# CHAPTER

# 1

# SELF-DRIVING TECHNOLOGIES

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## 1.1 INTRODUCTION

Modern civilisation relies on the automotive industry to connect people, boost economic growth, and advance technologies. From horseless carriages to today's smart mobility, the automotive industry has shaped civilisation. The contributions towards transportation, jobs, and economic development are significant.

Technological advances have changed the automotive industry over time. Road vehicles are constantly changing to meet the current transporttation demands and trends, emphasising enhancing safety and efficiency. Advanced technologies have the ability to transform transportation for humans. An autonomous vehicle (AV) is a mode of transportation that uses advanced technology to efficiently carry passengers. Currently, the development of autonomous vehicles is progressing significantly.

This chapter discusses the present trends, possibilities, and difficulties in automotive technology related to AVs. It explores AV technology and its broad impact on society and industry. It also emphasises the complexity involved in AV development.

### 1.1.1 Key Automotive Technology Drivers

The development of the automotive industry has been affected by environmental issues and climate change. Transportation is a significant

source of greenhouse gases and air pollution, necessitating a shift towards cleaner and more environmentally friendly option.

Electric vehicles (EVs) are considered to be among the key solutions for addressing environmental concerns. EVs are anticipated to replace traditional combustion vehicles to enhance urban air quality and reduce dependence on fossil fuels. Several manufacturers have made significant investments in developing EV models as their primary products.

Sustainable transportation initiatives extend beyond only passenger vehicles. Public transport, such as buses and railroads, is increasingly transitioning to electrification. Electric motorcycles and bicycles are transforming urban mobility, helping to create a transportation network that reduces environmental impact.

The EV system facilitates the successful integration of AV into road transportation. AV is taking the benefit of EV on environmental concern to another level. With AV capability to effectively manoeuvre and navigate, AV is expected to reduce the energy consumption in EV.

Using cutting-edge materials and production techniques in car manufacturing is an important aspect in progressing towards environmental sustainability. Aluminium, carbon fibre, and lightweight materials are being used in vehicles to improve energy efficiency.

## 1.1.2   Technological Advancements

The automotive industry is always evolving with technological advancements. The transformation is driven by the EV powertrain components and systems. In addition to electrification, AV technologies have also been a significant focus. Advanced driver assistance systems (ADAS) are a key component of AV that prioritise road safety by offering functions such as adaptive cruise control, automatic emergency braking, and lane departure warning. ADAS technology may greatly enhance driving safety and decrease road accidents.

Autonomous vehicles use sensors such as LIDAR, radar, camera and GPS. LIDAR technology utilises laser pulses to measure distances and create detailed 3D maps of the vehicle's surroundings to perceive and

navigate through complex road traffic with precision. Radar systems complement LIDAR by providing additional data on speed and distance. Radar is also important in adverse weather conditions where LIDAR may not be effective. GPS technology provides real-time positioning data, enabling AVs to determine their exact location for navigation purposes. Soon, these sensors may also be connected through a network to interact with other vehicles and infrastructure for the purpose of enhancing driving safety, traffic congestion, and traffic flow.

Furthermore, the application of artificial intelligence and machine learning in many technologies enables technologies in AV to learn and adapt to the changing environments and make real-time decisions.

## 1.2   CHANGING CONSUMER DEMANDS

Today's consumers are shifting towards customisation and sustainability. This is leading to the development of many technologies. Demand for eco-friendly cars is driving this development. Buyers traditionally prioritised pricing, fuel efficiency, and performance. However, automotive environmental impact is increasingly a major concern. As more individuals realise the environmental impact of gasoline-powered automotives, EVs and AVs have grown. Corwin et al. (2016) estimated that 69% of people globally would consider buying an EV for their next automotive, with 59% citing environmental concerns. To fulfil demand for eco-friendly vehicles, carmakers are investing in longer-lasting batteries, faster charging, and more efficient electric motors.

In addition to environmental concerns, consumers desire connected and personalised driving. People today desire automotives with cutting-edge equipment that improves driving. Car buyers now consider voice controls, enhanced safety features, and seamless communication with other devices. J.D. Power (2021) found that 68% of automotive buyers prioritise technology and connection. As a result, automotive manufacturers are adding high-tech amenities like entertainment systems, driver aid tools, and self-driving capabilities, coinciding with our book *Testing and Development of Autonomous Vehicle.*