

SELF-DRIVING VEHICLE AND THE FUTURE OF TRANSPORT

Kurhan Ye. R, student,

Voronova Ye.M., Associate Professor

Kharkiv National Automobile and Highway University

A self-driving vehicle, also known as an autonomous vehicle (AV) or a driverless car, is a mode of transport capable of sensing its environment and operating without human involvement. Unlike traditional cars, where the driver must constantly monitor the road, steer, and brake, an autonomous system uses a combination of advanced software and hardware to navigate from point A to point B.

To understand these vehicles better, the industry uses a classification system developed by SAE International, which ranges from Level 0 to Level 5:

- Levels 0–2: Require active human supervision (e.g., cruise control or lane assist).
- Level 3: The car can drive itself under specific conditions, but a human must be ready to take over instantly.
- Level 4: The vehicle is fully autonomous in certain areas or conditions (like "geo-fenced" city centers).
- Level 5: The "Holy Grail" of transport—a car that can drive anywhere a human can, in any weather, without a steering wheel or pedals.

In essence, a self-driving car is a "computer on wheels" designed to eliminate human error, which is currently responsible for over 90% of road accidents [1].

To replace a human driver, an autonomous vehicle must be able to "see," "think," and "act" in real time. This is achieved through a complex ecosystem of hardware and artificial intelligence:

- Sensors (The Eyes): Most self-driving cars use a combination of three main sensors:
- Cameras: High-definition cameras provide a 360-degree view, recognizing traffic lights, road signs, and lane markings.

- Radar: Uses radio waves to detect the distance and speed of other vehicles, even in heavy rain or fog.
- LiDAR (Light Detection and Ranging): Fires millions of laser pulses per second to create a precise 3D map of the surroundings.
- The Brain (Artificial Intelligence): All the data from sensors flows into a powerful onboard computer. Using Machine Learning and Computer Vision, the AI identifies objects and predicts their movement.
- Actuators: Once the AI decides to turn or brake, it sends electronic signals to the car's mechanical parts, such as the steering column and the braking system, to execute the maneuver.

The shift to autonomous driving brings a mix of revolutionary benefits and significant challenges [2].

Advantages:

- Safety: Human error (distraction, fatigue, or speed) causes the vast majority of accidents. AI doesn't get tired or look at a phone.
- Efficiency: Self-driving cars can communicate with each other to optimize traffic flow, reducing congestion and fuel consumption.
- Accessibility: Elderly people and individuals with disabilities who cannot drive traditional cars would gain a new level of independence.
- Productivity: Passengers can work, read, or rest during their commute, turning travel time into useful time.

Challenges:

- Technology Limits: AI still struggles with unpredictable weather (heavy snow) and complex human behavior (hand signals from a traffic officer).
- High Cost: The sophisticated sensors and computing power required make these vehicles very expensive for the average consumer.
- Legal and Ethical Issues: If an accident occurs, who is responsible? The owner, the software developer, or the car manufacturer? This remains a major legal hurdle.
- Cybersecurity: Since these cars are essentially connected computers, they

are vulnerable to hacking, which could have dangerous consequences.

Tesla: Led by Elon Musk, Tesla takes a "Vision-Only" approach. Unlike most competitors, Tesla refuses to use LiDAR, relying instead on high-resolution cameras and powerful AI (Full Self-Driving or FSD). As of 2026, Tesla is expanding its FSD software to Europe and China, aiming to turn millions of existing consumer cars into a "Rob taxi" network through software updates.

Waymo (Alphabet/Google): Waymo is currently the global leader in fully driverless operations. By early 2026, it has expanded to over 20 cities worldwide, including London and Tokyo. Unlike Tesla, Waymo uses an expensive, high-tech suite of LiDAR, radar, and cameras. Their vehicles operate as a dedicated taxi service where there is no human in the driver's seat at all.

Uber: After selling its own self-driving division years ago, Uber has returned as a major "platform" partner. In 2026, Uber does not build the cars; instead, it partners with companies like Waymo, Riviana, and Lucid to offer autonomous rides through the Uber app. Their goal is to be the "operating system" for all autonomous fleets.

Looking ahead to 2030 and beyond, the transport landscape will undergo a total transformation. We are moving toward a concept known as MaaS (Mobility as a Service). In this future, owning a personal car might become a luxury or even unnecessary. Instead, people will subscribe to autonomous fleets, summoning a vehicle via an app whenever needed [4].

Key trends include:

- **Smart Cities:** Road infrastructure will be equipped with sensors that communicate with cars to eliminate traffic jams entirely.
- **Autonomous Logistics:** Long-haul trucking will likely be the first industry to go fully driverless, significantly lowering the cost of shipping goods.
- **Redesigning Interiors:** Without the need for a driver's seat, cars will become "mobile rooms" where you can sleep, hold a business meeting, or watch a movie.

In conclusion, self-driving vehicles are no longer a science fiction dream; they are a rapidly evolving reality that will redefine how we move, work, and live. While significant technical, legal, and ethical hurdles remain, the potential benefits—fewer

accidents, lower emissions, and more free time—are too great to ignore.

The transition will likely be gradual, starting with highways and closed urban zones before reaching full global adoption. As the technology matures, it will not just change our cars, but the very fabric of our cities and our economy. The future of transport is not just about moving faster, but about moving smarter and safer.

References

1. SAE International (Taxonomy and Definitions)
2. Waymo Safety Report & Technology Overview : waymo.com/safety
3. Tesla AI & Autopilot Architecture : tesla.com/AI
4. MIT Technology Review / IEEE Spectrum : technologyreview.com or spectrum.ieee.org

CUSTOMS OPERATIONS AS AN ELEMENT OF PROFESSIONAL TRAINING OF FUTURE TRANSPORT SPECIALISTS

*Gnatko D.S., student,
Voronova Ye.M., Associate Professor,
Kharkiv National Automobile and Highway University*

The modern transport industry is impossible without properly organized customs control. Today, customs operations play an important role in ensuring the safety and legality of the movement of goods and vehicles across the border. In addition, they affect delivery times, transportation costs, and the overall efficiency of logistics processes. Therefore, knowledge of customs procedures is an important component of training future specialists in the field of transport.

For students studying in the transport field, learning customs operations provides not only theoretical knowledge but also practical skills. These include the ability to correctly process cargo, fill in customs documents, choose appropriate customs regimes, and anticipate possible problems during international transportation. Such knowledge makes it possible to effectively plan the work of transport enterprises and avoid unnecessary delays at the border.