Autonomous Vehicles

**600 word section (811 not including question/topic)**

**What does it do? (58 excluding question/topic)**

Autonomous vehicles can sense their environment and drive with little or no human input. They combine a variety of sensors to perceive their surroundings, such as radar, Lidar, sonar, GPS, odometry and inertial measurement units. When combined, these sensors and technologies interpret information to identify navigation paths, obstacles and other environment information such as signage or pedestrians.[[1]](#footnote-1)

**What is the state of the art of this new technology? (42 excluding question/topic)**

At present this technology would only be described as partially autonomous, as the majority of current vehicles can only drive in full autonomous mode under specific circumstances or in particular situations, and some with supervision or input from a human driver.[[2]](#footnote-2)

**What can be done now? (249 excluding question/topic)**

To understand the current state of the technology, its important to know and be able to distinguish between the 5 different levels of automation that have been identified below[[3]](#footnote-3):

**Level One Automation**; some smaller tasks, such as steering or acceleration are performed by the vehicle without human intervention, though all other functions are performed by the driver.

**Level Two Automation**; could be seen as an advanced cruise control or autopilot system (currently available in Tesla vehicles), whereby the car makes some safety actions, though the driver needs to remain alert at the steering wheel.

**Level Three Automation;** would still require a human driver, though they are able to transfer “safety-critical functions” to the vehicle, but only under specific traffic or environmental circumstances. There have been criticisms that this level of autonomy could be seen as the most ‘unsafe’ level in the development of autonomous vehicles, and some manufacturers are looking to skip this step altogether in their production.

**Level Four Automation;** the level four autonomous vehicle would be able to drive itself almost all of the time without any human input, though may not be programmed to drive in unmapped areas or during severe weather conditions.

**Level Five Automation;** this would be full automation in all conditions and could have driver input mechanisms completely removed from the vehicle (i.e., steering wheel and operation pedals).

Therefore at the present time, the majority of vehicles with autonomy would be seen to be at the level two state of automation.

**What is likely to be able to be done soon (say in the next 3 years)? (147 excluding question/topic)**

There is still a lot of development required before we will see fully autonomous vehicles on our city streets, it is estimated that by 2030, one quarter of vehicles on the road will be self-driving.[[4]](#footnote-4)

Currently there are multiple vehicle manufacturers investing in in research and development, artificial intelligence and initiatives towards the production of fully autonomous vehicles. As we saw above, Tesla and other manufacturers would be at Level Two Automation, in current vehicles. In the short-term (say 5 years), we could be at level three or four automation.

Although there are currently autonomous vehicles being used in industrial applications (fleet management, mining, oil & gas and defence), the technology to be at this level for passenger vehicles is currently insufficient for optimal safety and mass-production, we could be seeing more trials and testing of level 4 and 5 vehicles on our roads in the next three years.

**What technological or other developments make this possible? (315 excluding question/topic)**

There are both hardware and software technologies for autonomous vehicles. The hardware consists of sensors, LIDAR, cameras, radar, V2X and drive platforms:

**Sensors**; provide the car with all the information about its environment and surroundings.

**LIDAR sensors**; provide 3D scans of the environment, translating a 2D image into 3D understanding. Though because of the high cost of this sensor, it is not certain that this technology will be a future component of a fully autonomous vehicle.

**Cameras**; or ‘camera sensors’ are a more affordable technology than LIDAR sensors and have seen to be coupled/packaged with vision software solutions e.g., AI or embedded specialized sensors.

**Radar**; is a very common sensor for self-driving vehicles, though it is insensitive to environmental conditions like fog, rain, wind, darkness, or bright sunlight.

**V2X**; is the communication technology present that allows vehicle-to-vehicle, vehicle-to-infrastructure, vehicle-to-pedestrian and vehicle-to-network communication.

**Drive Platforms (NVIDIA);** this is the specialised hardware platform for autonomous driving that provides the necessary computing power and optimizes the self-driving software.

The software consists of ADAS, perception, planning modules, control systems and virtual simulation:

**ADAS**; is the ‘Advanced Driving -Assistance Systems’, which combines all algorithms that assist in performing a driving task.

**Perception**; is the only connection point between the vehicle and its surrounding environment. Artificial Intelligence is used in perception algorithms to understand raw sensor data.

**Planning module;** uses maps and rule catalogues that define “valid” driving operations such as scenario detection, scenario classification and trajectory planning.

**Control system**; converts the instructions derived from the planning system into actions.

**Virtual Simulation**, to construct Artificial Intelligence algorithms, vast amounts of driving data is required, which is an expensive exercise, this is where simulations play a critical role in the learning process for AI.[[5]](#footnote-5)

As established above, a great deal of technical challenges are present in the autonomous vehicle industry and a lot of development is still required to overcome these issues.

**300 word section (310 not including question/topic)**

**What is the likely impact? What is the potential impact of this development? What is likely to change? Which people will be most effected and how? Will this create, replace or make redundant any current jobs or technologies?**

The introduction of autonomous vehicles will impact any person or business that is linked to transportation or vehicle usage in any way, it could also change the way in which we live our daily lives and where we live. Specifically to automotive would be car dealerships, mechanics, auto parts manufacturers and suppliers, petrol stations, insurance companies, real-estate (relying on the promotion of rush hour travel times and short distance commuting). This would also affect government revenue from tolls, fines and parking, even policing would change as currently police officers spend 40 percent of their day dealing with traffic-related matters.[[6]](#footnote-6)

There are a variety of jobs that would be replaced or made redundant. Firstly, if we look at mechanics, if they do not stay up-to-date with advancements in vehicle technology the traditional mechanic could be made redundant, though if they stay abreast of this technology, their role would change over the years to more of a systems analytics and manager role.

Secondly, and most impacted would be professional driving positions; truck, bus, delivery and taxi/ride-share positions would completely disappear in the years to come. with autonomous vehicles already being used in the transportation industry, we will see the most detrimental effects to this industry before any others. It is difficult to predict the total number of people affected as it is not just the driver positions, but all jobs within these industries. America have estimated that as many as 8.7 million jobs could be lost in the trucking industry alone.[[7]](#footnote-7)

Its possibly too soon for accurate predictions, though at present the majority of jobs that have been created by the introduction of autonomous vehicles (and/or their development) are engineering and IT related, though the scope of careers is expanding, and like any business or industry- there will be supporting roles, such as admin, marketing, management, operations and production.[[8]](#footnote-8)

**300 word section (337 not including question/topic)**

**How will this affect you? In your daily life, how will this affect you? What will be different to you? How might this affect members of your family or your friends?**

In my daily life this could affect commutes to work and everyday travel, if I were to purchase a fully-autonomous vehicle, I could be working or using my time productively on my commutes. Though being a car enthusiast growing up around cars, I don’t think I would ever want one, which means I could be on the road around a majority of autonomous vehicles, if this is safer we can’t tell at this point (it will possibly only be safer once there is a higher percentage of autonomous vehicles using the road). This may also make my vehicle more expensive to run and use especially in the area of insurance, as being a minority driver on the road- I would be more of a liability. It would also make any vehicle parts more expensive in the future as they will start to become redundant and for special use only.

Within our family we have 2 people who are truck drivers and another who is a delivery driver, this would have a substantial impact on our family as these positions would be made redundant in the future, with re-training or further study becoming necessary to acquire new jobs.

We also have a family member who is a specialist engineer mainly performing custom work for people’s personal and hobby vehicles, as well as race cars by contract. The race car aspect of his work may stay the same for some time, dependant on the industry not adopting any of these technologies, though it could effect that industry as future generations may not even learn how to drive, therefore having a smaller pool of drivers and/or enthusiasts.

His work on people’s personal vehicles may decrease if they purchase an autonomous vehicle for work/commuting purposes as it becomes a ‘norm’ and only having their hobby vehicles, although majority of car enthusiasts would probably not want an autonomous vehicle under any circumstances, as he is a specialist in the area, his knowledge and service could become more valuable in years to come.

1. <https://en.wikipedia.org/wiki/Autonomous_car> [↑](#footnote-ref-1)
2. <https://neurohive.io/en/state-of-the-art/self-driving-cars/> [↑](#footnote-ref-2)
3. <https://emerj.com/ai-adoption-timelines/self-driving-car-timeline-themselves-top-11-automakers/> [↑](#footnote-ref-3)
4. <https://www.eenewsautomotive.com/news/autonomous-vehicle-rollout-current-state-play> [↑](#footnote-ref-4)
5. <https://neurohive.io/en/state-of-the-art/self-driving-cars/> [↑](#footnote-ref-5)
6. <https://chiefexecutive.net/understanding-impact-autonomous-vehicles/> [↑](#footnote-ref-6)
7. <https://dailycaller.com/2015/08/11/american-trucking-industry-could-lose-8-7-million-jobs-in-automation-revolution/> [↑](#footnote-ref-7)
8. <https://www.cnbc.com/2018/08/10/autonomous-vehicles-are-creating-jobs-heres-where.html> [↑](#footnote-ref-8)