# Autonomous Vehicles

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## What are autonomous cars?

An autonomous vehicle is a vehicle capable of sensing its environment and operating without human involvement. It utilises a fully automated driving system in order to allow the vehicle to respond to external conditions that a human driver would manage.

## SAE Automation Levels:

The Society of Automotive Engineers (SAE) defines 6 levels of driving automation ranging from 0 (fully manual) to 5 (fully autonomous):

I. **No automation (level 0):**
   - At Level 0, cars have no autonomous vehicle controls – but driving can be enhanced by warning or intervention systems like blind spot indicators.
   - The automated system may momentarily intervene but has no sustained vehicle control.

II. **Driver assistance (level 1):**
   - A low level of automation is present where the driver and the automated system share control of the vehicle.
   - Human driver have control over critical tasks along with minor technological assistance. Example- car might include a system that operates steering. Lane Keeping Assistance (LKA) Type II is a further example of Level 1 self-driving.

III. **Partial automation (level 2):**
   - This level of automation comes under advanced driver assistance systems or ADAS. The automated system takes full control of the vehicle: accelerating, braking, and steering.
   - The driver must be ready to respond at any point of automation failure. Example: Tesla's Enhanced Autopilot or Volvo's Pilot Assist II are Level 2 automation features.

IV. **Conditional automation (level 3):**

- Level 3 automation can control all aspects of driving in a mapped environment. The vehicle will handle situations that call for an immediate response, like emergency braking.
- Vehicles at this level have “environmental detection” capabilities and can make informed decisions for themselves, such as accelerating past a slow-moving vehicle. But they still require human override.

V. **High automation (level 4):**
- At level 4, no human intervention is required. Even in case of system failure, the car can stop by itself without driver’s assistance.
- But until legislation and infrastructure evolves, they can only do so within a limited area- supported only in limited spatial areas (geofenced). However, the cars will include functional driving apparatus, like wheels, brakes and gas pedals.

VI. **Full automation (level 5):**
- Level 5 cars are completely autonomous. These vehicles do not require human attention—the “dynamic driving task” is eliminated. There are no steering wheels, gas or brake pedals.
- They will be free from geofencing, able to go anywhere and do anything that an experienced human driver can do. Surprisingly so, the interiors of these vehicles are designed around and productivity of its passengers, with features such as offices or entertainment lounges.

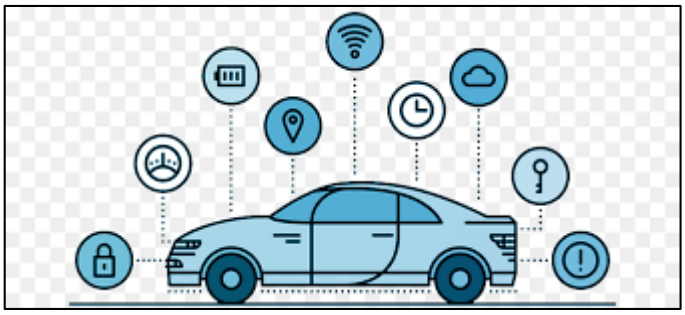
**Obstacles in the field of vehicle automation:**

- Difficulties of determining the intentions of pedestrians, bicyclists, and animals, and models of behaviour that must be programmed into driving algorithms.
- Driverless car designers face a challenge of producing control systems capable of analysing sensory data in order to provide accurate detection of other vehicles and the road ahead.
- Current road infrastructure may need changes for automated cars to function optimally; creating and maintaining maps for self-driven cars is difficult.
- Bad weather conditions will make it trickier- susceptibility of the car's sensing and navigation systems to different types of weather or deliberate interference, including jamming and spoofing.
- Competition for the radio spectrum desired for the car's communication is a big challenge.
- Government over-regulations and approval delays can lead to delay in deployment of automated vehicles on road.

## Impact on various societal sectors:

1) **Public health:** Driving safety experts predict that once driverless technology has been fully developed, traffic collisions (deaths and injuries) caused by human error, such as delayed reaction time, tailgating, rubbernecking, and other forms of distracted or aggressive driving should be substantially reduced.
2) **Welfare:** Automated cars could reduce labour costs; relieve travellers from driving and navigation chores, and also would lift constraints on occupant ability to drive, distracted and texting while driving, intoxicated, prone to seizures, or otherwise impaired.
3) **Traffic:** Autonomous vehicles might have adverse impact- increased in highway capacity could have a significant impact in traffic congestion. With most commuters not interested in ride sharing, this could increase peak period vehicle flows, which is likely to increase traffic congestion over the next 30 years or so says study.
4) **Economic effects:** Safer driving is expected to reduce the costs of vehicle insurance. Adversely so, there could be resistance from professional drivers and unions who are threatened by job losses.
5) **Energy and environment:** According to the Department of Energy, automated cars can reduce energy consumption in transportation up to 90%. On the other hand, increase in number if miles travelled by people can lead to traffic congestion and might also impact air pollution rates.
6) **Privacy:** Privacy could be an issue when having the vehicle's location and position integrated into an interface that other people have access to. In addition, there is the risk of automotive hacking through the sharing of information through V2V (Vehicle to Vehicle) and V2I (Vehicle to Infrastructure) protocols.

## CARS THAT ARE ALMOST SELF DRIVING:



1. **Toyota's Safety Sense** driver assistance package has been around for a while, but the 2019 model year marked the rollout of Safety Sense 2.0.
   The Safety Sense 2.0 pre-collision system includes features such as pedestrian and cyclist detection with automatic emergency braking, road sign recognition, and lane tracing assist, which helps keep the RAV4 centered in your lane, even if the road curves.
2. **The Leaf** is Nissan's electric compact car with ProPilot Assist which helps the Leaf steer, accelerate, and brake thanks to front-facing cameras and sensors that keep pace with surrounding vehicles.
3. **2019 Tesla Model 3** includes features such as automatic emergency braking, forward collision warning, and side collision warning. It also includes the Enhanced Autopilot system, which can steer, accelerate, brake, and even change lanes.
4. **2020 Volvo XC60** can scan the road for imminent collision risks, including cyclists, pedestrians, and large animals, and can help brake or perform evasive maneuvers to avoid a crash. The optional Pilot Assist system, which requires full driver attention and participation, can help accelerate, steer, and brake while traveling up to 80 mph.
5. **2019 BMW 5 Series** includes plenty of advanced safety features as standard equipment, including pedestrian detection, adaptive cruise control, and front and rear parking sensors. Step up to the 540i trim to get the option of the Parking Assistance Package, which lets you use the key fob to help guide the car into a tricky parking spot, all while you stand nearby. The Driving Assistance Plus Package includes Traffic Jam Assist, which is like cruise control specifically for stop-and-go traffic, keeping you centered in your lane and a safe distance from the vehicle in front of you.

**To conclude:**

Self driving cars will prove to be more functional and efficient as compared to human drivers. With the major forces of technology, striving everyday to bring this dream to life we can be sure that the day isn't far away when the first autonomous vehicle will hit the roads are prove to be a success.