Self-Driving Cars Ethical Discussion

Mohamed Hesham Sayed
Computer Engineering Department
College of Engineering and Petroleum
Kuwait University, Kuwait
2181155650
mohamed.sayed@eng.ku.edu.kw

Yessin Nader Serrid
Computer Engineering Department
College of Engineering and Petroleum
Kuwait University, Kuwait
2181156439
Yassine.serrid@eng.ku.edu.kw

***Abstract*- Self-driving cars, powered by advanced artificial intelligence (AI) and machine learning (ML), offer potential benefits such as energy efficiency and accessibility for elderly and disabled individuals. However, they also raise profound ethical questions, including accountability in the event of accidents and decision-making in high-stakes situations. This paper discusses the challenges associated with the implementation of autonomous cars, focusing on the development of an ethical system for decision-making. Several ethical theories such as utilitarianism, Kant's formulations, and the social contract theory are explored to analyze the acceptability of self-driving cars. Additionally, the paper highlights the necessity of improving infrastructure for safe operation of these vehicles, and public perception of this emergent technology. Through a survey, we collected views on trust in AI, potential blame assignment in case of accidents, and the environmental impact of self-driving cars. Our study concludes that although autonomous cars promise significant advantages, their deployment is not yet feasible due to ethical and technical limitations.**

Keywords—Ethics; Self-driving car; Artificial intelligence ; Machine learing;

I. INTRODUCTION

Self-driving cars, also known as driverless cars or autonomous cars, are navigated by autopilot systems and high-end sensors without any need for human interaction. Self-driving cars are connected using the manufacturer cloud and intelligent transport systems (ITS), the internet of things (IoT), and smart systems [1]. These systems help the self-driving car to collect data from the car itself and data coming from the outside environment, such as weather and traffic status. There are a lot of Asian countries that are contributing in the field of manufacturing driverless cars such as China, Korea, Japan, and Singapore and they are also building sites to test and evaluate driverless cars [2]. There are also a lot of positive things that we could mention about self-driving cars as they will help in reducing gas consumption and they will help people of old age and disabilities so they could get out and move around more often. Self-driving cars brought up a lot of ethical questions. For example, if the car gets involved in an accident, who is to blame; is it the car user, the manufacturer, or the idea of self-driving cars itself? However, self-driving vehicles will need an ethical system to be able to make decisions on the road. There are a lot of laws that the self-driving car ethical system can follow such as utilitarianism or principlism or Asimov's, as illustrated in "A Construction Manual for Robots' Ethical Systems" which was published in 2015. There was also another suggestion: when developing the driverless car ethical system, they could use a random number generator so that it would make fair decisions. Another suggestion was to give the driver a choice before starting the car where he/she would have to choose whether his/her life is more valuable than someone else's life. There is a big difference between a decision of a human driver and a driverless car, if a human took a wrong decision, he/she could be forgiven because a human could be stressed or could have a medical condition which made him/her take a wrong decision but if a software program took that wrong decision there is no way to make an excuse for that system [3].

Figure 1. Shows the self-driving car autopilot system

II. ABOUT SELF-DRIVING CARS

As mentioned in the introduction self-driving cars are vehicles that can drive by themselves with the help of an artificial intelligence system. Artificial intelligence is very important for the support and development of many industries nowadays [6]. self-driving cars are considered one of the most complex robotic systems and this will require a whole new level of machine learning [7]. There will be many challenges facing the idea of a self-driving car that will be discussed in section III.

III. THE PROBLEM

As mentioned above that self-driving cars are fully controlled by a computer program. Before a self-driving car starts its trip on the road, the program must consider every possible scenario that could happen on the road and the system must have a decision setup for every accident that could

happen, and those decisions must be set based on the basic moral rules that all humans should be aware of. One of the problems that faces self-driving cars is that they must decide whether it should protect the safety of the property or the safety of the people. For example, if a bike rider is wearing a helmet but another bike rider is not wearing a helmet, if the self-driving car has to make a choice to hit one of the bikers, it will choose to hit the one wearing the helmet, so that can minimize the percentage of an injury or death occurring, but from the traffic law point of view, the biker wearing the helmet is the one who is following the rules. This was an example of a problem that would face us if self-driving cars were on the roads, there are drivers who are following the law could get hurt because of a decision that a self-driving car made, so others will have to pay for a mistake they had nothing to do with it and other people could take advantage of those loopholes in the system to commit crimes. In October 2015, Volvo company declared that they will be responsible for any accidents or damage was done by their self-driving car, this means that people who own this car could do harmful things and not be held responsible for what happened [8].

One of the issues facing the developers of self-driving cars is that some of the roads are in a bad condition which will cause a problem for the self-driving car sensors to detect the obstacles that it might face, there are also some roads that have unmarked lanes which will cause a problem where the cameras of the self-driving car will not be able to center the car on the correct lane.

Unfortunately, we can't expect self-driving cars to share the road with cars that are being driven by humans as they will not get along because self-driving cars can't communicate with traditional cars that are driven by humans and that can cause accidents as humans and self-driving cars system make different decisions when there is a risk of an accident occurring [9].

A. *The utilitarian rule*

The Act Utilitarian theory declares that we should calculate the total happiness or benefit from a certain situation and calculate the total damage or loss that happened and if the total benefit exceeds the damage that happened this means that the action is acceptable. So according to the self-driving topic if we try to analyze the benefit and the harm that could be done by a self-driving car we will see that a self-driving car could make more harm than it can benefit us, for example, let's say a self-driving car sensor is disabled and caused the death of someone, of course, we can't blame a computer system for that, so that person who died just died due to a malfunction, so according to the utilitarian theorem the idea of self-driving being on the road is unacceptable.

B. *Kant's first and second formulations*

The Kantian theorem only focuses on the action that is resulted from goodwill and considers the consequences irrelevant. So, if we apply this theorem on the topic of the self-driving car, we will find that according to the Kantian theorem the self-driving car is acceptable as it was developed to keep people safe on the road and to minimize the percentage of harm and death.

C. Social contract Theory

The social contract theory focuses on benefiting society by some rules that constrain the behavior of individuals. If we apply the social contract theory on the topic of self-driving cars, we will find that it is acceptable from the perspective of the social contract theorem as it tends to benefit society [10].

IV. THE SOLUTION

Self-driving car's ethical issues can be solved from three-point of view: the consciousness of the public, the distribution of responsibility, and the making of laws. The consciousness level is concerned with teaching morality, and this is one of the most important solutions but it's also the slowest as it might take time to teach an artificial intelligence system moral by using machine learning. The distribution of responsibility considers both aspects legal and ethical. Responsibilities that are related to small matters could be resolved by ethics, but responsibilities that are considered complex and difficult to judge are handled by the law. Consumers and manufacturers are the two primary issues at the legislative level. When morality is unable to be resolved, the law is invoked. It is important to explain the distribution of responsibility between them while creating laws. Manufacturers should play a larger part in the development of self-driving cars; thus, a market access concept must be established [8].

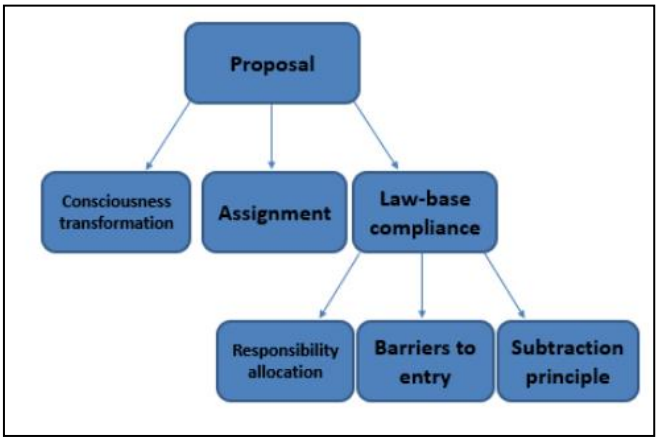

Figure 2. Ethical problem solution scheme

V. RESULTS AND DISCUSIION

Self-driving cars can be very helpful for the public if it was designed in a correct way where it does not have to make choices on the road that would put people in danger without any reason. The computer used to control and make decisions for a self-driving car needs to follow moral codes that both the public and law agree on so that if an accident occurred there would be a reference to judge by. As we discussed earlier that we must make better roads for self-driving cars so that the system can work properly on the road. For a self-driving car to be fully functional it needs to be equipped with a visual perception system. It consists of sensors like LADARs, RADARs, and LiDAR's which gives the system the ability to

collect data from the environment surrounding it. The data collect is used to perform some tasks as detecting obstacles, avoiding harmful objects on the road, and navigating. One more essential thing that a self-driving car should have is a system that consists of multiple cameras instead of a single camera system because having a system that consists of multiple cameras is better in collecting data than a system consisting of a single camera where having a single camera system can cause a lack in the data collection [11]. We can say that self-driving cars would be a great addition to our future but not right now because there were multiple reports recorded stating that some of the self-driving cars that are on our roads right now caused crashes that were fatal and that means that self-driving cars are not yet ready to be on the roads. It is recommended that the best way to test the software of the self-driving car is by recreating crashes in the form of simulation and to see how the system would react in this situation. Car crashes scenarios can be collected from police reports or from an online source [12].

Data analysis was made to see how the public will react to the idea of having a self-driving car and the results were as follows: it was found that 31% of the public were excited about the idea, 13% were worried, 31% are not encouraged at all and 27% of the public do not really care about the matter. Most of the respondents stated that the most important thing that they are looking for in a self-driving car that it is going to be easy to use and safe [13].

VI. The survey

We started the survey by asking the participants about their gender, then we asked them about their age, and then we asked them if they have ever heard about the topic or if they have any idea about it, after that we asked them if they had any kind of experience with an autonomous car, we also asked them if they think it's a good idea for self-driving cars to be on the road, then we asked them if they would be able to trust an artificial intelligence system to make decisions instead of you. We also asked them if a self-driving car was involved in an accident whom would they blame, would they blame the manufacturer or would they blame the passenger onboard of the self-driving car, and finally we asked them if they think self-driving cars would have a positive impact on the environment as it uses rechargeable batteries to operate.

VII. Survey results

From the results of the survey, it was found that 60% of the participants are females and 40% are males, 78% of the participants were in the range of age 19-24 and the rest were in the range of 23-34, it was also found that 80% of the participants have heard of the self-driving cars. It was found that 0% have been on board a self-driving car. 67% of the participants think that self-driving cars are not safe to be on the road, 33% of the participants think it's a good idea to trust an artificial intelligence system to make decisions on the road instead of them, 88.5% of the participants declared that if a self-driving car caused an accident, they would blame the manufacturer of the car, 78.5% of the participants think that self-driving cars will have a positive impact on the environment because it operates on rechargeable batteries.

VIII. Conclusion

As it was discussed earlier self-driving cars can be very helpful in a lot of ways as helping blind people or people with disabilities to move around easily and they can also be used to transport and drive kids to school so that the parents do not have to worry about dropping their kids to school before going to work. We can conclude from our research about this topic that self-driving cars are not yet ready to be on the road because the system is lacking a lot of features as the algorithm the system uses to make decisions, the system must follow a moral code so that everyone is satisfied and of course it should be accepted by the government. Finally, we can say that self-driving cars can be a great thing soon.

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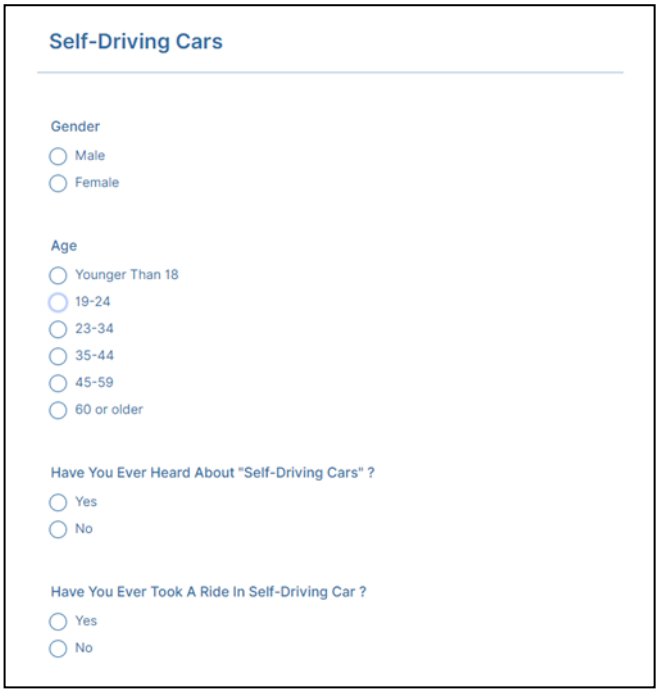
Survey



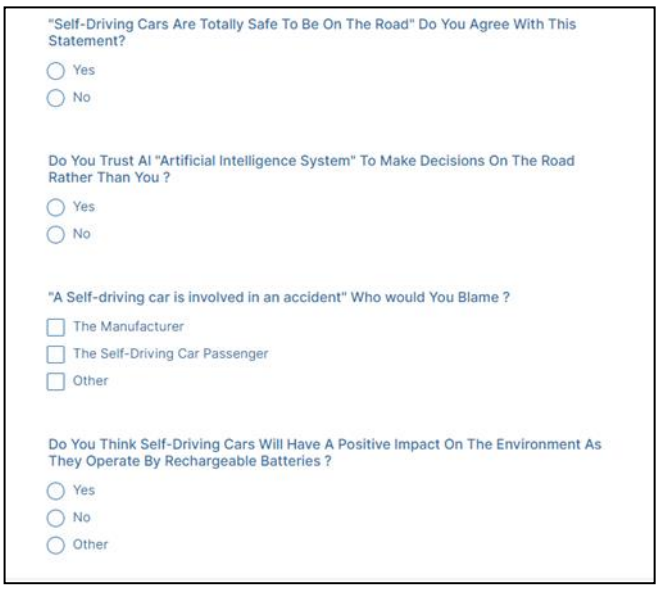
Self-Driving Cars

Gender
- Male
- Female

Age
- Younger Than 18
- 19-24
- 23-34
- 35-44
- 45-59
- 60 or older

Have You Ever Heard About "Self-Driving Cars" ?
- Yes
- No

Have You Ever Took A Ride In Self-Driving Car ?
- Yes
- No



"Self-Driving Cars Are Totally Safe To Be On The Road" Do You Agree With This Statement?
- Yes
- No

Do You Trust AI "Artificial Intelligence System" To Make Decisions On The Road Rather Than You ?
- Yes
- No

"A Self-driving car is involved in an accident" Who would You Blame ?
- [ ] The Manufacturer
- [ ] The Self-Driving Car Passenger
- [ ] Other

Do You Think Self-Driving Cars Will Have A Positive Impact On The Environment As They Operate By Rechargeable Batteries ?
- Yes
- No
- Other