



# **Autonomous Vehicles the Next Mobility Revolution**



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# Executive Summary

The implementation of autonomous vehicles will soon alter the landscape of transportation. The term Autonomous Vehicles refers to vehicles which, with a properly designed sensor system (radar, laser, and cameras), software and other tools, can circulate on the road network without a driver. This milestone has been set for a number of reasons. Main among them is the ability to incorporate numerous automotive technologies developed over many years, such as forward collision warning, lane departure alert and V2V (vehicle-to-vehicle) and V2I (vehicle-to-infrastructure) contact into one complicated system.

Furthermore, driverless vehicles promise to eliminate (or at least significantly reduce) road collisions, because autonomous vehicles will not be distracted by activities such as cell phone texting and other unwise conducts that people engage in while driving, in addition to their driving errors. However, despite the many achievements made in these ventures, significant challenges remain to be resolved. The level of safety plays an important role in the choice of a vehicle. If such transformation proved to compromise safety, the chances of choosing a traditional vehicle will increase significantly. In addition, maintaining the cost of producing autonomous vehicles at an affordable level is a major challenge.

Achieving the implementation of autonomous vehicles has come about through an impressive process of research, development and testing. It is not surprising in such an achievement that cooperative ventures have taken place between car companies, universities, government agencies, and other entities. Municipalities are asked to join the collaborative process through legalizing the use of driverless cars on their roads and highways, too.

Most relevant of all, perhaps, consumers need to be persuaded to take part in the upcoming transformation. With all these considerations in mind, the study was carefully conducted as a possible roadmap for major new technology developments in order to update the reader on active demonstrations of already completed autonomous vehicles, on-going projects, and what the future might hold.

This research provided a comparative overview of customers' understanding of advantages and fears about the planned introduction of autonomous vehicles on autonomous vehicles. To improve understanding, web-based multi-population surveys are used to study people's willingness to use and purchase autonomous vehicles in the future.



# Key Findings

The key findings that have come from the report are:

- **Revolution**

Partially autonomous vehicles that can take over such driving functions as steering and speed control are currently on the market. Highly autonomous vehicles that can operate under most conditions will be available for sale in the near future. This kind of mobility will lead to a new birth of freedom in the world. The standard of living, job opportunities, shopping and recreation will all increase dramatically, as accessibility no longer depends on individual drivers who are inflexible and easily distracted. The driver will spend his time reading, working or relaxing in the vehicle.

- **Testing**

Testing for driverless vehicles is ongoing and is expected to increase. Many tests are still in the R&D phase and include test areas for the type of vehicle, such as control (e.g. steering, acceleration, etc.). Since 2015, the Netherlands has allowed public road testing of self-driving cars; in 2017, China conducted private road testing in Beijing at speeds of up to 100 kilometers per hour, and several other cities are following this example. In 2017, Russian technology companies, Cognitive Technologies and Rosselmash, conducted experiments on driverless tractors. In addition, Cognitive Technologies also worked with state-owned KAMAZ to create the first driverless truck for the 2018 World Cup in Russia. Autonomous vehicles scheduled for road testing in the United Kingdom in 2019 and the same year the Swedish Transport Agency granted licenses for public road testing of self-driving vehicles. Overall, multiple driverless car trials have begun either in public or private trials, some involving the community and governments, businesses, companies (some with community involvement) or in private (by corporations, institutions, colleges, governments and the military) or both.

- **Regulations and Standards**

Given the technologies available today and what experts predict will be possible in the near future, policymakers will take the following measures that could lead to the introduction and widespread acceptance of autonomous vehicles. Political support is also a significant, if not the most critical, factor for the implementation of autonomous vehicles.

• **Safety**

Safety is a most required improvement of autonomous vehicles. Highway fatalities have decreased by 25 percent since 2005 due in part to smart auto technologies such as electronic stability control and anti-lock braking. Deaths are expected to decrease as the vehicles become more autonomous.

• **Technology**

Autonomous vehicles are among the most long-awaited technological developments of our days, with a wide range of social ramifications. Technological breakthroughs such as 5G connectivity and artificial intelligence (AI) are the main driving force enabling cars to operate on their own. Information and communication technology (ICT) are expected to require new modes of transport in the future, and this change is in line with consumer demand.



• **Customer Acceptance**

As far as consumers' actual views on autonomous vehicles are concerned, a variety of studies have looked at two types of car drivers with opposing viewpoints. The first group represent those showing an interest in self-driving cars, while the second group showed a lower interest and a distrust of self-driving vehicles. It is important to gradually grow consumer's trust in the technology before the concept autonomous vehicles is fully introduced.

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# Introduction

The concept and realistic implementation of autonomous vehicles has developed over the last decade. This was motivated both by increasing technical and technological capabilities and by the aptitude of experts' imagination. These rapid technical and conceptual advances have not yet been backed up by similar improvements in our community structure, our perception of the limits, as well as the advantages of this technology, or our thorough exploration of the legal and ethical implications of deploying autonomous systems in the context of human conflict. Such future thinking is increasingly focused on a broader concept of autonomy in which the robot itself undertakes to increase the speed of data processing and decision-making of sensors, to minimize human involvement and to replace the many functions of current unmanned device operators.

This book is a fact-based attempt to address these daunting issues in a way that is at once accessible, technologically sound and thought provoking to practitioners and decision-makers in the sphere of autonomous vehicles. This study provides an excellent overview of autonomous vehicles, their history, categorization, capabilities, limitations and future developments; The E-book also explores some of the issues surrounding the likely change in operating concepts, the impact that may have on areas such as policy and consumer acceptance, and the way in which the performance of automated systems could be assessed. These are complex issues which are likely to dominate the mode of deployment and operation of autonomous vehicles as their technical competence matures.

Autonomous vehicles are widely expected to have a transformational impact on society and will play a key role in other processes in the future.

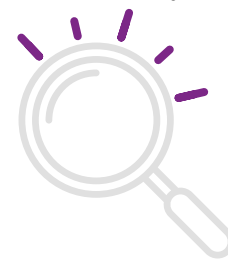


# Study Scope

The ultimate goal of the study is to evaluate how autonomous vehicle technology could contribute to road driving transformation and how the performance of automated vehicles could be assessed. In addition, this study discusses some of the complex issues surrounding the likely change in operating principles, such as the need for flexible, cost-effective and reliable systems and the potential changes in the financial costs and benefits of using autonomous vehicle technology as well as its disadvantages. The paper should serve as a comprehensive overview of literature so that readers can become acquainted with technology, prepare for the future of autonomous driving, and consider what technology can and cannot bring to the mobility industry.

## Purpose & Objectives

The purpose of the study is to contribute an analytical framework of the autonomous vehicle technology. It aims to provide an overview of the potential benefits and disadvantages that Autonomous Vehicle (AV) technology could bring to the global automotive industry and, more specifically, to the end user. The objective is to provide a rationale that any technological innovation has concrete consequences which have a direct effect on work, the market, environment, people's behavior, where Autonomous Vehicle technology is not an exception. Obviously, autonomous vehicles have a variety of positive attributes and will be included in this article, the purpose of which is to illustrate that certain innovations have such negative effects that cannot be prevented. In addition, special attention is paid to the issue of safety and ethics in the broad sense of the deployment of autonomous vehicles on the market. Regulation and tolerance of costumers also play a key role in this analysis.



# Structure of the Report

The remainder of the e-book is organised as follows:

**Section 1** provides an overview of autonomous vehicles. An important part of the chapter clarifies the terminologies associated with autonomous technology and touches upon its categories. Following the classification of the Society of Automotive Engineers (SAE), this research suggests six levels of automation (0-5) which, in three of them, the human driver monitors the driving environment and, in the other three levels, the automated system monitors the driving environment. The chapter continues with a brief history of Autonomous Vehicles, an overview of the field and the current status of the technology.

**Section 2** explores the use of autonomous vehicles for urban mobility and, more specifically, how the autonomous system will have an impact on public transport. Furthermore, this section examines the car sharing, which is a car rental concept where people borrow vehicles for limited periods of time, mostly on hourly basis. The concept is part of the wider phenomenon towards shared mobility. Finally, it examines the effect on capacity of the demand for autonomous vehicles.



## 12.4 Electric Vehicles are coming first because of Covid 19?

Costly electrification projects that have yet to produce sales to car manufacturers continue despite the loss of billions by car manufacturers, with car plants shut down for eight weeks and several dealerships unable to sell cars with home orders throughout the pandemic. However, the prevailing view of the industry is that electric cars must be a customer choice, and electrified powertrains are the backbone of self-driving vehicles and emerging mobility technologies.

As Sam Abuelsamid, Senior Analyst for the Washington-based Guidehouse Insights, a global management consultancy, said: "Electrification is clearly going to be a priority, it needs to be a priority, and for regulatory reasons, it needs to be given to Europe and China in particular, and to a lesser extent to North America." In addition, he added, that the reality is that autonomous vehicle technology is not yet ready, while electric vehicle technology is.

It is also a product line that is much closer to generating revenue than digital technology. Waymo and others have conducted several small commercial trials of self-propelled vehicles. Abuelsamid previously predicted thousands would be deployed globally by about 2023 and millions by 2025. Guidehouse now forecasts about 300,000 will be deployed by 2025 and 13 million by 2030. <sup>145</sup>

Even though some electric vehicle programs have seen delays, GM consistently has said its programs, including the GMC Hummer EV and Cadillac Lyriq EV, will see little to no delays from the pandemic. <sup>146</sup>

145. Hall, K. (2020, May). Coronavirus presents obstacles for autonomous vehicles. The Detroit News.

146. Govtech .(2020).Coronavirus Presents Obstacles for Autonomous Vehicles, May 26, 2020.

## Conclusion

The objective of this research was to establish a state-of-the-art approach to AV technology and its impact on society and the automotive industry. The latter is about to take a turn that others might call a revolution that will transform the way people use vehicles as well as their relationship with transport in a general. This transition to autonomous vehicles presents challenges that need to be overcome, particularly from a societal and technological perspective. Society will need to get acquainted with the idea that, in the near future, they could be surrounded by autonomous vehicles, and people will not have to drive, which requires them to change their habits. Technology readiness is being challenged by the advancement of other technologies, such as telecommunications and infrastructure. However, the strategy that will be used by the key players to have an impact on this future market will include both ethics and economics.

The outcome of this research reveals that, in this particular situation, technologies such as autonomous vehicles will, on the one hand, improve the everyday lives of many people, free parking in busy urban environments, minimize congestion and, most significantly, allow everyone access to the transport network and provide them with social inclusion. The transport industry is working actively to ensure that there is no further limitation on their mobility.

On the other hand, the autonomous vehicles will most likely reduce the production of traditional vehicles. Developing countries will record a rising demand in the long term, while developing countries will definitely increase their demand gradually. In addition, the growth of autonomous vehicle technology is reliant on the development of a number of other technologies, this time coming from diametrically opposed industries, such as telecommunications. The dependency issue highlights the fact that without the development of the network, the infrastructure, the reliability of the communication systems, the expansion of autonomous vehicles will slow down the development of these technologies. Like the expertise of electric vehicles, autonomous vehicle technology would be a game-changer in the fight for market share that threatens the world's largest automotive groups.

The development of the infrastructure and its standardization are also key factors. The network that will eventually be set up to serve these modern interactions will have to be organized, integrated between the various countries and stakeholders that have a role to play in their growth and utilization. Standardization in the sector would be a matter taken seriously by the authorities and regulators, to the full upstream, in order to prevent any mistake.

Improved awareness of the fundamental factors that affect the decision-making process of consumers is of critical significance in order to ensure a wider adoption of autonomous vehicles and car sharing.

The success of autonomous vehicles is subject to the willingness of the respondents to adopt them. However, the performance of autonomous vehicles relies on a supplier's perception of market demand, which is typically derived from a deep insight into consumer decision-making.

The application of policy measures usually relies not only on the characteristics of the system, but also on external constraints. Apart from the technological challenges and financial constraints, the necessary political support is also a significant, if not the most critical, factor.

Current automotive technologies and business models are colliding in the streets of the city to ignite a transformational revolution. Many people wonder how soon autonomous vehicles can continue to solve mobility problems. While various entities have defined unique forecast criteria for autonomous vehicle market penetration, experts expect autonomous vehicles to be commonly used and ready for commercial production by 2040. Optimists expect self-employed vehicles to be safe, affordable and widespread enough by 2030 to displace a lot of human traffic, providing huge savings and benefits.

Although there is general consensus on the prospect of digital mobility, there is a great deal of confusion on how to do it and how best to leverage it for success. There is significant confusion about the production of autonomous vehicles, the advantages and disadvantages, the effects of transport and market demand. The operation of a vehicle on public roads is complicated as the technology is still in the making. Considerable progress is needed before autonomous vehicles can work safely in mixed urban traffic, in weather conditions such as snow and where wireless communication is not available.

Although many new cars feature some of the technology that supports driving, we still do not have fully self-driving cars available for purchase. Years of testing and regulatory approval will be required prior to commercial availability in most jurisdictions.

As regards the cost of an autonomous vehicle, it appears that the first commercially available autonomous vehicles are likely to be expensive and limited in performance.

The transport and mobility industries have recently experienced a range of changes in the form of new technologies, the emergence of alternative forms of transport, the pressure to minimize carbon emissions and the need for environmental sustainability.

There are a number of other things that get in the way, in addition to perfecting the technologies they need. The required road infrastructure is inadequate, the connectivity networks required to connect these cars with each other and the new traffic laws needed to regulate these vehicles.

## Recommendations

This study focuses on autonomous vehicles, the biggest mobility revolution, and discusses complex issues such as policy issues, the benefits and challenges faced by policy makers, consumer behavior and citizens' acceptance of autonomous driving. Many experts can see that citizens lack the information and expertise needed to engage successfully. This is frustrating, because interest choice is at the core of the public decision-making process. Conversely, some people might feel wary of technological expertise while they are not experts, who can understand that their role can assist the identification of "win-win" solutions.

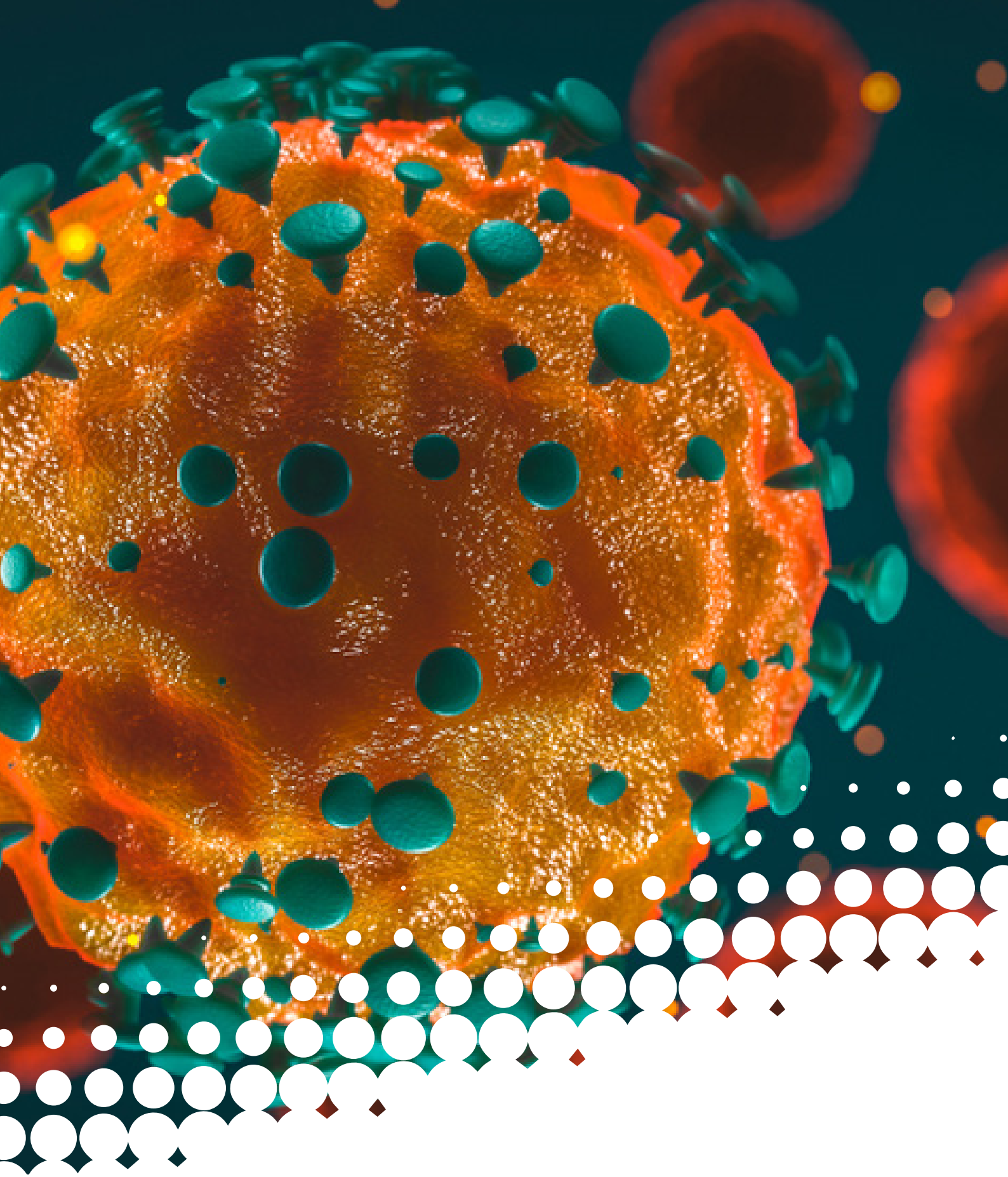
It is noted that there is sometimes a different prediction made by experts on the basis of the different level of expertise. A focus-group research with experts, can provide valuable follow-up research to explore the tools, policy incentives, legislation, etc. that car sharing suppliers need to meet the expected market potential. Car manufacturers, technology experts and other business leaders tend to lead the public debate on self-driving cars. But it is still a good move to test the pulse of the people who matter most — the customers, too. Furthermore, it is crucial to "take a step in the right direction". No one has said that it is easy to make an effective policy. The political insights gathered will contribute to the way policy makers prepare, develop and build a sustainable transport network by using autonomous vehicles. The policymakers must be prepared to justify why action is needed and prioritization rationale of issues that compete for time, energy and resources.

Another critical issue to consider, as mentioned above, and the barrier to fully autonomous vehicles is the question of regulation or liability against the question of hardware or technological capability. The need for both regulations and standards for autonomous driving technology has been acknowledged.

Insuring is about how self-driving cars make moral decisions before an accident. More precisely, the major question is whether people are comfortable allowing the computer to make tough choices in life and death scenarios, such as humans vs. animals, one person vs. multiple people and others. This research provides suggestions on how to make the most of this new technology and mitigate negative consequences on the basis of the research discussed in the previous chapters and outlined above.

In addition, in order to maximize the benefits of autonomous vehicles, it is of crucial importance to gain a full understanding of the perception of those potential users, such as the elderly, non-drivers or people suffering from some form of disability. Future research could aim to study, for example, the preferences of these specific user groups in order to identify and address their concerns. Besides, other possible users of autonomous vehicles should be considered; for example, people under the influence of alcohol should be able to use autonomous vehicles on their own.





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