

Study on Automatic Car Driver

Since many years scientists and researchers are trying to develop a technology to make car driving easy and comfortable. A biggest try is to make an auto driver for cars similar to auto pilot in airplanes. Tesla cars have started a initiative to lead this research. Tesla cars work by analyzing their environments using a software system known as “Autopilot”. The self-driving cars Google makes use LIDAR. Simply put, lidar is like radar, but with light instead of radio waves. This sensor technology makes Google's cars bypass the need for steering wheels and pedals. Google's development of self-driving technology began in January 17, 2009 at the company's secretive X lab run by co-founder Sergey Brin. The project was originally led by Sebastian Thrun, former director of the Stanford Artificial Intelligence Laboratory and co-inventor of Google Street View.



Hardware 1

Vehicles manufactured after late September 2014 are equipped with a camera mounted at the top of the windshield, forward looking radar (supplied by Bosch)^{[43][44]} in the lower grille and ultrasonic acoustic location sensors in the front and rear bumpers that provide a 360-degree view around the car. The computer is the Mobileye EyeQ3.^[45] This equipment allows Model S to detect road signs, lane markings, obstacles, and other vehicles. Upgrading from Hardware 1 to Hardware 2 is not offered as it would require substantial work and cost.^[46]

Hardware 2

Tesla HW2 camera & radar coverage as shown by the company's website.



Hardware 2, included in all vehicles manufactured after October 2016, includes an Nvidia Drive PX 2 GPU for CUDA based GPGPU computation. Tesla claimed that Hardware 2 provided the necessary equipment to allow full self-driving capability at SAE Level 5. The hardware includes eight surround cameras and 12 ultrasonic sensors, in addition to forward-facing radar with enhanced processing capabilities.^[22] The Autopilot computer is replaceable to allow for future upgrades.^[50] The radar is claimed to be able to observe beneath and ahead of the vehicle in front of the Tesla; the radar can see vehicles through heavy rain, fog or dust. Tesla claimed that the hardware was capable of processing 200 frames per second.

When "Enhanced Autopilot" was enabled in February 2017 by the v8.0(17.5.36) software update, testing showed the system was limited to using one of the eight onboard cameras, the main forward-facing camera^[53] The v8.1 software update released a month later enabled a second camera, the narrow-angle forward-facing camera.

Hardware 2.5

HW 2.5 (also known as '2.1') included a secondary node (without a GPU) to provide more computing power and wiring redundancy to slightly improve reliability

Hardware 3

According to Tesla's Andrej Karpathy, as of Q3 2018, there have been large neural networks developed for Autopilot that cannot be used due to the lack of computational resources in current Tesla hardware. The next version of the hardware (3.0) will provide the resources to allow for improved accuracy in predictions

HW 3.0 includes a custom Tesla-designed processor using application-specific integrated circuits (ASIC) chips. Tesla claimed that the new system would process 2,000 frames per second, 10 times more powerful than hardware 2.5.^{[57][58]} The firm described it as a "neural network

accelerator". The company claimed that 3.0 was necessary for "full self-driving", but not for "enhanced Autopilot" functions.^[59]

In October 2018, Tesla estimated first availability of Hardware 3 to be April 2019.

Elon Musk stated that customers who purchased the Full Self-Driving package will be eligible for upgrade to HW 3.0 without cost.

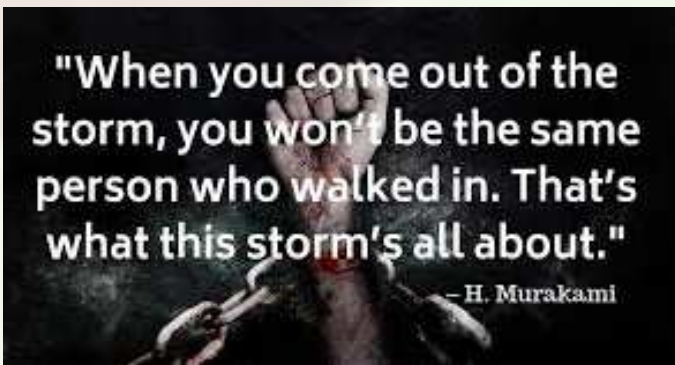


Waymo

Waymo LLC is a self-driving technology development company. It is a subsidiary of Alphabet Inc. Waymo originated as a project of Google before it became a stand-alone subsidiary in December 2016. As of 2018, Waymo had tested its system in six states and 25 cities across the U.S over a span of more than 9 years. Among the first places Google began testing its self-driving cars in 2009 was San Francisco Bay Area. Google's vehicles have traversed San Francisco's Lombard Street, famed for its steep hairpin turns, and through city traffic. The vehicles have driven over the Golden Gate Bridge and around Lake Tahoe. The system drives at the speed limit it has stored on its maps and maintains its distance from other vehicles using its system of sensors. It has since expanded its areas of testing.

Waymo operates in some of its testing markets, such as Chandler, Arizona, at level 4 autonomy with no one sitting behind the steering wheel, sharing roadways with other drivers and pedestrians. However, more testing is needed. Waymo's earlier testing has focused on areas without harsh weather, extreme density or complicated road systems, but it has moved on to test under new conditions. As a result, Waymo has begun testing in areas with harsher conditions, such as its winter testing in Michigan.

In 2014, a critic wrote in the MIT Technology Review that unmapped stopped lights would cause problems with Waymo's technology and the self-driving technology could not detect potholes. Additionally, the lidar technology cannot spot some potholes or discern when humans, such as a police officer, are signaling the car to stop, the critic wrote. Waymo has worked to improve how its technology responds in construction zones. Such automations can give a lead to great future. But we have to develop friendly roads to such technology and with proper maintenance.



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