The Use of Artificial Intelligence Autonomous Vehicles

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Introduction

In the ever-evolving landscape of transportation, AI autonomous vehicles emerge as a paramount force, reshaping the very foundations of mobility across the globe. This transformative development holds the key to a brand-new era of vehicles, pushing beyond the boundaries of what we consider impossible. Its implications go beyond a single function and span a spectrum of innovative possibilities for the average demographic, changing the modern world as we know it. At the core of AI autonomous vehicles lie four critical specialties that underline the nature of this phenomenon: technological advancements, social benefits, ethical and security considerations, and regulatory challenges. These dimensions represent the compass guiding our journey to grasp this cutting-edge knowledge of innovation to make informed decisions as we move toward the future. This paper serves the purpose to educate the reader on these topics and explore the limitless possibilities of this invention while also considering the ethical risks that arise when AI is involved in decision-making on the road.

Technological Advancements

The integration of advanced technology within autonomous vehicles represents decades of pinnacle research and software production in artificial intelligence, sensory technology within vehicles, and machine learning to navigate nature's obstacles on the road. What was once a far-fetched idea for the future has now evolved into a tangible design, promoting the beautiful synchronous symphony of AI decision-making in vehicles. These mobility machines are equipped with state-of-the-art components that enable users to take advantage of safety and efficient travel mechanics on the road. For instance, according to Hwang MH and Lee GS from Applied Sciences, Basel, Vol. 13, "Regenerative braking control based on AI algorithms aims to improve driving stability and comfort for Autonomous Vehicles"(Hwang MH, Lee GS, 2023,

Retrieved 20 Sept. 2023). The article discusses the differences between normal braking and regenerative braking, highlighting several advantages of the process. Normal braking has its flaws, influenced by human-like instincts that vary from person to person. In a hypothetical scenario, one might find themselves moments away from a fatal collision due to a miscalculation or delayed input from the driver (Hwang MH, Lee GS, 2023, Retrieved 20 Sept. 2023). Such a catastrophic situation could affect not only the individuals inside the vehicle, but also other bystanders involved in the crash. However, regenerative braking guided by AI algorithms offers a viable solution to this critical issue. Machine learning decision-making mimics human driving instincts to perfection while also providing a safety component to anticipate future collision events through ongoing data collection and analysis on the road. Professor Niki Trigoni from the University of Oxford Department of Computer Science, who co-supervised the study of AI vehicle navigation, states, "Precise positioning capability provides a foundation for numerous core functionalities of autonomous vehicles"(Niki Trigoni, 2022, Retrieved 20 Sept. 2023). Their study offers an interesting perspective on the tracking system of autonomous vehicles, enabling cars to navigate with complex software-engineered sensors through daily challenges on the road. Machine learning navigation and regenerative braking based on AI algorithms are essential for autonomous vehicles, fulfilling the primary purpose of transportation by safely and efficiently transporting individuals from one location to the next.

Ethical and Security Considerations

Now, we must discuss the ethical considerations surrounding the use of AI autonomous vehicles in public transportation sectors. While delving into this subject, it raises the question of who is responsible in the event of a critical accident or system failure on the road. For example, hypothetically, if an AI vehicle were involved in a significant collision, who bears responsibility:

the driver behind the wheel, the manufacturer, or the software engineer? Furthermore, considering ethical privacy concerns, should manufacturers and developers be allowed to track and store data analysis on users' driving behaviors on public roads? Location data and driving patterns are personal to public drivers who may not want their information known to the engineers of their AI vehicles. These examples share security situations where a trustworthy relationship between the producer and consumer must be established effectively. Patrick Lin, in a TED Talk about the ethical dilemma of self-driving cars, stated, "If a programmer were to instruct a car to avoid a certain obstacle with a set of code instructions, but this resulted in a fatal car accident, it would frame itself as a premeditated homicide"(Patrick Lin, 2016, Retrieved 20 Sept. 2023). He goes on to discuss how accidents like this are inevitable for both manual and self-driving vehicles. Consider a scenario where an autonomous car faces an approaching collision but must choose between colliding with another car or a person on a motorcycle. In this situation, the AI software would analyze the situation to minimize damage and choose to collide with the car, as this choice results in significantly lower injury risk compared to impacting the motorcyclist. Thus, emphasizing the urgency for software developers and manufacturers to prioritize minimal risk analysis in machine learning systems for public transportation road safety (Patrick Lin, 2016, Retrieved 20 Sept. 2023). By doing so, we can effectively address the ethical dimension of AI autonomous vehicles, particularly their decision-making processes aimed at ensuring the safety of users and others on the road. While accidents are inevitable risks on the road, the key lies in the mindset of computer specialists to reduce these occurrences through ongoing innovative and analytical capabilities of AI systems, as described in the scenario above.

Regulatory Challenges

Moving on, regulatory challenges arise when ensuring the safe development and use of AI autonomous vehicles. A complex yet understandable framework is key to this type of innovation. These technological structures must adhere to basic security standards for vehicle testing, certification, and validation procedures. According to Chu M. Zong, "To unlock the potential synergies between humans and machines, various topics in the research and application of human-AI partnerships must be explored through shared mental models"(Chu M. Zong, 2023, Retrieved 20 Sept. 2023). This highlights the importance of cooperation between AI and human interaction for synchronously efficient results. Additionally, the organization "The Society of Automotive Engineers" has established six levels of automation between the vehicle's AI and the driver, ranging from level 0 with no automation to level 5 with full automation (Chu M. Zong, 2023, Retrieved 20 Sept. 2023). It took time for "advanced driver-assistance systems" to collaborate with the driver through the lower levels of the vehicle's AI system. Finally, at the highest level, most self-driven vehicles were able to carry out level 5 and perform driving tasks under all conditions without any intervention from the user. This process ensures reliability for users who depend on vehicle machine learning technology and its swift decision-making on public roads. As mentioned earlier, addressing liability issues and creating foundational guidelines for data collection and its management use are essential. Successful software navigation for AI autonomous vehicles and collaboration between industry stakeholders and researchers hold the answer to many regulatory challenges. Balancing innovation and ensuring an ethical release is paramount for the integration and use of autonomous vehicles in our modern world.

Social Benefits

Finally, we must consider the social benefits of AI autonomous vehicles, recognizing their limitless potential to reshape not only our nation's transportation systems but those around the world. According to the author Hanky Sjafrie, “The first step in creating a self-driving vehicle is to make it aware of its surroundings, and sensors are undoubtedly the most important way to achieve this."(Sjafrie, 2019, pg. 11, Retrieved 20 Sept. 2023). Collaborating sensors with machine learning and an elaborate decision-making process, will alleviate traffic congestion, reduce fuel consumption, prevent critical accidents, and improve the overall flow of transportation networks, whether on busy highways or local roads (Sjafrie, 2019, Retrieved 20 Sept. 2023). Beyond improved public transportation usage, these specialized vehicles offer equal mobility for those with disabilities, special needs, and even the elderly, allowing them to maintain their independence in their daily lives within a fully functional society. AI autonomous vehicles also stand to democratize transportation by making it more affordable and accessible to a broader demographic of the population.

Conclusion

In summary, AI autonomous vehicles represent a powerful force reshaping the foundations of global mobility. They signify a profound technological shift toward the future of AI innovation while exploring the boundaries of ethics and regulations in our society. This innovative development not only promises peak advancements in artificial intelligence but also the exciting potential to revolutionize modern transportation, making it safer, more efficient, and accessible to a larger demographic. We must acknowledge the ethical obstacles and regulatory challenges that may arise as we navigate through the complex realm of public transportation. The role of machine learning is paramount in finding the balance between innovation and responsibility in the field of self-driven vehicles. To achieve this equilibrium, we must promote a

relationship that revolves around accountability and transparency, fostered by collaboration between stakeholders and software developers of AI autonomous vehicles. While security hypotheticals may be associated with this technological phenomenon, we must also consider the positive social impact that self-driven vehicles provide for underserved groups of the population. This type of transportation enhances the lives of those who face mobility challenges, offering them independence and opportunities for a better quality of life. The rise of AI vehicles holds the key to a transformative era in public transportation, with limitless potential for the motor world. It is essential that we find stability among AI technological innovation, ethics, security regulations, and social benefits to redefine how people move through integrated technological advancements in self-driven vehicles. As this concludes my research, I leave you with this question: What do you envision as the most significant role of modern transportation and the widespread adaptation of AI autonomous vehicles?

References

Ai empowers autonomous vehicles to attain safe and reliable navigation. Electronics For You. (2022, September 9). https://www.electronicsforu.com/news/whats-new/ai-empowers-autonomous-vehicles-to-attain-safe-and-reliable-navigation(Retrieved 20 Sept. 2023)

This article talks about how researchers from the Computer Science Department of Oxford developed an add-on solution for the AV software track system, where the AI can successfully navigate through certain weather conditions safely. Their main priority was to focus on numerous core functionalities of autonomous vehicles so that they could perform every road task. Motion planning, prediction, and collision avoidance are just some of the things that AI vehicles bring to the new modern world of transportation. Also, the team's goal is to enable this invention to drive safely in certain weather conditions. Making the autonomous vehicle fully functional, solving all obstacles present on public roads.

Chu, M., Zong, K., Shu, X., Gong, J., Lu, Z., Guo, K., Dai, X., & Zhou, G. (2023). Work with AI and work for AI: Autonomous Vehicle Safety Drivers' lived experiences. *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. https://doi.org/10.1145/3544548.3581564 (Retrieved 20 Sept. 2023)

This Journal entry talks about the process of how AI can be approved and implemented into vehicles by experienced and recruited drivers and put under certain risky situations where the drivers themselves feel comfortable with the AV's software. These drivers would usually be in "non-perfect" AV vehicles, filling in the gap for any misunderstanding. Also, 26 interviews were

conducted with these drivers to give a more accurate broad demographic representation of everyday drivers. Giving the researchers an understandable reason to take results for the interaction between the machine and driver. These experiments would then go on to contribute to the first empirical evidence of the first lived experiences of safety drivers and AI autonomous vehicles.

Engle, J. (2022, September 30). *Are driverless cars the future of Transportation?*. The New York Times. https://www.nytimes.com/2022/09/30/learning/are-driverless-cars-the-future-of-transportation.html (Retrieved 20 Sept. 2023)

This is a news article about how Cade Metz rode in the backseat of an AI-autonomous vehicle with no driver. It talks about how the emotional rollercoaster of a human being goes through when on the road with no physical driver. It describes what it's like from his point of view when sitting in the backseat of an AI vehicle. He then goes on about how there weren't any real issues with the car ride experience. And then talks about how other vehicles interact with the car as they saw in the driver's seat that no living thing was operating the vehicle.

Hwang, M. H., Lee, G. S., Kim, E., Kim, H. W., Yoon, S., Talluri, T., & Cha, H. R. (2023). Regenerative braking control strategy based on AI algorithm to improve driving comfort of autonomous vehicles. *Applied Sciences*, *13*(2), 946. https://doi.org/10.3390/app13020946 (Retrieved 20 Sept. 2023)

This article talks about how regenerative braking powered by AI can leave drivers in a more comfortable situation when put in critical conditions with one or more vehicles, potentially saving lives. An autonomous vehicle driving comfort experience mainly relies on vehicle control

which is made up of a process called “regenerative braking”. Unlike manual braking which has its human decision-making flaws implemented into the car, regenerative braking allows AI to make perfect predictions before collisions even occur. This developed algorithm was later verified by car simulations from “MATLAB/Simulink” which compared its new innovative braking system to manual processes. Also, it ensures driving comfort for passengers by limiting abrupt stops from the vehicle on public transportation roads.

Sjafrie, H. (2020). *Introduction to self-driving vehicle technology*. CRC Press. https://www.routledge.com/Introduction-to-Self-Driving-Vehicle-Technology/Sjafrie/p/book/9780367321253 (Retrieved 20 Sept. 2023)

This book aims to teach about the core concepts that make self-driving vehicles possible and not a fantasy. Its target audience is aimed at those with an interest in providing technical insights on autonomous vehicles. Serving as a good starting point for software developers in the field of AI and producing fully automated cars. It has been written by an active practitioner with experience in the field of “Advanced Driver Assistance Systems” and autonomous driving. It even covers the state-of-the-art theoretical fundamentals of multisensory data fusion and other SDV algorithms.

YouTube. (2015). *YouTube*. Retrieved September 20, 2023, from The ethical dilemma of self-driving cars - Patrick Lin(Retrieved 20 Sept. 2023)

This TED talk from Patrick Lin discusses “The ethical dilemma of self-driving cars” to the audience. He starts by presenting a hypothetical scenario where an AI vehicle is forced to decide to impact other vehicles by avoiding a crash up ahead. Resulting in an ethical decision of who

takes responsibility for the damage from this unfortunate event. Should it be the passenger who owns the AI autonomous vehicle the manufacturer who produced the body of the car, and finally the software engineer who wrote the code for the AI? He then concludes his speech by talking about the idea of avoiding crashes such as this, but ultimately understanding that impacts on public roads are inevitable and should be the main priority to avoid when developing AI self-driven vehicles.