

The Impact of Autonomous Driving on the Economic Costs of Transportation in Asia

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Abstract: There are significant challenges to integrating autonomous vehicles (AVs) into everyday transportation and trust is what affects their widespread. This essay explores strategies to improve public trust in intelligent driving systems including the multifaceted nature of trust, security assurances, transparency, and how ethical considerations affect user confidence. Using a combination of literature reviews and case studies, this study aims to ascertain key factors that contribute to trust building and make actionable recommendations for manufacturers and policymakers. Showing the importance of clear communication, reliable performance, and user-centered design in fostering trust and fostering acceptance of autonomous driving technologies. The existing researches mainly focus on technical security and system reliability but seldom explores the formation mechanism and psychological factors of user trust. In particular, there are gaps in research on how to fully build user trust through technical design and policy support. Therefore, an in-depth analysis of the trust-building of intelligent driving technology, starting from the two aspects of technology improvement and policy formulation, is crucial to promote the wide application and acceptance of intelligent driving technology.

Keywords: Autonomous Vehicles, Driver Trustworthiness, Human-Machine Interaction, Ethical AI, Vehicle Reliability.

1. Introduction

The advancement of global society has been accompanied by rapid population growth. Higher population generates social productive forces, but it also comes with many social problems. Asia, having the largest population share of 59.2% worldwide, is potentially experiencing these challenges with heightened severity compared to other regions. However, with the advancement of technology, AI has been implied in the realm of transportation networks, endeavors are focused on mitigating costs and enhancing the efficacy of traffic flow[1]. In the upcoming section, the term 'AV', shorthand for Automated Vehicles, will be introduced. These vehicles harness advanced AI technologies and cutting-edge computing capabilities to autonomously navigate and function, guaranteeing safe and efficient transportation without requiring direct human intervention. This autonomous operation minimized human error and maximized the overall efficiency of the transportation network. Despite the advantages of AI, this nascent technology frequently suffers questions[2]. Accepting new technology necessitates adopting fresh perspectives and approaches and may present challenges. The distrust and concerns surrounding AI, including safety issues with AVs, privacy concerns, and

potential loss of control over technology[3], which result in substantial resistance during implementation. Furthermore, concerns over giving up direct control over vehicles may induce feelings of insecurity among drivers and pedestrians. To optimize the effectiveness of AI, it is imperative to mitigate biases within the system. As AI's capabilities evolve, ensuring that its actions and suggestions remain logical. As AI assumes more responsibilities within society, both manufacturers and governments should manage and regulate its usage appropriately. Two solutions can address these challenges: First, AV manufacturers can conduct conservative driving tests that control actual driving behaviors to alleviate public fears towards AVs; alternatively, policymakers can introduce relevant regulations to govern AV operations. This essay contends that, while both strategies are viable options, considering Asia's current disparate economic foundation and infrastructure development, regionally restricts access for all parties involved. Therefore, imposing restrictions on AV manufacturers appears more reasonable[2].

2. Methods of Control

It is crucial to measure the relationship between the capability of an autonomous vehicle system and the driver's trust in the machine, as it is a key issue in human-machine trust, addressing insecurities and biases is key to maximizing AI impact, ensuring rational actions and fostering seamless collaboration. Researchers typically depict the interplay between system capability and trust utilizing a two-dimensional coordinate system, where the horizontal axis represents capability and the vertical axis signifies trust[4]. This framework allows for a comprehensive analysis of how the two factors interrelate and influence each other. (see Figure 1)

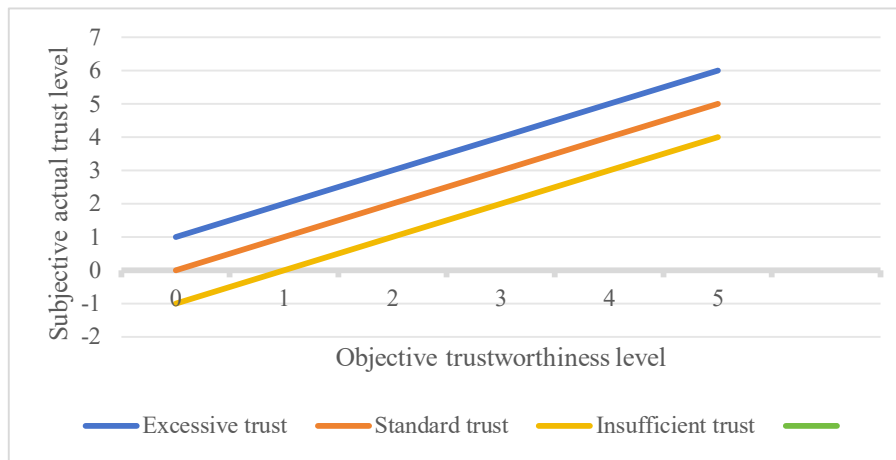


Figure 1: relationship between AV system capability and driver's actual trust level.

Insufficient trust refers to the driver's subjective perceived trust in a system falls short of the system's actual objective trustworthiness (the bottom area of Figure 1), usually because of the driver's underestimation of the automatic driving system's capabilities, leading to a disregard for the system's valuable suggestions. Consequently, the driver fails to fully utilize the automatic system's functions, limiting the overall benefits and efficiency of the system. Excessive trust means that the driver's subjective actual trust level is higher than the objective trust level (the upper area of Figure 1), usually because the driver overestimates the automatic driving system's capabilities, they may become overconfident and neglect the control the vehicle, leading to the misuse of automatic system functions. Manufacturers are responsible for the development and optimization of technology, which can directly affect the security and user experience of the system, while the government is responsible for formulating relevant policies and standards to maintain the uniformity and consistency of the industry's practices, as well as safeguard the entitlements and privileges of users. This approach

ensures that both the integrity of the sector and the well-being of its users are upheld to the highest standards. Combining these two perspectives, the trust problem can be comprehensively solved.

2.1. Controlled by Manufacture

Autonomous vehicle manufacturers play a crucial role in advancing intelligent driving considering its significant responsibility for ensuring public acceptance of autonomous vehicles [5]. Alternatively, they can introduce an optional, conservative driving mode, granting users the autonomy to choose a more deliberate and vigilant driving style[1]. Such driving modes can integrate intelligent speed regulation features, capping maximum speed and steering angle, while enhancing safety by augmenting the buffer zone between vehicles and pedestrians, thereby fostering a more secure driving environment. Through persistent, real-time surveillance and evaluation of road conditions, an intelligent system can dynamically adjust vehicle speed to guarantee safe operation across various scenarios. Manufacturers ought to also undertake safety and reliability assessments tailored to the intelligent system, and make these findings accessible to the public. The system should be tested across various environments such as extreme weather conditions, complex road situations, and emergencies [6] to demonstrate its performance to the public. By openly providing transparent test reports, Manufacturers can give the public a comprehensive understanding of the intelligent driving system. In addition, manufacturers can engage with the public through collaborative projects focused on developing and sharing intelligent driving systems. Engaging users in the processes of product design, testing, and refinement fosters their active participation in the overall product development life cycle[7]. However, this method requires high transparency of information, and autonomous vehicle manufacturers must actively provide society with comprehensive information regarding the capabilities, limitations, and durability of autonomous vehicle systems. This level of transparency not merely elevates public comprehension but also fosters a robust foundation of trust.

2.2. Controlled by Government

Governments hold a pivotal position in mitigating concerns surrounding autonomous driving technology and fostering public confidence[6]. Autonomous driving technology has emerged as an efficacious solution for significantly alleviating urban traffic congestion and enhancing overall mobility. [1]. Governments can strengthen urban infrastructure and elevate public trust in AI-driven automotive technologies. Increased funding for road development and upkeep is crucial. By expanding road networks, repairing damaged road surfaces, refining intersection layouts, and adopting other strategies, governments can increase traffic fluidity and road capacity. Concurrently, during the development of pedestrian walkways and bicycle lanes, urban planning endeavors ought to prioritize the safety and accessibility of pedestrians and non-motorized vehicles. Furthermore, governments may implement an intelligent traffic flow scheduling system designed to optimize traffic light duration and facilitate intelligent regulation of traffic lights. This sophisticated control mechanism is effective in controlling fluctuations in traffic volumes[8], minimizing vehicular delay and enhancing roadway throughput are among its objectives. Furthermore, contemporary technological advancements enable governmental entities to facilitate the digitalization and intelligentization of urban traffic oversight[9]. One illustrative application involves leveraging the Internet of Things (IoT) technology to establish an intelligent traffic surveillance system. This system enables real-time monitoring of roadway conditions, facilitating prompt interventions to regulate traffic flows efficiently. Moreover, developing an intelligent parking guidance system can effectively direct automobiles towards the closest parking spaces, mitigating urban vehicular congestion. Lastly, governmental authorities ought to strengthen the management of urban infrastructure support systems. Regular oversight and maintenance of roads, sidewalks, and traffic signal infrastructure are essential

to ensure their proper functioning to provide a conducive traffic environment for both motorists and pedestrians.

2.3. Methods Combination

Both approaches could be effective in increasing the public acceptance of self-driving cars. However, considering the Asian context, the substantial expenses tied to extensive infrastructure upgrades necessitate careful deliberation. Asia, as the largest and most densely populated continent, confronts economic challenges that impede the widespread advancement of urban infrastructure and the enhancement of public facilities. Progress in this area is gradual, and outcomes are not immediately apparent. In contrast, intelligent driving manufacturers can conduct efficient testing within a significantly short period of time. The manufacturer's research, development, and testing bear global applicability, resulting in reduced ongoing expenses and heightened efficiency. [9]. Manufactures can swiftly combine test outcomes with their actual products, showcasing their performance and safety[10]. Overall, this capacity can rapidly increase consumer confidence and their acceptance towards AI driving technology.

3. Conclusion

In summary, while AI driving technology holds immense promise in mitigating urban traffic congestion, widespread public skepticism poses a significant barrier to its effective deployment. To counteract these doubts, collaboration between AI-powered car manufacturers and government departments is necessary. Firstly, AI automakers must face the problem of the prevailing trust deficit and take action to fill the gap. This includes the clarity and openness of its technological processes. Manufacturers ought to proactively interact with the public through exhibition events, get people to accept through conducting rigorous safety demonstrations and enhance their presence within the community. By fostering enhanced comprehension and confidence in artificial intelligence systems among the general public, manufacturers can pave the way for urban transport networks. Secondly, governments occupy a pivotal position in promoting the implementation of AI-powered transportation solutions. This necessitates the establishment of a distinct regulatory infrastructure that underscores safety, confidentiality, and responsibility. Furthermore, governments ought to allocate resources towards upgrading urban infrastructure to adapt AI-guided vehicles, encompassing improvements to road markings, traffic signaling systems, and pedestrian crossings. Additionally, public education campaigns aimed at highlighting the benefits of AI driving technology and safety standards are essential to increase public confidence and acceptance. In conclusion, addressing the public's inquiries and concerns towards AI-driven transportation necessitates attempts from both government departments and manufacturers. Although this essay puts forward some suggestions for technical improvement, how to effectively combine technical improvement with policy support to increase user trust has not been deeply discussed. Future research could focus on a comprehensive analysis of users and explore how technology and policy work together to build trust. Simultaneously, researches should be conducted to verify the effectiveness of different solutions and promote the wide acceptance and application of intelligent driving technology. Through collaborative problem solving and necessary changes, the potential of AI technology can be fully harnessed to revolutionize urban mobility, alleviate traffic congestion and contribute to the development of safer and more efficient cities for everyone.

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