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An Evaluation of the Public Transportation System in Kathmandu Metropolitan City

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Abstract
This study evaluates the progress of public transportation in Kathmandu Metropolitan City. It has focused on its alignment with the needs of a growing urban population and the principles of a smart city. Data collection involved personal meetings and telephone interviews with ward representatives from a randomly selected one-third sample of the 32 wards in Kathmandu. Using observation sheets and citizen feedback, the study absorbed on the most commonly used public transportation modes: public buses and microbuses.The findings reveal several critical challenges, including unreliable schedules, poor vehicle maintenance, inadequate behavior of transportation staff, and insufficient accommodations for women, elderly individuals, and other disadvantaged populations. The study highlights the need for municipalities to address these issues comprehensively, incorporating technological solutions, stricter regulatory measures, and user-focused policies. It provides actionable insights for urban planners and policymakers to enhance the quality, accessibility, and inclusivity of public transportation in Kathmandu, paving the way for sustainable urban mobility and smart city development.
Keywords: public transportation, Kathmandu metropolitan city, smart city, urban mobility, inclusive transport, sustainable transportation, public buses, microbuses

Introduction

Public transportation is a critical component of urban development. It is serving as the backbone of mobility for residents and supporting economic, social, and environmental sustainability. In urban areas, efficient public transportation reduces traffic congestion, minimizes environmental impact, and ensures equitable access to essential services for diverse populations (Litman, 2021). The role of public transportation becomes even more pronounced in rapidly growing cities where urbanization intensifies the demand for reliable mobility systems.Kathmandu Metropolitan City, the capital and largest city of Nepal, has experienced rapid urbanization over the past few decades. With an increasing population and a growing number of vehicles, the city's transportation system faces multiple challenges, including traffic congestion, air pollution, and inadequate infrastructure (Dhital, 2020). Public transportation in Kathmandu primarily consists of buses, microbuses, and shared vehicles, which, while popular, struggle to meet the needs of the urban population in terms of reliability, comfort, and inclusivity (Adhikari, 2019).The concept of a smart city offers a framework for addressing these challenges. A smart city leverages technology, sustainable practices, and inclusive planning to improve the quality of life for its citizens. For public transportation, this involves creating systems that are accessible, efficient, and environmentally friendly while accommodating the needs of vulnerable populations, such as women, elderly individuals, and those with disabilities (World Bank, 2022). In this context, evaluating Kathmandu's public transportation system is essential to understanding how the city can integrate smart city principles into its mobility infrastructure.This study aims to evaluate the current state of public transportation in Kathmandu Metropolitan City. By examining its performance, accessibility, and alignment with smart city principles, the research seeks to identify critical areas for improvement. The study focuses on key challenges such as transportation scheduling, vehicle maintenance, and inclusivity measures for vulnerable populations.

Objective of the Study

This article aims to assess the current state of public transportation in Kathmandu Metropolitan City by examining its efficiency, accessibility, and responsiveness to the needs of its citizens. It explores critical aspects such as transportation schedules, the condition of vehicles, staff behavior, and inclusivity for vulnerable groups. By analyzing these elements through the lens of existing literature and performance benchmarks, the article seeks to:

1. Identify the key challenges faced by commuters in Kathmandu.
2. Highlight gaps between current public transportation infrastructure and citizen expectations.
3. Propose actionable recommendations to modernize the public transportation system, incorporating smart city principles for sustainability and efficiency.

Literature Review

Smart city transportation principles emphasize sustainability, efficiency, inclusivity, and the integration of technology. Globally, cities such as Singapore and Amsterdam have implemented intelligent transportation systems (ITS) that use real-time data to optimize traffic flow, reduce congestion, and enhance public transit reliability (World Bank, 2022). These systems include smart ticketing, GPS-enabled vehicle tracking, and multimodal transport integration to ensure seamless connectivity for users (Litman, 2021).

Locally, Nepal has begun integrating smart city concepts into urban planning, particularly in Kathmandu. However, the implementation of smart transportation systems remains limited. A study by Adhikari (2019) highlights that while there is a growing acknowledgment of the need for technological upgrades, challenges such as poor infrastructure, lack of funding, and limited technical expertise hinder progress. Aligning public transportation in Kathmandu with smart city principles requires prioritizing issues like accessibility, environmental sustainability, and the use of digital tools to enhance user experience.

Metropolitan cities worldwide demonstrate a variety of approaches to improving public transportation. For example, Curitiba, Brazil, is recognized for its Bus Rapid Transit (BRT) system, which combines high-capacity buses, dedicated lanes, and well-designed stations to offer affordable and efficient transport to its citizens (Cervero & Kang, 2011). Similarly, Seoul, South Korea, has implemented an integrated public transportation system that uses real-time tracking and seamless intermodal transfers (Kim & Kim, 2019).

Compared to these cities, Kathmandu's transportation system lacks the infrastructure and technology needed to offer similar benefits. Dhital (2020) noted that Kathmandu's reliance on informal and semi-formal transportation systems (e.g., microbuses) results in inconsistent service quality, lack of accountability, and limited coverage. Bridging this gap requires learning from global best practices while considering the local socioeconomic and geographic context.Several studies have explored the challenges of public transportation in Kathmandu. Pandey et al. (2018) identified key issues such as insufficient public transport vehicles, lack of regular maintenance, and inadequate road infrastructure as significant barriers to an efficient system. Moreover, gender-based challenges, such as safety concerns for women, are frequently cited in the literature, with research by Bhandari (2020) emphasizing the need for gender-sensitive transport policies.Citizen feedback studies, such as those conducted by Thapa (2021), reveal widespread dissatisfaction with unreliable scheduling and the unprofessional behavior of transport staff. Additionally, the environmental impact of outdated and poorly maintained vehicles has been highlighted as a pressing concern, with contributions to air pollution being a significant drawback of the current system (Karki, 2019).

Public transportation in Kathmandu is a lifeline for its growing population, with a variety of modes serving commuters across the valley. The Old Bus Park (Ratnapark) functions as a central hub for public buses, minibuses, and microbuses, offering connectivity to numerous destinations within the city. Additionally, battery-powered three-wheelers, an eco-friendly alternative, provide an accessible means of transport for shorter distances, catering to commuters who prioritize sustainability (Manandhar, 2023).Despite the availability of these options, Kathmandu's public transportation system faces numerous challenges, including overcrowding, unreliable services, and a lack of modern infrastructure. These issues, compounded by the rapid growth of the urban population, highlight the need for transformative initiatives. Municipal authorities have expressed their aspiration to transform Kathmandu into a "smart city," emphasizing the integration of innovative technologies to enhance urban life.The concept of a smart city is central to modern urban planning, representing a vision of cities equipped with advanced technologies to optimize efficiency, improve citizens' quality of life, and reduce environmental impact. Though the term "smart city" encompasses various aspects, including "intelligent city," "digital city," and "sustainable city," its core goal is to create a sustainable and safe environment for all (Albino et al., 2015; Dameri, 2013; Hollands, 2008). A smart city leverages data analysis and technology to enhance functions in sectors such as transportation, healthcare, energy, and infrastructure.

From a transportation perspective, smart cities use technology to improve efficiency, reduce congestion, and make commuting more accessible and sustainable. Intelligent transportation systems (ITS), which incorporate GPS tracking, real-time data sharing, and integrated ticketing systems, are common

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features in smart cities. For Kathmandu, the adoption of such measures could revolutionize its public transportation system, addressing issues like overcrowding and inefficiency while promoting eco-friendly commuting practices.

The Kathmandu Valley is experiencing rapid population growth and urbanization. By 2022, the metro area population of Kathmandu reached 1,521,000, marking a 3.33% increase from 2021 (World Population Review, 2022). This surge has placed unprecedented pressure on the public transportation infrastructure, exacerbating existing issues such as overcrowding, unreliable services, and traffic congestion. There are five major areas for improvement in road safety laws in Nepal: seat-belt regulations, helmet laws, speed laws, child restraint laws, and drinking and driving laws (Dhungana et al., 2024).

Methodology

This study employs a mixed-methods approach to thoroughly evaluate the state of public transportation in Kathmandu Metropolitan City. By integrating qualitative and quantitative research techniques, the study ensures a holistic analysis that captures both systemic challenges and the lived experiences of commuters. This methodology offers a balanced framework for identifying gaps, measuring performance, and proposing targeted solutions. The research focuses on all 32 wards of the Kathmandu Metropolitan City, with one-third of the wards randomly selected for data collection. This sampling strategy ensures the findings are representative of the entire metropolitan area while remaining practical in terms of time and resources. Random sampling minimizes bias and allows for generalization across the diverse geographic and demographic landscape of the city. The study uses three key methods: semi-structured interviews, structured observation sheets, and citizen feedback surveys. The collected qualitative and quantitative data were analyzed to uncover patterns, identify challenges, and highlight opportunities for improvement. By comparing the findings against established benchmarks for smart city transportation systems, the study provides actionable recommendations for modernizing Kathmandu's public transportation network.

Findings and Discussion

The public transportation system in Kathmandu Metropolitan City predominantly consists of public buses and microbuses, which are the primary modes of commuting for a significant portion of the population. Public buses operate on major routes, providing essential connectivity across the city, while microbuses cater to smaller neighborhoods and less accessible areas. Despite their extensive presence, the quality and efficiency of these services vary considerably.The general condition of vehicles reflects significant shortcomings. Many buses and microbuses are outdated and poorly maintained, with visible signs of wear and tear. Issues such as broken seats, inadequate ventilation, and poor cleanliness are prevalent, making these vehicles uncomfortable and unsafe for daily commuting. The lack of consistent upgrades to the vehicle fleet further exacerbates the problem, with older vehicles contributing to increased air pollution and operational inefficiencies.

Table 1: Major Quality of Transportation recommended

Uptake public transport	Travel mode
	Passenger kilometer travelled
Travel efficiency	Public transport patronage
	Speed of journey
	Travel time
	Vehicle fuel consumption
	Reliability departure and arrival time
Accessible	Catchment area time
	Catchment area distance
Affordability	Cost of travel
Travel experience	Road safety
	Personal security
	Comfort

Findings from Qualitative Perspectives of Participants

Participants provided rich insights into the challenges and shortcomings of Kathmandu's public transportation system. Commuters highlighted unreliable schedules and long waiting times as significant issues, particularly during peak hours. Many expressed frustrations with inconsistent services, often causing disruptions to their daily routines. Concerns over the unprofessional behavior of transportation staff were frequently reported, with passengers describing instances of rudeness, lack of assistance, and poor enforcement of reserved seating for women and the elderly. Female passengers further emphasized the need for safety measures, citing harassment and overcrowding as recurring problems.Local authorities acknowledged these issues but pointed to resource constraints and systemic inefficiencies as major barriers to improvement. They admitted that while feedback from citizens is valuable, the current mechanisms for addressing complaints are informal and underutilized. Authorities also recognized the importance of integrating smart technologies, such as GPS tracking and electronic ticketing, but identified limited technical expertise and funding as obstacles to implementation.Policymakers and urban planners noted the critical gaps between Kathmandu's public transportation infrastructure and smart city benchmarks. They emphasized the urgent need for adopting sustainable practices, such as introducing electric buses, to address air pollution and reduce operational inefficiencies. While inspired by successful models from cities like Curitiba and Seoul, they stressed the importance of tailoring solutions to Kathmandu's unique geographic and socioeconomic conditions. Across all perspectives, there was a shared call for more inclusive policies, reliable scheduling systems, and technology-driven innovations to modernize the transportation system.

The Quantitative Findings

The quantitative findings provide a measurable understanding of the public transportation challenges in Kathmandu Metropolitan City, aligning with qualitative insights. The data, collected from passengers, ward representatives, and policymakers, highlight critical areas requiring reform. Below is a summary of the findings supported by illustrative table.

Indicator	Response (%)
Accessibility and Inclusivity	
Accessible for people with disabilities	Always (5%)
Reserved seating availability	Excellent (10%)
Service Reliability	
Schedule adherence	Very Reliable (5%)
Average waiting time during peak hours	<10 min (10%)
Safety and Comfort	
Feeling safe on public transport	Always (15%)
Cleanliness of vehicles	Excellent (5%)
Comfort of seats and space	Excellent (10%)
Technological Integration	
Awareness of real-time tracking apps	Yes (15%)
Willingness to use digital payment systems	Yes (70%)
Environmental Concerns	
Importance of adopting electric vehicles	Very Important (60%)

The results indicate significant gaps in inclusivity and accessibility for vulnerable populations, including women, the elderly, and individuals with disabilities. While the majority of respondents reported using public transport regularly, they identified notable deficiencies in infrastructure and policies promoting equitable access.Service reliability emerged as a significant issue, with most participants reporting long waiting times and unpredictable schedules. Peak-hour congestion further exacerbates the unreliability of public transportation.

Passenger safety and comfort are critical concerns. A significant proportion of respondents highlighted overcrowding and the poor physical condition of vehicles as factors undermining their travel experience. There is limited awareness and usage of technology in Kathmandu's public transportation system.

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Most respondents expressed interest in digital tools like real-time tracking and smart payment systems, underscoring an unmet demand for technological modernization. Participants expressed a strong preference for eco-friendly transportation solutions. Most recognized the importance of transitioning to electric buses to address pollution and promote sustainable urban mobility.

The quantitative findings reveal critical insights into the state of public transportation in Kathmandu Metropolitan City. Accessibility emerged as a significant concern, with only 15% of respondents finding public transportation consistently accessible to people with disabilities. Reserved seating for vulnerable groups, including women and the elderly, was rated poorly, with 40% deeming it inadequate. These results highlight the urgent need for infrastructure upgrades to ensure equitable access for all commuters. Service reliability also proved to be a major issue. Over 55% of respondents reported schedules as unreliable or very unreliable, and 65% faced waiting times exceeding 20 minutes during peak hours. Such unpredictability disrupts daily routines and diminishes public confidence in the transportation system. The findings underscore the necessity of implementing fixed schedules and real-time tracking systems to enhance reliability.Passenger safety and comfort were additional areas of concern. While 60% of respondents felt unsafe at least occasionally during their commutes, cleanliness and comfort levels were rated poorly by over 40% of participants. Overcrowded and poorly maintained vehicles were frequently cited as contributing factors, emphasizing the need for fleet upgrades and stricter maintenance standards. Technological integration is minimal, but demand for it is high. Only 15% of respondents were aware of real-time tracking apps, but 70% expressed willingness to adopt digital payment systems if available. This reflects a significant gap between current services and commuter expectations, suggesting an opportunity for modernization through smart city technologies.

Environmental concerns also resonated strongly among participants. A majority (60%) rated the adoption of eco-friendly vehicles, such as electric buses, as very important, underscoring the growing public awareness of sustainability issues. These findings suggest that transitioning to cleaner technologies could address both environmental and commuter concerns. The quantitative data highlight critical gaps in accessibility, reliability, safety, and technology integration within Kathmandu's public transportation system. These insights provide a roadmap for policymakers to prioritize inclusive policies, modernize infrastructure, and adopt sustainable practices to create a more efficient and equitable urban mobility framework.

Public transportation schedules in Kathmandu are highly inconsistent, with frequent delays and a lack of adherence to fixed timetables. This unreliability forces passengers to wait for long periods, particularly during peak hours, significantly impacting their daily routines.

The absence of regular inspections and maintenance programs has led to a deterioration of vehicle conditions. Mechanical failures and breakdowns are common, causing service disruptions and compromising passenger safety.

The behavior of transport personnel, including drivers and conductors, often fails to meet professional standards. Complaints of rudeness, unhelpfulness, and a lack of respect towards passengers, particularly women and elderly individuals, were frequently reported during the study. Training programs for staff are either insufficient or non-existent, resulting in a lack of customer service awareness.

The transportation system lacks adequate provisions for women, elderly individuals, and people with disabilities. For instance, reserved seating is often not enforced, and vehicles are not equipped with ramps or other accessibility features. This exclusionary environment discourages vulnerable populations from using public transport.Feedback from citizens provides valuable insights into the challenges they face while using public transportation. Passengers expressed dissatisfaction with the unpredictability of services, overcrowding during peak hours, and the poor condition of vehicles. Many also highlighted safety concerns, particularly for women and children, due to the unprofessional behavior of transport staff. On a positive note, citizens acknowledged the affordability of public transportation, making it a crucial option for lower-income groups despite its shortcomings.

In addressing these challenges, Shahin et al. (2024) emphasized the urgent need for organized and efficient public transportation systems. RSS (2023) noted that "traffic jams are a daily reality due to an overload of vehicles, inadequacy of public transport, and inefficient traffic management." The widening roads would not solve the problem. Instead, it called for prioritizing large-capacity vehicles over smaller ones and promoting dignified and organized public transportation. The critical importance of adopting electric vehicles, not only to mitigate air pollution's harmful effects on public health but also to support a self-sufficient economy by reducing business losses and operational costs. To lead by example, it proposed that public institutions, including government offices, schools, and hospitals, should prioritize the use of electric vehicles.

The challenges of Kathmandu's public transportation have been long recognized. Himalayan News Service (2019) described commuting in public vehicles as an "unpleasant experience" characterized by overcrowding, lack of proper operating schedules, inadequate bus stops, and uncomfortable rides. These issues, coupled with untimely and unreliable services, continue to disrupt the daily lives of citizens. It underscored the urgent need for a safe, efficient, and quality public transportation system in the Valley to address the growing population density and its associated mobility challenges. It is necessary to strengthen the road safety practices to reduce accidents and fatalities (Giri et al., 2023).

Kathmandu's public transportation system significantly lags behind smart city benchmarks, with critical gaps in technology integration, sustainability, and inclusivity. While smart cities leverage advanced technologies for real-time tracking, electronic ticketing, and efficient route management, Kathmandu relies on outdated, manual operations. This inefficiency leads to unpredictable schedules, cash-only payments, and poor commuter experience, emphasizing the urgent need for digital transformation.Environmental sustainability is another pressing concern. Unlike smart cities that prioritize low-emission vehicles or electric buses, Kathmandu's transportation system predominantly uses aging diesel and petrol-powered vehicles, contributing to high levels of air pollution and carbon emissions. Implementing eco-friendly alternatives, such as electric buses and solar-powered infrastructure, could mitigate these issues while promoting a greener urban environment.Inclusivity remains one of the most glaring deficiencies. Women, elderly individuals, and people with disabilities face significant barriers, from a lack of priority seating and ramps to unsafe environments for women commuters. By adopting inclusive practices like accessible infrastructure and gender-sensitive policies, Kathmandu can make its transit system equitable and user-friendly.

Recommendations

Municipal authorities should establish a centralized scheduling system to standardize public transportation timetables. This can include the introduction of fixed schedules for buses and microbuses, monitored through digital systems to ensure adherence. Public awareness campaigns can also be conducted to inform citizens about updated schedules.

Regular vehicle inspections should be mandated to ensure roadworthiness and passenger safety. Policies requiring transport operators to meet minimum safety and cleanliness standards must be enforced. A system of penalties for non-compliance, combined with incentives for maintaining high standards, can encourage better practices.

Comprehensive training programs are essential to enhance the professionalism and effectiveness of Kathmandu's public transportation system. Drivers, conductors, and other staff should undergo rigorous training in customer service and professional conduct, ensuring respectful and efficient interactions with passengers. Additionally, gender sensitivity and inclusivity training are crucial to address the diverse needs of passengers, including women, the elderly, and people with disabilities. A focus on traffic regulations and road safety measures will not only reduce accidents but also foster a safer commuting environment.

Public transportation must be inclusive and accessible to all segments of society. Introducing reserved seating for women, elderly passengers, and people with disabilities, along with strict enforcement, is a step toward equitable commuting. Infrastructure upgrades, such as wheelchair ramps and designated spaces for mobility devices on buses, are also necessary. Public awareness campaigns can educate citizens on respecting these spaces, fostering a culture of empathy. Furthermore, women-only buses or compartments during peak hours can enhance safety and comfort for female commuters, addressing a pressing concern in Kathmandu.

Modern technology can revolutionize Kathmandu's transportation system, bringing it closer to smart city benchmarks. Developing real-time tracking systems through mobile apps or web platforms can offer passengers updates on bus locations, estimated arrival times, and seat availability, reducing uncertainty and wait times. Implementing smart ticketing systems, such as prepaid cards or mobile payments, can streamline fare collection, improve efficiency, and minimize cash handling issues. Finally, using data analytics to monitor passenger flow and identify high-demand routes will enable transport operators and municipal authorities to optimize resources and plan more effectively.

Conclusion

This study highlights the pressing challenges facing the public transportation system in Kathmandu Metropolitan City, including unreliable scheduling, poor vehicle maintenance, unprofessional staff behavior, and limited inclusivity for vulnerable populations. While public buses and microbuses remain vital for daily mobility, their current state does not meet the needs of a rapidly urbanizing population. Citizens' dissatisfaction, coupled with the gap between existing practices and smart city principles, underscores the urgency for reform.

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The findings indicate that improving Kathmandu's public transportation requires comprehensive measures such as implementing reliable scheduling systems, enforcing strict vehicle maintenance policies, and introducing inclusive practices for women, elderly individuals, and disadvantaged groups. Additionally, leveraging technology for real-time tracking and smart ticketing can modernize the system and enhance user experience.

The transportation in urban development, municipal authorities must prioritize the reform of public transportation as a cornerstone of Kathmandu's smart city aspirations. By addressing the identified challenges and aligning with global best practices, Kathmandu can transform its transportation system into a more efficient, accessible, and sustainable model, improving the quality of life for its residents and fostering economic growth.

This study calls on policymakers, urban planners, and stakeholders to act decisively, ensuring that public transportation becomes a driver of sustainable urban development in Kathmandu.

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