**THE ETHICAL DILEMMA OF CRASHES IN SELF DRIVING CARS**

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**INTRODUCTION**

As driverless cars are becoming more developed, many questions have arisen surrounding their capabilities. Since the primary reason for the development of automated cars is for improved road safety, many ethical questions focus on the potential dangers of the cars. To understand the basis of these ethical questions, it is vital to know the key technologies behind the driverless cars.

**The Technology**

The core component of self-driving car technology is the use of sensor systems. Google’s cars, for instance, utilize many cameras, radar systems, and laser systems that work together to monitor and react to the surroundings of the vehicle. The cameras are separated to create a parallax that determines an object’s distance, working in a similar fashion to people’s eyes. The radar system monitor’s the movement of other cars and controls the gas and brakes accordingly. The most important sensor is located on top of the vehicle and is known as a LIDAR laser remote sensing system. Provided by Velodyne, this sensor has 64 laser beams and can rotate 360-degrees to operate in a range of 100 meters with extremely high accuracy [1]. When combined with the other sensors located around the vehicle, the software of the car can recognize and react to the road, cars, pedestrians, and hazards [2].

The Velodyne LIDAR system that Google utilizes in their cars has 64 laser beams. Essentially, the sensor works by emitting the beams, which will hit a surface and bounce back to the sensor that has receivers to measure the distance the lasers travelled. The 64-beam LIDAR system is composed of 4 groups of 16 laser emitters and 2 groups of 32 receivers and has the capability to spin at 900 RPM [3]. Since these emissions all occur while the system is rotating, the system is able to produce a very high quality image of the surroundings. Even a 32 beam LIDAR system at an auto show saw “not only other vehicles, buildings and signs, but also pedestrians on the sidewalks and even picked up cracks in the pavement and worn paint in crosswalks” [4]. This capability is a significant demonstration of the amazing technology of these sensors. However, this technology still has plenty of room to improve in areas such as the range or the number of beams, so they can register their surroundings more quickly and farther away. Despite the powerful capabilities of the sensor systems, most of the concerns from people question how effectively they can react in sudden or unexpected situations.

**THE SCENARIO**

I am currently employed at Google Inc. and working with the team for the driverless car. I am assigned the position of analyzing crashes and determining how the car should react in disastrous events. However, this presents an ethical dilemma for me, because I have to decide which reaction the car takes is the most moral.

For the first aspect of this scenario I must consider a situation that compares the lives of Google’s passengers to the lives of others. For instance, the automated car is driving along a road in the woods with severely limited vision around a turn. If another car comes speeding around the turn with broken brakes in the direction of the automated car, the driverless car has a moral decision to make in how it reacts. It could either swerve to avoid the collision or slow down to brace for impact. In the first option, although the automated car likely saves its own passengers, the reckless car could continue off the road resulting in a fatal collision with a tree. However, in the second option, the collision between the cars could keep both of the cars on the road but result in possible injuries for the automated car’s passengers [5]. This situation raises one very large ethical question for me of whether to value the lives of passengers for Google’s car more than others’.

For the second aspect of the scenario I must consider a situation that compares the lives of one person versus the lives of many. For example, Google’s car is heading into a 2-way single lane tunnel. If a child suddenly runs in front of the automated car, the car is faced with another moral decision. It could either try to slow down but still hit the child or swerve into oncoming traffic to avoid the child. In the first option, the child still gets hit, but the automated car does not risk the lives of others. Meanwhile, in the second option, the child is saved, but the automated car could risk the safety and lives of anyone in the other lane [6]. This situation raises the ethical question of whether one’s life is worth the lives of many others.

**Potential Effects**

The decision I make for these ethical situations could have a professional impact on the company, a financial impact on Google, and an impact on the technology of driverless cars.

For myself, making this decision is very tough since this ethical scenario will ultimately affect the lives of others or my own in the future. In my opinion, the decisions for this scenario should not rest solely on one man, since they can have a huge effect on the company. I think the second situation is an easier decision to make for the company. Although it is a shame for anyone to get injured, I believe that risking the lives of many people is not worth a singular person’s life. I think Google would also prefer only suffering damage to their own cars instead of others’. This point is also relevant to the first situation, where Google may not want to suffer damage to their own car. However, the fact that the fast driver could be saved could influence Google to sacrifice vehicle damages.

Financially, crashes can have a tremendous impact on the company. The LIDAR systems that Google currently uses on their cars can cost from $30,000 to $85,000 [7]. Although these automated cars are not ready for mass production, any damages that these cars receive would result in huge expenses for the company. Therefore, they might be influenced to make the decisions that avoid the worse collisions in each situation. For instance, the car will avoid the other vehicle in the first situation and it will hit the singular person in the second situation.

Since this is a new technology, its success can rely on how the public approves of the decisions the car makes in these scenarios. Even the slightest risk shown from the cars can cause a stir of panic among people, because the technology is new and involves people entrusting their lives with it. So, it is important for Google to conduct surveys or experiments to determine how a normal driver would react in these potential situations.

**EVALUATING THE SCENARIO**

One of the most important aspects to consider when evaluating the potential decisions for these situations is the code of ethics. For this scenario, the two most important code of ethics to consult are from the National Society of Professional Engineers (NSPE) and the American Society of Mechanical Engineers (ASME). Since the ultimate goal of implementing driverless cars onto modern roads is to improve the safety of them, safety should also be of utmost importance in the evaluation of these situations. Finally, I will also utilize additional resources to assist me in coming to a decision.

**Code of Ethics**

Codes of ethics for engineering societies are extremely valuable resources when it comes to making an ethical decision for these situations.

The code of ethics for the National Society of Professional Engineers (NSPE) is particularly influential since it mentions how engineering can have a direct impact on the quality of life for all people. This is especially true for this technology and scenario, because it can improve the safety of automobile transportation. The first and most important canon for this scenario from the NSPE is to “Hold paramount the safety, health, and welfare of the public” [8]. This point is especially vital to this scenario since it basically states that the safety of the public comes before all else. When considering this canon, my opinion towards the first option is heavily influenced to favor having Google’s car stop the other car from flying off the road. Hopefully this decision would save the lives of all people involved at the cost of some injuries. This canon from the NSPE also influences my decision for the second situation, because it essentially states that the safety of the public is more valuable than a singular life. So, I would not choose for the car to swerve into oncoming traffic with other vehicles.

For the most part, the code of ethics for the American Society of Mechanical Engineers (ASME) is very similar to that of the NSPE. However, the ASME also includes important fundamental principles for engineers to follow. One important principle for engineers is for them to strive “to increase the competence and prestige of the engineering profession” [9]. This principle is rather influential, because it makes me consider how my decisions will reflect on the engineering community, the company, and this technology. Therefore, my decisions in this scenario must accurately depict how this technology will achieve its goal of improving the safety of transportation for consumers of Google’s car. So, this principle partially influences me to choose the option in the first situation where the automated car swerves out of harm’s way, because it will demonstrate to the consumer’s how Google’s car will protect them. It also influences my decision for the option to have the car just slow down in the second situation, because people would not want a car that swerves into oncoming traffic since it would risk the passenger’s life.

**Safety**

An extremely vital factor in the decision making for this scenario is the safety of both the passengers and others, because it is such an important focus for the technology of driverless cars. To ensure the safety of passengers and pedestrians, Google has integrated several considerate features in their vehicles. For example, the car has a top speed of 25 mph, its front consists of a foam bumper and flexible windshield, and it provides seatbelts and an emergency braking system for the passengers [2]. These features mainly only influence my decision for the second situation, because they demonstrate that any collisions with pedestrians are much safer than with other vehicles. So, it would be more beneficial to just try to slow down in the second situation.

**Additional Sources**

There are many components that I have referenced to help influence my decisions for this scenario. The first source, from *Time.com*, titled “How to Make Driverless Cars Behave” is particularly influential for the first situation. The information is influential because it discusses how multiple injuries should, in most cases, be prioritized over a single death [5]. So, it makes me consider the option for the first situation where the automated car runs into the runaway car to save the lives of any passengers in that car at the cost of any injuries everyone involved might suffer.

The second source, from *PC Magazine*, titled “Who Should Be the Self-Driving Car’s Moral Compass?” is more influential for the second situation. The information provided form this article is influential because it includes a poll of what people would do if they were in the same situation. The results showed that 64 percent of people would continue to drive straight and slow down instead of swerve into traffic [6]. Since I should consider the opinions of the consumers, this information is heavily influential towards choosing the option of just slowing down in the second situation.

To further help form decisions regarding this scenario, I had a discussion with a friend of mine, Nicholas Hammond, on the busy street of Forbes Ave. I believe that being on the street and watching how hectic the cars could be was incredibly influential for my decision making process. It was influential for the first situation, because it made me realize that Google’s car should attempt to stop runaway vehicles since they could potentially hit pedestrians. The street was also influential for the second situation, because I realized that if a car swerved out of the way of one person, it could potentially hit others or cause a worse incident with other vehicles. The discussion I had with Nick was also very valuable. He was able to further emphasis the value of human life over simple injuries [10]. So, the discussion was influential for the first situation in that it would be more ethical to save the runaway car. It was also influential for the second situation, because the lives of many are worth more than almost any singular life.

**ETHICAL RECOMMENDATIONS**

For any other engineers that are faced with making an ethical decision, there are many factors to consider. One of the most useful pieces of information to utilize is the code of ethics of engineering societies. These codes can be incredibly helpful for realizing what is most important in a scenario. In most cases, the safety and well-being of the public should come before anything else. So, it is wise to remember that almost all human life is extremely valuable and most sacrifices are worth taking to keep it.

**CONCLUSION**

Overall, I would choose to save the life of the runaway car in the first situation and sacrifice injuring the singular person to keep others safe in the second situation. I believe that saving the runaway car in the first situation is better, because saving the lives of anyone in that car would be worth any injuries Google’s car or passengers might suffer. I also believe that although the singular person may get injured or killed, the lives of many others are much more valuable. The most important factors in making this ethical decision is the consideration of how valuable all lives are and how it is the ethical duty of engineers to protect the safety of the public. Although these decisions may not be the best financially, considering how expensive the sensors are, they are ultimately more ethical. Therefore, I firmly believe the ethical decisions I have made regarding the automated cars are the best for the company and the public.

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**ADDITONAL RESOURCES**

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“Ethics Cases.” *Texas Tech University.* Texas Tech University. (2014). (website) <http://www.depts.ttu.edu/murdoughcenter/products/cases.php>

“Public Health and Safety – Delay in Addressing Fire Code Violations.” *National Society of Professional Engineers*. National Society of Professional Engineers. (2014). (website) <http://www.nspe.org/sites/default/files/BER%20Case%20No%2013-11-FINAL.pdf>

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