Micro Devices Enable a Self-Driving Future

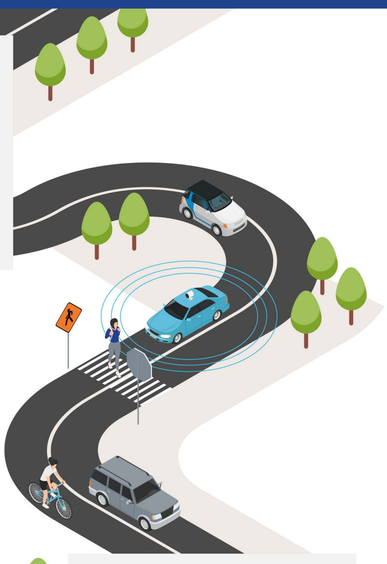
Americans are becoming more confident in self-driving cars, with 55% reporting they would trust a self-driving car with a better safety record than human-driven cars, according to an ARM report.

As these cars take to the road, they're being supported by numerous microdevices to enable a variety of actions.

Here are 5 tasks every self-driving car must perform:

1. Sense the Surroundings

Human drivers constantly look at their surroundings — road conditions, other vehicles, mailboxes on the side of the road. Self-driving cars have to act as their own eyes to look at signs, avoid objects, follow curves along the road and judge distances between other cars.



How it Works:

Self-driving cars can use a combination of sensors like camera, radar and LiDAR systems. A camera can recognize text and color of street signs, for example. A radar sends radio waves from the car out, to find objects and measure their shape and distance from the car.

LiDAR sensors achieve the same task with laser lights pulsed at a much higher rate to create a 3D map of all the objects around the car. These sensors work together to provide accurate "visuals" and redundancy.

2. Communicate

Self-driving cars needs to communicate with the infrastructure surrounding them — roads, lights and emergency services — as well as with other vehicles. Communication should be in real time and reliable.

How it Works:

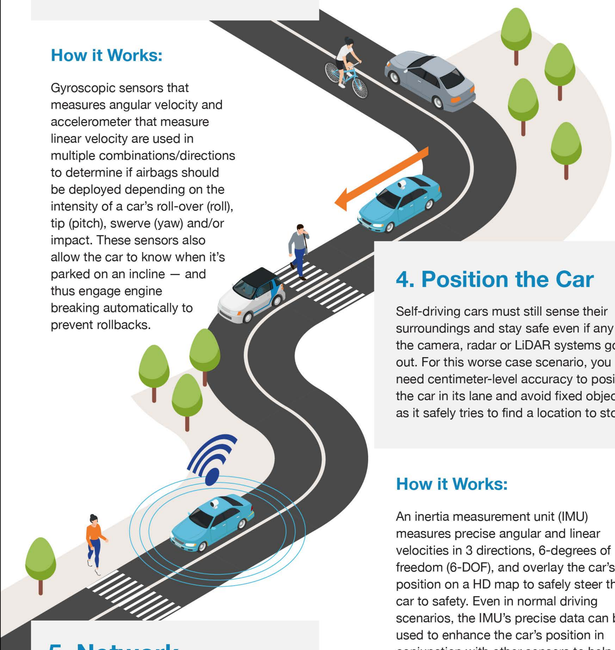
Current Dedicated Short-Range Communications (DSRC) technology like V2X enables cars to communicate safety messages with nearby infrastructure and vehicles. Soon, especially with the emergence of 5G technology, cellular based V2X (C-V2X) will further enhance the communication's content, speed and range. For example, beyond just safety messages, C-V2X can collect and provide real-time road conditions, HD map updates and pedestrians/bicyclists locations (via their smartphone). Based on such information, the car determines the quickest and safest course of action.

3. Be Safe

You want the airbag to deploy in a crash, but not when you go over a speed bump. And no rolling backward down a hill. Self-driving cars must be as safe or safer than traditional cars.

How it Works:

Gyroscopic sensors that measures angular velocity and accelerometer that measure linear velocity are used in multiple combinations/directions to determine if airbags should be deployed depending on the intensity of a car's roll-over (roll), tip (pitch), swerve (yaw) and/or impact. These sensors also allow the car to know when it's parked on an incline — and thus engage engine breaking automatically to prevent rollbacks.



4. Position the Car

Self-driving cars must still sense their surroundings and stay safe even if any of the camera, radar or LiDAR systems go out. For this worse case scenario, you need centimeter-level accuracy to position the car in its lane and avoid fixed objects as it safely tries to find a location to stop.

How it Works:

An inertia measurement unit (IMU) measures precise angular and linear velocities in 3 directions, 6-degrees of freedom (6-DOF), and overlay the car's position on a HD map to safely steer the car to safety. Even in normal driving scenarios, the IMU's precise data can be used to enhance the car's position in conjunction with other sensors to help simplify and reduce computation time so that the car can react quicker to situations.

5. Network

Self-driving cars relies on its network connectivity to quickly, accurately and reliably send and receive large amounts of senor and communication data so that it can react accordingly to various driving situations in real-time.

How it Works:

Numerous networking protocols such as CAN, LIN, FlexRay, PCIe, ethernet, etc. are used within the cars today depending on the car's architecture. One thing is clear, as data continues to increase to enable self-driving, a higher speed networking architecture that maintains signal integrity is a challenge. Car makers are exploring beyond 10Gbps networking backbone, new components/PCB design and adapting zonal architecture to meet these demands and challenges.

Epson Provides a Complete Automotive Solution

To learn how Epson's industry-leading timing and sensing devices can support your autonomous driving products and projects, visit Epson.com/microdevices

EPSON®
EXCEED YOUR VISION