
Current Regulatory Landscape of Automated Driving Systems in the United States of America

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Abstract

Automated Driving Systems (ADS) refers to a set of technologies and systems that allow a vehicle to operate without human intervention or control. An ADS typically includes sensors, cameras, radar, lidar, GPS, and a computer system that processes the data collected by these sensors to make decisions about the vehicle's movements and actions. The goal of an ADS is to allow the vehicle to safely navigate roads, obey traffic rules, and avoid obstacles without the need for a human driver.

Keywords:

Autonomous Driving System;
Autonomous Vehicle;
Regulatory Compliance.

ADS is an important aspect of the development and deployment of self-driving vehicles, which are expected to transform the transportation industry. However, it is important to have regulations in place to ensure this new technology is rolled out to the public in a safe and responsible manner. In the United States, federal and state governments are working towards building a regulatory framework that will achieve that but the efforts are still in their early stages with a lot of work to be done.

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1. Introduction

Autonomous vehicles (AVs) have been a fantasy for many years, but in recent years they have become a reality due to significant advancements in Automated Driving Systems (ADS). ADS is the technology that enables a vehicle to drive itself. The development of ADS is driven by advances in artificial intelligence, machine learning, sensors, and GPS.

AVs can potentially offer benefits such as increased safety, reduced traffic congestion, and improved accessibility for those who cannot drive. The rise of AVs will also likely change the way we think about and use transportation. For example, the development of ride-sharing services and AVs could lead to a reduction in the number of personally owned vehicles. Additionally, the widespread deployment of AVs has the potential to create new jobs and industries while disrupting existing ones.

With new technology in the market, it is important to ensure the technology is safe for the public. The objective of this publication is to understand the current regulations in place in the United States for Automated Driving Systems.

2. Automated Driving Systems (ADS)

The Society of Automotive Engineers (SAE) has defined six levels of automation for vehicles, providing a standard for measuring the level of automation in vehicles. These levels range from level 0, where the driver is in full control, to level 5, where the vehicle is fully autonomous and driverless[1][2].

- Level 0: No Automation –Driver is responsible to perform all driving tasks with no assistance provided by any kind of automation technology.
- Level 1: Driver Assistance - The vehicle can assist the driver with specific functions such as cruise control or lane-keeping assistance. This means that the vehicle is able to help the driver with specific driving tasks, but the driver is still in control of the vehicle and must be ready to take over at any moment.
- Level 2: Partial Automation - The vehicle is capable of controlling the accelerator, brake, and steering, but the driver must be ready to take control at any moment. This means that the vehicle can perform some driving tasks on its own, but the driver must be prepared to take over if necessary.
- Level 3: Conditional Automation - The vehicle can perform all driving tasks under specific conditions however, the driver must be prepared to take over when necessary. This means that the vehicle is capable of driving itself in certain situations, but the driver must be ready to take control if needed.
- Level 4: High Automation - The vehicle can drive on its own under some conditions. That means presence of a driver is strictly not needed but the driver still might have the option to intervene if needed.
- Level 5: Full Automation - The vehicle can drive on its own under all conditions. That means presence of a driver is strictly not needed but the driver still might have the option to intervene if needed.

In terms of SAE levels of automation, Automated Driving Systems (ADS) is the technology that powers vehicles at levels 3 and above [2]. These systems use a combination of sensors, cameras, radar, lidar, GPS, and a computer system to process data and make decisions about the vehicle's movements and actions.

The benefits of ADS are numerous and far-reaching and have the potential to transform the way people and goods are transported.

- **Improved Safety:** One of the most significant benefits of ADS is improved safety. Human error is the cause of most road accidents, but with ADS, the risk of driver error is greatly reduced. By removing the potential for human error, ADS has the potential to greatly reduce the number of accidents and deaths on the roads. This would lead to significant savings in terms of lives and resources, as well as reduced traffic congestion and emissions.
- **Improved Accessibility:** Another benefit of ADS is improved accessibility. For people who are unable to drive, such as the elderly or differently abled, ADS could provide them with access to safe, reliable transportation. This would greatly improve their quality of life, as well as reduce the need for caregivers and support systems.
- **Increased Productivity:** One of the most exciting benefits of ADS is the potential for increased productivity. With ADS, passengers could use their time in a vehicle for other activities, such as work, entertainment, or rest, instead of driving. This could lead to increased efficiency, as well as reduced stress and fatigue.
- **Reduced dependence on personal car ownership:** With AVs, people may opt for shared transportation options instead of owning a personal vehicle, which can help reduce the cost of transportation and lead to more efficient use of vehicles.
- **New transportation-related business models:** AVs can create new opportunities for businesses to develop transportation-related services and products, such as ridesharing, package delivery, and transportation-as-a-service.

3. Importance of Regulating ADS

ADS is bound to unlock the future of transportation and brings a plethora of benefits with it. However, despite the potential benefits, it is important to regulate ADS to ensure that they are safe and reliable for use on public roads.

One of the main reasons why regulation is important is to ensure the safety of the passengers, other road users, and the general public. Autonomous vehicles are complex systems that rely on sophisticated sensors, cameras, and algorithms to make decisions and operate the vehicle. If these systems fail, the consequences could be catastrophic, so it is essential that they are regulated to ensure that they meet safety standards.

Another important reason to regulate ADS is to ensure that they are reliable and able to operate in a variety of driving scenarios. Autonomous vehicles should be able to operate safely in all weather conditions, traffic conditions, and road configurations. They should also be able to handle unexpected events and make

decisions in real-time to avoid accidents. By regulating ADS, we can ensure that they are capable of operating safely and reliably in a variety of driving scenarios.

Moreover, regulation can help to ensure that ADS is accessible and affordable for all. While ADS offer many benefits, they can also be expensive to develop and produce, making them inaccessible to many people. Regulation can help to reduce the cost of ADS by standardizing the technology and reducing the costs associated with research and development.

4. Current Regulatory Landscape for ADS in the United States

As of 2022, the regulatory landscape for Automated Driving Systems (ADS) in the United States is still in its early stages. Currently, at the federal level, there are no regulations for ADS. Since 2016, the federal government has published various voluntary guidelines for the development of ADS however these are not enforced regulations at the federal level. The federal government argues that implementing strict regulations will impede the development of this fledgling and rapidly evolving technology. The lack of regulations at the federal level then leaves the states to implement their own regulations to control the development and deployment of ADS.

The National Highway Traffic Safety Administration (NHTSA) is the primary federal body responsible for regulating the safety of motor vehicles in the United States. NHTSA has been actively involved in developing guidelines and best practices for the development and deployment of ADS. The agency has released several reports and guidelines since 2016 to ensure that ADS are deployed safely and responsibly.

In September 2016, NHTSA released the “Federal Automated Vehicles Policy (FAVP)” [1] which outlined a uniform national framework for the testing and deployment of automated vehicles. The FAVP established a 15-point safety assessment for manufacturers to assess the safety of their vehicles and provided guidance on the safe deployment and operation of automated vehicles on US roads. This policy formally adopted the six levels of automation as defined by SAE. It also clarified the role of the federal government and states in regulating automated vehicles. As per the policy, the federal government will only be responsible to set safety standards for automated vehicles while the individual state will be responsible to implement regulations that will allow the operation of automated vehicles on US roads. Additionally, the policy set out principles for the collection, sharing, and protection of data generated by automated vehicles.

In September 2017, NHTSA released "Automated Driving Systems 2.0: A Vision for Safety (AV 2.0)" [2] which replaced its prior version (i.e., FAVP) and outlines a more comprehensive approach to regulating ADS. The updated language focuses on the enabling technology (ADS) rather than the autonomous vehicles. NHTSA also recommends that anyone engaged in the testing and deployment of ADS should publicly disclose the Voluntary Safety Self-Assessments (VSSA) [5]. The VSSA has 12 safety design elements - like cybersecurity, crashworthiness, post-crash ADS behavior, etc. - that any ADS should consider. It emphasizes the roles both federal and state governments will play to regulate ADS and suggests a framework that states can use to implement regulations.

In October 2018, NHTSA released “Preparing for the Future of Transportation: Automated Vehicles 3.0 (AV 3.0)” [3] which does not replace AV 2.0 but instead builds upon it. It mainly focused on the challenges and opportunities associated with the deployment of autonomous vehicles on the nation's highways. The report outlines a comprehensive plan for the safe deployment and integration of autonomous vehicles into the transportation system and highlights the key actions that NHTSA and its partners need to take to prepare for this future.

In January 2020, NHTSA released its most comprehensive guidelines yet for autonomous vehicles titled “Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0 (AV 4.0)” [4]. This report builds upon its predecessor AV 3.0 and mainly focuses on the following areas to ensure that the United States continues to lead the research and development of autonomous vehicles:

- **Research and Development:** NHTSA will support and promote research and development activities aimed at advancing AV technologies and ensuring their safe deployment.
- **Collaboration:** NHTSA will encourage collaboration among industry, government, and academic partners to foster a coordinated approach to AV development and deployment.
- **Regulation and Policy:** NHTSA will update its regulations and policies to keep pace with the rapidly evolving AV industry and ensure that AVs are developed and deployed in a way that enhances safety for all road users.

- International Leadership: NHTSA will lead international efforts to advance the safe deployment of AVs, working with other countries and international organizations to develop common standards and best practices.

At the state level, some states, such as Michigan, California, and Arizona, have been active in promoting the development of ADS and have enacted laws to allow for the testing and deployment of ADS vehicles on public roads[6].

Michigan enacted a legal framework (Section 257.665) for autonomous vehicles (AVs) in 2013 to encourage innovation and development. Michigan was the first state to offer manufacturer license plates (M-Plates) to non-OEM companies for AV testing. In 2016, the state of Michigan enacted the Safe Autonomous Vehicle (SAVE) Project (Section 257.665b), which permitted eligible AV stakeholders to develop on-demand transportation fleets. Michigan established the first connected and automated AV corridor with dedicated AV lanes between Detroit and Ann Arbor in 2022 [6].

California legalized self-driving cars in 2012 and ordered the California Department of Motor Vehicles (DMV) to regulate their safety. The DMV's 2014 AV tester program has strict requirements and only 60 stakeholders have permits. Only 4 permit holders were granted in 2018's stricter Driverless Program [6].

From 2015 to 2018, Arizona executive orders decreased autonomous vehicle (AV) testing and operation rules. Remotely monitored AVs no longer need a safety driver. Arizona established the Institute for Automated Mobility Consortium to promote AV development and testing. Arizona also approved for-profit AV transportation services in 2018 and presently has over 600 AVs in operation by diverse parties [6].

5. Conclusion

The metamorphosis of the transportation system has already begun with the advent of ADS technology. Autonomous vehicles will not only improve the overall quality of life for individuals by saving time but also would help save millions of lives lost in road accidents yearly across the world. This would also increase the penetration of transportation to remote locations and also provide accessibility to differently abled individuals who cannot drive today. An idea that was a fantasy years ago is now a reality, especially with manufacturers reorienting their strategies to focus on electric and self-driving vehicles.

However, for these benefits to be realized, it is crucial that governments ramp up their efforts to establish clear regulations. These regulations should ensure that autonomous vehicles are developed, tested, and deployed in a safe and ethical manner, and that they adhere to strict standards of privacy and security. The future of autonomous vehicles is indeed promising, but it is up to governments to take the necessary steps to make sure it is a future we can all look forward to. By establishing clear regulations, governments can help to ensure that the benefits of autonomous vehicles are maximized and that the risks are minimized.

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