Autonomous Vehicles

Report by Nicholas Young (S3793515) – Group 14

Self-Driving cars have long been a concept that one could categorize as futuristic. The idea that technology could exist which would allow a person to transport themselves to and from locations without having pay attention to the road at all may seem far off, but in reality, this technology is already well under development - with the ideal product potentially right around the corner. Companies such as Tesla, Uber and Google have been actively developing prototypes of self-driving vehicles and testing them on public roads, in real situations – paving the way for the inevitable presence of autonomous vehicles in our society. It is important to understand just what this technology is, and the impact it may have on society overall.

## What Does It Do?

Autonomous vehicles are vehicles capable of self-operating without the intervention of human drivers. They use various types of sensors and software contained within the vehicle to control and navigate the vehicle as it travels to its destination. Current prototype vehicles use sensors such as radar, lasers, high-powered cameras or sonar to actively build and maintain a map of their immediate surroundings – these are the eyes of the autonomous components of the car.

The software counterpart extracts and processes the information gathered by the censors to determine how the car should operate. This software controls navigation, plotting paths and relaying instructions to the vehicle’s actuators which are in control of the car’s acceleration, breaking and steering functions which work in tandem with the software’s hard coded rules to calculate algorithms that allow for object avoidance predictive modelling. The hard-coded rules also give the car the ability to discriminate between similar looking objects such as bicycles and motorcycles, allowing the car to act accordingly on the road.

There are currently 6 different levels of autonomy when classifying the self-driving capabilities of a vehicle. These levels are:

* + Level 0 – The human driver is in total control of the vehicle. No autonomous functions whatsoever are present in the vehicle.
  + Level 1 – The vehicle is capable of performing some autonomous functions such as breaking and cruise control, however they are only capable of performing these actions one at a time and not simultaneously.
  + Level 2 – The vehicle is capable of performing multiple autonomous functions simultaneously such as acceleration and steering – however, a human is still required to be in a position of control in order for the vehicle to be safely operated.
  + Level 3 – The vehicle is capable of performing all functions for the vehicle to be autonomously operated safely under certain conditions, however a human is still required to be in a position of control in order to take control in situations where the vehicle is unable to autonomously operate in a safe manner.
  + Level 4 – The vehicle is capable of performing all functions required to self-operate in most conditions. The human driver is not required to be present at the steering wheel while the vehicle is self-operating in these conditions, but they must be able to take over if the situation requires it. The vehicle will attempt to self-park if they cannot.
  + Level 5 – Fully autonomous. The vehicle is capable of performing all functions required to self-operate in all conditions, regardless of driver presence or not. This is the ideal level of automation, where features such as steering wheels are optional, and the driver’s presence is not required for any driving related operation whatsoever.

Currently state of the art autonomous vehicle technology would be classified as level 2, although a classification of level 3 is estimated to be achieved within the next year, with a level 4 classification following early in the next decade.

## What is the likely impact?

The impact of autonomous vehicles on society – both positive and negative – will become more severe as higher levels of autonomy are achieved. Currently at an autonomy level of 2, the impact on society could be described as minimal with the only real impact being speculation on what further impacts autonomous technology could bring. Autonomy levels of 3 and above are where the true impacts of this technology will make themselves known to society.

Laws will need to be made regarding what actions are legal for the designated driver to take while the vehicle is operating autonomously, as driver attentiveness may be key to preventing an accident whether it is caused by the vehicle or another party. It will also need to be legally defined who is at fault when or if the autonomous vehicle gets into an accident that can not be blamed on a third party. Is it the driver’s fault for inattentiveness or the vehicle’s and therefore the manufactures fault for faulty design? Insurance rules will also be likely to change as the definition of risky driving will be altered, likely to – as mentioned above – driver inattentiveness or something similar.

As the autonomy level increases to the point where drivers in vehicles are wholly optional, self-driving technology will almost assuredly impact the job market as companies will no longer require regular drivers for public transport (taxis, ubers, busses), and trucks. These people will be made redundant by self-driving technology.

On a more positive side, self-driving technology will allow the regular drivers (or in this case, passengers) in their own vehicles to relax or work at their own leisure while their vehicle transports them from point A to B. It will allow those unable to operate vehicles due to factors such as disability to be fully mobile and independent without having to rely on public transport or others. It will also reduce the opportunity for accidents caused by human error to occur. The downside of this is more gasoline powered cars on the road will result in more pollution, and more cars in general will see an increase in traffic and a decrease in parking availability at popular locations.

## How will this affect you?

The current state of self-driving technology has almost no notable impact on the average person, however this is likely to change as the level of autonomy increases. For me personally, I can not see self-driving cars affecting my life in any notable way until the level of autonomy reaches 5. At that point, my daily life will be impacted primarily by the activities I perform in my car while travelling to and from my destinations.

Assuming a fully autonomous self-driving car is affordable for the average person, I would be able to sleep, eat or work at my own leisure while travelling to and from destinations. Assuming the laws allow autonomous vehicles to operate with no human presence inside the vehicle – I would no longer have to take public transport to locations in the inner city as I could use my own vehicle as a personal taxi, having it drop me off and self-park nearby while I attended to tasks. It could then be called to retrieve me and take me home later on.

A fully autonomous vehicle would also influence my relations with friends and family. Giving lifts to stranded friends would be easier than ever, especially during unfavourable times of day. Designated drivers would also no longer be necessary as a self-driving car could safely take you home regardless of your level of inebriation. My parents could use a fully autonomous vehicle to stay mobile when they are older and no longer able to operate a vehicle at an ideal level, safely giving them a method of transportation that they can use at their leisure.

## Conclusion

Self-Driving vehicles will fundamentally alter the way people see road travel. The potential impact that these vehicles have on society should not be underestimated, as current progress on autonomous technology makes achieving a high level of vehicular autonomy essentially inevitable. It is important that focus be put on laws created by people who understand the technology to ensure that safety standards for the operation of these vehicles be held in the highest regard.

# References

1. Self-Driving Cars Explained: How do self-driving cars work—and what do they mean for the future? (2018, February 21). Retrieved March 19, 2019, from <https://www.ucsusa.org/clean-vehicles/how-self-driving-cars-work> - No author was listed by the website.
2. Wadud, Z. (2019, March 19). Driverless cars: How you’ll use free time for work and rest – according to research. Retrieved March 19, 2019, from <https://theconversation.com/driverless-cars-how-youll-use-free-time-for-work-and-rest-according-to-research-113090> - Publish date is accurate.
3. Pollard, T. (2019, January 29). What are autonomous car levels? Levels 1 to 5 of driverless vehicle tech explained. Retrieved March 19, 2019, from <https://www.carmagazine.co.uk/car-news/tech/autonomous-car-levels-different-driverless-technology-levels-explained/>
4. Matthews, K. (2018, October 03). The Legal Implications of Driverless Cars. Retrieved March 19, 2019, from <https://www.lawtechnologytoday.org/2018/10/the-legal-implications-of-driverless-cars/>