

## **Driverless Cars: From level 1 to level 5**

On the streets in the city or high ways in the countrysides, cars are running around busily. Most adults drive to their work places and shopping malls. This is called the “modern” life. However, we are not satisfied with this — the exhaustion darkens the sky and accidents are taking people’s life everywhere, everyday. To achieve our goal of zero emission and zero fatality, scientists are now introducing the technology of Driverless cars. On the journey to this dream, there are five levels we should go through.

### **Level 1**

The vehicle take control of individual functions like acceleration or breaking. For example, these functions may include Electronic stability control, ABS, and Adaptive cruise control. These can be convenient when running long journeys. However, it’s still driven by human most of the time.

### **Level 2**

At this level the car can control two things at the same time. Although it’s a small step from Level 1, it’s still significant. For example, since it’s easy to be tired when the car is driving itself, the car may also include a system that make sure the driver is awake at the same time it’s speeding up. Also, accident avoidance function takes control of the car when it thinks you’re going to have an accident because human can’t react quick enough. Researchers believe the number of life saved because of this technology is phenomenal.

### **Level 3**

The masterplan states that safty-critical functions can be completely assigned to the vehicle under certain driving or environmental conditions. Some people feel nervous when sitting in a self-driven car, while researchers found that people can become accustomed to it surprisingly quickly. This technology is almost available now. There are three ways the car can keep in the correct lane: Satellite navigation finds the road, Lidar (Spinning laser) pictures the environment, and Radar detects the environment in short range. However, a human driver is still required to take over in emergencies, and the tiring driver problem still exist.

### **Level 4**

Cars at this level can perform all driving functions and monitor roadway conditions for an entire trip within the operational design domain of the vehicle. There will be no control facilities like steering wheels or brakes. To achieve this, GPU is used to analyze the large amount of data sent from sensors around the car. However, even with artificial intelligence, it’s still hard to understand human behavior because it differs from places to places, especially in different culture.

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## **Level 5**

Full autonomy is achieved in this level. The car can act like a human in every scenario. The only input may be a post code or a GPS coordinate. People can do anything along the way.

During the advancement of technology, there are some researchers that propose some ethical concerns. For example, when dealing with accident which either an old man or a woman with her baby will be harmed inevitably, the car needs to decide which one to prioritize. Therefore, some level of morality must be put into the program of the car personally. Besides, since our cities are built for traditional cars, many new infrastructure should be built to accommodate the autonomous cars, like charging bay. Most urgently, if these driverless cars do commercialize into taxi service, many drivers will lose their jobs.

Nonetheless, the technology is going forward. The future is definitely belongs to the autonomous cars.