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User Perception and Preferences in Dynamic Ridesharing Platforms

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Abstract

This study investigates user perceptions and preferences regarding dynamic ridesharing services, with the objective of integrating behavioral insights into the design of more user-centric mobility platforms. A questionnaire-based survey was conducted to collect both quantitative and qualitative data from potential ridesharing users, focusing on expectations, preferred features, willingness to tolerate trade-offs such as longer travel times or detours, and key deterrents to adoption. Results indicate a strong willingness to share rides for cost savings and environmental benefits, while highlighting safety, affordability, and travel efficiency as the most valued attributes. Conversely, fear of harassment and concerns about excessive detours or wait times were identified as the main barriers to adoption. The study concludes that effective ridesharing platforms must prioritize user safety, ensure efficient routing, and maintain competitive pricing to enhance user experience and encourage widespread acceptance of dynamic ridesharing solutions.

Keywords: Dynamic Ridesharing; User Perception; Multi-Objective Optimization; Shared Mobility; Ride-Hailing Platforms; Behavioral Insights

Introduction

The landscape of urban mobility is undergoing a significant transformation, with dynamic ridesharing emerging as a promising solution to address challenges such as traffic congestion, environmental pollution, and escalating transportation costs. Dynamic ridesharing systems represent an evolution in the concept of ridesharing, moving beyond static, pre-arranged carpooling by enabling the formation of carpools on short notice, often with minimal prior notification. This research outlines how this flexibility allows drivers and riders to share rides, making it an adaptive solution to modern urban mobility challenges. These systems utilize real-time data to match ride requests with available drivers, optimizing routes and resource allocation to enhance operational efficiency and user satisfaction [1]. The objective is to maximize the utilization of each vehicle and minimize the total number of vehicles required by matching passengers to vehicles [2]. Studies have shown that optimized ridesharing can significantly reduce Vehicle Miles Traveled and associated emissions, contributing to urban sustainability goals [3].

While extensive research has focused on the algorithmic and technical optimizations required to enhance the scalability and efficiency of these platforms [4], a significant gap remains in integrating these technical solutions with a deep understanding of user behavior. Specifically, the development of multi-objective optimization frameworks for ridesharing platforms, which must balance conflicting objectives such as minimizing travel time and maximizing affordability, often lacks a crucial behavioral dimension. The human element user perception, preferences, and acceptance is equally critical for the successful adoption and sustained growth of ridesharing services. Existing literature highlights factors such as convenience, cost, and accessibility in the adoption of ride-hailing services [5]. However, a deeper understanding of the trade-offs users are willing to accept, specific feature preferences, and the underlying concerns that discourage ridesharing participation is essential for developing truly user-centric platforms that effectively handle these conflicting objectives. For instance, while economic incentives might drive initial interest, factors like perceived safety and travel time reliability significantly influence long-term satisfaction and willingness to continue using such services [6]. The technological effect and technology-enabled supply elasticity of digital platforms are key determinants in their success during urban anomalies [7].

This paper addresses this gap by presenting findings from a dedicated user perception study conducted within the context of a hybrid multi-objective optimization framework for dynamic ridesharing platforms. The primary objective of this study was to gather comprehensive quantitative and qualitative insights from potential ridesharing users to complement technical simulation results, providing a crucial behavioral dimension to the overall assessment. Specifically, this research aims to:

- Identify demographic characteristics and current engagement patterns of ridesharing users [8].
- Evaluate user preferences for specific ridesharing features, including safety measures, cost-sharing models, and communication.
- Assess user tolerance for inherent shared mobility trade-offs, such as increased travel time and detours, which are critical in defining the objective functions of an optimization model.
- Uncover significant deterrents to ridesharing adoption from the user's perspective.
- Explore potential incentives that would encourage greater adoption and sustained use of dynamic ridesharing services.

By understanding these user-centric aspects, this paper provides valuable guidance for ridesharing platform developers, urban planners, and policymakers to design and implement systems that not only are technically efficient but also align with user expectations and foster widespread acceptance.

Literature Review

The growth of ridesharing and ride-hailing services has prompted extensive research into the factors influencing user adoption, satisfaction, and overall behavioral patterns. This section reviews key themes in the existing literature that underpin the importance of user perception in the success of shared mobility platforms.

1.1 User Adoption and Satisfaction Factors

A substantial body of research has investigated the determinants of user adoption and satisfaction in ride-hailing and ridesharing contexts. Studies consistently point to several key drivers. Convenience and affordability are frequently cited as primary motivators for choosing ride-hailing services over traditional transportation modes [9]. Research in Malaysia emphasized that perceived ease of use, security, and perceived value significantly influence customer satisfaction among e-hailing users [10]. Similarly, a systematic literature review on ridesharing identified customer satisfaction, service quality, and trust as the most significantly researched factors influencing both riders and drivers [11]. The intention to use ride-hailing services is also influenced by perceived value and reduced perceived risk [12]. An extended Technology Acceptance Model has also been used to study consumers' intention to use ride-sharing services [13].

Furthermore, factors such as reliability, responsiveness, and tangibility (e.g., vehicle quality) are crucial for user satisfaction [14]. The perceived safety/security of the service, including aspects like driver vetting and real-time tracking, is paramount for user comfort and willingness to utilize these platforms [15]. User comfort during cab rides, influenced by driver behavior, also impacts driver ratings and the reputation of ride-hailing firms [16].

1.2 Trade-offs and Barriers in Shared Mobility

While ridesharing offers numerous benefits, it often involves inherent trade-offs for users, such as potentially longer travel times or detours compared to direct private trips. Research indicates that users' willingness to accept these trade-offs is a critical aspect of adoption, particularly when weighed against benefits like cost savings or environmental contributions [17]. Studies exploring what influences people to choose ridesharing have classified motivating factors and barriers based on demographic, psychological, and situational aspects [18].

Common barriers to ridesharing adoption include concerns about safety, such as fear of harassment, and issues related to service efficiency, such as excessive detours or long wait times [18]. The adoption and utilization of ride-hailing services are influenced by attitudinal factors [19], and various issues can challenge the adoption and dissemination of ride-hailing platforms [20]. Understanding travelers' behavioral intention to adopt ride-hailing services, based on factors like price, safety, convenience, and access, is crucial for both platforms and management organizations [21]. Addressing these concerns through robust security features, transparent pricing, and efficient routing algorithms is vital for overcoming user hesitation and increasing adoption rates. Geographical and demographic factors also play a role in the uneven growth of ride-hailing [22].

1.3 The Role of User-Centric Design

The literature increasingly emphasizes the importance of incorporating user feedback and preferences into the design and operation of shared mobility systems. This user-centric approach ensures that platforms are not only technologically advanced but also cater to real-world user needs and expectations. The integration of user insights is crucial for developing practically viable and socially acceptable ridesharing platforms [23]. Customer-focused ride-pooling assignment heuristics can address service quality degradation due to waiting and detour time [24]. Dynamic pricing and matching algorithms are also critical for providing a good experience with low waiting times for both riders and drivers [25]. Furthermore, understanding driver location preferences can impact revenue and dispatch efficiency [26].

In summary, while the technical optimization of ridesharing systems is well-explored, the human dimension, encompassing user perceptions, satisfaction drivers, and barriers to adoption, is equally significant. This study contributes to the literature by specifically examining these user-centric factors within the context of a dynamic ridesharing framework, providing empirical evidence to inform the design of more effective and widely adopted shared mobility solutions.

Methodology

To ensure that the proposed hybrid ridesharing framework is user-centric and addresses real-world needs, a dedicated user preference study was conducted. This questionnaire-based survey allowed for the direct collection of quantitative and qualitative insights from potential ridesharing users, complementing technical simulation results by providing a crucial behavioral dimension to the overall assessment.

1.4 Survey Design and Content

The survey was meticulously designed to gather comprehensive data on several key areas relevant to dynamic ridesharing. It incorporated a mix of question types, including multiple-choice, Likert scale ratings (typically 1-5 scales for agreement or importance), and open-ended questions. This hybrid approach facilitated both the statistical analysis of quantifiable preferences and the extraction of nuanced qualitative insights from textual responses. The key areas covered included:

- **Demographic Information:** Basic demographics of respondents, including age, occupation, gender, and general travel patterns, to understand the characteristics of the surveyed population.
- **Current Ridesharing Platform Engagements:** Questions on existing ridesharing platform usage habits, frequency, and experiences, establishing a baseline of user familiarity and interaction with such services.
- **Feature Preferences:** Evaluation of preferences for specific ridesharing features, such as safety measures (e.g., driver/passenger rating systems, real-time tracking, gender-based matching options), diverse cost-sharing models, and communication features. These were typically assessed using Likert scales to quantify importance.
- **Trade-off Tolerance:** Insights into users' willingness to accept trade-offs inherent in shared mobility, specifically focusing on their tolerance for increased travel time (detours) or waiting times in exchange for cost savings or environmental benefits.
- **Discouraging Factors:** Identification of significant deterrents to ridesharing adoption (e.g., concerns about harassment, excessive detours, privacy issues) through direct questioning and open-ended feedback.
- **Incentives for Adoption:** Exploration of potential incentives that would encourage greater adoption and sustained use of dynamic ridesharing services, such as discounted trips, loyalty programs, or improved reliability.

1.5 Sampling and Data Collection Procedures

A non-probability sampling approach was employed for participant recruitment, specifically utilizing purposive and snowball sampling techniques. This method was chosen to target individuals who were current or potential ridesharing users, ensuring the relevance of the collected feedback.

- **Recruitment:** Participants were primarily recruited through online platforms, social media groups, and community networks relevant to urban transportation users in Nigeria.
- **Administration:** The questionnaire was administered digitally via an online survey platform, ensuring anonymity and convenience for participants. Data collection was conducted over a period of several weeks to allow for sufficient response accumulation.

- **Sample Size Consideration:** A total of 100 samples were collected. While aiming for broad participation, the effective sample size for qualitative insights was guided by the principle of data saturation, where no new themes or significant insights emerged from additional responses to open-ended questions. For quantitative analysis, sample size was considered sufficient when statistical measures exhibited reasonable stability.

1.6 User Data Analysis

The collected user data underwent a systematic analysis to extract meaningful insights.

- **Quantitative Analysis:** Numerical data from Likert scales and demographic questions were analyzed using descriptive statistics (e.g., mean scores and percentages). This provided a clear overview of overall preferences, usage patterns, and the relative importance users placed on various features.
- **Qualitative Analysis:** Responses from open-ended questions were subjected to a thematic review. This involved identifying recurring concepts, sentiments, and suggestions, allowing for a deeper understanding of underlying user perceptions, concerns, and unmet needs. These qualitative insights were crucial for informing the user-centric design aspects of the proposed framework.

Results

This section presents the findings from the questionnaire administered to understand user preferences, behavior, and concerns regarding dynamic ridesharing systems. A total of 100 responses were collected.

4.1 Demographics The demographic profile of the survey respondents is summarized in the table below:

Table 1: Demographic Profile of Respondents

Category	Option	Percentage (%)
Age Group	18–24	26.1
	25–34	42.0
	35–44	23.2
	45–54	5.8
	55 and above	2.9
Gender	Male	65.2
	Female	33.3
	Prefer not to say	1.4

Category	Option	Percentage (%)
Occupation	Student	34.8
	Employed	30.4
	Self-Employed	21.7
	Unemployed	7.2
	Other	1.4

The majority of respondents were aged between 25 and 34 (42.0%), followed by the 18–24 age group (26.1%), indicating that the survey predominantly captured responses from younger to middle-aged adults. Males constituted the larger portion of respondents (65.2%). In terms of occupation, students (34.8%), public sector employees (30.4%), and self-employed individuals (21.7%) represented the most significant groups. The geographical distribution of responses indicated a spread across various cities in Nigeria, with a notable concentration in Adamawa State, Abuja, and Kaduna. The diversity in location is valuable for assessing the scalability and generalisability of the proposed framework.

4.2 Ridesharing Familiarity and Willingness

An overwhelming majority of respondents (87.0%) reported familiarity with existing ridesharing services, suggesting a strong baseline for the adoption of enhanced dynamic ridesharing platforms. Furthermore, 72.5% expressed willingness to share rides to mitigate costs and environmental impact, indicating a favorable market for dynamic ridesharing concepts. The presence of a 23.2% 'Maybe' group suggests a segment that could be convinced with specific incentives or assurances.

Regarding service expectations, the largest proportion of respondents (46.4%) indicated comfort with an additional waiting time of 6–10 minutes, with a combined 82.6% accepting up to 10 minutes. Similarly, 49.3% of respondents preferred a minimal detour of 0–10%, and 84.1% would accept up to a 20% detour from their original route. These figures highlight the necessity of designing efficient routing algorithms that minimize both waiting times and detours to align with user expectations and enhance satisfaction.

4.3 Feature Preferences

Respondents were asked to rate the importance of various ridesharing features on a linear scale, where 1 represented 'Not Important' and 5 represented 'Very Important'. The mean scores for each feature, ranked by perceived importance, are presented in Table 2.

Table 2: Importance of Ridesharing Features (Mean Scores)

Feature	Mean Score
Ride safety/security	4.09
Affordability	3.65
Digital payment option	3.49
Real-time driver tracking	3.36
Driver/passenger rating system	3.38
Gender-based ride matching	3.16
Short travel time	3.39
Customer support	3.26
Flexible payment options	3.09
In-app communication	3.07
Incentives	3.03
Low waiting time	2.78

"Ride safety/security" (4.09) was identified as the most critical feature, aligning with the qualitative insights regarding concerns about harassment. "Affordability" (3.65) and "Short travel time" (3.39) also ranked highly, indicating user desires for cost-effective and efficient journeys. Features such as "Real-time driver tracking" (3.36), "Driver/passenger rating system" (3.38), and "Gender-based ride matching" (3.16) all received significant importance scores, suggesting user demand for enhanced safety and trust mechanisms.

4.4 Barriers and Concerns Respondents were asked to identify factors that would discourage them from using a ridesharing service, with multiple selections permitted. The proportion of respondents selecting each concern is presented in Table 3.

Table 3: Discouraging Factors for Ridesharing Adoption

Discouraging Factor	Percentage of Respondents (%)
Fear of harassment	46.4
Long detour or wait time	46.4
High cost	43.5
Lack of trust in system	40.6
Inconvenient pickup locations	39.1
Low smartphone or data access	18.8
Other	1.4

The most prominent discouraging factors, each cited by 46.4% of respondents, were "Fear of harassment" and "Long detour or wait time". These findings directly align with the high importance attributed to safety and efficient travel in the feature preferences. "High cost" (43.5%) and "Lack of trust in the system" (40.6%) were also identified as significant barriers, pointing to the need for competitive pricing strategies and robust trust-building measures.

4.5 Incentives for Frequent Usage

When asked about preferred incentives for frequent ridesharing app usage, "Discounted trips" emerged as the most compelling, selected by 46.4% of respondents, indicating that direct cost savings are a primary motivator for increased usage frequency. This was followed by "Flexible payment options" (30.4%) and "Loyalty rewards" (21.7%).

4.6 Qualitative Insights The open-ended comments provided valuable qualitative insights, often reinforcing the quantitative findings and offering specific recommendations for system improvement. These qualitative insights were obtained:

- **Safety Enhancements:** Recurring suggestions included more robust driver/passenger profiling, integration with police checkpoints, in-app emergency buttons, AI-powered safety analytics, and the use of dashboard cameras.
- **Convenience and Efficiency:** Users emphasized the need for user-friendly applications, streamlined booking processes, transparent pricing, efficient navigation, and optimized matching algorithms to minimize time wastage.
- **Service Quality:** Feedback highlighted the importance of well-maintained and clean vehicles, prompt and serious attention to passenger complaints, and the implementation of robust penalty or retraining systems for low-rated drivers.
- **Flexibility and Options:** A specific suggestion included providing an in-app option for "ladies only" rides, addressing a segment's desire for increased comfort and security.

Discussion

The findings from this user perception study provide critical insights into the behavioral dimensions of dynamic ridesharing, directly complementing the technical optimizations of the framework. The high reported familiarity with ridesharing services (87.0%) and the strong willingness to share rides (72.5%) for environmental and cost benefits indicate a receptive market for dynamic ridesharing [18, 23]. This underscores the potential for widespread adoption if user concerns are effectively addressed.

The paramount importance users place on "Ride safety/security" (mean score of 4.09) is a critical takeaway, directly correlating with "Fear of harassment" being a leading discouraging factor (46.4%). This highlights the necessity for ridesharing platforms to prioritize and visibly implement robust safety features, such as real-time tracking, driver/passenger rating systems, and potentially gender-based matching options [15]. The hybrid framework's optimization for minimizing travel time directly mitigates the concern of "Long detour or wait time" (46.4%), demonstrating a crucial alignment between technical solutions and user needs [24].

The strong preference for "Affordability" (3.65) and "Discounted trips" as the most compelling incentive (46.4%) further validates the economic considerations as a primary driver for user adoption. This aligns with the framework's success in minimizing total operational cost, which directly addresses the user's high preference for affordability [25]. The observed tolerance for moderate additional waiting times (up to 10 minutes for 82.6% of respondents) and detours (up to 20% for 84.1% of respondents) suggests that users are willing to accept some trade-offs in exchange for cost savings or environmental benefits, provided these trade-offs are within reasonable limits and managed efficiently by the system [17]. These findings are essential for defining the objective functions and constraints of a multi-objective optimization model, which must explicitly trade off factors like cost and time. The study provides empirical evidence to inform the weights and acceptable bounds for these conflicting objectives.

While the user survey provides invaluable insights, it is important to acknowledge its limitations. The non-probability sampling approach (purposive and snowball sampling) means that the findings may not be statistically representative of the broader population, and generalizations should be made with caution [18]. Additionally, the qualitative analysis of open-ended responses, while informative, was not subjected to a full thematic analysis, which could potentially uncover deeper, more nuanced insights

Conclusion

This study successfully investigated user perceptions and preferences concerning dynamic ridesharing services, providing a crucial behavioral dimension to the development of efficient and user-centric ridesharing platforms. The findings underscore a significant market receptiveness for dynamic ridesharing, driven by users' willingness to share rides for economic and environmental benefits. Key insights highlight the critical importance of safety, affordability, and efficient travel time management in fostering user adoption and satisfaction.

The study identified "Fear of harassment" and "Long detour or wait time" as the most prominent discouraging factors, emphasizing the need for robust safety features and optimized routing algorithms that minimize inconvenience [18]. User preferences for "Discounted trips," "Flexible payment options," and "Loyalty rewards" indicate that economic incentives play a significant role in encouraging frequent usage. By quantifying user tolerances for trade-offs, this research provides essential input for the design of multi-objective optimization models, enabling them to produce solutions that are not only mathematically optimal but also socially and practically viable.

By integrating these user insights, ridesharing platforms can move towards a more human-centered design, addressing not only technical efficiencies but also the psychological and practical concerns of their users [23]. Future research could benefit from larger, more representative samples and more in-depth qualitative analyses to further explore the complexities of user behavior in dynamic ridesharing contexts.

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