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IT-104-002
10/1/2018

Research Paper: Self-Driving Cars

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**Introduction**

A self-driving car (autonomous vehicle) is a car that does not require a human operator, but rely mostly on sensors and artificial intelligence to operate itself. The car is able to sense its surroundings using technology such as radar, laser, and computer vision. According to science 101, “self-driving cars throw out electromagnetic waves in the form of radio waves and laser beams, and they also emit sounds and record the reaction of the sound waves off of objects. Using radio waves is known as RADAR (RAdio Detection and Ranging), using laser beams is known as LIDAR (Laser Illumination Detection and Ranging), and using sound waves is known as SONAR (Sound Navigation and Ranging)” (Robertson, 73). Each of these features work on different aspects. For example, laser lights reflect objects in the car’s surroundings and also help the car realize the size and shape of the objects. RADAR and SONAR help measure the distance and speed between the car and the objects, which laser might miss sometimes (Robertson, 74).

Other features include controlling the acceleration and direction of the car.

With this complicated technology comes complicated issues. Self-driving cars should operate like a human driver, being alert and always accurate to avoid devastating consequences. However, existing autonomous cars are not fully developed. The cars not only need more technical development, but also face ethical and legal challenges that needs to be addressed. This paper will discuss the topic of self-driving cars, and will analyze its security, legal, social, and ethical issues.

**Background**

According to an article called “History of autonomous car” by Bonnie Gringer, the idea of self-driving cars dates back to 1939 in New York Word’s fair exhibit where it was first mentioned. The fair even showed automated highways system where autonomous cars can be
driven on. However, this vision is still in progress today as cars are still adapting new autonomous features, but are not fully autonomous. According to the Union of Concerned Scientists, there are no fully-autonomous vehicles operating in the United States (ucsusa, 2018). Nonetheless, many companies have adapted the use of partially autonomous features such as assisted parking and lane features. This technology is still considered new, however, it is expected that it will change the world future transportation system.

**Potential Benefits**

Self-driving cars can be beneficial in many aspects. With the advancement of this technology, it is expected that self-driving cars will improve road safety as accidents due to human errors, such as impaired driving, would decrease. Road capacity is also expected to extremely increase as self-driving cars move in unison which reduce traffic jam. Researchers describes this movement as “platooning” as cars move closely together creating an aerodynamic savings (USA Today, para. 4).

According to the article, “Driverless Cars May Increase Road Reliance,” self driving cars will increase traffic flow and decrease accidents. This, however, all depends on people’s relationship with their own cars and how they choose to operate them. For example, if people are more likely to go out because they do not have to drive, more cars would be on the road. Furthermore, self-driving cars is expected to consume less energy proving to be environmentally friendly (USA Today, para. 1). Other beneficial options include charging the cars electronically rather than pumping them with gas which has a huge impact on the environment.

**Legal and Ethical Issues**

Self-driving cars promise to be safer than regular cars, but they are not guaranteed to be 100% safe. Before lunching any fully-autonomous car, researchers have to program it to be able
to avoid or realize potential accidents. When a regular car gets involved in an accident, the driver/s are usually responsible for that crash. This is not the case with self-driving cars as it is difficult to figure out who is responsible if a crash would to occur. Many manufacturing companies promise to take full responsibility of accidents caused by self-driving cars once they are fully developed and sent to the market (Lohmann, p. 1). For powerful companies, such as Audi and Volvo, to say this indicates that they expect self-driving cars to be extremely safe once they are available to the public.

Nonetheless, many other companies are being hesitant in acknowledging that they would take full responsibility in case of accidents, injuries, or death. Such companies include Tesla which already offers semiautonomous cars. Tesla argues that, even though they believe their cars are already safer than other vehicles, they responsibility of a future accidents involving one of their self-driving cars would be on the owner themselves (Lohmann, p.2). These debates raise the question of whether any human being should be responsible for such occurrence as self-driving cars are being adapted to society. Lohmann argues that this issue should be looked at as the role the owner plays owning such car, and not by the immediate actions of the owner (Lohmann, p. 3). Regardless of how it should be, there are no doubts that self-driving cars would bring their own ethical and legal systems.

**Security Concerns**

One of the major obstacles facing self-driving cars is non other than hackers. Due to the fact that autonomous cars use many artificial intelligence features, the possibility of it being hacked is a critical issue. The vulnerability of these cars is propose many security threats, and protecting them from cybersecurity attacks is a public safety concern. For example, researchers at University of South Carolina and Chinese security firm from Qihoo 360 revealed that they
were able to block various Tesla sensors which resulted in objects being invisible to its navigation system (MIT Technology Review, 2017, para. 8). This is a serious issue that can result in fatal consequences. Although the use of self driving cars could reduce the amounts of accidents due to human errors, the concern of cybersecurity attacks has always been a major issue. The hacking of autonomous cars could result in a great public safety dilemma. Cybersecurity attacks is currently one of the main problems concerning self-driving cars.

According to an article called, “Google, Baidu, Tesla Gunning Self-Driving Car Development” by the Investor’s Business Daily magazine, “By 2035 -- about the time today's toddlers will be out of college and in the car market -- sales of fully autonomous vehicles will comprise 9.8% of the global market for new light vehicle sales, or about a $38 billion market for autonomous-vehicle features, according to BCG.” (Chandler et al, para. 2). As this industry grows in the future, security concerns should be resolved as soon as possible.

**Social Problems**

With self driving cars being a very attractive alternative transportation system for future drivers, the popularity it might attract could cause an opposite reaction and reduce its efficiency. As drivers use the time of them driving in other activities such as answering phone calls, conducting meetings in their cars and simply just relaxing until they reach their destination, people are expected to drive more and increase their time on the road. The results would be more traffic jam, and additional environmental impact. These issues are mainly associated with how society would react to such technology and how they choose to acknowledge the negatives and take responsibility as they increase their commute time.

Moreover, people who are unable to drive, such as people with disabilities and older adults, will have access to personal transportation with self-driving cars, and that could result in
decrease road capacity. Increased road traffic would be an inverse reaction to what it has been promised from these cars, and would potentially increase accidents. These issues and changes should be well understood as researchers decide on taking further steps. Nonetheless, it does not seem that social issue such as the previous example will be a determining factor in terms of developing self-driving cars.

**Further Required Research**

The production and development of autonomous cars has accelerated tremendously and rapidly over the past eight or ten years. Nonetheless, the issues surrounding these vehicles needs to be addressed before sending them to society. Further research needs to be conducted regarding the security of the self-driving cars, the negative social impact it might present, and the safety of its features. The ethical and legal responsibilities concerning self-driving cars also needs to be determined and research before implementation.

**Conclusion**

Regardless of the negative aspects, self-driving cars are believed to be the future of driving. The cars would be able to operate under any conditions without the help of a driver. The car would provide many benefits to the current transportation system, including the increase of road capacity and the use of efficient energy which will help the environment. Nonetheless, technology barriers have to be resolved, and regulation has to be set very clearly for these types of cars. Reviewing the ethical problems related to self-driving cars is also essential and the use of an ethical guide could help with designing the cars and minimizing future problems. The factors determining a crash including the way the other car is heading and environmental conditions should also be taking into consideration when designing self-driving cars. Nonetheless, such cars will sure present an exciting future.
The merge of self-driving cars rises numerous concerns about the safety of the future transportation systems. In order to fully understand how autonomous cars work, people needs to understand how regular cars work. In regular cars the driver needs to see its surroundings and needs to know the location of other objects around the car. Self-driving cars have to be able to do the same through special technology. Self-driving cars emits electromagnetic wave and laser beams in order to recognize its surrounding and not have to rely on a human driver. The article looks on how the car works in such details.


Self-driving cars are not completely safe, but it does promise to be much safer than regular cars. With that being said, who would hold responsibility in case of a crash involving this types of cars are an ethical issue. This articles looks into the responsibility gaps and draw lessons from the legal literature of self-driving cars. The article suggest that the ethical dilemma should be looked at in terms of human-robot relationship and not by the immediate actions of the owner. The article also discusses whether the safety of the self-driving cars is going to increase it’s use or encourage the manufacturing of safer regular cars.

Wolkenstein, A. (2018). What has the trolley dilemma ever done for us (and what will it do in the future)? on some recent debates about the ethics of self-driving cars. *Ethics and*
Self-driving cars are facing many technological and ethical issues that needs to be addressed before lunching them into the streets. There have been extensive efforts to look into the ethics of autonomous vehicles. The debates presented in the article covers the issues of privacy, data protection, and responsibility issues. The article discusses the subject of “Crash-optimization algorithm” which discusses how the car should react in case of an inevitable crash. An example of this is whether the car should crash into 5 people on the right, or change to the left and crash into one person instead.


This article discusses the civil liability issues regarding self-driving cars. They look into the manufacturing liability for defect products. It suggests that future accidents would be caused by a system malfunction rather than human error. The article argues that responsibility should placed on manufacturers to result in “adequate allocation of liability”. In order to avoid liability, the manufacturers would have to achieve high safety standards before selling self-driving cars.


Currently, the United States does not have any legally operating self-driving cars.

Nonetheless, autonomous features are becoming more popular and its popularity is expected
to change future transportation systems. This article discuss how self-driving cars operate and what impacts they present. It talks in details about the environmental, equity, and safety issues regarding self-driving cars. It also discusses how the benefits of self-driving cars on how they would increase shared rides.


The article discusses the development of self-driving cars and analyze their progress. The difference between partially autonomous cars and fully autonomous is that partially autonomous cars allow the drivers to intervene when needed. Self-driving cars are looked at as whether they are “connected” meaning if they communicate with other cars and objects on the road. Safety is the major concern when developing vehicles as many people die in car accidents each year. The article finally looks at the business aspect and present companies’ views on the topic.


The article looks at the fast development of self-driving cars. Cars with partially autonomous features are expected to be the most used cars in ten years. Fully self-driving cars would be next in popularity as people are adapting to the autonomous technology. This, however, is faced with many obstacles including financial challenges which slows down their development. The article discusses the concerns lawmakers presented at a senate hearing.