal motion sensors can determine the exact position.
LIDAR: a rotating laser scanner, generates a precise 3D map of the surroundings.
Camera: to detect the traffic lights and any moving objects on the road.
Rear Radar
Wheel Encoders: for speed control.
Central Computer: to control the car using specific algorithms that can make all the driving decisions.
Radars: to maintain a fixed distance from cars ahead.
An easily accessible mechanism to engage and disengage the autonomous technology.
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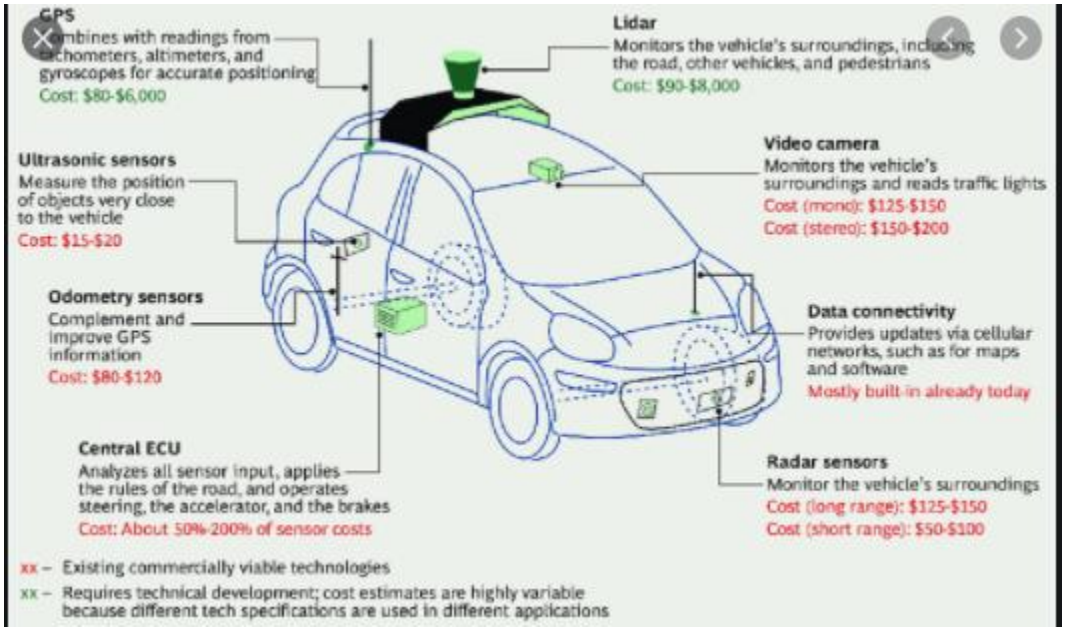
GPS
mbines with readings from
chometers, altimeters, and
gyroscopes for accurate positioning
Cost: $80-$6,000
Lidar
Monitors the vehicle's surroundings, including the road, other vehicles, and pedestrians
Cost: $90-$8,000
Ultrasonic sensors
Measure the position of objects very close to the vehicle
Cost: $15-$20
Video camera
Monitors the vehicle's surroundings and reads traffic lights
Cost (mono): $125-$150
Cost (stereo): $150-$200
Odometry sensors
Complement and improve GPS information
Cost: $80-$120
Data connectivity
Provides updates via cellular networks, such as for maps and software
Mostly built in already today
Central ECU
Analyzes all sensor input, applies the rules of the road, and operates steering, the accelerator, and the brakes
Cost: About 50%-200% of sensor costs
Radar sensors
Monitor the vehicle's surroundings
Cost (long range): $125-$150
Cost (short range): $50-$100
xx – Existing commercially viable technologies
xx – Requires technical development; cost estimates are highly variable because different tech specifications are used in different applications

Self-driving cars in a nutshell

A self-driving car is capable of sensing its environment and navigating without human input. To accomplish this task, each vehicle is usually outfitted with a GPS unit, an inertial navigation system, and a range of sensors including laser rangefinders, radar, and video. The vehicle uses positional information from the GPS and inertial navigation system to localize itself and sensor data to refine its position estimate as well as to build a three-dimensional image of its environment.

Data from each sensor is filtered to remove noise and often fused with other data sources to augment the original image. How the vehicle subsequently uses this data to make navigation decisions is determined by its control system.

Breaking Down the Technicals

Mapping and Localization

Prior to making any navigation decisions, the vehicle must first build a map of its environment and precisely localize itself within that map. The most frequently used sensors for map building are laser rangefinders and cameras. A laser rangefinder scans the environment using swaths of laser beams and calculates the distance to nearby objects by measuring the time it takes for each laser beam to travel to the object and back. Where video from camera is ideal for extracting scene color, an advantage of laser rangefinders is that depth information is readily available to the vehicle for building a three-dimensional map. Because laser beams diverge as they travel through space, it is difficult to obtain accurate distance readings greater than 100m away using most state-of-the-art laser rangefinders, which limits the amount of reliable data that can be captured in the map. The vehicle filters and discretizes data collected from each sensor and often aggregates the information to create a comprehensive map, which can then be used for path planning.


Self-Driving
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