# REVOLUTIONIZING MOBILITY: EXPLORING THE FUTURE OF AUTONOMOUS VEHICLES

**Abstract**

Since the dawn of human civilization mobility has played a major role in adaptability, survival and henceforth the existence of mankind, invention of wheel was a milestone which has changed the face of mobility Forever. Another such breakthrough invention which has widely impacted the automobile industry is the autonomous vehicle. An effective introduction of autonomous vehicles in the market will lead the first "Automobile revolution". From this survey paper we intent to walk you through the different developmental stages of an autonomous vehicles. As atonicity in vehicles is the ultimate form of mobility hence the name Sovern mobility

**Keywords:** Sovereign, simulators, sensors, autonomous vehicles,

**Authors**

**Mohit Panwar**
UG Student
Department of Computer Science Engineering
Malla Reddy University
Maisammaguda, Secunderabad, India
mohitmunnu6@gmail.com

**Challa Srija**
UG Student
Department of Computer Science Engineering
Malla Reddy University
Maisammaguda, Secunderabad, India
srijachalla2003@gmail.com

**G. Srinivasa Yeshwanth**
UG Student
Department of Electronics and Communication Engineering
Malla Reddy College of Engineering & Technology
Maisammaguda, Secunderabad, India
yeshu.mrcet2019@gmail.com

**Vishakh Adolph**
Junior Research Fellow
Indian Institute of Space Science and Technology
vishakhadolph@gmail.com

## I. INTRODUCTION

Tesla is a brand which needs no introduction it is the company which has come closest to commercializing automatic vehicles on road. there have been many attempts in creating autonomous vehicle since 1980 that was when the first autonomous vehicle was made by Nav-lab at Carnegie Mellon for a fully functional Autonomous vehicle to commercialize emphasis must be put on perception systems and simulators [2018], here the sensors are primarily used for perception, ultrasonic, LiDAR, RADAR, cameras, GNSS, IMU, RTK, etc. are few examples [2018].

Mechanical engineering is the domain in which vehicle manufacturing fell, but now with changing times vehicle manufacturing has become a broad umbrella of iot, ML, robotics [2022] hence leading to smart vehicles these smart vehicles support features like sensing the environment, obeying traffic guidelines, navigating by themselves, ensuring pedestrian and passenger safety, parking, connecting to the internet, making quick decisions, etc. [2022]. This requires advances in many aspects of vehicle autonomy, ranging from vehicle design to control, perception, planning, coordination, and human interaction[rp2018]

**There are various levels of automation**

- **Level 0:** Involves no automation and completely dependent on the human intervention
- **Level 1:** Automation provides assistance with functions as TSR, ACC, etc., but Accelerator and brakes are under human control
- **Level 2:** Steering and accelerator are automated but safety related decisions are taken by the driver himself
- **Level 3:** The vehicle takes full responsibility for monitoring its surroundings and addressing safety-critical issues with conditional driving automation, relieving the driver of these responsibilities. This was stated in Sensors 2021, 21, 706.
- **Level 4:** The vehicle is equipped with high driving automation, and the driver retains control only in the event of an unsafe automated situation. Steering, braking, acceleration, and monitoring of the surroundings are all handled by the vehicle
- **Level 5:** The driver effectively becomes a passenger when the vehicle is fully automated, requiring no human intervention. [rp2021]

From This paper we aim to explain the present state of autonomous cars and its effects on different societal issues, such as safety, effectiveness, and sustainability. The most recent findings in autonomous vehicle technology, including sensing, perception, decision-making, and control systems, will be reviewed. We will also look at the difficulties and moral issues surrounding the use of autonomous cars, including the legal issues, security issues which includes privacy of the user.

## II. LITERATURE SURVEY

In this Research paper “A Systematic Review of Perception System and Simulators for Autonomous Vehicles” author and others (Francisca Rosique*, Pedro J. Navarro * , Carlos Fernández and Antonio Padilla) have provided an overview of the state-of-the-art in perception systems and simulators used in autonomous vehicles research. The authors identify several key topics within this field, including sensor technology, data processing and

 

fusion, machine learning, and simulation environments. They review and compare different types of sensors used in autonomous vehicles, such as cameras, lidar, and radar, and discuss their strengths and limitations. The paper also evaluates different simulation environments and tools for testing and validating autonomous vehicle perception systems, and explores the use of virtual reality and game engines for this purpose.

The authors identify several research gaps and challenges in this field, such as the need for better standardization and benchmarking of sensor performance, as well as the need for more realistic and diverse simulation scenarios. They conclude that perception systems and simulators play a critical role in the development and testing of autonomous vehicles, and that further research in this area is essential for the safe and effective deployment of this technology in real-world settings. Overall, this paper provides a comprehensive overview of the current state of autonomous vehicle perception systems and simulators, and highlights key areas for future research and development.

The paper "Planning and Decision-Making for Autonomous Vehicles" authored by Wilko Schwarting, Javier Alonso-Mora, and Daniela Rus, provides an overview of the challenges and opportunities associated with planning and decision-making in autonomous vehicles. The authors identify key components of autonomous vehicle decision-making, such as perception, prediction, planning, and control, and discuss the challenges of integrating these components into a cohesive decision-making framework. The paper also reviews various approaches to planning and decision-making in autonomous vehicles, including rule-based systems, behaviour-based systems, and model-based systems. The authors discuss the strengths and limitations of each approach and identify key research questions for each.

Additionally, the paper examines the role of machine learning and artificial intelligence in autonomous vehicle decision-making, and discusses the potential benefits and risks of these technologies. The authors emphasize the importance of designing decision-making systems that are transparent, accountable, and safe. Overall, the paper provides a comprehensive overview of the challenges and opportunities associated with planning and decision-making in autonomous vehicles, and highlights key areas for future research and development. It underscores the need for a multidisciplinary approach to autonomous vehicle development, including experts in engineering, computer science, psychology, and public policy.

## III. THE PAPER "A SURVEY OF AUTONOMOUS VEHICLES

Enabling Communication Technologies and Challenges" authored by M. Nadeem Ahangar, Qasim Z. Ahmed, Fahd A. Khan and Maryam Hafeez provides a comprehensive overview of the communication technologies that enable autonomous vehicles and the challenges associated with these technologies. The authors identify key components of autonomous vehicle communication systems, such as vehicle-to-vehicle (V2V) communication, vehicle-to-infrastructure (V2I) communication, and vehicle-to- pedestrian (V2P) communication, and discuss the technical and regulatory challenges of implementing these systems.

The paper also reviews various communication technologies used in autonomous vehicles, including cellular communication, dedicated short-range communication (DSRC), and Wi-Fi. The authors compare the strengths and limitations of each technology and discuss

 

their implications for safety, security, and privacy. Additionally, the paper examines the role of artificial intelligence and machine learning in autonomous vehicle communication, and discusses the potential benefits and risks of these technologies. The authors emphasize the importance of designing communication systems that are secure, robust, and scalable.

Overall, the paper provides a comprehensive overview of the challenges and opportunities associated with autonomous vehicle communication technologies, and highlights key areas for future research and development. It underscores the need for a coordinated and interdisciplinary approach to developing communication systems that can enable safe and efficient autonomous driving.

## IV. THE PAPER "A REVIEW ON AUTONOMOUS VEHICLES

Progress, Methods and Challenges" provides a comprehensive overview of the progress, methods and challenges associated with autonomous vehicles. The authors review the history of autonomous vehicle development and discuss the various levels of automation, from driver assistance to full automation. They also explore the various sensors and technologies that are used in autonomous vehicles, such as lidar, radar and cameras, and discuss the strengths and limitations of each. The paper also examines the methods used for developing and testing autonomous vehicles, including simulation, controlled testing environments, and real-world testing. The authors discuss the advantages and disadvantages of each method and the challenges associated with validation and verification of autonomous vehicle systems. In addition, the paper highlights the regulatory and ethical challenges associated with autonomous vehicles, including liability, privacy, and security concerns. The authors discuss the need for standards and regulations to ensure safety and reliability, and also examine the potential impact of autonomous vehicles on society, such as changes to urban planning and transportation infrastructure. Overall, the paper provides a comprehensive overview of the progress, methods and challenges associated with autonomous vehicles. It underscores the need for a multidisciplinary approach to autonomous vehicle development, involving experts in engineering, computer science, law, ethics and public policy. The paper concludes by highlighting the importance of continued research and development to address the challenges and opportunities of autonomous vehicles

## V. FUTURE SCOPE

Newer, more sophisticated sensors will probably start to be made available for use in autonomous cars as sensor technology continues to progress. The potential advantages and restrictions of these novel sensors, as well as how they can increase the effectiveness and safety of autonomous driving systems, might be the subject of research. Legal and ethical issues: As autonomous cars spread, there will be more questions regarding who is legally responsible for what and how they should be used. Future studies could concentrate on creating rules and moral frameworks that can direct the creation and application of autonomous vehicle technology. Human-machine interaction: Because it can impact the usefulness and safety of autonomous driving systems, human-machine interaction is a crucial topic of study. Cybersecurity: As linked and data-dependent autonomous cars develop, they can be subject to hacker assaults. Future studies may concentrate on creating cybersecurity regulations and protections to defend these systems against possible dangers. Impacts on society and the economy: Autonomous driving technologies have the potential to have a big influence on society and the economy. Future studies might examine the possible social and

 

economic effects of these systems, such as modifications to the transportation system, employment losses, and environmental effects.

## VI. CONCLUSION

This survey article has offered a thorough analysis of the current status of autonomous driving cars, covering the essential technologies that make them possible, the degrees of autonomy, and the difficulties in their adoption. It is evident that the technology of autonomous driving has advanced significantly in recent years, but there are still a number of challenges to be addressed before it can be widely used. Safety is one of the biggest problems with autonomous driving. Autonomous cars must be built to function safely and reliably if they are to dramatically reduce the number of accidents on the road. Advanced sensor technologies, communication systems, and control algorithms are necessary for this since they can identify and react to possible risks on the Legal and regulatory problems with autonomous driving provide another difficulty. Regulations and legislation governing the operation, liability, and moral concerns of autonomous cars will need to be created as they become more common. In order to make autonomous driving safe, responsible, and advantageous to society, business, government, and other stakeholders will need to work together.

There are social and economic repercussions in addition to technological and regulatory difficulties. The impact of autonomous driving on the environment, employment displacement, and transportation infrastructure might be enormous. Future studies in this field should concentrate on comprehending and minimising the possible drawbacks of autonomous driving while maximising its potential advantages. Future research in a number of areas has the potential to boost the field of autonomous driving. The development of sensor technology, human-machine interaction, cybersecurity, as well as societal and economic effects, are a few of these. In order to overcome the obstacles facing autonomous driving and realise its promise to revolutionise transportation and society, more research and development must be done in these areas. The area of autonomous driving has been thoroughly covered in this review article, covering its current state, difficulties, and potential future paths. This survey report is intended to be a helpful tool for academics, decision-makers, and professionals in this sector.

## REFERENCES

[1] 2018-A Systematic Review of Perception System and Simulators for Autonomous Vehicles Research Francisca Rosique, Pedro J. Navarro, Carlos Fernández and Antonio Padilla.
[2] 2018-Planning and Decision-Making for Autonomous Vehicles Wilko Schwarting,1 Javier Alonso-Mora,2 and Daniela Rus.
[3] 2021-A Survey of Autonomous Vehicles: Enabling Communication Technologies and Challenges M. Nadeem Ahangar, Qasim Z. Ahmed 1, Fahd A. Khan 2 and Maryam Hafeez.
[4] 2022-A Review on Autonomous Vehicles: Progress, Methods and Challenges Darsh Parekh, Nishi Poddar, Aakash Rajpurkar, Manisha Chahal, Neeraj Kumar, Gyanendra Prasad Joshi and Woong Cho.

 