

**Steering Safety:**

**The Role of Autonomous Vehicles in Reducing Human Errors and Transforming Transportation**

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# INTRODUCTION

## *Introduction to the topic*

Every day, good people die due to motor vehicle accidents. Children are left with no parents. A family loses loved ones and must learn to cope with the devastating loss. This takes place because of fatal crashes, and many of them are due to human errors (Background). Thousands of Americans die on the roads each year (The Deadly Myth That Human Error Causes Most Car Crashes). Many of these accidents are the results of human errors. For instance, excessive speeding, tailgating, texting while driving, distraction, and inattentiveness all contribute to these fatal disasters (Crashes are no accident). Is there a way to prevent vehicle accidents due to human errors? Automakers such as Tesla, Pony.ai, Waymo, Apple, Kia-Hyundai, Ford, Audi, and Huawei are designing vehicles that can operate on their own that could reduce human errors on the roads (Top Self Driving Car Companies In 2022). This may be the key factor needed to prevent tragic fatal car accidents.

## *History of the topic within society including ethical issues*

In 1869, Midland, Irish, the first recorded fatal automobile accident occurred to Mary Ward after she fell from the steam carriage and died afterward because of the injuries from the iron wheels (The world's first automobile fatality). The trend of fatal accidents continues until this day. In 2020, The U.S Department of Transportation's National Highway Traffic Safety Administration estimated 38,860 people died in motor vehicle accidents (2020 Fatality Data Show Increased Traffic Fatalities During Pandemic). Dr. Steven Cliff (2020), NHTSA's Acting Administrator made this statement during that time, "Safety is the top priority for the U.S. Department of Transportation. Loss of life is unacceptable on our nation's roadways, and everyone has a role to play in ensuring that they are safe. We intend to use all available tools to reverse these trends and reduce traffic fatalities and injuries... The President's American Jobs Plan would provide an additional \$19 billion in vital funding to improve road safety for all users, including people walking and biking. It will

increase funding for existing safety programs and allow for the creation of new ones, with a goal of saving lives”. As promising as this may sound, from January through September 2021 an estimated 31,720 people died in motor vehicle accidents, an increase of approximately 12% from the 28,325 fatalities estimated for the first nine months of 2020 (NHTSA Data Estimates Indicate Traffic Fatalities Continued to Rise at Record Pace in First Nine Months of 2021). Is it possible to truly reduce this horrific trend that continues to haunt mankind?

Autonomous vehicles, better known to others as driverless cars, were first created at the 1939 World’s Fair by General Motors (History of Autonomous Cars, 2022). Since then, there has been on going innovation. By 1984, the Carnegie Mellon University Navlab group had built vehicles such as cars, vans, SUVs, and buses that were controlled by computers (Navlab: The Carnegie Mellon University Navigation Laboratory, 2022). Today, Tesla, one of the well-known vehicle manufacturers, is creating autonomous vehicles packed with advanced hardware that provides full self-driving capabilities (Future of Driving, 2022).

Questions may arise as driverless vehicles go into the market. Some may question whether autonomous vehicles will reduce death tolls and car collisions. More than just reducing death tolls and car collisions, autonomous vehicles will reduce the social and economic cost of caring for the victims of these accidents (World Health Organization, 2015). When this takes place, the government will have strong ethical, public policy, and economic reasons to invest in driverless vehicles as accidents decrease (Sparrow, R., & Howard, M., 2017). Others may question if a human driver’s total reliance on technology to operator the vehicle while taking their eyes off the road is safe or not. They may even argue that people may fall asleep while the vehicle is operating on its own, play games on their phone, read a book, or even jump into the back seat. A solution to this would be to provide the vehicle with the capability to monitor if human driver is paying attention to the road and traffic (Sparrow, R., & Howard, M., 2017). If these conditions are not met, the vehicle could alarm the driver and the speed of the vehicle could reduce as a result (Sparrow, R., & Howard, M., 2017).

### *Relevance to society related to ethics*

There are many benefits autonomous vehicles offer to societies. Autonomous vehicles have the potential to reduce human errors, which will also reduce motor vehicle accidents by 90%, thus saving billions of dollars each year (Autonomous Vehicles Factsheet). The improvement of safety and public health will increase, along with productivity, quality of life, mobility, and travel (this is especially true for the disabled and elderly as well) (Autonomous Vehicles Factsheet, 2022). Some more benefits of autonomous vehicles offer are the reduction of congestion, energy use, the cost of public and private transportation (Autonomous Vehicles Factsheet, 2022). Commuters will benefit greatly from autonomous vehicles also by increasing traffic flow and avoiding traffic congestion (5 Effects of the Adoption of Autonomous Vehicles, 2020).

### *Statement of the problem or thesis statement*

The purpose of this study is to determine how autonomous vehicles would benefit the environment and society. Self-driving cars promise a large range of potential benefits such as assisting people with disabilities, increasing road safety, rising productivity, saving money with the reduction of vehicle accidents, lessening traffic congestion, and decreasing greenhouse gases from carbon emissions (Benefits of Self-Driving Vehicles, 2022). As written in the previous paragraphs, deaths from vehicle accidents continue to occur. Good people die due to other human errors. Children are left with only one parent to care for them. In the worst-case scenario, both parents' lives are lost. A family loses loved ones and is forced to cope with the pain of separation. There must be a way to prevent these tragedies.

## LITERATURE REVIEW

### *Literature on the topic*

According to the article written by Automotive Plastic, autonomous vehicles have a promising future with the improvements they will bring to the roads. One area of improvement is safety. Safety is the top priority in autonomous vehicles. Automotive Plastic believes and stated, “Enabling seat belts, airbags, side-curtain bags, windshield inner-layers, pedestrian collision protection safety features, padded dashed, and plastics will continue to enhance safety in self-driving cars” (Autonomous Vehicles, 2022). Other features, such as the break boosters that are programmed to bring a vehicle to a stopping point if needed, increase safety for the vehicle (Autonomous Vehicles, 2022). The vehicle will not be weighed down by heavy metal structures but will be composed of lightweight multi-material composites (Autonomous Vehicles, 2022).

Another area of improvement are the sensors. Sensors are very important for driverless vehicles. The sensor in smart cars has the capability to see through the body panel material and view the vehicle surrounding (Autonomous Vehicles, 2022). Another feature of these sensors is the Light Imaging Detection and Radar (LIDAR). Creating a 3D map of the surrounding area in real time, LIDAR detects objects and determines the shapes and sizes within and along the road (Autonomous Vehicles, 2022). Autonomous vehicles have a promising future with the improvements they will bring to the roads.

### *Literature on the topic*

The National Road and Motorists Association (NRMA), an Australian company that provides roadside assistance and advocates for motorists and road-users, believes driverless vehicles will benefit and impact the future of mobility (Driverless cars: The benefits and what it means for the future of mobility, 2022). Having partnered with the New South Wales Government, HMI Technologies, Telstra, IAG, and Sydney Olympic Park, NRMA launched the first autonomous shuttle trail in New South Wales (NRMA joins first ever automated shuttle trial). NRMA believes autonomous vehicles improve safety, since 94% of

accidents are caused by human error. Not only will it improve safety but transport connectivity. It is already difficult enough to travel from point A to point B with all the current traffic congestion. In fact, NRMA noted that congestion had cost New South Wales \$6.9 billion in 2017 (Driverless cars: The benefits and what it means for the future of mobility, 2022). Driverless vehicles will know how to navigate on their own and pick the best route. Some benefits that come with these robotic vehicles are the reduction in pollution and emissions. It is believed that a reduction of transport energy consumption by 90% will occur once the vehicles fully take on the road. Though there are a lot of benefits to this invention, a large amount of study still needs to take place and must be ongoing to understand what all is required for a fully driverless vehicle (Driverless cars: The benefits and what it means for the future of mobility, 2022). The chairman of NRMA (2022) stated, “The impact of autonomous vehicles will profound to the point that it is hard to imagine a section of Australia that won’t be affected... Australia is not ready for the mobility revolution and we need to be.” NRMA believes that the best way to introduce new technology while gaining consumer perception is through autonomous vehicle trails (Driverless cars: The benefits and what it means for the future of mobility, 2022). These trails will examine how autonomous vehicles, road users, roadside infrastructure, and other vehicles interaction with each other (Driverless cars: The benefits and what it means for the future of mobility, 2022). Figure 1 in the appendix displays a timeline of the full automation NRMA provided. It could be as early as 2025 where fully autonomous vehicles could take on the road, according to NRMA (Driverless cars: The benefits and what it means for the future of mobility, 2022).

### *Literature on the topic*

In the article titled, “Transportation Research Part C: Emerging Technologies”, Robert Sparrow, a Professor of Philosophy at Monash University, and his colleague, Mark Howard, both believe that driverless vehicles will one day represent the future of transport (Sparrow, R., & Howard, M., 2017). Technological challenges are the setbacks that need to be overcome for autonomous vehicles to fully operate on their own on the roads (Sparrow, R., & Howard, M., 2017). A popular believe that driverless vehicles can take place

on the roads will involve the increase of the levels of existing automation tasks that are already performed by humans, such as cruise-control, anti-skid braking system, lane change assist, and automated freeway driving (Sparrow, R., & Howard, M., 2017). By adopting these existing automation tasks, the beginning of fully autonomous driving has already begun. As the capacities of these technologies progresses and extends, engineers can create and produce vehicles that can operate in different sets of environments and road conditions (Sparrow, R., & Howard, M., 2017).

Sparrow and Howard both believe that the safest way to bring a driverless vehicle to the market would be to design one that can fully operate on its own without a human driver. This may have some call to question whether this idea is good. In the case where a child crosses the road while a driverless car is operating, the computer will make a calculation and determine the best outcome. This may result in crashing into other vehicles or running into buildings or bystanders, or if the computer calculates that it is in the best interests of the passengers to hit the child crossing the road, that may occur instead. Sparrow and Howard argue that an autonomous vehicle does not need to be perfect in the sense of having the capabilities of avoiding collisions and making critical decisions; however, if driverless vehicles produce less road accidents and fatalities than humans while moving at the same speed, this will display the benefits autonomous vehicles provide (Sparrow, R., & Howard, M., 2017).

### *Literature on the topic*

In the article titled “Transitioning to Driverless Cars”, Gilles Duranton, the Dean’s Professor of Real Estate at the University of Pennsylvania, Wharton School, speaks more about the benefits of autonomous vehicle. Duranton mentions that residents of American cities spend nearly 90 minutes traveling daily (Duranton, G., 2016). One-way driverless cars will benefit society is by reducing travel costs by enabling people to work, play, and enjoy the view, as the car operates themselves (Duranton, G., 2016). Duranton brings up the fact that 30,000 Americans die on the road yearly and driverless cars could reduce the number of deaths (Duranton, G., 2016). People will no longer need to own a car that sits idle in the parking lot most

of the day but will instead subscribe to services who provide cars on demand (Duranton, G., 2016). This is very similar to Uber and the services they provide. An expensive system of traffic lights and signals will not be needed (Duranton, G., 2016); thus, allowing the government to save money. The full implementation of driverless vehicles on the roads will take time. Duranton (2016), stated in the article, “Many of the benefits of driverless cars in terms of smoother rides and greater capacity at intersections will be realized only when all cars are driverless. We may have cars driven by humans roaming the streets for 20 years or more after the first fully driverless cars have appeared” (p. 195). These benefits display a bright future for society.

## **DATA**

*Original data collection - sample size of at least 10 people.*

I created a poll titled “Ethical Survey” with a Google form and emailed the poll to close friends and family members. I asked thirteen questions in my poll. My end goal of the poll was to see if the participants would trust and purchase an autonomous vehicle over a regular automobile after taking the survey. For the first question (ex. Figure 2), I asked the participants to rate themselves as drivers on the scale of one through five. Question two through six (ex. Figure 3 through 7) were fact questions; for instance, how many vehicle accidents occur in the United States each year? And how many were cost my human error? To my surprise, most of them answered incorrectly. For question seven (ex. Figure 8a & Figure 8b) I asked what they would do to prevent vehicle accidents that result in death of injuries. On question eight (ex. Figure 9) and nine (ex. Figure 10) I asked if they know someone with a safe driving record, and if they do, how safe would they feel with that person driving with them in the car. On question ten (ex. Figure 11), on a scale from one through five, I asked how safe they would feel riding in a driverless vehicle knowing there is a reduced percentage of motor vehicle accidents. The eleventh question (ex. Figure 12) asks the participants to choose what level of driverless vehicle they would feel most comfortable in. Question twelve (ex. Figure 13A & 13B) had them typing down the first thing that comes to mind when they hear the phrase, “driverless



vehicle.” For the last question (ex. Figure 14), I asked if the participants would purchase a driverless vehicle. Their responses were quite interesting.

### *Data analysis*

Most accidents that occur are due to human errors. I asked the participants to rate themselves as a driver (ex. Figure 2). Five of the twelve participants rated themselves as five, while four rated themselves as four and three as three. The participants view themselves as average to excellent drivers. Question two through six had them thinking a little (ex. Figure 3 to 7). Only half of the participants answered correctly. That really displays the accurate knowledge one has about the number of accidents occurring each year due to human errors and the death rate from these accidents. On question 7 (ex. Figure 8A & Figure 8B), participants were able to give their solutions to prevent accidents that are ongoing. Only one person mentioned driverless vehicles as a solution; everyone else mentioned solutions such as reducing speed, less distractions, focus on the road, be more attentive, etc. For questions eight and nine (ex. Figure 9 and Figure 10), I was able to see that even if driverless vehicles could be safer than humans, many of the participants would not feel safe riding in a vehicle that is fully operated by a computer. The idea of completely trusting in a machine is not something people are ready for. There was a small percentage of participants selecting level 4 and level 5 driverless vehicles; the majority preferred level 1 through 3 (ex. Figure 12) as their level of comfort, thus displaying people want to be in control of a vehicle. I do not blame people for being skeptical about driverless vehicles. When I asked what came to their mind when they heard the phrase, “driverless vehicles”, everyone responded differently (ex. Figure 13A & Figure 13A). The public is not ready to trust in self-operating vehicles. More than half would not purchase a driverless vehicle even if it can improve safety (ex. Figure 14) while the other half of the answers are “yes” mixed with “I will consider”. To sum up the data analysis, most of the participants are not ready to trust a driverless vehicle yet, while the others are somewhat ready for the change. Even if it can be proven that a driverless vehicle can reduce the number of accidents occurring each year, it would still be difficult for the public to fully rely

on it, and from the data I collected, it is mainly because people want to have full control of the vehicle when they are driving.

## **CONCLUSIONS AND REACTION**

### *Ethical issues that exist for society*

Death is still occurring as this research is being conducted. Lives are lost. Good people die in vehicle accidents, and many of them are due to human errors. It is an issue that is yet to be solved. Even with the invention of traffic lights and safety features in vehicles, this tragedy has plagued mankind. This further implies that there are many more lives to be lost each year. Unless something is done, the roads we travel on today may not be safe at all for our family to travel on tomorrow. There is hope, however. Scientists and engineers are developing self-driving vehicles that may solve this dilemma. Autonomous vehicles can contribute to society in many ways and save countless lives every year. Though it has not been fully accepted by everyone, there is a place for autonomous vehicles in the future and the benefits it will bring may change the world.

### *Conclusion / Summary / Recommendations*

Since the creation of vehicles, people have always had control over a vehicle while driving. Not having that control is difficult for many people. There is more trust in a human being operating a vehicle than a computer managing a vehicle. Even if there is a greater chance of error, which may cause accidents because a human-being is driving the vehicle, for many, they would trust in the human more than the computer. The idea of a computer operating a car will probably not be accepted for many more years to come. I believe this is the case simply because people have not seen how much these vehicles can benefit society.

The benefits that come with autonomous vehicles are numerous. With advanced computer systems integrated into driverless vehicles, this may help society in many ways. Vehicles can make a split-second decision before a disaster occurs. Sensors such as LIDAR can detect objects on the road or along the road and determine if they are hazardous debris. The sensor can also create a 3D map of the surrounding area in real time. The driverless vehicle will be able to travel with ease without running into congestion because it will know how to navigate on its own and pick the best route. The government will be able to save billions of dollars from the benefits of autonomous vehicles. Pollution and emissions will be reduced, and a reduction in transport energy consumption will take place.

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## Appendix A

### Data Analysis and Copy of the Data Collection Instrument and Results

Figure 1

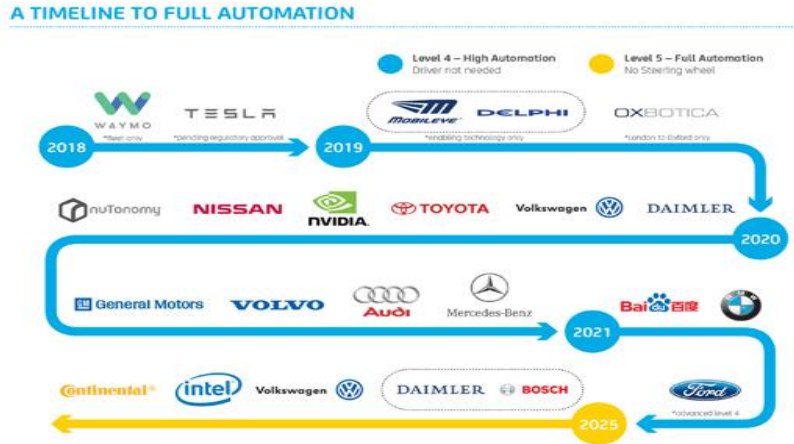


Figure 2

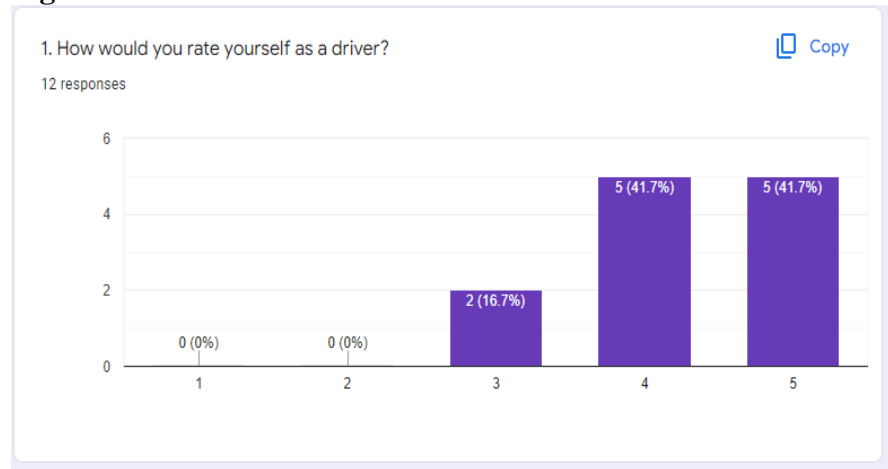
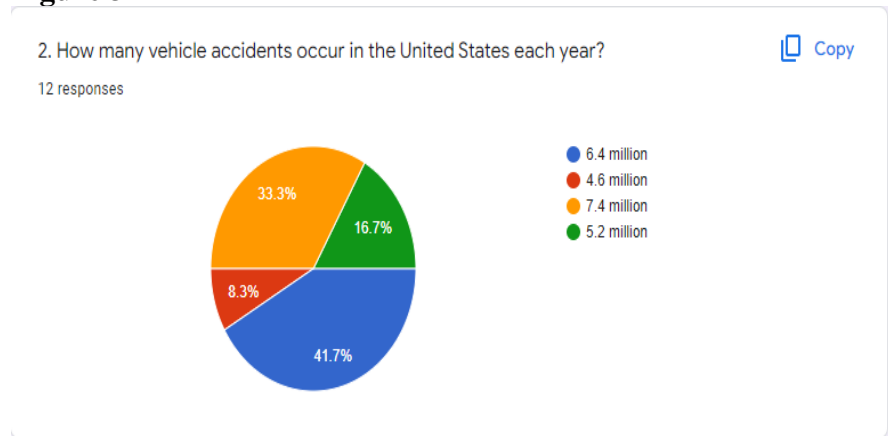
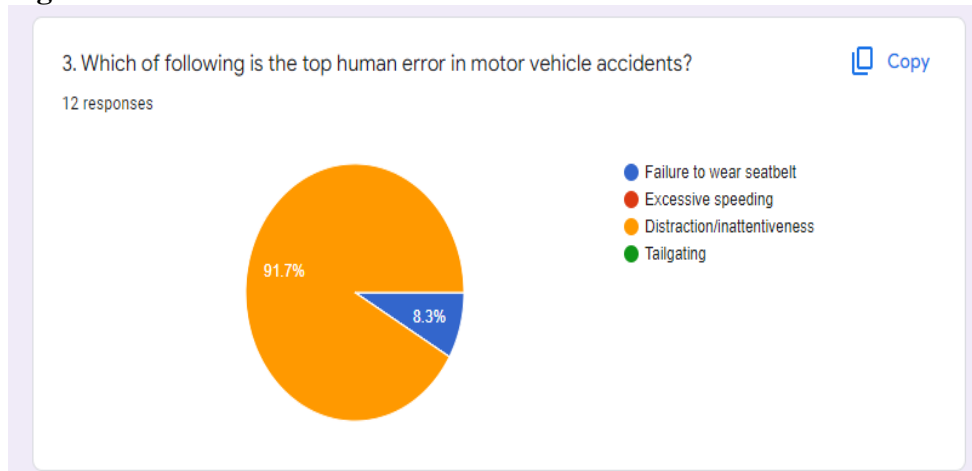


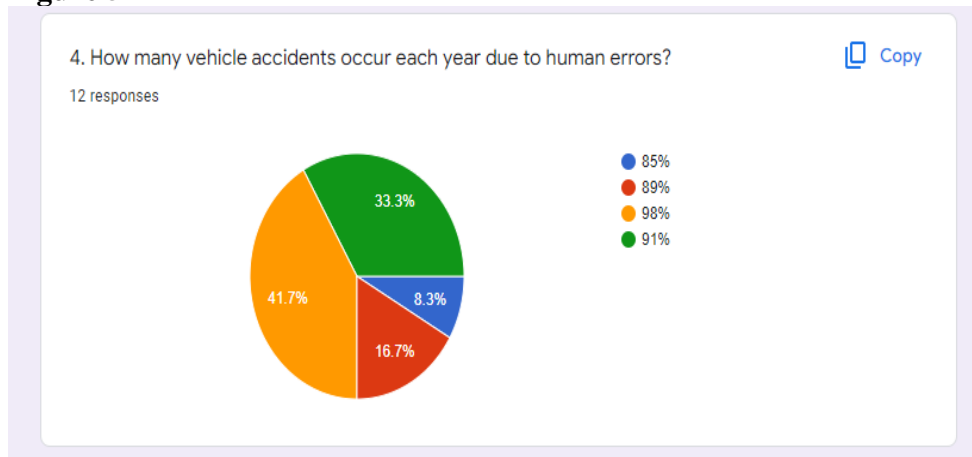
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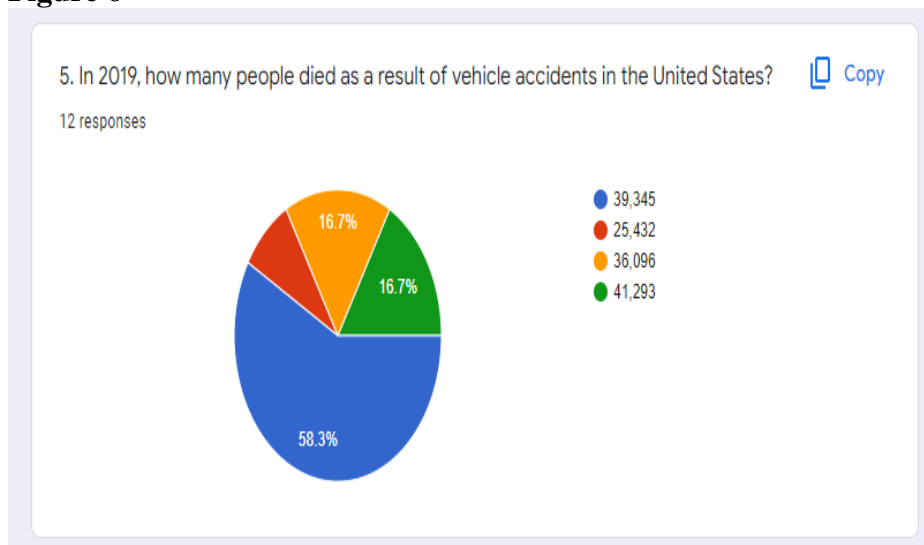
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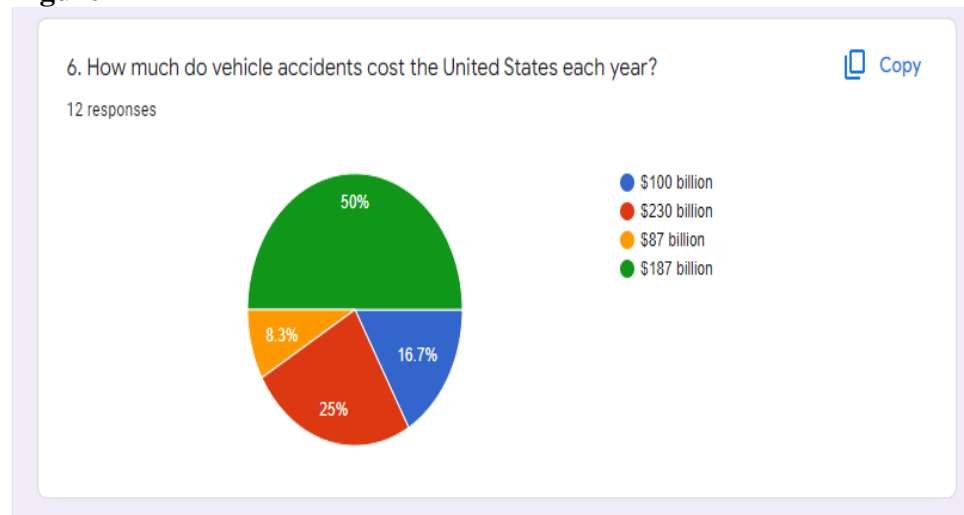
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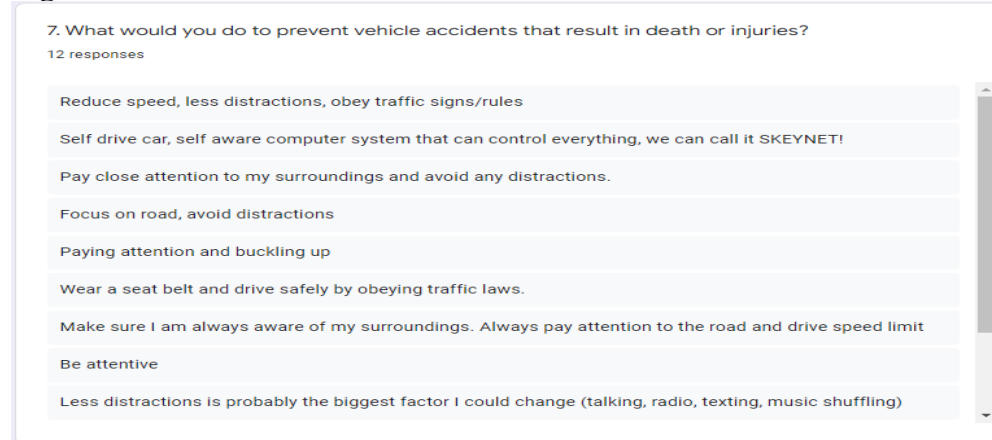
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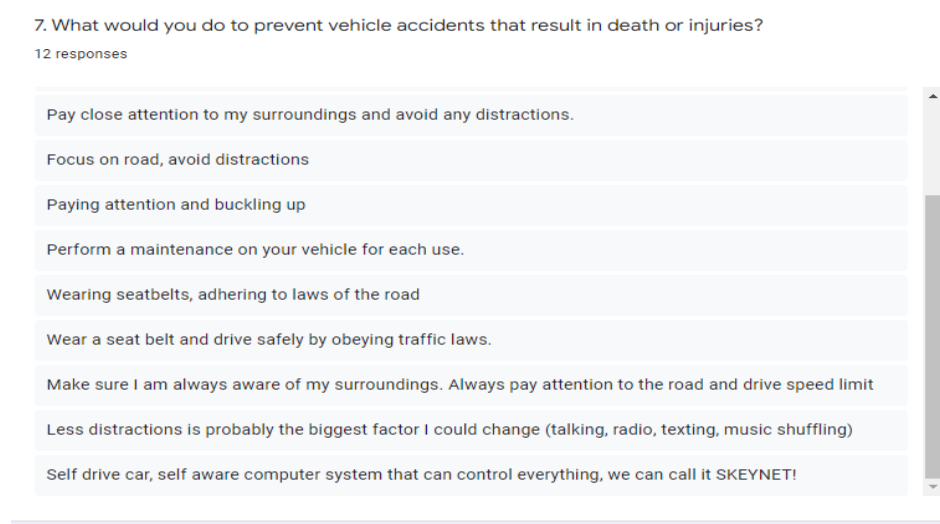
**Figure 7**



**Figure 8A**



**Figure 8A**

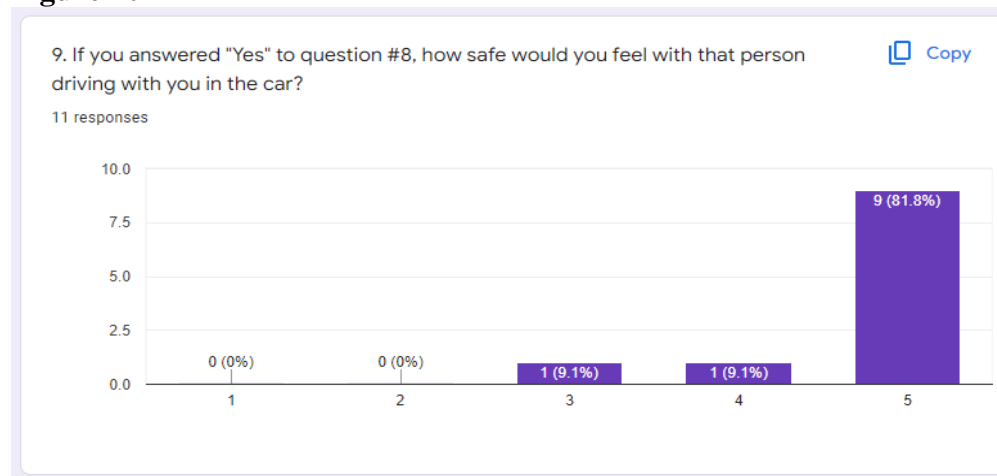




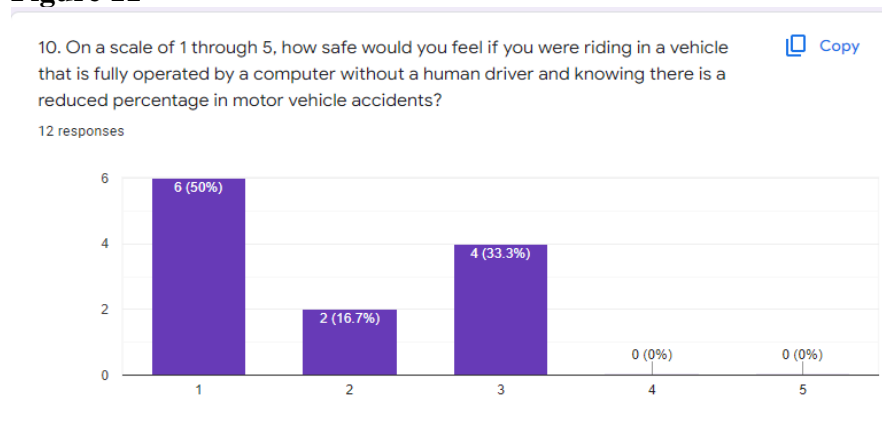
**Figure 9**



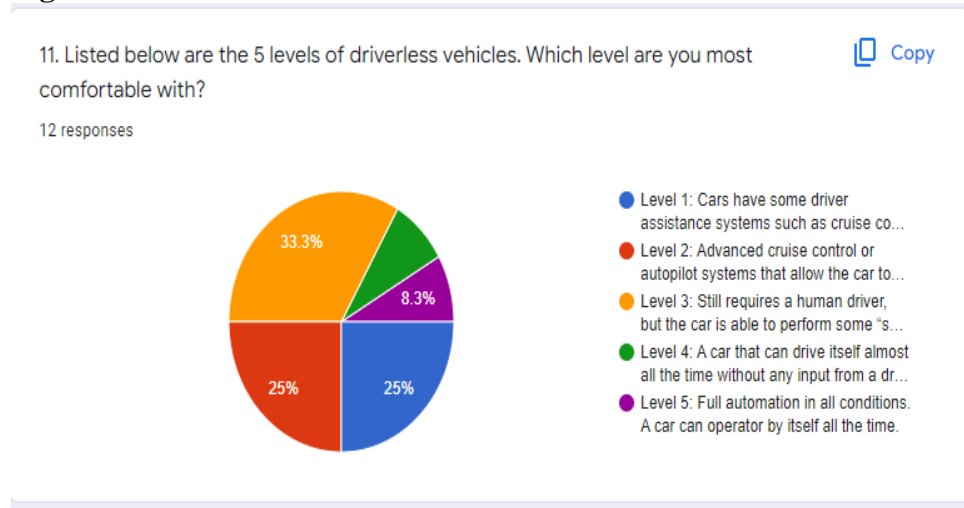
**Figure 10**



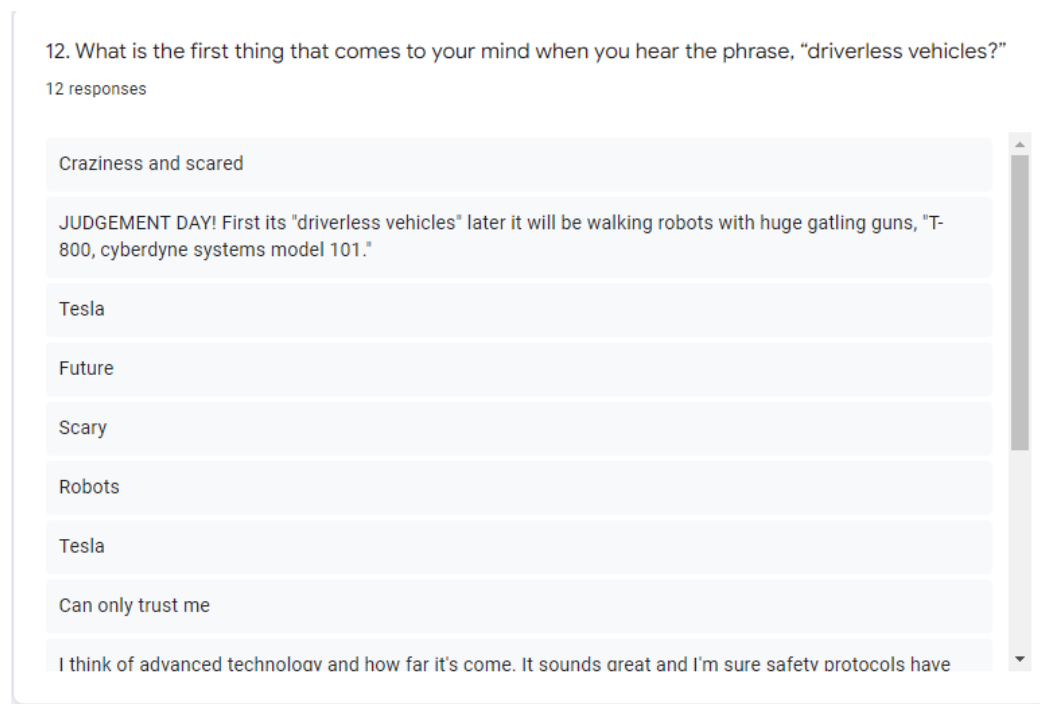
**Figure 11**



**Figure 12**



**Figure 13A**



**Figure 13B**

12. What is the first thing that comes to your mind when you hear the phrase, "driverless vehicles?"

12 responses

Tesla

Can only trust me

I think of advanced technology and how far it's come. It sounds great and I'm sure safety protocols have been put in place before they come out with these types of cars. However, I can't help but to feel that this technology isn't meant to replace human drivers but maybe enhance the driving and safety measures of a person driving. I do not want to rely and trust technology 100%  
With great technology come great consequences. What if your car gets hacked by someone with evil intentions? What if the technology fails? I also feel that our human race and future generations should still keep basic driving skills otherwise I feel as if we will keep disabling ourselves. Thank you.

Artificial intelligence

Someone doing their make up in the passenger seat.

Automation robotics

**Figure 14**

13. If driverless vehicles can improve safety, reduce traffic congestion and pollution, increase mobility (for elderly, young, and disabled individuals), give greater convenience, efficient, and reliability for drivers/passengers, and decrease vehicle maintenance cost and requirements, would you purchase a driverless vehicle if the price ranges between \$20,000 to \$30,000? (Answer "Yes" or "No" and explain why)

12 responses

No, I'd rather drive and have control of the vehicle.

My current car is only worth \$1000, why would I pay 30 times the price or a high cost, high maintenance vehicle that might turn out to be a terminator! NO DEAL!

Yes. Cars that are safer are always preferred when you have families and must be taken in account when purchasing.

Yes, for all the benefits and the affordable price range

No because the safety of my kids are still a concern. Can't trust a robot.

No, I would still like to have control over the car

Yes, because I don't want to die in a car accident. If it's more efficient and safer and affordable then I'm willing to use it.

No, I only trust me