Public Acceptance of Autonomous Vehicles in Public Transportation

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The field of autonomous vehicles (AVs) is advancing rapidly, with prototype development and on-road testing of AVs frequently occurring, suggesting that AV deployment for public transportation may soon become a reality.

Keywords: autonomous vehicles ; public transportation ; public perception

1. Autonomous Vehicles in Public Transportation

Public transportation is crucial in densely populated cities, in which parking is at a premium and gridlock is the norm. Prototype development and on-road testing of AVs are frequently happening, suggesting that AV deployment for public transit may soon become a reality [1][2]. Despite their usefulness, prior studies have only covered a small subset of possible applications for autonomous vehicles (AVs); thus, we still do not know how the general public feels about AVs being integrated into the public transit system [3][4]. Therefore, this research explores the potential for increased AV deployment in public transit, particularly in densely populated places in which such deployment is particularly important.

Public transportation utilizing Avs is not without challenges; while autonomous trains in subway and metro systems are one example, employing Avs as public road transportation brings unique challenges [4][5][6]. These vehicles must interact with humans in their natural environs rather than in a controlled laboratory setting [7]. Public transportation networks could be revolutionized by introducing safer and more efficient shared mobility made possible by autonomous road public transport, notwithstanding these challenges [8][9]. Further, Avs can free up personnel for jobs and services that require more people by providing dependable, safe, on-demand public transport in low-demand or underserved locations [10][11].

Recent years have seen a proliferation of studies examining the potential impact of Avs on urban transportation, and there is also a growing number of studies examining how people feel about and react to Avs in the personal transportation and shuttle service sectors [12][13]. These studies show that Avs have widespread support among researchers. Concerns about their speed, efficiency, and safety are still major obstacles. Security, framework security, vehicle control, morals, legitimate liability, and integration with other transport modes all affect how the public views Avs, and whether or not they will adopt them as viable means of public transit [14][15][16].

Congestion in urban areas and pollution from vehicle emissions can be mitigated by promoting public transit usage [17]. AVs can lessen the likelihood of mistakes and free up resources so that more humans can be allocated to tasks and services that need them. However, security, framework security, vehicle control, morality, legitimate liability, and integration with other modes of transportation must all be addressed to ensure the efficient deployment of autonomous road public transport in public transportation networks [18][19]. In achieving universal adoption and transforming public transportation networks, autonomous road public transport can provide safer, more efficient, and environmentally friendly shared mobility if certain barriers are removed.

2. General Problem to Optimizing General Public Transportation

Public transportation design has become a topic of significant interest and research in recent years, owing to its critical importance in modern urban environments. One of the most pressing challenges facing public transport systems is the potential impact of autonomous vehicles, as noted in a previous study by Owais [20]. The advent of autonomous vehicles could significantly disrupt traditional public transport systems and necessitate rethinking their design to accommodate changing travel patterns and preferences.

Another critical challenge in public transportation design is optimizing transit assignment models, which allocate transit resources such as buses and trains to meet passenger demand effectively. This task is particularly challenging as it necessitates balancing numerous factors such as transit frequency, passenger demand, and network connectivity. Several studies by Owais and Shaim [21] have attempted to address this problem.

The placement of traffic sensors is yet another critical design issue affecting public transport systems. Proper placement of these sensors is essential for detecting traffic congestion and predicting transit travel times accurately. This problem has been the subject of extensive research over the past few decades, as discussed in several research [21][22][23]. Various optimization techniques have been proposed to address this problem, and the accurate placement of sensors can lead to improved travel times and reduced congestion.

Overall, designing public transportation systems is a multifaceted problem that demands careful consideration of various factors, such as the impact of autonomous vehicles, optimization of transit assignment models, and placement of traffic sensors. Addressing these challenges is crucial for ensuring effective management of public transport systems, meeting the demands of passengers, and keeping pace with the ever-changing urban landscape.

3. Public Acceptance of AVs in Public Transportation

The rise of autonomous vehicles (AV) has sparked considerable interest and discussion regarding their potential use in public transportation. AV has the potential to revolutionize public transportation, but there are concerns and uncertainties about its adoption and implementation [18][19].

The public's worries about the safety and security of autonomous cars must be addressed as they become increasingly common in public transit [24]. Accidents involving AVs in the past have raised issues about the reliability of the technology, so these worries are not unwarranted [24][25]. In addition, passengers' security and privacy are at risk because of the possibility of hacking. As a result, scientists are investigating potential solutions, such as improving cybersecurity measures to foil hacking efforts and creating more foolproof communication networks for AVs [26][27].

AVs' threat to the job market is another big issue, especially for the transportation industry [28]. Introducing AVs may potentially displace these workers, which would have severe societal and economic repercussions. However, many believe that introducing AVs would create new employment prospects, particularly in technological research, development, and transportation service providers [29]. However, these worries must be addressed, and solutions developed to reduce the negative impacts of AVs on employment, such as training and re-skilling programs for affected workers [28][29].

Despite these worries, people nevertheless have high hopes for the benefits of adopting autonomous buses and taxis. Increased safety is a major perk, as AVs have the potential to cut down on mishaps prompted by human mistakes. In addition, AVs have the potential to make life easier for persons who have trouble getting around, such as the elderly or people with disabilities [30]. Possible benefits of AVs include faster and more efficient transportation and less traffic congestion [31]. Therefore, the development and deployment of AVs in public transit networks must consider and embrace these potential benefits.

People also have opinions on the best way to introduce driverless buses and trains to city streets. Others may choose a mixed traffic environment to imitate real-world driving circumstances [32][33], while others may favour dedicated AV lanes to avoid contact with other vehicles. While some prefer on-demand AV services, others feel more secure with predetermined itineraries. Acknowledging and responding to these preferences during AVs' design, testing, and rollout can boost public acceptability and adoption of these technologies. Public policy and legislation should also address liability and legal responsibility in the event of accidents or other issues [34] before AVs are introduced.

The preference for autonomous vehicles in public transportation depends on their autonomy. Others prefer vehicles with a human backup driver for safety [31], while some prefer completely autonomous vehicles without human intervention. Comfort and confidence in technology also influence preferences. According to research, people more familiar with AV technology are more likely to prefer completely autonomous vehicles [29][35].

Frequently cited advantages of autonomous vehicles in public transportation include enhanced safety, reduced traffic congestion, and increased accessibility for marginalized populations. Autonomous vehicles are anticipated to reduce human error and enhance traffic flow, resulting in fewer accidents and smoother traffic. Additionally, AVs can be tailored to the requirements of the disabled and elderly, making transportation more accessible for these populations [36]. In addition, using autonomous vehicles can reduce transportation's [31] environmental impact by reducing both the number of automobiles on the road and emissions.

However, there are potential drawbacks to implementing autonomous vehicles in public transportation. One concern is the possibility of exacerbating existing inequalities, particularly in low-income and minority communities in which AV services may be limited [17][18]. In addition, implementing AV technology in public transportation systems can be expensive, and the benefits may not always outweigh the costs [37]. Lastly, there is the possibility of technical difficulties and unanticipated outcomes, which could result in system failures and accidents.

The implementation cost of autonomous vehicles in public transportation is important for governments and consumers. Although developing and deploying AVs is costly, proponents argue that long-term labor cost savings and increased efficiency will offset these costs. Concerns exist regarding the affordability of AV-based public transportation, particularly for low-income communities that rely heavily on public transportation [19][24][38][39].

Another factor that influences preferences for AV implementation in public transportation is efficiency. AVs can reduce congestion and travel times by optimizing routes and reducing the required stops for each journey [25] This increased efficacy could result in improved accessibility and mobility for passengers, especially those with disabilities or limited mobility. However, concerns exist that AVs may exacerbate existing disparities in access to transportation, as autonomous transit and ride-sharing services may not reach all areas or communities.

Another significant factor in implementing autonomous vehicles in public transportation is convenience. Autonomous vehicles have the potential to provide passengers with greater flexibility and convenience by facilitating on-demand services and reducing delay times [26]. In addition, the ability to perform other duties, such as work or leisure activities, during the commute could make public transportation more appealing to some passengers. Concerns exist, however, that these conveniences may jeopardize safety and security, as passengers may be less vigilant and attentive during journeys [17].

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