**Autonomous Vehicles**

**What does it do?**

An autonomous vehicle is a type of vehicle that is capable of operating without any human assistance (What is an Autonomous Car? – How Self-Driving Cars Work | Synopsys, 2020). They are able to drive through busy street and along highways without the need of a human to take control of the vehicle at any time. Autonomous vehicles also have the ability to sense its surrounding environment which helps the vehicle to predict and react to traffic conditions. This allows the vehicle to do things such as change lanes or swerve the vehicle to avoid a collision.   
  
Currently there a six levels of driving automation ranging from fully manual to fully autonomous which is defined by the Society of Automotive Engineers (SAE) (J3016B: Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles - SAE International, 2020). This classification is based on the amount of human interaction and attentiveness required in operating the vehicle rather than the vehicle's capabilities. These are the current levels of driving automaton as defined by the Society of Automotive Engineers are (SAE International, 2016) (The 6 Levels of Vehicle Autonomy Explained | Synopsys Automotive, 2020):

* **Level 0 (No Driving Automation) -** All driving actions are performed by the driver. The vehicle may contain systems that aid the driver, but these systems are not considered autonomous as they do not drive the vehicle such as emergency braking system (EBS).
* **Level 1 (Driver Assistance) -** The driver completes most aspects of driving but has assistance from an automated system that shares control of the vehicle. Driver assistance systems at level 1 automation include cruise control and parking assist.
* **Level 2 (Partial Driving Automation) -** The automated system can take full control of a vehicles functions (accelerating, braking, and steering) however the driver must monitor the system and be prepared to regain control of the vehicle.
* **Level 3 (Conditional Driving Automation) -** All aspects of driving are automated, but a driver must still be prepared to regain control of the vehicle. At level 3 automation vehicles can make informed decisions by themselves such as accelerating past a slow-moving vehicle and emergency braking.
* **Level 4 (High Driving Automation) -** The vehicle is fully autonomously and does not require any human interaction or attention for safety reasons but still has the option to manually override.
* **Level 5 (Full Driving Automation) -** The vehicle is fully autonomous and does not require any human interaction or attention at all. At level 5 autonomation vehicles will not require any controls (steering wheel and accelerator/brake pedal) whatsoever.

Currently car manufacturers are able to achieve a level three classification in autonomous driving as defined by the SAE. This means that cars with a level three classification can drive themselves however a driver must still be attentive and prepared to regain control of the vehicle. At this level a vehicle can accelerate, brake, change lanes, park itself, sense the surrounding environment of any potential dangers and avoid a collision. Some manufactures have been able to achieve a level four classification in autonomous driving but only under specific circumstances along pre-defined routes (The Current State of Autonomous Vehicles, 2020). No vehicle currently sold to the general public has a level four classification.

The biggest technological innovation that have allowed autonomous vehicles to progress and perform at its current state has been the rapid and continual development of artificial intelligence and machine learning. In combination with on board sensors and cameras in the vehicle, companies have been able to use the data gathered from their fleet of vehicles to construct and test in a simulated environment (The Current State of Autonomous Vehicles, 2020). By testing in a simulated environment these simulations are able to map in great detail routes, intersections and surrounding environment from which the artificial intelligence and machine learning on board vehicles can learn and improve its decision making.

**What is the likely impact?**

The potential impact of autonomous vehicles will have a significant impact on society and a wide range of industries around the world. This technology has the potential to positively impact the word by reducing congestion which also reduce energy consumption and by improving safety on roads (Anderson et al, 2014). With autonomous vehicles in operation, it will be able to reduce congestion and improve traffic flow thus vehicles will be more fuel efficient and potentially output less energy into the environment (Julia Pyper, 2020). More importantly with a fully developed vehicle automation system it can significantly reduce the amount of deaths, injuries and accidents that are happening on roads today. Accidents involving human error such as speeding, tailgating and drink driving would now be a thing of the past (Zhang, 2020). It is estimated that autonomous vehicles could "eliminate 90% of all auto accidents in the United States, prevent up to US$190 billion in damages and health-costs annually and save thousands of lives” (Ramsey, 2020).

While many positive can be gained, the widespread introduction of vehicle autonomation could potentially have a negative knock on effect in other industries. The biggest industry that will be impacted by the introduction of vehicle autonomation will be the transport industry. Significant job losses will occur around the world as the position of a professional driver such as taxis, buses and trucks are made redundant (Mui, 2020). Additionally, vehicle repair shops will suffer a significant income loss as vehicle autonomation will significantly improve road safety leading to less accidents involving vehicles.

**How will this affect you?**

With the introduction of autonomous vehicles into the world it has the potential to provide me a more reliable, healthy and safer mode of transport. If the autonomous technology ever reaches a level 5 classification, it would mean that I am more likely to reach my destination on time without any delays. There would be less congestion on roads making it more environmentally healthy for me and the world. As a result, less time would be spent on travel which will give me back more time in the day that I can use to be more productive. Also, streets will be a lot safer as there will be a lot less accidents involving vehicles as the human error factor when driving is now taken away.

On the other hand, if someday autonomous vehicles were to take over the world it could have unintended consequences. An autonomous vehicle would be entirely controlled by computer hardware and software thus security would be a massive concern. A person with malicious intent could potentially find and exploit flaws in the security system of vehicles that could result in them taking full control of a vehicle or much worse using it as a weapon that could cause other vehicles to crash purposefully. If at any point a situation like this were to occur, it would cause a massive disruption to the transport system as it would grind to a halt and it would strike a lot of fear and concern amongst people including myself moving forward with the technology. With that being said, I do believe overall the introduction of autonomous vehicles will have a positive impact on the world and in society, but a cautious approach should be taken with such important technology.

References

Anderson, J.M., Kalra, N., Stanley, K.D., Sorensen, P., Samaras, C. and Oluwatola, O.A., ‘Autonomous Vehicle Technology A Guide for Policymakers’, The RAND Corporation, 2014.

Digital Trends. 2020. *The Current State Of Autonomous Vehicles*. [online] Available at: <https://www.digitaltrends.com/cars/the-current-state-of-autonomous-vehicles/> [Accessed 18 April 2020].

Julia Pyper, C., 2020. *Self-Driving Cars Could Cut Greenhouse Gas Pollution*. [online] Scientific American. Available at: <https://www.scientificamerican.com/article/self-driving-cars-could-cut-greenhouse-gas-pollution/> [Accessed 14 April 2020].

Mui, C., 2020. *Will Driverless Cars Force A Choice Between Lives And Jobs?*. [online] Forbes. Available at: <https://www.forbes.com/sites/chunkamui/2013/12/19/will-the-google-car-force-a-choice-between-lives-and-jobs/?ss=future-tech#77b784cb3995> [Accessed 14 April 2020].

Ramsey, M., 2020. *Self-Driving Cars Could Cut Down On Accidents, Study Says*. [online] WSJ. Available at: <https://www.wsj.com/articles/self-driving-cars-could-cut-down-on-accidents-study-says-1425567905> [Accessed 14 April 2020].

Sae.org. 2020. *J3016B: Taxonomy And Definitions For Terms Related To Driving Automation Systems For On-Road Motor Vehicles - SAE International*. [online] Available at: <https://www.sae.org/standards/content/j3016\_201806/> [Accessed 12 April 2020].

Synopsys.com. 2020. *The 6 Levels Of Vehicle Autonomy Explained | Synopsys Automotive*. [online] Available at: <https://www.synopsys.com/automotive/autonomous-driving-levels.html> [Accessed 12 April 2020].

Synopsys.com. 2020. *What Is An Autonomous Car? – How Self-Driving Cars Work | Synopsys*. [online] Available at: <https://www.synopsys.com/automotive/what-is-autonomous-car.html> [Accessed 12 April 2020].

Sae.org. 2016. *AUTOMATED DRIVING LEVELS OF DRIVING AUTOMATION ARE DEFINED IN NEW SAE INTERNATIONAL STANDARD J3016.*. [online] Available at: <https://web.archive.org/web/20161120142825/http://www.sae.org/misc/pdfs/automated\_driving.pdf> [Accessed 12 April 2020].

Zhang, B., 2020. *[INFOGRAPHIC] Autonomous Cars Could Save The US $US1.3 Trillion Dollars A Year*. [online] Business Insider Australia. Available at: <https://www.businessinsider.com.au/morgan-stanley-autonomous-cars-trillion-dollars-2014-9?r=US&IR=T> [Accessed 14 April 2020].