Ethical Implications of Autonomous Vehicles: What Does The Future Hold?

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IST 336–Group #3

Meet The Team–Group #3

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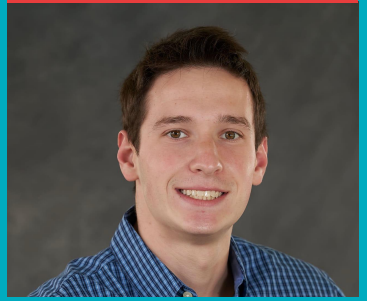

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What are Autonomous Vehicles?

- Also known as self-driving cars, vehicles that can operate without human intervention.
- Using various sensors, cameras, radar, and software to perceive their environment and make decisions based on the information gathered.
- Machine learning, computer vision, and artificial intelligence to analyze data from their sensors and make decisions on how to operate.

Timeline of Autonomous Vehicles

- **1980s**: The first automated guided vehicles (AGVs) were introduced in factories and warehouses.
- **1990s**: The U.S. military began to develop autonomous vehicles for use in combat situations, including unmanned aerial vehicles (UAVs) and unmanned ground vehicles (UGVs).
- **2004**: The Defense Advanced Research Projects Agency (DARPA) launched the first Grand Challenge, a competition for autonomous vehicles to navigate a desert course. None of the vehicles were able to complete the course.
- **2009**: Google began working on self-driving cars, using a modified Toyota Prius.
- **2012**: Nevada became the first state to legalize the operation of autonomous vehicles on public roads.
- **2014**: Google unveiled a fully functional self-driving car without a steering wheel or pedals.
- **2016**: Uber began testing self-driving cars in Pittsburgh, Pennsylvania.
- **2018**: Waymo, a subsidiary of Alphabet (Google's parent company), launched a self-driving taxi service in Phoenix, Arizona, marking the first commercial deployment of autonomous vehicles.
- **2021**: Tesla's "Full Self-Driving" system became available to a limited number of customers.

Autonomous Vehicles Benefits

- **Improved Safety:** Autonomous vehicles have the potential to significantly reduce the number of accidents caused by human error.
- **Increased Mobility:** Have the potential to increase mobility for individuals who are unable to drive, such as the elderly or people with disabilities.
- **Reduced Traffic Congestion:** Reduce traffic congestion by streamlining routes and eliminating the demand for individual parking spaces. They might also communicate with one another to enhance traffic flow and reduce accidents.
- **Environmental Benefits:** By optimizing driving routes and limiting idling time, you may minimize pollutants and improve fuel efficiency.
- **Increased Efficiency:** Autonomous vehicles have the potential to improve transportation system efficiency by reducing idle time and optimizing routes, potentially reducing the number of vehicles on the road.
- **Cost Saving:** Help cut costs of parking, fuel, and insurance

Levels of Autonomy Based on Capabilities:

Level 1 - Driver Assistance

Few automated features, such as cruise control or lane departure warning

Level 2 - Partial Automation

More advanced features, such as lane-keeping assistance and adaptive cruise control

Level 3 - Conditional Automation

The vehicle can take over most driving functions, but the driver must still be available to intervene if necessary

Level 4 - High Automation

The vehicle can operate without human intervention in certain conditions and environments

Level 5 - Full Automation

The vehicle can operate without human intervention in any condition or environment

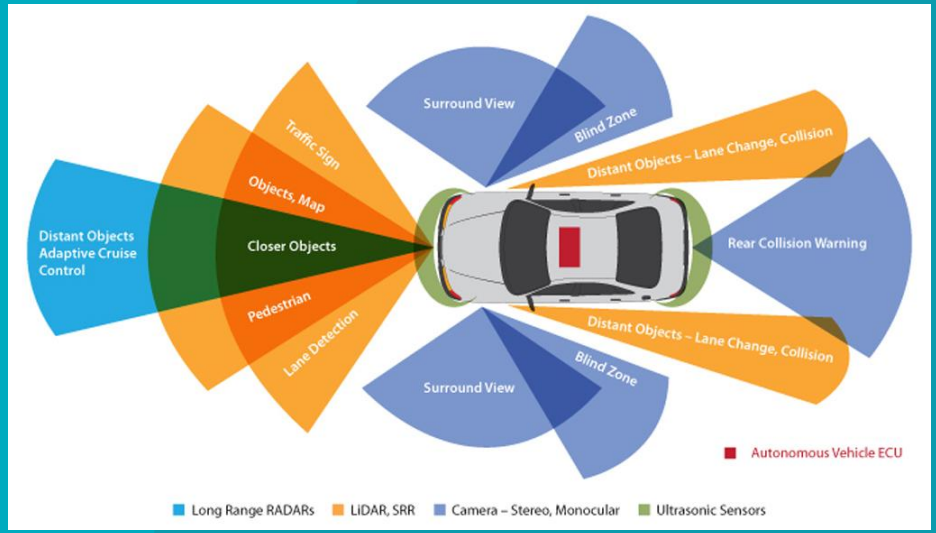
Technology and Infrastructure

Technology

- Sensors
- Mapping and Localization
- Artificial Intelligence and Machine Learning
- Control Systems

Infrastructure

- Communication Networks
- Mapping and Localization Systems
- Cybersecurity Systems
- Road Infrastructure
- Regulations and Standards



Privacy Concerns

- Self-driving cars could be hacked with ransomware, IoT attacks, DDoS, not allowing owners to enter, control, start or exit the vehicle.
- Hackers could disable networks, range sensors and cameras, resulting in collisions, or change final destinations to an undesired location.
- An autonomous vehicle’s operating system could be hacked, exposing personal information on other connected devices.
- “Although the consumer owns the smart car itself", it says. the right to "access, limit access to, use, and destroy data" is usually retained by the car manufacturer.”

Drivers are concerned about sharing private data

The reasons motorists don't want to share data

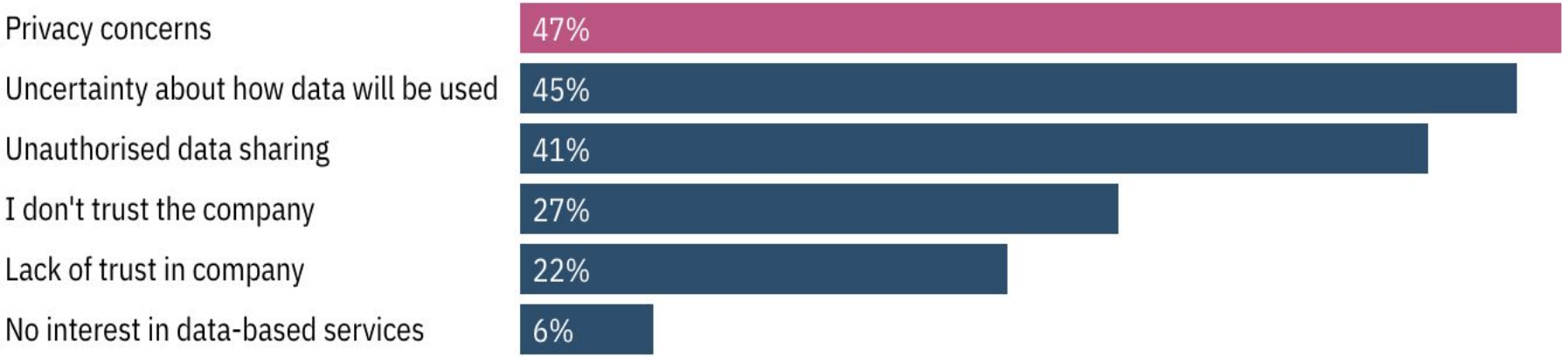


Chart: Tech Monitor • Source: Capgemini: Vehicle Data Monetization

TECH MONITOR

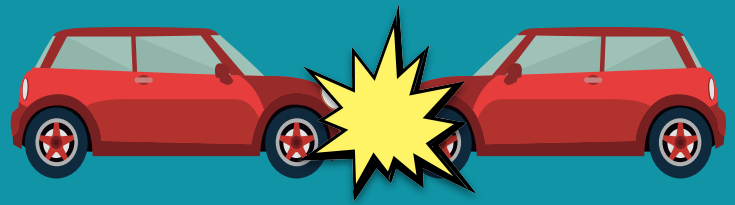
Accidents with an Autonomous Vehicle

Quick Fact:

- Road traffic injuries are the 9th leading cause of death globally
- 400 Crashes by Autonomous vehicles reported in 11 months
- In 2020, an estimated 4.8 million people were injured in motor vehicle crashes in the United States.

Crash News:

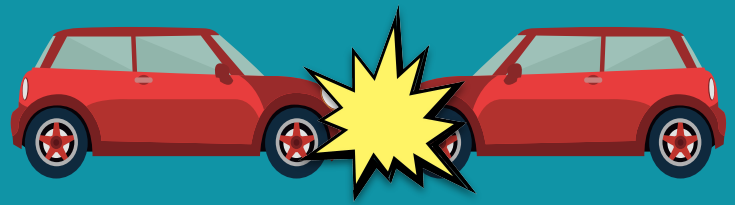
- Waymo self-driving car accident (2019)
- Uber self-driving car accident (2018)
- Tesla Autopilot accident (2016)



Accidents with an Autonomous Vehicle

In an accident involving an autonomous vehicle, the situation can be complicated and will depend on the specific circumstances of the incident. Generally speaking, the following could happen:

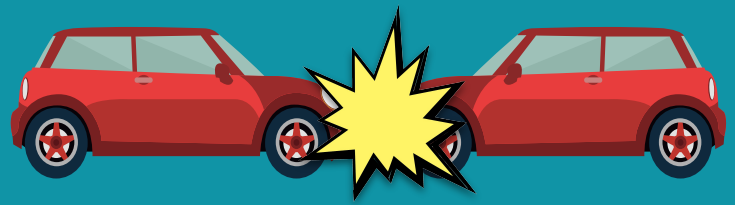
- Who is liable If the accident is caused by a defect in the autonomous vehicle's hardware or software?
- Who is liable if the accident is caused by the actions of the human driver of another vehicle?



Accidents with an Autonomous Vehicle

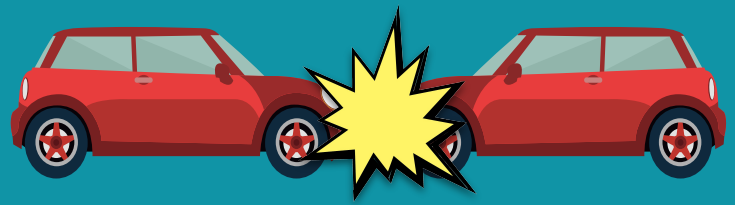
In an accident involving an autonomous vehicle, the situation can be complicated and will depend on the specific circumstances of the incident. Generally speaking, the following could happen:

- What if the accident is caused by the autonomous vehicles actions?
- What if the accident is caused by the actions of a pedestrian or a cyclist?



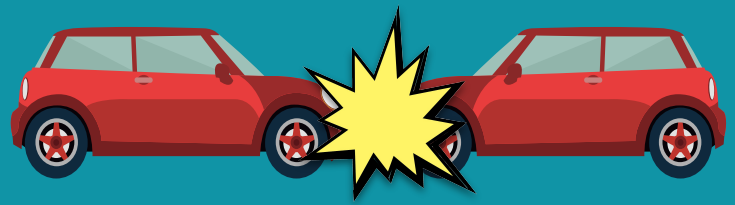
Accidents with an Autonomous Vehicle: Laws

- Liability: One of the primary legal issues in an accident involving an autonomous vehicle is determining who is liable for any damages or injuries.
- Regulations: Many countries and jurisdictions have established regulations for autonomous vehicles, which may include requirements for testing, certification, and operation of these vehicles.
- Negligence: In many cases, accidents involving autonomous vehicles will be analyzed under negligence laws, which require a finding of fault or responsibility for the accident.



Accidents with an Autonomous Vehicle: Laws

- Insurance: Insurance coverage for accidents involving autonomous vehicles is another legal issue that can vary depending on the jurisdiction.
- Data privacy: Autonomous vehicles collect a large amount of data about their surroundings and operations, which can raise privacy concerns.



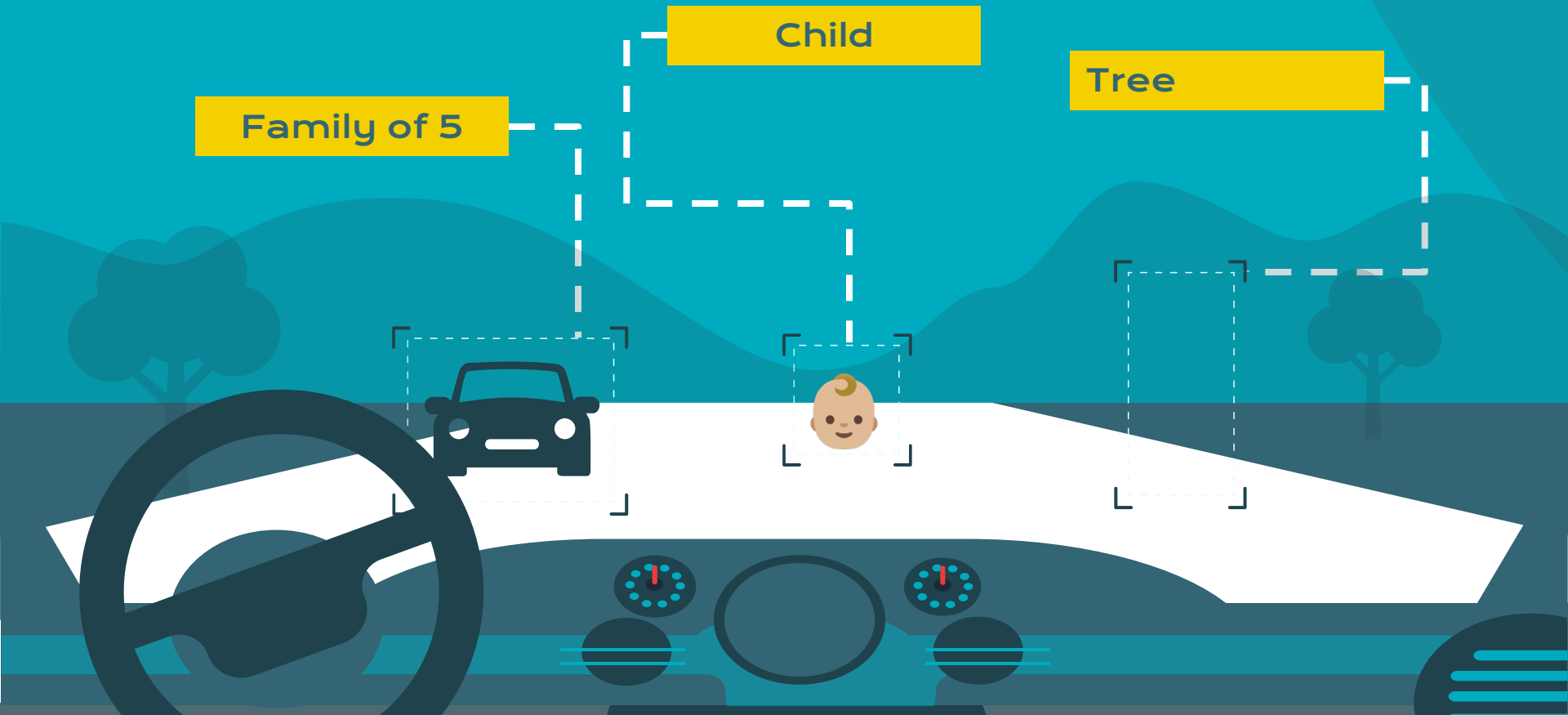
Ethical Implications of Autonomous Vehicles

- Programming Decisions
- Driver Responsibility
- Cyber Security & Data Privacy

#1 Programming Decisions

- Programmed to follow rules & make split-second decisions
- Dilemma: extent of decisions
  - Life vs Death
- Moral Decisions: Outcomes vs. The manner in which you achieve them
- Who gets to make these decisions or “play God”

Hypothetical Dilemma



#2 Driver Responsibility

- Expectations for driver accountability
- Tesla requires driver to keep hands on wheel and steer even while in autonomous mode
- In the case of an accident, who is responsible?
- Should we expect driver to intervene and make a decision?

#3 Cyber Security & Data Privacy

- Threats to safety and sensitive data
  - Remote hacking
  - Malware & viruses
  - Data privacy
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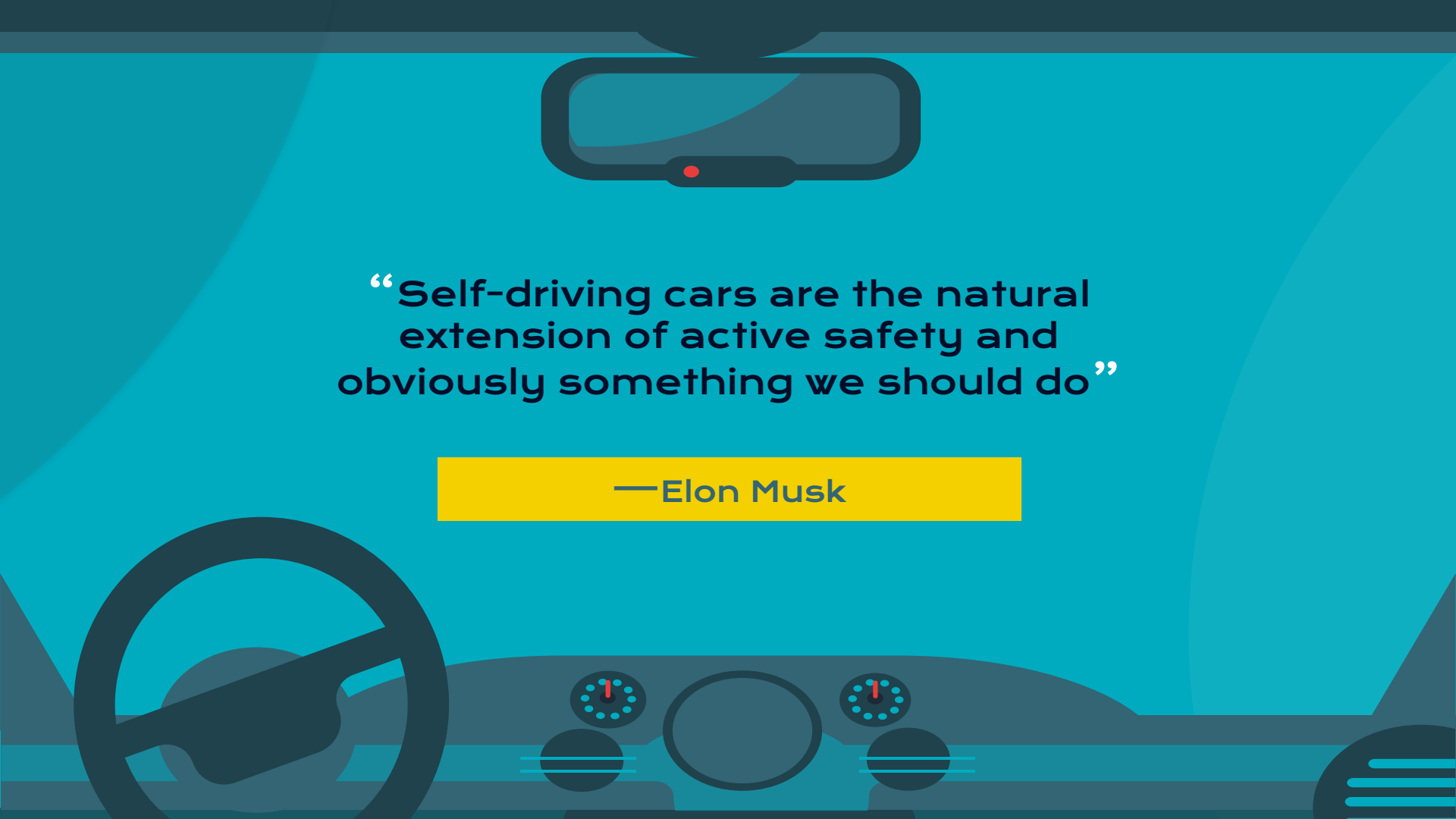
What ethical considerations do you think need to be taken into account when programming autonomous vehicles?


“Self-driving cars are the natural extension of active safety and obviously something we should do”
—Elon Musk

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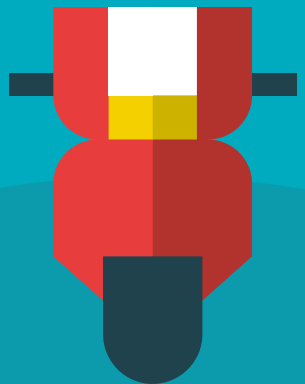
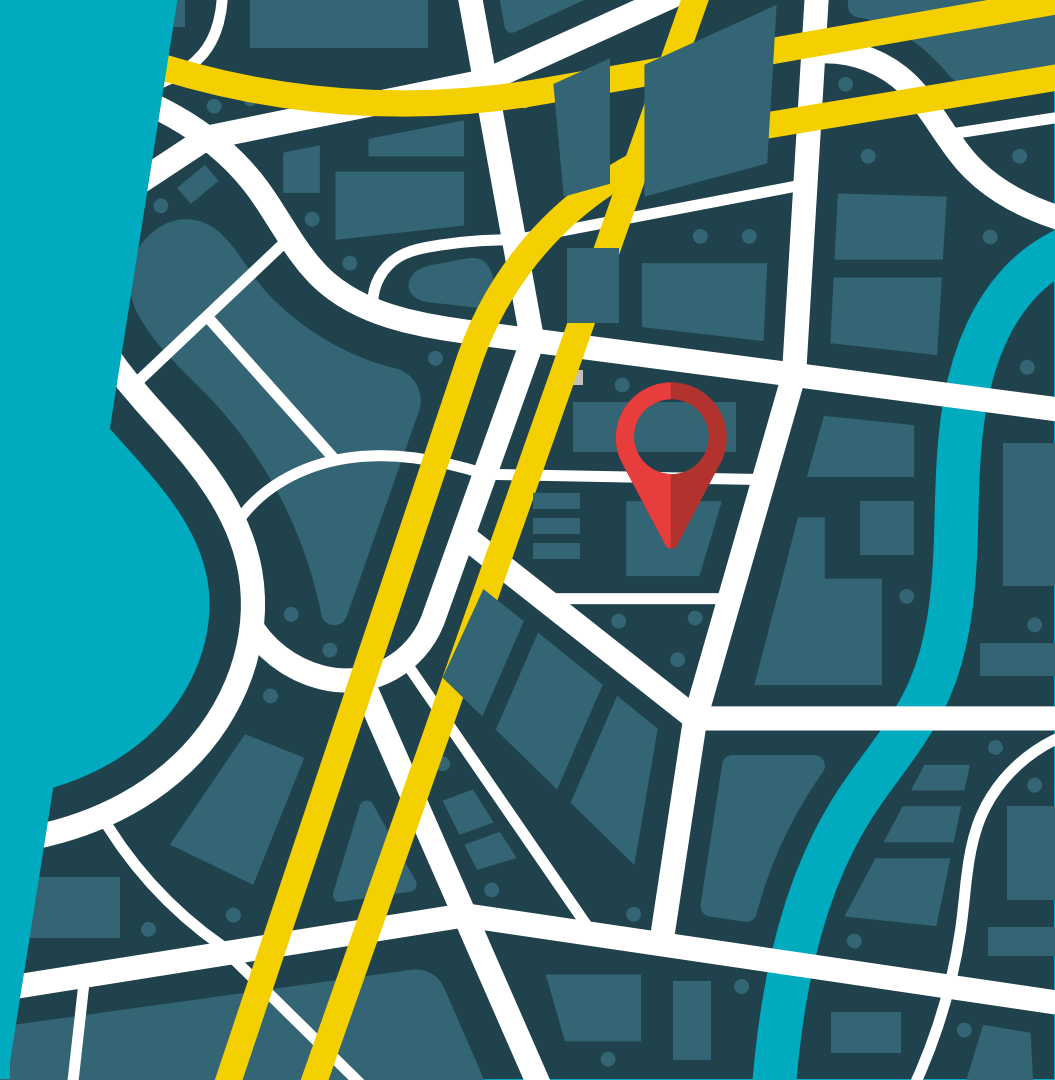
Survey and Results



Question Categories

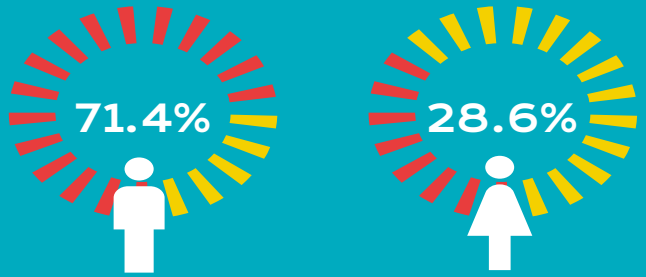
- Demographics
- Who’s at fault in an accident
- Safety of these vehicles
- Autonomous features



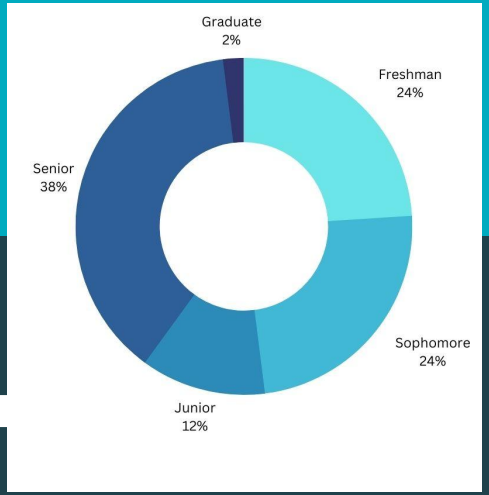
Demographics

1. What gender are you?
2. What year are you in school?
3. What university do you attend?
4. What is your major?

Gender



Class Standing



96% of respondents attend Syracuse University

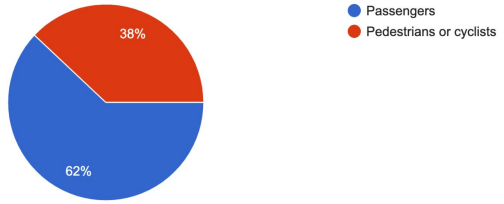
Results

Would you feel safe riding in a self-driving car, knowing that it relies on computer algorithms and sensors to operate?

50 responses

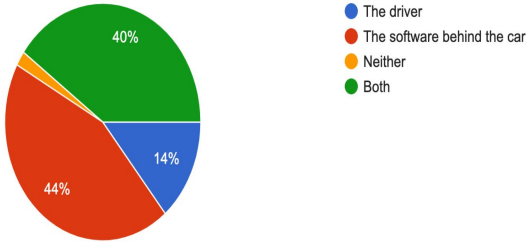
In the event of an unavoidable accident, should a self-driving car prioritize the safety of its passengers or the safety of other road users (such as pedestrians or cyclists)?

50 responses



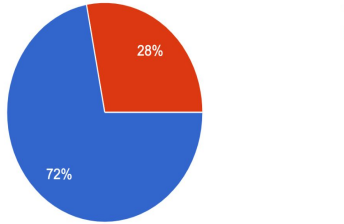
If a self-driving car hits someone, who is at fault?

50 responses



Do you believe that self-driving cars have the potential to reduce the number of accidents caused by human error?

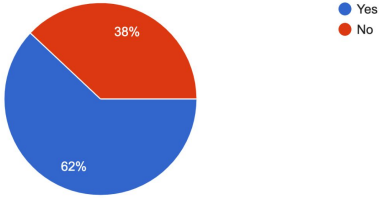
50 responses



Results

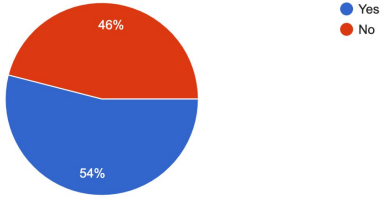
Do you think self-driving cars in the future will be able to make ethical decisions in complex situations, such as a "trolley problem" scenario where an accident is inevitable?

50 responses



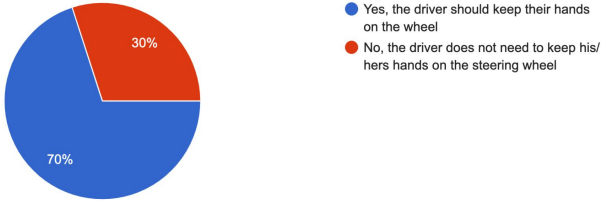
Should self-driving cars be programmed to avoid certain areas or neighborhoods, even if it means taking a longer route to a destination?

50 responses



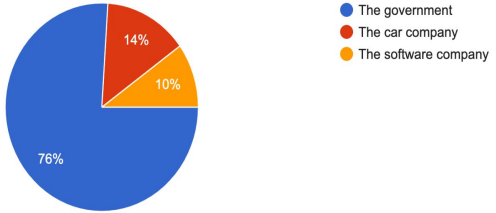
Should the driver be responsible to keep their hands on the steering wheel and be attentive, even when the vehicle is running in its fully autonomous mode?

50 responses



Who should be responsible for making the driving regulations of autonomous vehicles?

50 responses



How AI can be involved (pros/cons)

- AI allows self-driving cars to perceive their surroundings, make decisions, and take actions as necessary
- Sensors and machine learning algorithms are used to create a real-time understanding of the car's environment

Pros:

- Reduces accidents caused by human error
- Potentially reduces the amount of traffic
- Easier for people who are not able to drive

Cons:

- Safety and reliability concerns
- Ethical concerns about decision making in some situations
- Job losses in the transportation industry

Protecting Autonomous Vehicles from Attackers

With autonomous vehicles becoming more common, hackers will inevitably try to compromise them for their own personal gain

This is why it is absolutely important to make sure these vehicles are held under very strict cybersecurity standards

How Hackers Attack Autonomous Vehicles

1. **Remote Access**

   Hackers can remotely access vehicle systems through the Internet or Bluetooth

2. **Backdoors**

   Attackers can insert a backdoor into the vehicle when the vehicle is being made

2. **Planting a Device**

   Anyone can plant a device inside the car that can gain them access to vehicle systems

4. **Altering Sensors**

   By messing with the sensors on the vehicle, this is another way for attackers to cause damage to your vehicle

How to Protect Against Attacks

- As the security of these cars is so important, there are steps to be taken in order to ensure the safety of riders
  - Change the default password
    - If the vehicle came with one, change it, and make sure that it is complex
  - Update software
    - Make sure that you are up to date with the newest software the manufacturer has put out, as they often include patches to vulnerabilities
  - Prioritize security
    - Manufacturers, in the creation of these vehicles, should always make sure that security standards are met
  - Enable GPS only when needed
    - GPS can be tracked through an attack called spoofing, which interferes with the system by using radio signals

Human Error

- Humans still need to program self-driving cars
- Can be unpredictable, self-driving cars may have problems with responding to human behavior
- May struggle in some situations, that may require human action or awareness
- Error in software coding or car sensors

Video Clip

Lesson Learned - Jacob

- One thing that I learned while working on this project was just how important cybersecurity is in these vehicles not just for the creator of the vehicle
- It is not only the responsibility of the manufacturer to come up with patches to found vulnerabilities, but also the driver of the car to keep the vehicle software up to date

Lessons Learned - Harley

- Through real-world testing, self-driving cars have taught us important lessons about the limitations of current technology and the need for ongoing development to improve safety and reliability

Lessons Learned- Joanna

- Self-driving cars provide benefits to safety, mobility, traffic, & finances
- Self-driving cars pose an abundance of ethical challenges
  - Developing ethical standards is complicated but critical
  - Not everyone is going to agree on the direction of policy
  - Elevate all voices and perspectives
  - Stakeholders should strive to protect the well-being of the public & act ethically
- Next steps:
  - Continue developing, designing, & testing
  - Regulations
  - Spread awareness
  - Invest in spatial restructuring

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Lessons Learned- Ud

- Overall, the legal landscape surrounding self-driving cars is still evolving, and there are many complex issues that need to be addressed. As self-driving cars become more common on our roads, it's important for regulators to ensure that they are properly regulated and that they meet the needs of society.

Lesson Learned - Adam

- The development and deployment of self-driving vehicles provides several benefits while also posing considerable hurdles. It is critical for stakeholders to work together to ensure that these cars are safe, dependable, and equitable. Furthermore, continued study and regulation are required to maximize the benefits and reduce the negative consequences of this technology.

Lessons Learned-Sage

Overall a majority of the people believe that autonomous vehicles are safe for the road and that the car should prioritize the safety of the people inside the vehicle

Questions and Answers

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