Autonomous Vehicles

## What does this technology do?

Autonomous vehicles are cars or trucks that are able to operate without input from a human driver, and never require a human to take control and intervene to safely operate the vehicle. Autonomous vehicles rely on sensors, actuators, complex algorithms, machine learning systems and powerfully processors to execute software. (Synopsys.com, 2021).

Autonomous vehicles are able to use sensors located in different parts of the vehicle to create a map of their surroundings and use video cameras to check for pedestrians, vehicles and other obstacles. These cameras can also detect stop signs and read the instructions presented by traffic lights. Vehicle detection is enhanced by the use of radar sensors. Lidar sensors send pulses of light to detect road edges identify lane markings and measure distances.

These sensor inputs are then processed by sophisticated software which plots the required path and manipulates the acceleration, braking and steering to achieve the objective. Hard coded rules, obstacle avoidance algorithms and predictive modelling help ensure that the software operates the vehicle safely and remains in compliance with traffic rules and regulations.

Advanced autonomous vehicles are connected and capable of communicating with other vehicles or infrastructure such as new model traffic lights programmed to send instructions directly to autonomous vehicles without relying on a video camera to interpret the light signals.

There are currently no fully autonomous vehicles available, however testing is taking place. Partially autonomous vehicles are available and are classified by the following system based on their degree of autonomy (Hecht, 2018).

* Level 0: All major systems are controlled by a human driver
* Level 1: Most systems are controlled by a human driver but some ancillary systems such as cruise control or automatic breaking may be controlled by the car. Only one automated system can function at any given time.
* Level 2: The vehicle is capable of two or more simultaneous automated functions, such as steering or acceleration but a human driver is necessary for safe operation.
* Level 3: The vehicle is capable of managing all safety critical functions under some conditions but a human driver must be present and take over when alerted.
* Level 4: The autonomous vehicle is fully autonomous in some driving scenarios but not all
* Level 5: the autonomous vehicle is capable of self driving in every situation.

Oxbotica in the United Kingdom is currently performing a government backed effort to test a fleet of six Ford Mondeos. The cars will operate on a nine-mile circuit from Oxford parkway station to the main train station in the in both day and night conditions.

Progress continues towards level 5 fully automated autonomous vehicles however progress from level 3 to level 4 and 5 has been slower than expected and slower than the rate of progress from level 0 to level 3. Earlier estimates of level 5 fully automated autonomous vehicles being available and common in 2020 have proven overly optimistic and current estimates for achieving level 5 autonomy suggest decades rather than years.

## What is the likely impact?

The impact of widespread adoption of autonomous vehicles could potentially be significant for our society. It is believed that self-driving cars will significantly reduce crashes and thereby decrease injuries and fatalities. Autonomous vehicles can move faster and more safely than conventional vehicles and could drive closely to each other to reduce air resistance. This coupled with decreased accident-related disruptions may reduce congestion and allow for more efficient transportation. Increased efficiency in our transportation network would decrease our energy consumption and pollution output which would be a significant environmental benefit.

To help illustrate the potential positive impact of autonomous vehicles PWC (2013) estimates that in the United States of America autonomous vehicles may reduce vehicle accidents from 10.8 million per year to 1.1 million. They further estimate the widespread adoption of autonomous vehicles will reduce the American fleet from 245 million down to 2.4 million and also reduce the transport related yearly energy consumption from 19 billion gallons down to 190m gallons. (PWC, 2013) It is also worth noting that autonomous vehicles can make transportation more accessible by giving people who are unable to drive the ability to use our motorways.

As with any change of this scale, there will likely be significant negative impacts as a new disruptive technology is adopted. The potential for job losses is notable. The Bureau of Labour Statistics lists that almost a million people in the United States of America are employed in motor vehicles and parts manufacturing with an additional three million people employed in the dealer and maintenance network. Truck, bus, delivery and taxi drivers account for nearly 6 million professional driving jobs. Virtually all of these ten million jobs could be eliminated in the next ten to fifteen years, and this list is by no means exhaustive. (Kantor, Z, 2015)

It is worth noting that these industries are dominant in many parts of the United States of America and communities affected by these disruptive changes may be less able to move to any employment opportunities required by the emergent autonomous vehicle industry.

Map

Description automatically generated

(Quoctrung Bui, 2015)

## How will this affect you?

I believe that the primary effect autonomous vehicles will have on me is to reduce the cost of my transportation. Traditional car ownership is very inefficient due to the small amount of time you actually spend driving your car. The RAC foundation in the United Kingdom estimates that the average car is parked at home for 80% of the time, parked elsewhere for 16% of the time and is only on the move for 4% of the time. (RAC, 2012). If we move to a transportation model where car ownership is rare and people instead hire self-driving cars on an on demand basis the cost for our transportation could decrease.

Autonomous vehicles would also increase my opportunity to be productive as time spent commuting to work or between appointments could be used for study or meetings rather than paying attention to the road. Americans spend an average of 293 hours driving per year, which is equivalent to over seven 40 hour work weeks. (Adorney, 2019). If even a portion of this commuting time can be converted to productive activity then the personal and economic benefits would be significant.

I would also appreciate the improved peace of mind when commuting due to the improved safety outcomes full implementation of autonomous vehicles could bring. In the United States of America the National Highway Transportation Safety Administration found that somewhere between 94% and 96% of all motor vehicle accidents are caused by some kind of human error. (NHTSA, 2016). Even if you consider yourself an above average motorist you always have to be careful of what other drivers are doing and could be involved in an accident through no fault of your own. Replacing the average driver with an autonomous vehicle would make everyone much safer.

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