Ethics in Autonomous Vehicles

========================

Liam Pearce

0530877

For decades, humanity has been trying to improve on past technologies, push past previous innovations all for one common goal, to better mankind in the future. From man creating the first fire to Alexander Graham Bell inventing the first practical telephone. Every innovation and invention in-between and beyond these was to improve the way we as humans live. Throughout the evolution of transportation, the modern day of 2016 allows us to enhance the practicality and technology of the automobile.

Beginning in the late 1800’s inventors such as Karl Benz from Germany and Henry Ford from Michigan began developing early models of the automobile. In today’s modern day and age, we relive those historic names within car companies such as Mercedes-Benz and Ford. If Henry Ford and Karl Benz were able to see what there companies have evolved into today, they would be blown away with the technology and innovations that go into their vehicles compared to their early models.

One of the newest and most brilliant pieces of technology that is on the horizon today is the production and testing of autonomous vehicles. Autonomous vehicles, or self-driving cars, are vehicles that are designed to driving to destinations without any interaction from the human driver [1].

Now companies Ford, Mercedes-Benz and even more are beginning to test and incorporate this technology to at least assist drivers in operating their vehicles in order to prevent human error and possibly tragedy. This is all to achieve that one common goal, to better humanity.

Every car manufacturer has taken its own approach on this technology, from GPS mapping, to radar sensors, to cameras, to software development to using all of the above [2]. Nowadays it is quite common to purchase a vehicle that has assisted braking, that will automatically apply the brakes if it senses you are trailing to close to the vehicle in front of you. Or a vehicle that beeps at you if you go to change lanes and it detects another vehicle hidden in your blind spot. Even vehicles that have the ability now to parallel park themselves if you’re not capable of doing so yourself seem to be the norm in new cars now. These are all examples of semi-autonomous vehicles, as they don’t have complete control over every single action and decision the car makes. The driver still has some responsibility in controlling the vehicle [3].

But some companies seem to have separated themselves from the pack a little bit and have advanced themselves to the point where they are already road-testing cars that can do all that and more for you, such as braking for a red light or a stop sign, yielding to oncoming traffic, and stopping when a child runs out into the road after their soccer ball. Even on a cold rainy day when you bring your family out for dinner, the car will drop you off at the front doors of the restaurant and find itself a parking spot, and then pick you back up whenever you are finished [4]. Both the American manufacturer Tesla, and the internet-related service company Google have stepped ahead of the competition and are that much closer to achieving the worlds first autonomous vehicle.

The all-electric manufacturer Tesla has created a system for there vehicles where they release software updates, much like an iPhone receives from Apple, that updates the car to include newer, better security and features. Two of the newest updates includes version 7.0 and 7.1 of Tesla’s fleet of cars [5]. These updates brought in two features that stunned the customers of these cars when they woke up the next day to find out there car was able to do these. The first feature called “Summon” allows the customer to call on the car through an app on their smartphone that calls on the car to come pick you up. The car will turn on, and drive to you. You can also exit the car and the car will drive off to park in a parking spot and shut off. This feature has a range of 40 feet. Although Tesla has big plans to allow you to be anywhere in the country and it will drive itself to meet you. It will even stop to charge itself along the way and it will sync up with you calendar to arrive exactly when you need it to [4].

The second feature takes advantage of and electric assisted braking system, radars, cameras, and 12 sensors positioned to sense 16 feet all around the car in every direction at all speeds. Taking advantage of these technologies, Tesla incorporated the Autopilot feature that allowed it to steer, change lanes, manage speed, and also controls the motors and brakes. It will also scan for a nearby parking space and alert you when one is available, to parallel park on command. What’s most intriguing about this update though is that every single individual Tesla offers real-time feedback to a database that updates every other Tesla in its fleet, so that the system is constantly learning and improving itself in different types on weather and road conditions. So if a Tesla takes a sharp turn a little too fast, it will send an update to the database that notifies every other Tesla that that corner is a sharp turn and to slow down [5].

There is no doubt that this is the newest and most advanced technology surrounding the automotive world, but there are so many questions we have to ask ourselves before we sit in the drivers seat of an autonomous vehicle. Do we really trust the vehicle to be making what may be a life or death situation for us in extreme circumstances? And is so, who will be held reliable is tragedy strikes? How much faith do we really have in technology?

One of the leading companies, Google having not made past-production vehicles, but has been testing these autonomous vehicles for well over 6 years now. They have outfitted Toyota’s, Lexus’, Audi’s and others, creating over 20 self-driving prototypes with built-in image sensors and cameras. These prototypes have recorded well over 1 million miles but have been in a reported 14 accidents on public roads, 11 of them were the result of being rear-ended by a distracted driver. Another accident was the results of a human driver taking the car off of self-driving mode in order to manually control the car while running an errand, a human error [6]. With that being said, many would say that statistic there is enough to prove that self-driving cars are already better than human drivers. Seeing how 12 of 14 accidents were the result of human error.

But that is everyday, typical driving. There are extreme situations where even humans don’t expect what’s coming.

Now there are already many upsides to autonomous vehicles that have already been calculated. Most of the advantages have to deal with saving money. There is a reported ~2,000 vehicular fatalities each year in Canada, most caused by human error [7].

Self-driving cars could reduce collisions by an estimated 90%, which would save $37.4 billion (roughly $1068/person) [7]. This is because autonomous vehicles are being technologically advanced to perform just as well as human drivers and eventually outperform human capabilities.

They could eliminate 5 billion hours Canadian spend behind the wheel each year, which would save $20 billion (roughly $571 and 143 driving hours/person). It could save $5 billion in congestion costs and an extra $2.6 billion in fuel costs ($217/person) [7]. With less car collisions causing traffic to back up, less time would be spent waiting in traffic leading to less congestion on the roads. As well with the autonomous vehicles being programmed to drive the speed posted on the road, less fuel would be consumed unnecessarily accelerating and braking. This would also positively impact environment sustainability.

In total, that would save every individual household roughly $2,700 and Canadians as a whole, $65 billion [7].

But with that, there are also many downsides to autonomous vehicles being put on the roads. Many factors of this include that costs could actually increase for owning an autonomous vehicle. As well there would be a huge loss of jobs if autonomous vehicles were the main source of transportation. Security would also have kept up-to-date with modern practices to prevent hackers from breaking into systems. Many federal and municipal laws would also have to change to accommodate autonomous vehicles and the service they would provide. Lastly, many social and ethical issues would arise, as they would now have to control the natural human behavior in all situations.

Earlier it was stated that autonomous vehicles could save $5 billion in congestion costs, and an extra $2.6 billion in fuel costs [7]. That would only be assuming that autonomous vehicles all worked together as a unit in order to bring down the traffic. As well, with households saving more money, allows households to spend more as well. The circumstance also exists that a household may now have more money to spend on the purchase of a new autonomous vehicle. This would then bring traffic and fuels costs back up as there are now more vehicles on the road than ever before [8].

A driving factor that would change the way humans looks at autonomous vehicles would be how they impact the economy in relation to the jobs that will be modified, lessened or even completely taken away. The possibility exists that public transport companies and cities would invest in autonomous vehicles to make the typical trips that city buses and taxicabs would take to and from each destination. This would take away all drivers from these companies as the city buses and taxicabs would be driven autonomously and would only need to be programmed to drive their designated routes. This would also greatly impact insurance companies as they rely on human error in order to profit. Without the element of human error, insurance companies would be forced to change their policies and cut jobs, as they would not be able to afford keeping employees when accidents on the road are at an all-time low. Post-service mail carriers and delivery service drivers such as UPS and FedEx would also have job on the line as there service can also easily be replaced by autonomous vehicles delivering good to destinations. In total, the possibility exists that millions of jobs will be at risk during the phase that introduces the autonomous vehicle [8][9].

With semi-autonomous vehicles already being put into effect on public roads, fully autonomous vehicles would have to face a whole new range of challenges that are well addressed well before they hit the roads. Flaws in security could lead not only to system crashes, but also hackers being able to fully take over the vehicular controls with everything from the GPS navigation, to steering, accelerating and braking [10]. Security in modern vehicles has already had to be enhanced (as seen with Jeep in the summer of 2015) with hackers being able to enter into their system and take over the steering column.

Consider years down the road when transportation companies have taken their drivers out of vehicles to cut costs on employment. If a hacker were to break into the networks of a truck or vehicle such as a FedEx truck, they could deactivate sensors and take control over the vehicle causing it to crash. They could also take full control over the truck and drive it to a remote destination stealing the contents of the vehicle and the vehicle itself. This could also threaten other lives on the roads. Companies would be able to assess risks and evaluate possible solutions for these risks well before they implement autonomous vehicles [10].

There are many features on autonomous vehicles that would be considers access points for hackers and if even one of these features is left vulnerable it could leave the entire vehicle, and its contents and even passengers inside at risk. Data and communications that flow between vehicle-to-vehicle, vehicle to mobile device and vehicle to company would also have to be protected, as it would also be at risk [10].

A possible way to protect passengers and data would be to incorporate a centralized token service. Hackers would now not only have to break the network, they would also have to compromise the token. Creating and implementing security for autonomous vehicles will be a very difficult task, seeing as smartphones and home computers are routinely hacked in modern day. Companies would have to collaborate in order to create proper security measures before autonomous vehicles go mainstream, because a hack into an autonomous company, may prove to be one of the deadliest yet [10].

Many federal, provincial and municipal laws would have to change as autonomous vehicles start rolling onto the streets. Since the vehicle is fully operating itself, theoretically you would not need any driving experience to sit in the driving seat of the vehicle. Recently, 4 U.S States have passed laws to allow autonomous vehicle to drive on their roads [11]. But what one state allows may vary entirely from what another state allows. This could lead to autonomous vehicle owners not travelling out of their state, as they may not be certified in another state, or autonomous vehicles are simply not allowed in another state.

It is important that all states stay on the same page and communicate together when enforcing and passing new laws as already, some states have enacted certain laws that are not allowed, or are modified in another state. For example Florida only allows drivers with a valid drivers license to operate an autonomous vehicle and original manufactures are not held responsible for accidents if the vehicle has been modified in any way (as seen with Google’s car).

Other states may change or modify these liabilities of autonomous vehicles as they see suit. This would be because autonomous vehicles would greatly impact the way people with disabilities getting around. If a man were blind this vehicle would do the driving for him so that he can get around town without having to rely on other people to bring him places or public transport.

\*social issues

\*ethical issues