# Artificial Intelligence in Automotive Industry: the Journey of Driverless Cars
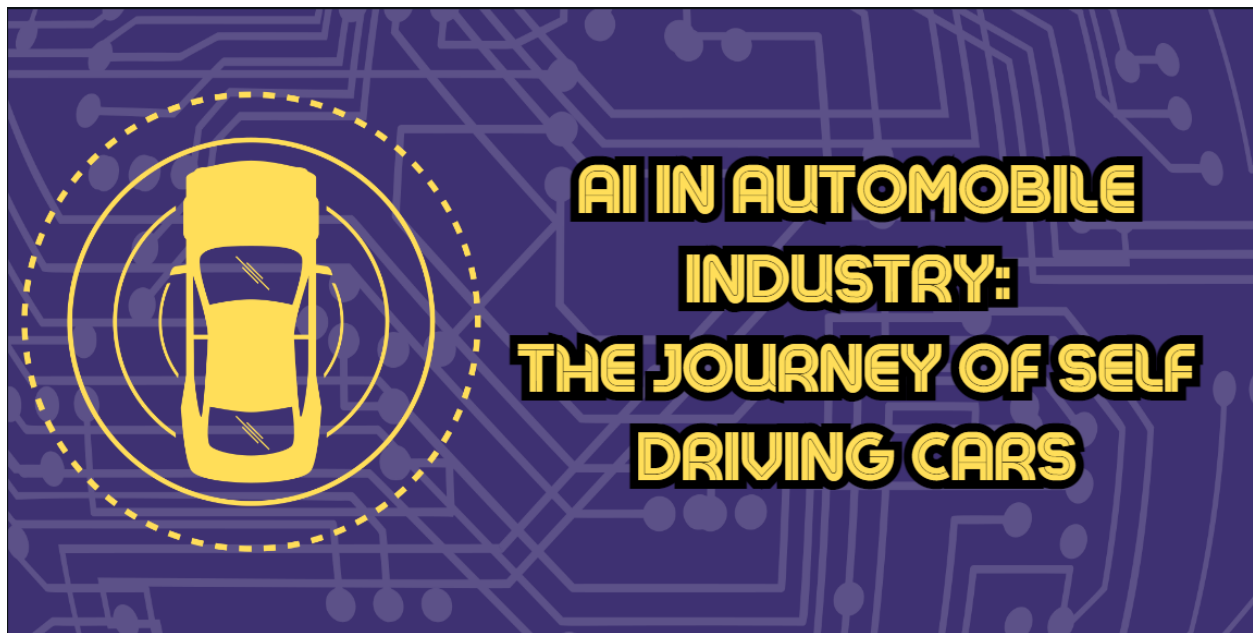
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# Artificial Intelligence in Automotive Industry: Driverless Cars

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## Abstract

The aim of this study research paper is to represent the views of AI in automobile industry. AI in automotives refers to the incorporation of artificial intelligence technology into the design, development, and operation of cars. Artificial intelligence (AI) technologies such as driving safety, efficiency, & comfort.

One of the primary approaches of AI in automotive is of creation of self-driving automobiles. These cars employ advanced sensors, cameras, and other artificial intelligence (AI) technology to detect and respond to their surroundings in real time, letting them to travel roads and highways safely and effectively without the need for human interaction.

AI is also being used to improve the overall driving experience for users. For example, automakers are developing AI-powered systems that can recognize and respond to driver preferences, adjusting things like seat position, temperature, and music based on previous behavior and data analysis.

In addition, AI is being used in automotive manufacturing and supply chain management to optimize production processes, reduce waste, and improve quality control.

While there are many benefits to using AI in automobiles, there are also challenges that must be addressed, such as ensuring the safety and security of AI systems, addressing ethical considerations, and navigating regulatory and legal frameworks. However, as AI continues to advance and become more advance & is likely to play an increasingly important role in the future of the automotive industry.

## 1. Introduction

We are advancing automotive technology by moving artificial intelligence capabilities from the cloud to car systems in the form of more potent processors, stronger vehicle networks, and onboard storage, which support automated driving and digital assistants. The ability of cars to comprehend human behavior and assist people in moving and reaching their destinations precisely and safely is advancing. HERE is attempting to link location information connected to navigation with sensor-based information acquired from Audi, BMW, and Daimler vehicles to help drivers avoid obstacles and road dangers along their path.

One of the main areas where AI is being used in automotives is in the development of autonomous vehicles. These vehicles use advanced AI technologies to detect and respond to their environment in real time, allowing them to navigate roads and highways safely and efficiently without human intervention. AI is also being used to improve the overall driving experience for users, with automakers developing AI-powered systems that can recognize and respond to driver preferences, adjusting things like seat position, temperature, and music based on previous behavior and data analysis.

AI is also playing a key role in automotive manufacturing and supply chain management. By using AI-powered systems to optimize production processes, reduce waste, and improve quality control, automakers can streamline their operations and reduce costs.

AI can detect several aspects of the driver and the vehicle. It can detect a vehicle's speed and position as well as the driver's attention (and whether or not he veers off the intended course). The automobile will stop if the driver veers off the intended and expected

course because it detects a problem. This demonstrates how useful AI in automobiles is.

While AI has the potential to bring about significant benefits in the automotive industry, some challenges must be addressed. These include ensuring the safety and security of AI systems, addressing ethical considerations, and navigating regulatory and legal frameworks. Nonetheless, as AI technology continues to advance and become more sophisticated, it is likely to play an increasingly important role in shaping the future of the automotive industry.

## 1.1 Essential elements of AI
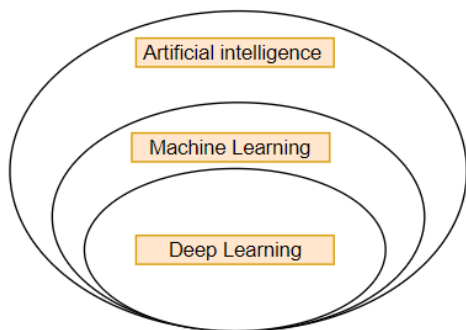


### 1.1.1 Machine Learning

Artificial intelligence (AI) is used in machine learning, which enables systems to automatically learn from their experiences without explicit planning. The development of computer programs that can obtain data and use it for self-study is the main goal of machine learning.

Machine intelligence
Learning Machines
In-depth Learning

The process of learning starts with understanding data, for instance, firsthand it may seem difficult, to look for patterns in

data and make more accurate decisions. The fundamental goal is to make it possible for the system to read automatically without manual assistance or intervention and to adjust their activities accordingly.

### 1.1.2 DL

Deep learning: Data filtering are modeled after those of the human brain in the AI process known as deep learning. In artificial intelligence, deep learning is a type of machine learning that uses readable networks that can be directed from random or unlabeled data. Otherwise called profound brain learning or a profound brain organization.

The advent of deep learning in the digital age has resulted in an explosion of data across all channels and all parts of the globe. This data, which is also known as big data, comes from places like social media, online search engines, marketplaces, and online movie theaters. This enormous amount of data can be shared with fintech applications and is simple to access.

However, the commonly constructed details are so extensive that understanding and extracting pertinent information can take decades. AI-automated support systems are becoming increasingly commonplace as businesses become accustomed to the tremendous power that can result from exposing this wealth of knowledge.

### 1.1.3 Big Data

Big data is that enormous amount of information that is a blend of efficient and casual information gathered by associations that can be planned and utilized in AI projects, expectation displaying, and another high-level examination and analytical applications.

## 2 Literature Review

Artificial intelligence (AI) has been transforming the automotive industry in

recent years, and this literature review aims to provide an overview of the current state of research in this field.

One of the most significant areas where AI is being used in the automotive industry is in autonomous driving. According to M. Quddus et al. (2016), autonomous vehicles are expected to have a significant impact on transportation in the future, and AI is the key technology behind this transformation. They highlight that AI algorithms can process large amounts of data from various sensors, such as cameras, lidars, and radars, and enable the vehicle to make decisions and take actions based on the situation.

AI is also being applied in the creation of smart and connected automobiles. AI algorithms, as explained by A. Mohan et al. (2021), may be used to analyze data from many sources, like sensors, GPS, and social media, to give personalized and predictive services to drivers and passengers. This may encompass anything from personalized music and navigation to proactive car maintenance and health monitoring, according to them.

Another use of AI in the automobile sector is supply chain management. AI may be used to optimize logistics and transportation operations, reduce inventory costs, and increase supplier performance, according to J. Choi et al. (2021). They emphasize the ability of AI algorithms to analyze massive volumes of data from numerous sources, like as sales predictions, client demand, and shipping routes, to deliver real-time insights and suggestions.

Here's a literature review of some key research papers and articles on AI in automotives:

2.1 "Artificial Intelligence and its Application in the Automotive Industry" by Divya Kasturi and Kshitij Gupta (2021): This paper provides a comprehensive overview of the applications of AI in the automotive industry, including autonomous driving, in-vehicle infotainment systems, predictive maintenance, and supply chain management. The authors discuss the benefits and challenges of implementing AI in these areas and provide insights into the future of AI in the automotive industry.

2.2 "Artificial Intelligence in Autonomous Vehicles: A Systematic Review" by Seifeddine Ben Hadj Ali et al. (2020): This paper presents a systematic review of the literature on AI in autonomous vehicles, including studies on perception, decision-making, and control. The authors discuss the challenges and opportunities associated with the implementation of AI in autonomous vehicles and highlight the need for further research in this area.

2.3 "Deep Reinforcement Learning for Autonomous Driving: A Survey" by Kevin Quao et al. (2021): This paper provides a survey of the literature on deep reinforcement learning (DRL) for autonomous driving. The authors discuss the challenges of using DRL in this context and highlight recent advancements in DRL-based autonomous driving systems.

2.4 "Artificial Intelligence for Predictive Maintenance in Automotive Industry: A Review" by Tanmay S. Chavan and S. R. Sangvikar (2019): This paper presents a review of the literature on the use of AI for predictive maintenance in the automotive industry. The authors discuss the challenges and benefits of implementing AI-based predictive maintenance systems and provide insights into the future of this technology.

# 3.Requirement

## 3.1 Road Accidents

Road accident is one of the simplest causes of death in India that can be simply avoided by taking up of certain and required safety measures which can reduce the total number of fatalities as well as total number of major injuries caused due to road accidents in India.

According to a report a total of 4 lakh road accidents were recorded all over India in 2021 which was already an increased number from last year's 2020 3.5 lakh. (source TOI (Times of India)) and this number is increasing day by day and people are being more neglected day by day.

According to Daily updates the major causes presented in road accidents are as follows:

Major Cause of Road Accidents Death
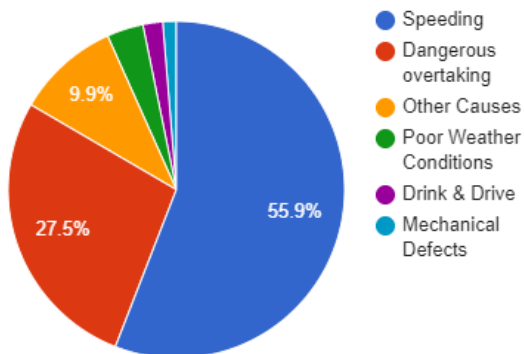


Speeding (55.9%) max*

Reckless Driving (27.5)

Other causes (9.9)

Poor weather condition (3.5)

Driving under influence of drugs/alcohol (1.9)

Mechanical defects (1.3) min*

## 3.2 Stealing of Vehicle's

Automobile industry is one of the major growing industries in the world as the population is finding more easy and comfortable ways of traveling in their daily needs and is also being considered in their daily requirements like a vehicle to commute is now becoming a need considering the day-to-day circumstances.

Vehicle stolen Yearly
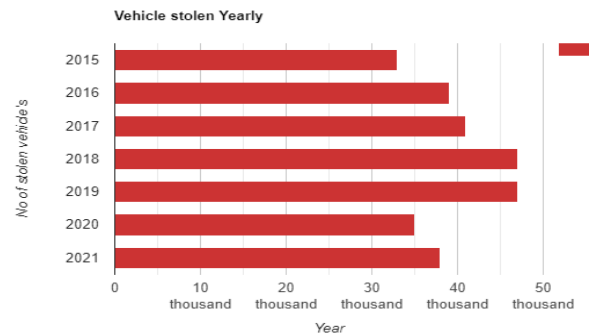


The Indian automobile market is already expanding significantly. It has increased by over 20% during the previous five years. As the economy continues to strengthen, this increase is anticipated to persist. In India, there will likely be more than 30 million automobiles on the road by 2023. Car theft has increased because of the more vehicles on the road.

Low-cost vehicles like the Maruti Suzuki Swift and the Hyundai i20 account for most stolen automobiles in India. Since they are simple to sell on the black market, these models are preferred by thieves. If you own one of these cars, take additional precautions to prevent theft.

Maharashtra is the state with the most auto thefts. This comes because it is India's most

populated state. Mumbai, which is in Maharashtra, is one of the world's cities with the densest populations. Thieves will find it simpler to steal automobiles and get away with them.

On Indian roadways, the typical automobile is about 12 years old. This is so they may get by with an older model as most individuals cannot afford a new car. We may anticipate more new vehicles on the road as the economy recovers. But this also implies that thieves will have more chances to steal them.

## 3.3 Driver Distractions

The safety factor while driving a car is something that cannot be ignored. This is a key feature that can cause or prevent disasters. Although all cars in the standard or elite class are equipped with the latest technologies available, which increases the possibilities for safe driving, the statistics tell a different story. According to the accident lawyer website, the main form of interference is texting, talking to a passenger, loud music, alcohol, etc. And even more worryingly, teenagers cause most of them.

## 4. How AI is solving the problem.

Artificial intelligence is taking the automotive industry by storm, as all major car companies use their resources and expertise to find the best. Similarly, when intelligence is applied to the information in the car, it distinguishes the atmosphere and evaluates the appropriate recommendations when navigating or showing obstacles. In 2015, the adoption rate of artificial intelligence-based systems in new vehicles was only 8%; In 2025, this number should increase to 109%. This is due to the installation of various artificial intelligence systems in vehicles.

## 4.1 Driverless Car

The basic terminology of this whole concept is to reach this stage of automobile in which the driver can sit back with no pressure of driving through heavy traffic with hurting feet or driving on a long run with a brick back the driverless car concept is basically the term defined to the ability of the car to drive on its own without any human assistance or with the minimum chance of failure and maximum accuracy of avoiding any type of casualty on the road as well as keeping up with the traffic norms and follow them changing across the highways.

Driverless cars seem like a major miracle requirement but it's basically the, age of technology that has its play, the major backbone of the whole concept lies on the mind of technology, even if the prototype is build there still a long run to go for India for driverless cars.

The car will have to process a large amount of data at the same time which may not seem difficult but all coming from different type of input source and requiring a different type of code of processing to redirect the whole input to the accurate output is the major task that is to be handled carefully and requires a lot of way long time to go.

## 4.2 Driver Assist Feature

While relatively few companies use fully automated copy, a growing number of builders are encouraging the practice. While introducing features that help the driver not get caught behind the wheel, many companies are wary of AI-based features, but still reject vehicles with advanced safety features. Inadvertent braking, collision avoidance systems, standard and bicycle alerts, cross-traffic alerts, and smart trip

panels are among the small AI features. The willingness of automakers to grow automated cars, transmission trucks and other vehicles opens up many new opportunities. Companies that bring rubber to the streets and disrupt this exciting new market will find valuable dollars.

# 5. Autonomous Cars

An autonomous car is a self-driving car. Drivers don't have to worry about steering here. This depends on the degree of independence that the model can readily provide. These vehicles operate like conventional vehicles without the need for human passenger screening or human passengers in the vehicle.

## 5.1 Levels of Automation

There are six levels of automation Levels of automation:

Level 0: no usage of intelligence aka normal car with total responsibility of driver and his senses

Level 1: Assistance to driver using any type of so-called comfort features i.e. cruise control

Level 2: A more inclusion of the system that steering along lanes i.e., lane keep assist and cruise control or controlled acceleration.

Level 3: Conditional automation means Environmental detection capabilities. The vehicle can take on most driving tasks, but human override is still required. Major control is still in the hands of humans.

Level 4: Here the vehicle systems get major control of the whole scenario that is steering
control of speed and brakes.

Driving from one place to another under controlled circumstances and human assistance is also a part of this level.

Level 5: the total control is transferred to the machine with or without driver.

India is currently at level-2 automation with features like:

- Adaptive Cruise Control
- Lane Departure Warning
- Fatigue Detection
- Night Vision Assist
- Occupant safety

Where the basic technology related to Autonomous cars, India is still preserved with the simple and starting level of ADAS and self-parking functions India still has a long run to complete for the drivers to see a fully automated car on road.

## 5.2 ADAS

ADAS features belong to all these levels of automaton depending of the features and amount of assistance it is providing for the driver.

The currently most leveled up version of ADAS in India was introduced with self-parking vehicles in 2020 with the MG launching its international luxury SUV 'MG Gloster' which according to MG was the car assisted with level-1 autonomous features.
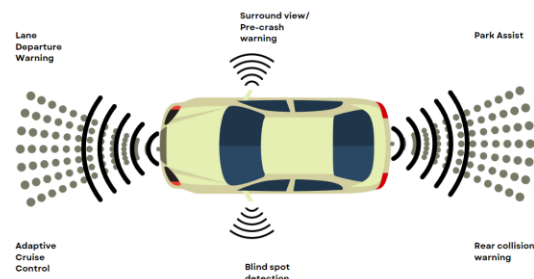


The history of ADAS is not that old for the case of India this is due to a weak tech bone of India.

### 5.2.1 About ADAS

4 ESSENTIAL CONTROL POINTS OF ADAS

ADAS Advance Driver Assistance System belongs to the level 2 automation. It's a set of sensors and processing which provides help to the driver in decision making or allows comfort to the driver
Features like:
Cruise Control
Lane Keep Assist
Collision warning
Blind Spot Monitoring system
etc.

It even has an active participation for driver error management system allowing the driver to keep with those errors for better and safer driving experience.

### 5.2.2 Why ADAS

ADAS allows and adds up to the driver safety and assistance program allowing the driver to have a better driving experience and keep up with the norms of safe driving.

- Cruise Control
- Lane Keep Assist
- Collision warning
- Blind Spot Monitoring system

# 6. Vehicle communication Architecture

Advanced vehicle communications and services in V2X (Vehicle to Everything) and Internet of Vehicles (IV):

• V2X, which means "everything in the world," is an umbrella term for automotive communication systems. Which defines the limits of processing by keeping up the input and output of the whole scenario maintain minimum bandwidth and low latency to achieve that level of transfer. Achieving complete independence. mode.

There are several V2X capabilities such as

- vehicle-to-vehicle (V2V),
- vehicle-to-vehicle (V2I),
- pedestrian (V2P)
- vehicle (V2N)

In this multicultural ecosystem, cars communicate with other vehicles, infrastructure such as robots and parking lots, pedestrians on smartphones, and mobile network operators. Different operating cases have different requirements and need to manage an efficient and costly communication system. A global IoV is achieved by various wireless technologies combined together to surpass the internet and including the heterogenous access of networks.

• IoV– is an advanced developed version of IOT segment.

• IoV major paths:

- Vehicles management
- Novel domains:
- Commercial
- Collaboration
- Communication
- Powerful processing
- Compatibility
- Scalability
- Connectivity
- Network awareness

IoV data is obtained from outside sources (vehicles, infrastructure, sensors, etc.). This data is collected, cleaned, and stored in the database, in the nearby edge/device/vehicle (in case of less latency). Our main data center with AI capabilities also runs on the cloud, so data is stored in the cloud as needed after proper

feature extraction. In this case, the latency will be longer.

## 7. Pros and Cons

As you may have guessed, we have a lot of data from the automobile and a lot of data from the smartphone owner. Artificial intelligence, which we also provide for cars, makes suggestions. We already know you have a meeting tomorrow morning since we accessed your calendar, and we also know your petrol level is low. We will utilize artificial intelligence to send a notice to your smartphone stating, "Please leave half an hour early because you need to acquire petrol." The best qualities are:

a) safety,

b) convenience,

c) cost effectiveness,

d) predictive driving,

e) accessibility.

AI is evolving at such a breakneck pace that it appears mystical at times. According to academics and engineers, AI might become so powerful that it would be difficult for humans to manage. Humans created AI systems by instilling them with every imaginable intelligence, which today appears to be a threat to humans. The flaws are as follows: -

f) Privacy Threat

g) Technical Issues & Software Defects

h) Uncertain Choices

## 8. Economical aspects

The use of artificial intelligence in cars has the potential to the way we look at cars and related concepts to this day. However, all good things come at a price. Artificial intelligence termed as a dream, but the technology is very expensive. The use of sensors, smart screens, touch screens, etc. is not cheaply available on the market. These electronic components are among the most sophisticated available on the market, and their sophisticated nature is required for artificial intelligence to function optimally. The use of microprocessors and microcontrollers is a key element of this technology. You are the one who executes and controls all the functions. Therefore, they must be the best on the market, which indirectly means an increasing cost factor. To be able to do so, you have to invest huge sums of money. In fact, statistics show that companies developing artificial intelligence-related technologies have spent $4.7 billion to date.

## 9. Conclusion

We seem to be at a point on the timeline where it is difficult to predict the future of humanity in the context of artificial intelligence. We are always welcoming new technologies that seem to be changing our lives. increase. But the important fact here is that our empathy for the changes we embrace must have positive consequences for the well-being of society and ultimately the well-being of mankind. Artificial intelligence is the kind of change that shouldn't be taken for granted. What makes it unique, unlike any other knowledge humans have ever industrialized, is its ability to act individually. It is a change that will soon have not only positive impacts on society but also severe negative impacts. So if we are engaging in a change that is expected to change the way we live, whether it is related to employment, privacy, or ultimately the very nature of humanity, we are confronted with its implications. You have to be ready to do so, but eventually, you will. There is an absolute need for a legal policy framework that can safely mitigate AI-related challenges and compensate those affected in the event of fatal errors.

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