Ethical Issues Regarding Autonomous Vehicles

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***Abstract*— As the advancements in autonomous vehicles progress, there have been discussion relating to the ethics of them. Who should be held responsible for accidents caused by autonomous vehicles? Should corporations be held accountable if their vehicles are involved in a crash or should it be the passenger's responsibility to keep an eye on the road? While we continue to advance in technology allowing autonomous vehicles to become closer to being on the roads, we believe that there is also a responsibility for society to discuss future ethical issues that may arise.**

I. INTRODUCTION

In the late 19th century, the introduction of automobiles led to a significant technological revolution across the world. These automobiles would become an integral part of many people's everyday lives being the main source of transportation. As with all technologies, automobiles became more advanced as time went on, adding features such as assisted parking and cruise control, making them safer and more convenient. Another example of advancements being made would be making vehicles more autonomous. Currently, there are many research projects focusing on making vehicles fully autonomous, and this will eventually lead to another technological revolution. As we stand on the cusp of this revolution, many questions have arisen regarding the ethics of autonomous vehicles [1].

II. RELATED WORK

A. Forced-Choice Algorithms

Autonomous vehicles may be put in situations where they must balance two very difficult situations, introducing problems of forced-choice algorithms. Janet Fleetwood states "Autonomous vehicles present classic ethical conflicts" referring to the balance of an individual's and community's interest. The individual's interest would be that the vehicle's passenger would arrive at the target destination quickly and safely, while the community's interest would be that the roads are safe for all drivers, vehicles, bikers, and pedestrians [1]. There are times when drivers would need to disobey the traffic laws in order to keep others safe, such as when drivers would cross the double yellow line into the lane for oncoming traffic in order to avoid a road cyclist on the side of the road. Technically speaking, the driver has disobeyed the law, but from an ethical standpoint, that may have been the correct decision for the driver to take. They prevented hitting and injuring the cyclist by breaking the law, but the question arises whether an autonomous vehicle could make this split second decision. If they are programmed to strictly follow the traffic laws, the vehicle would just stay in the same lane, and potentially hit and injure the cyclist, however, this is not the ultimate outcome that many people would want. Fleetwood refers to a research scientist at the University of Virginia Transportation Research Council who stated that autonomous vehicles must decide which action to take quickly with incomplete information using ethics that the programmers had coded into the program. However, they also state that the public does not expect "superhuman wisdom" but more of an action and decision that indicates it was thought out and defensible [1]. This would mean that autonomous vehicles would not be held to making the "perfect" decision every time, as there are no true answers to ethics, but as long as the decision has enough reasoning and consistency behind it, the public should accept the decision. However, if an accident does occur, there is still a question of who should be held responsible for it. Is it the makers of the vehicles or the owner of the vehicle? Or is there no party to give fault to? Fleetwood states that we must consider some method of providing legal protection for the decisions these vehicles make. Discussions have arisen regarding whether or not manufacturers should take into account a risk ratio into the forced-choice algorithm. There is a high possibility, however, that manufacturers would not want to implement this risk ratio into their forced-choice functions. Passengers of these vehicles would most likely expect that the vehicle they were in would prioritize their lives over other vehicles or pedestrians, while in reality this risk ratio would make it so that based off of analysis of the situation, the vehicle would prioritize other vehicles and bystanders' lives over the passengers. This would cause the consumer acceptance rate to plummet, which would not be ideal [1].

B. Abuse and Misuse of Autonomous Vehicles

Apart from forced-choice algorithms, another ethical dilemma that may arise has to deal with the abuse and misuse of these autonomous vehicles. The big question here is how susceptible these autonomous vehicles would be to hacking. Patrick Lin notes how almost every computing device that has been created has been hacked successfully, and if this is applied to autonomous vehicles as well, this could cause a huge problem [2]. If these vehicles are very susceptible to hacking, then the hackers could do major damage by causing accidents, leading to a potentially huge number of human lives lost. If a scenario does arise where autonomous vehicles are indeed very easy to hack, what should the vehicle do? Should it shut down and stay at the scene of the crime or go to the police to report the incident? There is not a clear answer to this question as of now, but it is definitely one

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worth keeping an eye on, as the more advanced and closer we get to fully autonomous vehicles, these issues become more and more important.

C. Responsibilities of Accidents

Finally, the question of who is held responsible for crashes involving autonomous vehicles is very crucial. There are people who believe that the manufacturers should be held responsible for any crash caused by the vehicle. Alexander Hevelke and Julian Nida-Rümelin refer to Marchant and Lindor's statement that if the main responsibility of crashes were on the manufacturers, this liability burden could prohibit future development regarding these vehicles [3]. However, this is not what we are looking for when assigning manufacturers the responsibility of crashes caused by their vehicles, as we would still like to see innovation and advancements made. This brings upon the question of if partial liability could be designed so that manufacturers are still held liable in some aspect, but they would not be burdened and worried too much about the potential consequences to the extreme where they will stop innovation. The answer to this question remains unknown, although it seems like some kind of partial liability law could be established, but this, Hevelke and Nida-Rümelin state, is a discussion that an ethical analysis would not solve, so we will close this question here [3].

The other side of the argument would be that users of the autonomous vehicles should be held responsible for the accidents that occur, which Hevelke and Nida-Rümelin state as duty to intervene [3]. The argument can be made that the users should have the duty to pay attention to the road and surrounding traffic in order to make a decision to intervene in a situation when necessary. Thus, with this argument, the users of the vehicle would be held liable for not closely paying attention to the road and traffic. However, this would then make the utility of autonomous vehicles almost useless. The whole appeal of an autonomous vehicle is making travel more comfortable and less stressful for human drivers, but requiring users of these vehicles to still have a duty to pay attention to their surroundings would contradict what the vehicles were made to do. An alternative approach to still keeping the user of the vehicle liable for accidents, but not requiring them to keep an eye on the road for every second they are on the road is that the users would be held morally responsible for deciding to take the risk of using the vehicle, which Hevelke and Nide-Rümelin state as responsibility of the driver as a form of a "strict liability" [3]. It is natural that the more vehicles are used, the higher the chances of an accident occurring. Adding onto that, the user of the autonomous vehicles must have made a choice in order to take the vehicle, so they took into consideration that the action of taking the vehicle would heighten the potential of accidents happening, hence they would be liable for any accidents that would occur. The issue with this approach would be that there is a sense of luck involved. Two users of the same model of an autonomous vehicle could both decide to take their vehicles on a ride around town, but one user gets into an accident. As they were both using the same model, we can assume that the safety qualities of each vehicle were the same, and there were no major flaws within the two programs as well. However, one user was just purely unlucky to get into an accident. Is it morally correct to hold that user liable for the unlucky chance that their vehicle had made the wrong decision and got involved in an accident? Hevelke and Nida-Rümelin explore a Nagelian example in which they determine that according to Nagel, bad luck is only morally irrelevant if the driver/user of the vehicle is completely without fault [3]. The driver is never truly without fault as they decided to take the risk of taking the vehicle knowing the potential outcomes of an accident occurring as mentioned previously. This would mean that from a Nagelian standpoint, luck is irrelevant to the ethical consideration of the user being held liable for accidents that occur, making both duty to intervene and responsibility of the driver as a form of a "strict liability" both viable options in regards to who should be held responsible for accidents involving autonomous vehicles.

III. Conclusion

There are still many uncertainties surround the ethics of autonomous vehicles. As the technology continues to develop, it should be in the public's best interest that more discussions regarding the ethical scenarios and laws of autonomous vehicles are brought up. We are on a cusp of a technological revolution, and our ethical laws should also change with the changing times.

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