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AUTOMOTIVE MOBILITY

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AUTONOMOUS DRIVING: THE FUTURE OF TRANSPORTATION

The term autonomous driving, also known as self-driving or driverless technology, refers to the use of artificial intelligence (AI), sensor technology, and other advanced technologies to control and operate a vehicle without human intervention. While the work on autonomous driving has been evolving for decades, it is only in recent years that technological advancements have made the widespread use of autonomous driving a realistic possibility.

With autonomous driving, a vehicle moves self-controlled, without human intervention, based on an onboard computer. In many autonomous vehicles, AI algorithms are used to analyze the environment and navigate safely on the road. The prerequisite for driverless navigation through traffic is a well-designed combination of sensors and software. With cutting-edge technology like V2X communication (vehicle-to-everything communication), autonomous vehicles perceive their surroundings, including other automobiles, pedestrians, and obstacles on the road. Based on this information, the vehicle's onboard computer controls steering, acceleration, and braking. The technology of autonomous driving is used for individual passenger transportation as well as for commercial transportation (e.g., autonomous trucks). Although these two forms of autonomous driving encompass very different use cases, the general benefits and challenges of autonomous driving apply to both.

What Are the Benefits of Autonomous Driving?

Autonomous driving offers many benefits, whether in terms of improved quality of life, increased efficiency for businesses, or environmental protection and sustainability.

Improved Road Safety: According to an analysis of accident reports and statistics by the National Highway Traffic Safety Administration, 94% of all crashes are caused by human error (e.g., driving under the influence, speeding, or falling asleep due to exhaustion). As autonomous vehicles are equipped with sensors and other technologies, they have a 360-degree view of their surroundings. Based on the collected data, autonomous vehicles can react quicker than any human driver ever could. With V2X and particularly vehicle-to-vehicle communication used in Autonomous Driving, automobiles share information with each other about their respective speed, position, and other factors, allowing them to coordinate their movements which minimizes the likelihood of accidents.

Increased Efficiency: According to a study from the University of Cambridge, driverless cars could improve overall traffic flow by up to 35%. With V2X, vehicle-to-vehicle communication, and automated route planning based on real-time traffic data, autonomous vehicles identify the optimal routes. This leads to reduced congestion, resulting in shorter travel times and less fuel consumption. Due to autonomous vehicles' ability to self-diagnose, downtime associated with repairs and maintenance can be reduced. Autonomous vehicles can operate much longer than automobiles operated by human drivers, who need to take breaks and rest, increasing utilization and efficiency.

Reduced Emissions: As mentioned above, autonomous vehicles use optimized driving patterns and routes, which contribute to energy-efficient driving, leading to reduced emissions. Many autonomous vehicles are being designed as electric or hybrid, which further contributes to the reduction of emissions as part of a sustainable approach to transportation.

Increased Productivity: With autonomous vehicles, drivers can use the commute for other activities, such as working or relaxing. This leads to a better work-life balance and increased individual productivity. For companies that rely on transportation, the reduction of travel time achieved with autonomous vehicles, such as autonomous trucks, improves their overall productivity as a business.

Accessibility for All: Autonomous driving makes the world of transportation more inclusive by improving accessibility. Autonomous vehicles have the potential to provide mobility for people who are unable to drive, such as persons of older age or people with disabilities. As these groups currently rely on traditional public transportation, autonomous driving may offer them individual mobility and independence, improving their overall quality of life.

Improved Vehicle Utilization: Since autonomous vehicles can operate without a human driver, fewer vehicles are needed. Looking at individual transportation, one reason a family may possess two cars is that both parents can go to work by car. But what if it was possible to have one vehicle drop off one parent, pick up the other afterward — and also replace the school bus for the kids? Autonomous driving will fundamentally change the way we think about car ownership, and is likely to give the shared economy a push. In commercial transportation, the higher utilization rate of vehicles based on autonomous driving helps to improve fleet management, as 'empty miles' are significantly reduced.

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Autonomous Driving: Challenges Ahead

Despite the many benefits of autonomous driving, some challenges still need to be addressed before its use becomes widespread.

Technical Challenges: As mentioned, autonomous vehicles require a complex network of sensors, cameras, and other technologies to function safely. These sensor data need to be processed using sensor fusion, which requires huge amounts of processing power that is still not fully available today. A board computer does not know from its own experience or intuition how to handle dangerous situations (e.g., a pedestrian bursting into the road), so it needs to draw from collected data, either in real-time or using shared data from a data network.

Operational Design Domain (ODD): Autonomous vehicles must be able to function reliably under a variety of conditions, including inclement weather and challenging road environments. The term Operational Design Domain (ODD) refers to the set of conditions that must be fulfilled for an autonomous vehicle to operate safely. Defining the ODD is a complex task involving considerations from multiple stakeholders regarding safety, usability, and commercial viability. Updating the ODD for autonomous vehicles is always a work in progress, as technology improves over time and new use cases emerge quickly.

Legal and Regulatory Challenges: Countries worldwide have strong sets of rules and frameworks that govern the use of vehicles and drivers' behavior regarding liability and security. But what if you remove the human factor from that equation? Who is responsible for a possible accident involving self-driving cars? There are currently no consistent laws in place to govern the operation of autonomous vehicles. Governments need to develop a legal and regulatory framework that ensures the safety and security of these vehicles and the public. Although there are rules and legislative frameworks for autonomous driving in many countries, international legal regulations and standards need to be developed as autonomous driving will become a global phenomenon in the upcoming years. Developing a unified set of international rules should also be considered, as autonomous vehicles may be equipped in the future with a standardized system for real-time communication and information exchange based on V2X, which will be comparable to security systems used in airplanes.

Public Acceptance: Despite the obvious benefits of autonomous driving, there is still a significant level of skepticism and concern among the public regarding the safety and reliability of autonomous vehicles. Manufacturers and governments need to educate the public and demonstrate the safety and benefits of this cutting-edge technology.

Conclusion: What Does the Future Look Like With Autonomous Driving?
While the widespread use of autonomous passenger cars is still a few years away from becoming a reality, the future of self-driving technology lies in other applications. One of the first use cases is the operation of autonomous trucks based on the hub-to-hub concept, which will revolutionize the transportation industry. Meanwhile, the future of passenger cars will likely feature an autonomous hybrid solution, where journeys will be a mix of self-driving technology within the ODD and manual driving by human drivers whenever conditions exceed the ODD.

Autonomous driving has the potential to revolutionize individual and commercial transportation and thereby improve the lives of many people worldwide. By reducing accidents caused by human error, increasing efficiency, providing mobility for those unable to drive, reducing emissions, and increasing productivity, this technology has the potential to make a significant impact on society. However, there are still challenges that must be overcome before autonomous driving becomes a widespread reality. With continued technological development, investment, and public education, however, the future of autonomous transportation looks bright.

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Founded in 2006, Ginkgo Management Consulting, a member of the Eraneos Group, is an independent strategy consultancy specializing in complex digitization projects. The consulting spectrum includes the management and implementation of digital and other comprehensive transformation projects, as well as classic CIO consulting, data analytics & AI, and cybersecurity services.