INTERNATIONAL JOURNAL OF RESEARCH AND SCIENTIFIC INNOVATION (IJRSI)
ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue VI June 2026

Proposed Architecture and User Acceptability Framework for TriGo: An Online Tricycle Booking System

Ace Vincent T. Alferos, Christian P. Abuzo, Alliah C. Coronel, Jeves Ediza, Ruissan A. Ramos

Department of Information Technology, Pangasinan State University, Alaminos City Campus, Alaminos City, Pangasinan, Philippines

DOI: https://doi.org/10.51244/IJRSI.2026.1306000493

Received: 03 July 2026; Accepted: 08 July 2026; Published: 20 July 2026

ABSTRACT

This study investigates the digital transformation of tricycle transportation in Bolinao, Pangasinan, emphasizing a tricycle dispatch system designed to enhance operational efficiency and community mobility. Bolinao's 30 barangays rely on the traditional "torno" queuing method, managed through physical blackboards at terminals, resulting in prolonged driver idle times, unnecessary travel without passengers, and extended commuter wait times. The lack of centralized trip records limits the Bolinao Tricycle Operators and Drivers Federation (BTODF) in effectively overseeing operations or addressing conflicts. Mobile technology presents a promising avenue for improving coordination. The study designed a digital booking and dispatch system to facilitate online ride requests and operational management. Utilizing a descriptive developmental methodology guided by the Agile Software Development Life Cycle, the project produced a prototype design of the TriGo mobile application tailored to the federation's requirements. Design priorities were informed by 115 purposively sampled respondents, comprising commuters, tricycle drivers, TODA officers, and an IT expert validator, who identified operational needs through observation, interviews, and a needs-assessment questionnaire. The ISO/IEC 25010 standard is proposed as the framework for future evaluation across functional suitability, performance efficiency, usability, reliability, and portability. Core elements include internet connectivity and mobile GPS, connecting commuters and drivers through a three-tier architecture spanning the Presentation, Application, and Data tiers. The proposed design of TriGo features a nearby-driver algorithm, real-time GPS tracking, in-app messaging, incident and operational reporting, SOS alerts, and driver ratings, intended to modernize tricycle operations while maintaining the established TODA community framework. This architecture addresses the operational gaps identified in the manual torno system, offering a scalable, community-responsive alternative without displacing existing organizational structures. Digital transformation is most effective when designed to complement, rather than replace, established governance, positioning TriGo as a viable model for future deployment and evaluation of user acceptability and operational impact in Bolinao.

Keywords: Tricycle dispatch system, torno, TODA operations, mobile application, Bolinao Pangasinan

INTRODUCTION

Transportation is a critical component of contemporary society, facilitating economic activity, social interaction, and the movement of people and goods. In developing countries, transportation accessibility and efficiency have been closely linked to community development and quality of life [2]. In the Philippines, tricycles remain the predominant mode of short-distance transport, especially where larger vehicles face operational constraints [9]. Digital transportation platforms worldwide have reshaped access to these services, with ride-hailing and mobile transit applications improving accessibility, efficiency, and user satisfaction [3], as reflected in usability comparisons of platforms such as Grab, Angkas, and Joyride [6].

This study addresses the persistent operational inefficiencies of Bolinao, Pangasinan's manual tricycle dispatch system by providing a technology-based solution tailored to its community context. Bolinao comprises 30 barangays, each served by its own Tricycle Operators and Drivers Association (TODA), which coordinates drivers, assigns terminals, and implements guidelines under local government supervision [4]. This study aims to design and develop TriGo: A Digital Tricycle Booking and Dispatch System for Efficient Community

Transportation, which specifically aims to: (1) identify existing tricycle transportation operations under TODA organizations in Bolinao; (2) determine the common transportation challenges experienced by drivers and commuters; (3) develop a proposed architecture for a digital tricycle dispatch system based on the identified needs and requirements; and (4) propose a framework, based on the ISO/IEC 25010 software quality standard, for evaluating the user acceptability of TriGo once deployed.

Bolinao continues to rely on the manual 'torno' queuing system, in which drivers wait their turn using physical blackboards ('pisara') at each terminal, with no digital backup and frequent monitoring inaccuracies. Riders must either visit terminals in person or wait roadside for available drivers, relying entirely on informal coordination. Idle time between turns reduces driver income, and the absence of centralized trip records prevents TODA organizations and local government from effectively monitoring operations or resolving disputes.

The scope of this study is the development of a mobile booking and dispatch system for tricycle commuters and drivers in Bolinao, Pangasinan. In identifying the operational needs that shaped the system's design, the study involved 115 respondents selected through purposive sampling (commuters, tricycle drivers, TODA officers, and an IT expert validator). The study covers only tricycle services recognized by Bolinao's local TODA; other municipalities, and features such as payroll, tax, and accounting, are outside its scope. Real-time GPS tracking and automatic dispatch may be delayed under poor connectivity, and offline operation is not supported. As this study covers the design and development stages of TriGo only, empirical evaluation of the deployed system is recommended for future research.

METHODOLOGY

This study employed a descriptive developmental research design. The descriptive component was used to characterize the existing tricycle transportation operations under TODA organizations in Bolinao and to identify the common challenges experienced by both drivers and commuters through structured interviews and direct observation. The developmental component guided the systematic design and construction of the TriGo prototype application. This dual-method approach is appropriate for studies that seek to both understand an existing problem and produce a working technological solution as a direct response [5]. The Agile Software Development Life Cycle (SDLC) was adopted as the project development methodology because it supports iterative development and continuous incorporation of stakeholder feedback [1]. Development proceeded through structured sprints: registration and booking modules, the nearby available driver algorithm and SOS emergency alerts, the commuter incident and operational reporting module, and finally the post-ride driver rating module.

Figure 1: Agile Method

The study was conducted in the municipality of Bolinao, Pangasinan, which comprises 30 barangays, each with its own designated TODA. Purposive sampling was used to select respondents who have direct and relevant experience with the local tricycle transportation system, as this technique ensures that the most informed and contextually appropriate participants contribute to identifying the operational needs the system was designed to address [8]. A total of 115 respondents participated in the study. Commuter respondents were identified based on observed foot traffic at primary tricycle terminals across the municipality, with two commuters selected per barangay to ensure geographic representation. Driver and federation officer respondents were coordinated through the Bolinao Tricycle Operators and Drivers Federation (BTODF), prioritizing those with significant experience in the manual torno system. IT expert validators were drawn from qualified professionals and faculty members to provide a technical review of the proposed system's design and architecture. Data collection instruments included structured observation at tricycle terminals, in-depth interviews with the BTODF President and selected officers, and a structured questionnaire that captured respondents' experiences with the manual torno system and their perceived needs for a digital alternative. This dataset directly informed the feature set and interface design decisions detailed below.

Table 1. Respondents of the Study

Respondents	Number of Respondents
Commuters	60
Tricycle Drivers	40
TODA Officers	10
IT Validators	5
Total Respondents	115

The operational issues identified among commuters and drivers in the manual torno system were used as the basis for selecting the features built into TriGo. Table 2 maps each identified problem to its corresponding proposed feature in the system.

RESULTS AND DISCUSSION

Table 2. Mapping of Identified Problems to Proposed TriGo Features

Persona	Identified Problem	Proposed TriGo Feature
Commuter	Must wait at the terminal or roadside with no way to know when a tricycle will arrive.	Online booking with nearby-driver algorithm.
Commuter	No way to verify a driver’s identity or track the ride for safety.	Real-time GPS tracking and SOS alert
Commuter	No structured channel to communicate with the driver before or during the ride.	In-app messaging
Driver	Idle time and dead mileage while waiting for a torno turn at the terminal.	Nearby-driver dispatch algorithm
Driver	No centralized trip records to monitor operations or resolve disputes.	Admin dashboard with centralized trip records
Driver	No formal mechanism to report incidents or assess driver conduct.	Incident reporting and post-ride driver rating

Beyond mapping individual features to identified problems, Table 3 compares the manual torno process with the proposed TriGo workflow across key operational functions.

Table 3. Comparison of the Manual Torno Process and the Proposed TriGo Workflow

Operational Function	Manual Torno System (Current)	TriGo (Proposed)
Waiting Time	Determined by queue position at the terminal; commuters have no visibility into driver availability or estimated arrival.	Nearby-driver algorithm matches commuters to the closest available driver, with real-time GPS providing an estimated arrival time.
Dispatch Delay	Sequential queuing managed manually via a physical blackboard (pisara), prone to monitoring inaccuracies and missed turns.	Dispatch is triggered automatically upon booking confirmation, removing dependence on manual blackboard coordination.
Trip Record-Keeping	No centralized records; TODA officers cannot systematically monitor operations or resolve disputes.	Centralized trip records are stored in the Data Tier, accessible to TODA officers through the Admin Dashboard.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue VI June 2026

Rider Safety & Communication	No structured channel for reporting incidents or contacting drivers; safety relies on informal presence at terminals.	In-app messaging, SOS alerts, and incident reporting provide structured, traceable safety mechanisms.
Feedback & Accountability	No formal mechanism for rating or evaluating driver conduct.	Post-ride driver rating provides a structured performance and accountability record.

This comparison is based on the system's design objectives and the operational gaps identified during the needs assessment; these anticipated improvements are proposed for validation once TriGo is deployed.

As this study covers the proposed architecture and prototype design of TriGo, quantitative ISO/IEC 25010 evaluation results are not yet available. The ISO/IEC 25010 software quality model [7] is proposed as the framework for the system's evaluation after deployment, covering functional suitability, performance efficiency, usability, reliability, and portability. Future studies should conduct empirical testing involving commuters, tricycle drivers, TODA officers, and IT experts to obtain measurable results across these dimensions.

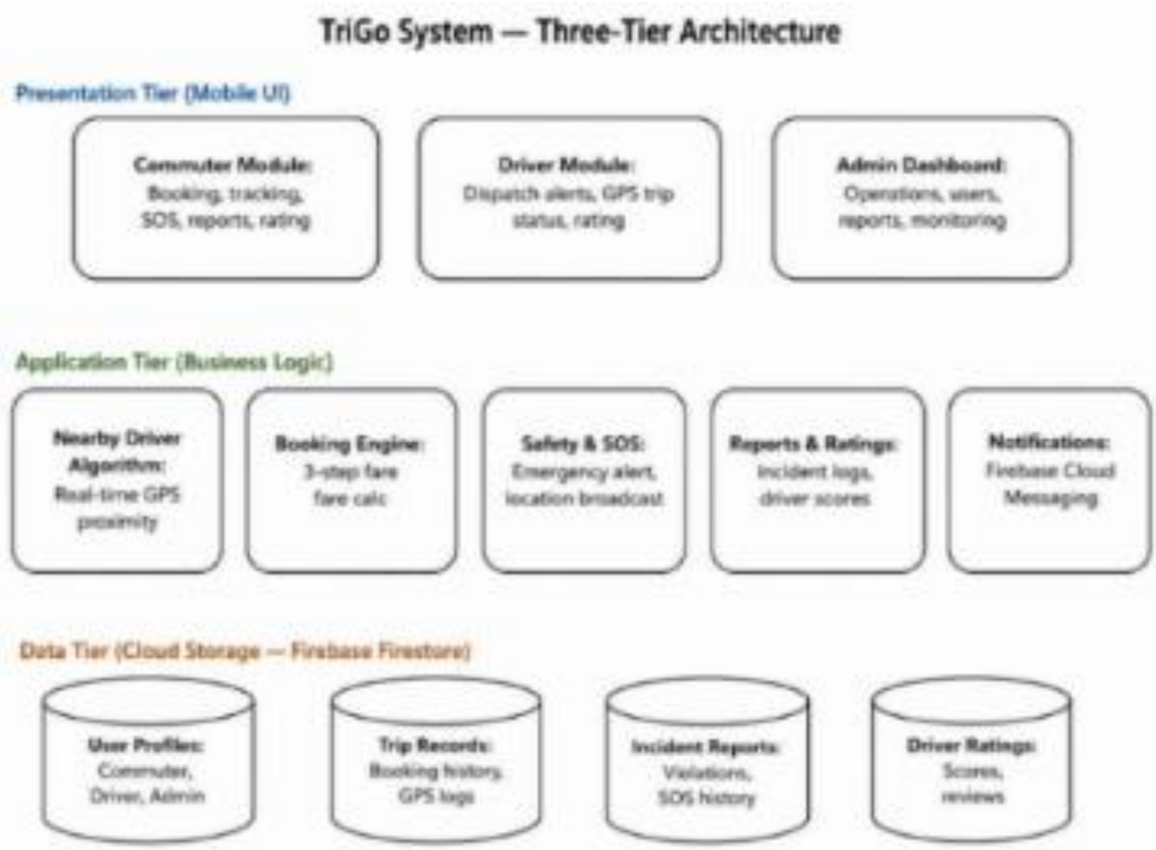
The architecture description that follows builds on these mapped features by detailing how each is structured across the system’s presentation, application, and data tiers.

The Presentation Tier (Mobile UI) is the front-facing layer through which commuters, drivers, and administrators interact with the system, each given a role-appropriate interface as detailed in Table 4.

The Application Tier (Business Logic) is the processing core of the system, handling driver matching, booking, safety, reporting, and notification functions, as detailed in Table 4.

The Data Tier (Cloud Storage, Firebase Firestore) is the persistence layer, storing user, trip, incident, and rating data. Firebase Firestore was selected to support real-time data synchronization and scalability across all tiers.

Figure 2: Three-Tier Architecture



To further clarify how each proposed feature is structured across the system's layers, Table 4 maps the key TriGo features to their corresponding components in the Presentation, Application, and Data Tiers.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue VI June 2026

Table 4. Mapping of TriGo Features to Three-Tier Architecture

Feature	Presentation Tier	Application Tier	Data Tier
Nearby-driver dispatch	Driver search screen	Nearby Driver Algorithm	Trip Records
Real-time GPS tracking	Live map view	Booking Engine	Trip Records
In-app messaging	Chat interface	Notifications module	Trip Records
SOS emergency alert	SOS button	Safety & SOS module	Incident Reports
Incident reporting & rating	Report & rating forms	Reports & Ratings engine	Incident Reports, Driver Ratings
Admin monitoring	Admin Dashboard	All business logic modules	User Profiles, all collections

Figure 3 shows the driver-matching screen design, reflecting the Nearby Driver Algorithm intended to connect commuters with the closest available driver using real-time GPS proximity.

Figure 3: Search for nearest driver

Figure 4 shows the Booking Summary screen design, intended to present a transparent fare breakdown and payment options, addressing the lack of standardized fare computation in the manual system.

Figure 4: Booking and Ride Summary

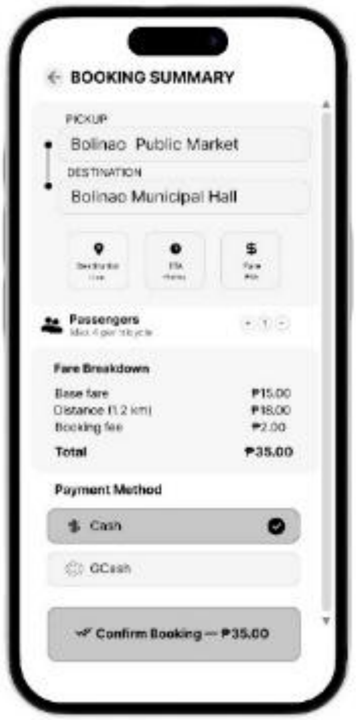


Figure 5 shows the proposed live tracking interface, designed to let commuters monitor driver location, contact the driver directly, and access an SOS button, addressing the manual system's lack of trip visibility and safety mechanisms.

Figure 5: GPS tracking

Figure 6 shows the design for Commuter Incident Reporting and SOS Emergency Alert. Commuters would be able to report service concerns, such as reckless driving or overcharging, for review by TODA and administrators [8]. The SOS feature is designed to transmit the user's real-time location to facilitate emergency response [10].

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue VI June 2026

Figure 6: Commuter Incident and SOS Alert

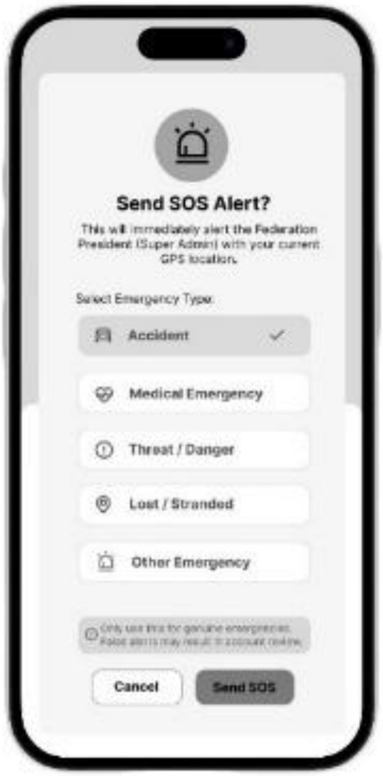


Figure 7 shows the proposed Post-Ride Driver Rating screen, allowing commuters to rate driver professionalism and service quality. Accumulated ratings are intended to serve as a performance record accessible to TODA officers for monitoring and accountability [1].

Figure 7: Post-Ride Driver Rating

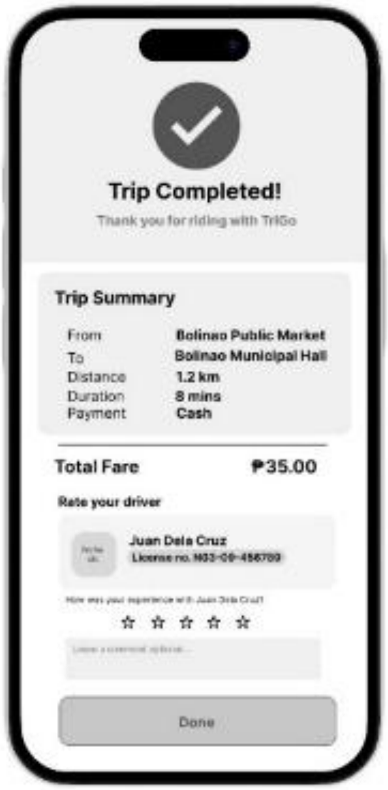
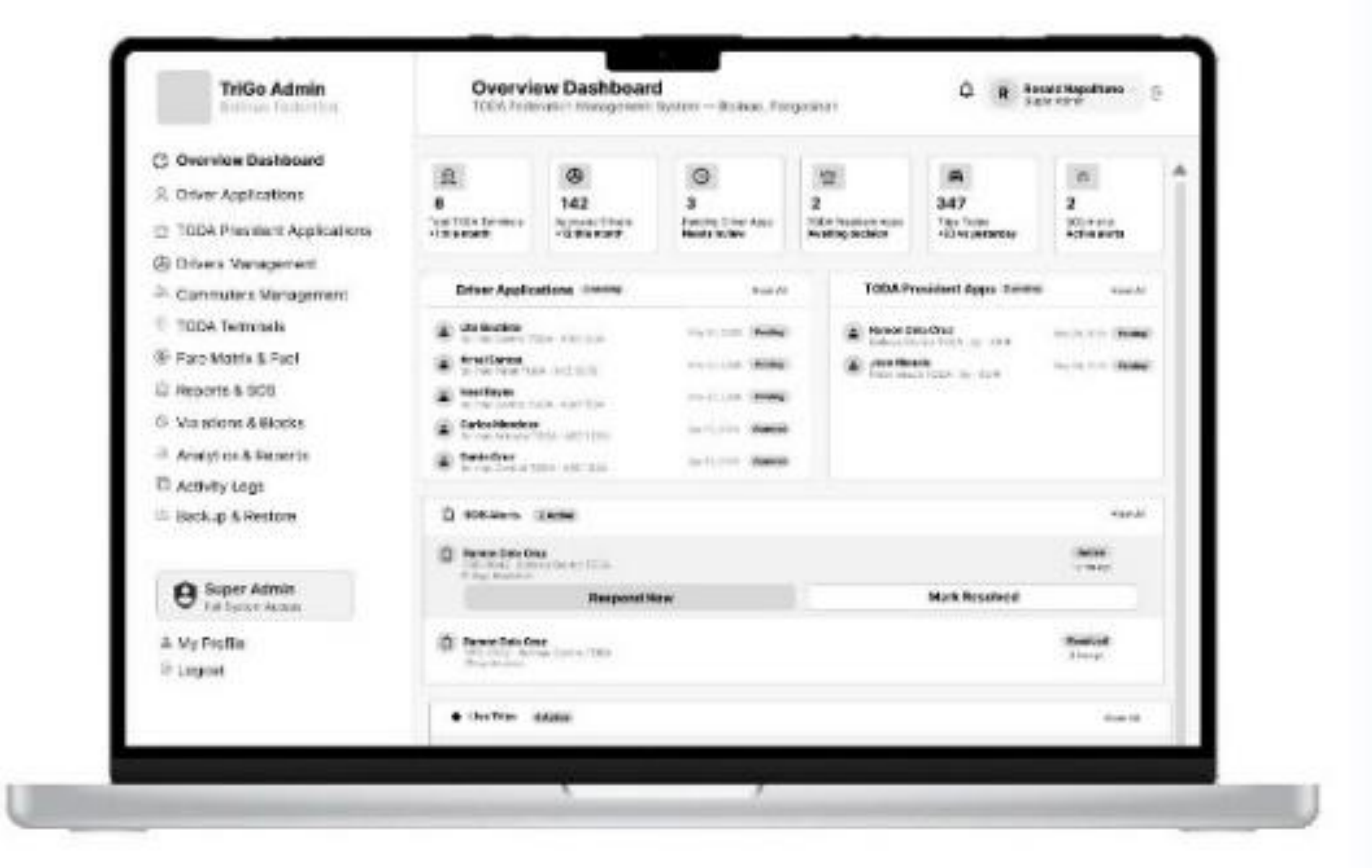


Figure 8 shows the design of the Super Admin Dashboard, intended to give TODA officers centralized visibility over trips, user accounts, incident reports, and driver ratings without navigating multiple screens.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue VI June 2026

Figure 8: Super Admin Dashboard



CONCLUSION

The proposed TriGo architecture illustrates that digital transformation can strengthen, rather than replace, existing community transportation governance. Each feature was designed around a specific gap identified in the manual torno system, giving the architecture a clear, community-grounded rationale. Built on Agile SDLC and a three-tier design, TriGo is intended to be scalable and responsive to Bolinao's tricycle community. Future research is recommended to deploy TriGo and empirically evaluate its user acceptability, performance, and operational impact.

REFERENCES

1. Aniag, J. J. R., Cruz, A. R., Festijo, I. C. N., Garcia, L. S. A., & Munez, R. M. (2023). Tricycle operators and drivers' association automated sequencing using a Raspberry Pi. Academia.edu. https://www.academia.edu/download/102889793/TRICYCLE_OPERATORS_AND_DRIVERS_ASSOCIATION_AUTOMATED_SEQUENCING_USING_A_RASPBERRY_PI.pdf
2. Ashraf, A., & Idrisi, M. J. (2024). Smart and sustainable public transportation - A need of developing countries. International Journal of Networked and Distributed Computing, 12, 144–152. https://doi.org/10.1007/s44227-024-00023-2
3. Chalermpong, S., Kato, H., Thaithatkul, P., Ratanawaraha, A., Fillone, A., Hoang-Tung, N., & Jittrapirom, P. (2023). Ride-hailing applications in Southeast Asia: A literature review. International Journal of Sustainable Transportation, 17(3), 298–318. https://doi.org/10.1080/15568318.2022.2032885
4. Department of Transportation. (2020). Guidelines on tricycle operations and TODA regulation. https://dotr.gov.ph/
5. Galang, N. A. A., Villeno, A. M. M., Camaro, P. J., & Cabauatan, R. R. (2025). Impact of digital platform economy and ride-hailing services on urban mobility in Pampanga. Journal of Technology and Systems, 7(1), 28–57. https://doi.org/10.47941/jts.2506
6. Gumasing, M. J. J., Deinla, E. C. C., Espaldon, A. K. P., Jarin, D. R. I., & Mercado, N. C. (2023). The

usability of transport network vehicle service apps in the Philippines: A comparison of Grab, Angkas, and Joyride. In Proceedings of the 2023 5th International Conference on Management Science and Industrial Engineering (pp. 310–318). https://doi.org/10.1145/3603955.3603974

7. Moumane, K., & Idri, A. (2023). ISO/IEC 25010-based quality evaluation of mobile applications for health services in Morocco. Research Square. https://doi.org/10.21203/rs.3.rs-2720323/v1
8. Ong, A. K. S., Prasetyo, Y. T., Lagura, F. C., Ramos, R. N., Sigua, K. M., Villas, J. A., & Diaz, J. F. T. (2023). Determining tricycle service quality and satisfaction in the Philippine urban areas: A SERVQUAL approach. Cities, 137, 104339. https://doi.org/10.1016/j.cities.2023.104339
9. Philippine Statistics Authority. (2021). Transport statistics in the Philippines. https://psa.gov.ph/statistics/survey/transport
10. Verma, R., Singh, B. K., & Zahidi, F. (2024). Management of GPS tracking systems in transportation. In Intelligent Transportation System and Advanced Technology (pp. 251–263). Springer Nature Singapore.