Artificial Intelligence and Reimagining Autonomous Vehicles:
Exploring Solutions, Recommendations, and Future Research Directions

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ABSTRACT

AI (artificial intelligence) will likely be the driving force behind autonomous vehicles becoming widely used within the next 15 years. The auto manufacturing process is expected to grow and develop over time as many phases of the development process, including design, prototyping, testing, production and development, project management, and business support, become more and more reliant on artificial intelligence. Embracing AI fully in the field of autonomous vehicles requires the development of the necessary capabilities, the establishment of a culture of AI, and the upskilling of automakers. In this article, the author examines how artificial intelligence (AI) and autonomous vehicles (AVs) are intersecting, as well as the challenges and opportunities that they represent for the future of transportation.

INTRODUCTION

AI (artificial intelligence) will likely be the driving force behind autonomous vehicles becoming widely used within the next fifteen years. The auto manufacturing process is expected to grow and develop over time as many phases of the development process, including design, prototyping, testing, production and development, project management, and business support, become more and more reliant on artificial intelligence. Embracing AI fully in the field of autonomous vehicles requires the development of the necessary capabilities, the establishment of a culture of AI, and the upskilling of automakers. In this book chapter, the author examines how artificial intelligence (AI) and autonomous vehicles (AVs) are intersecting, as well as the challenges and opportunities that they represent for the future of transportation. Combined with IoT, edge intelligence, 5G, and blockchain technologies, the combination of these technologies opens up the possibility of highly connected, secure ecosystems for autonomous vehicles

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(Biswas & Wang, 2023). There has been a particular focus placed on artificial intelligence led decision making, sensor integration, and machine learning as they are applied to AV navigation and safety. It is becoming more and more important for autonomous vehicles to be able to adapt to diverse traffic scenarios because of the development of learning-based decision-making frameworks (Liu et al., 2021). A number of critical elements are addressed in this book chapter that will enable the author to highlight challenges and opportunities for sustainable and innovative development in this area. There is no doubt that autonomous vehicles will improve sustainable urban mobility in the future, but determining how they can be aligned with diverse user preferences and policy constraints remains a critical challenge (Acheampong et al., 2021). It is now possible to develop cooperative and competitive behavior between multiple vehicles with game-theoretic decision frameworks that enable autonomous cars to negotiate complex mixed-traffic environments (Yan et al., 2023).

Almost every aspect of our lives is being affected by artificial intelligence (AI), and this is especially true in the automotive industry, where AI has been a particularly disruptive force. The rapid development of autonomous vehicles (AVs) has attracted significant investment and attention worldwide in recent years. Similar to previous transportation revolutions, the factors that will support or restrain the widespread adoption of AVs will transcend those directly related to mobility. A major influence will be the growing awareness of global warming and other environmental impacts, for example (Martínez-Díaz & Soriguera, 2018). Autonomous vehicles benefit from built-in sensor self-diagnosis frameworks that facilitate fault detection and operational resilience (Min et al., 2023). Many long-standing transportation challenges can be resolved by AVs, including improvements in road safety, congestion, parking and fuel conservation. Since the advancements in AV technologies in research and development, closed room testing, and public testing, many of these technologies have been successfully used in the real world. There are several factors that affect the public's acceptance of autonomous vehicles, including perceptions of safety, trust, and ethical concerns (Othman, 2021). The rise of smart cities has increased the popularity of automated vehicles. Despite this, legislators, urban administrators, policymakers, and planners are unprepared to deal with the potential disruption caused by autonomous vehicles (Faisal, Kamruzzaman, Yigitcanlar, & Currie, 2019). Autonomous vehicles that incorporate models that explicitly quantify prediction uncertainty are more reliable and trustworthy (Tang et al., 2022).

Research and development of autonomous vehicles are motivated by the need for increased driving safety, an increasing population that also contributes to an increase in the number of vehicles on the road, expanding infrastructure, the comfort of relying on machines for tasks such as driving, and maximizing resources and time management (Parekh et al., 2022). Automated intelligent systems are expanding the scope of autonomous vehicles while posing new regulatory and technical challenges (Bathla et al., 2022). The automotive industry will likely see an increase in the emergence of new products and services based on artificial intelligence in order to enhance the driving experience in the future. Connected and autonomous vehicle ecosystems require coordinated upgrades to roadway infrastructure (Rana & Hossain, 2023). When it comes to autonomous vehicles, artificial intelligence cannot operate in isolation from the rest of the world. As artificial intelligence advances, a considerable amount of hardware will be needed to aid autonomous vehicle development. With the use of more autonomous techniques, different types of errors may be generated. In the absence of proper handling, such errors may result in critical safety concerns (Wang et al., 2020). There will be a noticeable change in the worldwide transportation market as a result of autonomous vehicles. The use of autonomous vehicles will improve the quality of life and safety on the road. There will be a significant reduction in the number of traffic accidents (Wiseman, 2022). While autonomous vehicles have received considerable attention, many of their components are