Passenger Information System (PIS) at Magufuli Bus Terminal in Dar es salaam, Tanzania: Awareness and challenges in utilization.

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Abstract:

This study investigates the level of awareness, challenges and usage of Passenger Information Systems (PIS) among passengers at the Magufuli Bus Terminal in Dar es Salaam, Tanzania. Introduced by the Land Transport Regulatory Authority (LATRA) in 2024, the PIS aims to modernize public transport communication by offering real-time updates on bus schedules, delays, and departures. However, the effectiveness of such systems depends not only on technological deployment but also on public awareness, user confidence, and sustained utilization. To evaluate these dimensions, the study employed a descriptive mixed-methods approach, integrating quantitative data from structured questionnaires with qualitative insights drawn from interviews and document reviews. A stratified random sampling technique was used to select 345 respondents, primarily passengers, ensuring demographic representation. Results reveal that 69.52% of passengers were not aware of the existence of the PIS, and among those who were aware, usage was inconsistent and infrequent. Key barriers identified include low digital literacy, insufficient system promotion, complex user interfaces, and limited trust in the accuracy of the system's information. Interviews and document reviews further highlighted gaps in public sensitization efforts and technical limitations in system updates. This paper contributes to the growing body of literature on intelligent transport systems in Sub-Saharan Africa by providing empirical evidence on user-side challenges in PIS adoption. The findings emphasize that awareness alone does not ensure system engagement. Effective adoption requires targeted public outreach, user-friendly design, multilingual accessibility, and improved system reliability. Aligning digital transport innovations with user-centered communication strategies is essential for optimizing their impact in urban mobility systems.

Keywords: Passenger Information System (PIS); Public Transport; Awareness; LATRA; Magufuli Bus Terminal;

1. Introduction:

Efficient Passenger Information Systems (PIS) are vital tools in modern urban transport networks, offering commuters real-time and static updates on bus schedules, routes, fares, delays, and operational changes. These systems enhance travel efficiency, improve safety, and promote satisfaction by ensuring timely access to accurate transport information. Globally, PIS has contributed to reduced waiting times, more reliable travel planning, and increased public trust

in transportation systems, particularly in high-traffic urban and intercity terminals (Brakewood & Watkins, 2014; Zhao, Deng, & Song, 2015).

In Tanzania, the Land Transport Regulatory Authority (LATRA) introduced a PIS at the Magufuli Bus Terminal in 2024 as part of its broader efforts to digitize public transport services (LATRA, 2024). The terminal, one of the busiest intercity hubs in Dar es Salaam, was selected as a pilot site to demonstrate the potential of smart mobility solutions in enhancing passenger experience and operational efficiency. The system was expected to address long-standing issues such as passenger congestion, lack of schedule transparency, and poor communication between service providers and travelers (Magesa & Lupala, 2021).

However, early field observations and informal reports suggest that public engagement with the system remains limited. Many passengers are unaware of the PIS, and those who are aware often use it irregularly. Contributing factors may include digital illiteracy, inadequate publicity, limited technical support, and low user confidence in the reliability of system data (Kumar, Mwakyusa, & Mwantimwa, 2020; World Bank, 2022). These challenges present serious concerns about the return on investment and the overall success of LATRA's digitization efforts.

This study, therefore, aims to assess the level of public awareness, challenges and actual usage of the PIS at the Magufuli Bus Terminal. Specifically, it seeks to: determine the proportion of passengers who are aware of the existence and functions of the PIS, examine how frequently and effectively passengers use the PIS and Identify the key barriers that hinder system awareness, access, and adoption.

The findings of this study are intended to inform transport policymakers, LATRA, and technology implementers about critical gaps between digital infrastructure deployment and user uptake. Insights from this research will support the development of more targeted public engagement strategies, interface redesigns, and policy frameworks that promote inclusive, accessible, and reliable public transport systems in Tanzania and other emerging urban centers in Sub-Saharan Africa (Adeyemi & Salami, 2021).

2. Literature Review:

Passenger Information Systems (PIS) encompass integrated technologies that deliver real-time and static information about public transport operations, including bus arrival times, route options, service delays, and fare structures. These systems typically use mobile applications, digital signage, websites, and audio announcements to disseminate information to passengers (Zhao et al., 2015). By improving transparency and facilitating informed travel decisions, PIS enhances the overall user experience and operational efficiency of public transport services.

Modern PIS significantly contribute to urban mobility by enhancing commuter confidence and satisfaction. Real-time transit information has been empirically shown to reduce perceived waiting times, improve service reliability perceptions, and promote continued use of public transportation (Brakewood & Watkins, 2014). Furthermore, PIS supports demand management by enabling travelers to avoid peak congestion periods, which optimizes service delivery and resource allocation (Ming et al., 2020). These benefits align with sustainability objectives by encouraging modal shifts from private vehicles to public transport, thereby mitigating urban traffic congestion and reducing carbon emissions.

Despite technological advancements, the effectiveness of PIS hinges on user awareness, accessibility, and engagement. Cats et al. (2016) highlight those advanced systems often suffer from low utilization rates without sufficient public outreach and user-friendly design. In developing countries, challenges such as limited digital literacy, low smartphone penetration, and inadequate user education further constrain adoption (Kumar et al., 2020). These socio-technical barriers indicate that even well-designed PIS may underperform unless complemented by

inclusive design practices and comprehensive sensitization campaigns.

Implementation of intelligent transport systems, including PIS, is gradually expanding across African urban centers; however, progress is hampered by institutional, financial, and infrastructural limitations (Adeyemi & Salami, 2021). In Tanzania, the Land Transport Regulatory Authority (LATRA) has incorporated PIS within its broader digital transformation agenda for public transportation. Nonetheless, research by Magesa and Lupala (2021) indicates low public awareness and engagement with PIS at intercity bus terminals such as Magufuli. Passengers frequently lack knowledge about system functionalities or struggle to utilize the system due to limited digital skills and skepticism about reliability.

Recent studies (e.g., World Bank, 2022; Nkundabera et al., 2023) emphasize persistent challenges related to system maintenance, user interface design, and language inclusivity that affect system effectiveness in Tanzanian urban settings. These findings reveal critical gaps in targeted public engagement strategies, capacity building, and feedback mechanisms necessary to enhance adoption and user satisfaction.

While the literature establishes the technical potential and socio-economic benefits of PIS globally, there is a relative scarcity of recent empirical studies focusing on user-centered perspectives and contextual challenges in Sub-Saharan Africa, particularly Tanzania. Many studies emphasize technological deployment without adequately addressing socio-cultural factors such as digital literacy, trust, and language diversity, which profoundly influence PIS uptake. This study seeks to fill these gaps by investigating passenger awareness and utilization of PIS at Magufuli Bus Terminal, contributing localized insights that can inform more inclusive and effective system design and implementation.

3. Methodology:

This study employed a descriptive research design to assess the level of awareness and usage of the Passenger Information System (PIS) among passengers at Magufuli Bus Terminal in Dar es Salaam. The terminal was selected due to its role as a major intercity transport hub and one of the initial sites for implementing LATRA's digital PIS platform.

A proportional stratified random sampling technique was used to ensure representation across different passenger categories. The estimated terminal population consisted of 6,401 individuals, including passengers, LATRA officers, police, and drivers. The sample size was determined using Yamane's formula (1967):

$$n = \frac{N}{1+N(e)^2} = \frac{6401}{1+6401(0.1)^2} = 315$$

However, recognizing the need for greater statistical power and representativeness, the study increased the sample size beyond the minimum calculation, targeting 378 participants. Out of these, 315 passenger responses were fully completed and analyzed in this paper.

The margin of error was set at 10% (0.1), which is higher than the conventional 5%. This choice reflects practical constraints such as time, resources, and the dynamic nature of the terminal environment. While this margin may limit the precision and generalizability of the findings, it remains adequate for exploratory purposes in this context.

Microsoft Excel was utilized to create visual representations of the results, including graphs and charts.

4. Data Analysis:

This section presents the analysis and interpretation of data collected through structured questionnaires and interviews. Questionnaires were completed by passengers at Magufuli Bus Terminal. The data were analyzed using descriptive statistics and cross-tabulations via SPSS statistics 20, while interview data were analyzed thematically. Key findings are presented in both narrative and tabular formats.

4.1 Awareness of the Passenger Information System (PIS)

Out of 315 respondents, 124 passengers (39.4%) reported being aware of the existence of the PIS at Magufuli Bus Terminal, while 191 (60.6%) indicated they were unaware of such a system. This suggests that a majority of the terminal's users do not have sufficient knowledge about the digital information system available to them.

Table 1: Passenger Awareness of PIS

Awareness of PIS	Frequency	Percentage
Aware	124	39.4%
Not Aware	191	60.6%
Total	315	100%

4.1.2 Cross-Tabulation: Awareness of PIS by Age Group

To better understand factors influencing awareness, a cross-tabulation was performed to compare awareness levels across different age groups.

Table 2: Awareness of PIS by Age Group

Age Group	Aware (%)	Not Aware (%)	Total Respondents
18–25	32 (25.8%)	92 (74.2%)	124
26–35	51 (48.1%)	55 (51.9%)	106
36–45	28 (59.6%)	19 (40.4%)	47
46+	13 (50.0%)	13 (50.0%)	26
Total	124	191	315

The results suggest that awareness is significantly lower among younger passengers (especially those aged 18–25), while higher awareness levels are observed in the 36–45 age group. This may reflect differing levels of attention to transit information or digital engagement habits.

4.1.3 Utilization of the PIS

Among the 124 passengers who were aware of the system, only 59 (47.6%) reported having used it, indicating that awareness does not necessarily translate into active usage. Reasons for non-use included mistrust in the system's accuracy, difficulties in accessing or understanding the platform, and a preference for verbal information from staff.

4.1.4 Thematic Analysis of Interview Data

Interviews with LATRA officers, terminal staff, and bus operators revealed three dominant themes:

System Usability: Respondents noted that the interface is not user-friendly, especially for first-time users and elderly passengers.

Digital Literacy Barriers: A lack of basic digital skills among passengers especially those from rural areas was cited as a key constraint.

Trust and Perceived Reliability: Many passengers mistrusted the accuracy of the displayed information due to previous inconsistencies or system downtimes.

4.1.5 Limitations of the Data Analysis

While the study employed rigorous methods, several limitations should be acknowledged:

Self-report Bias: Responses on awareness and usage may be influenced by social desirability or inaccurate self-assessment.

Non-response Issues: A portion of the sampled passengers did not complete the questionnaire, and their perspectives may differ from respondents.

Limited Observation Period: The study was conducted over two months, which may not

capture seasonal variations in passenger behavior or PIS functionality.

5. Results and Discussion:

5.1 Results

5.1.1 Awareness of the Passenger Information System (PIS)

Only 39.4% of passengers surveyed at Magufuli Bus Terminal were aware of the Passenger Information System. The remaining 60.6% reported no knowledge of the system, indicating a significant awareness gap.

5.1.2 Usage of the PIS

Among the 124 passengers who were aware of the system, less than half (47.6%) had ever used it. Many cited reasons such as unfamiliarity with how the system works, doubts about the accuracy of the information provided, or a preference for in-person inquiries.

5.1.3 Awareness by Age Group

Cross-tabulation showed lower awareness among younger passengers (especially aged 18–25), with only 25.8% of that group reporting awareness. Awareness was higher among the 36–45 age group (59.6%), suggesting a potential link between travel experience and engagement with terminal systems.

5.1.4 Interview Insights

Qualitative interviews revealed the following dominant themes:

System Usability: Many passengers found the interface unclear or difficult to navigate, particularly those not accustomed to digital technology.

Digital Literacy: A common barrier, especially for passengers from rural areas or with lower education levels.

Trust and Reliability: Some passengers expressed doubts about the accuracy of the information displayed on screens, especially when system updates lagged behind real-time operations.

5.2 Discussion

The findings demonstrate that despite the presence of PIS infrastructure at Magufuli Bus Terminal, actual usage remains low due to a combination of awareness, accessibility, and trust issues. These results align with Cats et al. (2016), who argued that even advanced systems can fail to meet their potential if user engagement is not prioritized. Similarly, Kumar et al. (2020) identified low digital literacy and limited outreach as significant barriers in developing country contexts.

The low awareness among the 18–25 age group is particularly noteworthy, as this demographic is generally assumed to be more digitally literate. This discrepancy may reflect a cultural preference for informal, verbal information sharing, or it may point to system placement and visibility issues i.e., young passengers may not notice or prioritize digital signage.

Additionally, the relatively higher awareness among older passengers (36–45) suggests that experience and frequency of terminal use may influence engagement more than digital familiarity alone.

The issue of trust in system accuracy emerged as a key constraint. When information displayed is perceived as outdated or inconsistent with on-the-ground activity (e.g., boarding times or platform changes), users may revert to manual methods of inquiry, further undermining the PIS.

The digital divide defined by literacy, affordability, and device ownership—also limits interaction with mobile-based PIS applications. This supports the findings by Adeyemi & Salami (2021), who observed that socio-technical challenges in African cities hinder the success of smart mobility systems.

5.2.1 Summary of Key Barriers to PIS Usage

To better visualize the main obstacles identified through both quantitative and qualitative data, Table 3 summarizes the core barriers affecting effective PIS usage at Magufuli Bus Terminal.

Table 3: Summary of Key Barriers to PIS Usage

Barrier	Description
Low Awareness	Majority of passengers unaware of the system's existence
Limited Usability	Poor interface design and lack of clear instructions
Digital Literacy Gaps	Many users lack the digital skills to navigate or interpret the system
Lack of Trust	Doubts about the accuracy and reliability of information provided
Cultural Preferences	Some passengers prefer verbal inquiries over digital sources
Inadequate Sensitization	Few public education efforts to promote or explain how the system works

6. Conclusion:

This study assessed the level of awareness and utilization of the Passenger Information System (PIS) among passengers at Magufuli Bus Terminal in Dar es Salaam. The findings reveal that although the infrastructure for PIS is in place, its impact is undermined by low awareness, limited usage, and various socio-technical barriers. The majority of passengers were either unaware of the system or found it difficult to use due to issues such as poor interface design, limited digital literacy, and a lack of trust in the system's reliability.

Despite the potential of PIS to improve public transportation experiences, its underutilization highlights the need for more user-centered and inclusive implementation strategies. To enhance the effectiveness of PIS at intercity terminals like Magufuli, the following actions are recommended:

- Targeted awareness: Conducting targeted awareness campaigns using posters, announcements, and demonstrations within the terminal.
- Simplifying user interface: Simplifying the user interface of digital screens and mobile applications to make them more intuitive.
- Providing support: Providing multilingual support for both audio and visual outputs to serve diverse passenger demographics.
- System updates: Implementing regular system updates to ensure accuracy and build trust among users.
- Integrating digital literacy support through staff assistance or help desks at key entry points.
- Feedback mechanisms: Encouraging feedback mechanisms to allow passengers to report issues or suggest improvements.

6.1 Future Research Directions

Further studies could explore:

- Comparative studies across terminals to identify implementation best practices.
- User experience research focusing on marginalized groups such as elderly passengers or those with low literacy levels.
- Operator and staff perspectives to understand the internal challenges in maintaining and promoting the PIS system.

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