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Smart Ride-Hailing for Tier-3 Cities

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The increasing integration of digital technology into transportation systems has greatly improved urban mobility, especially in metropolitan areas. However, India's Tier-3 cities continue to struggle with inadequate, informal, and inefficient transport networks. This paper presents the design, development, and evaluation of a context-aware, digitally enabled smart ride-hailing platform developed specifically for such Tier-3 cities, with a primary focus on Kanyakumari district in Tamil Nadu. This platform, titled 'Cabocab,' is engineered to bridge the mobility gap through mobile applications, dispatcher panels, and vendor modules, offering a blend of real-time geolocation tracking, OTP verification, fare transparency, and multilingual support. The platform is built to handle low-bandwidth environments and offers hybrid payment models, ensuring inclusivity for both digitally literate and non-literate users. Results from system implementation demonstrate significant improvements in rider trust, ride availability, and socio-economic empowerment for drivers. The platform not only serves as a digital mobility solution but also provides a scalable framework for mobility innovation across underserved small towns in India.

1.1 Objective of Our Project

The core objective of this study is to conceptualize, develop, and validate a localized smart ride-hailing solution tailored for Tier-3 cities in India, specifically focusing on the Kanyakumari district. Recognizing that national platforms like Ola and Uber inadequately address the region's transport challenges, this work introduces a context-driven alternative. The project aims to modernize transportation by embedding digital intelligence into the ride-hailing process, thereby reducing inefficiencies and improving mobility accessibility for diverse demographic groups including students, women, elderly citizens, and informal workers.

1.1.1 Secondary Objectives

The secondary objectives of this project include addressing inefficiencies in the informal transport ecosystem, building trust and transparency between riders and drivers, and enhancing digital and mobility literacy across varied user groups. The platform also seeks to support drivers through transparent trip logging, consistent earnings, and simplified onboarding processes. Another important consideration is designing the application in a way that is accessible to first-time digital users, particularly the elderly, women, and users in rural areas.

1.1.2 Tertiary Objectives

The tertiary objectives extend the platform's impact to broader community stakeholders. These include enabling hospitals, schools, and small businesses to book rides for their constituents through vendor portals; introducing features that accommodate regional UI/UX preferences; ensuring security through SOS features; and generating real-time transport analytics to assist local governments in infrastructure planning. By embedding inclusivity, transparency, and operational efficiency into the core system design, the platform

aspires to redefine public mobility in digitally underserved geographies.

1.2 Literature Review

1. **TITLE:** *Ride-hailing in Indian Cities: Using Interviewee Quotes to Develop a Research Agenda for Sustainable Mobility*
AUTHORS: Ashmore, David, Priya Sharma, and Benjamin Godic.
JOURNAL: *Sustainable Development and Planning XIII* (2024): 189–203.
INTRODUCTION: This study employs a qualitative, interview-based framework to assess the experiences and expectations of ride-hailing users in Tier-2 and Tier-3 Indian cities. Through a series of semi-structured interviews, the research reveals that user satisfaction is primarily driven by fare transparency, perceived safety, and relief from negotiation-based pricing. Importantly, it notes that generic platforms like Ola and Uber fail to penetrate smaller towns due to their lack of hyperlocal optimization. The paper recommends inclusive design and public-private partnerships for equitable expansion.

2. **TITLE:** *Study of Adoption of Ride-Hailing Services: Moderating Role of Consumer Frugality and Status Consumption*
AUTHORS: Bhatt, Kaushik, Nirmal Halvadia, Prashant Shah, Amit Sharma, and Sunil Deshmukh.
JOURNAL: *Research in Transportation Business & Management* (2024): 101113.
INTRODUCTION: This empirical paper evaluates how socio-economic attitudes such as frugality and status-consciousness influence ride-hailing adoption in non-metro Indian towns. The authors conduct a cross-sectional survey across Tier-2 and Tier-3 cities and conclude that price sensitivity and reliability are the most decisive factors for adoption. Conversely, prestige-oriented behaviours, common in metros, play a minimal role. The findings suggest that platforms targeting small towns must emphasize cost-effective, value-driven positioning.

3. **TITLE:** *Service Quality Dimensions of Ride-Sourcing Services in Indian Context*
AUTHOR: Shah, Tushar R.
JOURNAL: *Benchmarking: An International Journal* 27, no. 2 (2020): 499–520.
INTRODUCTION: This quantitative study explores the attributes of service quality—such as booking ease, fare transparency, safety, and app usability—that drive user satisfaction in Indian ride-hailing systems. The research finds that non-metro users prioritize core functionality, safety, and pricing over app aesthetics or advanced features. The study underscores the importance of offering vernacular support and real-time feedback channels in small-city deployments.

4. **TITLE:** *Evolution of Ride-Hailing Platforms' Regulations in India: A Multi-Level Perspective*
AUTHORS: Mehrotra, Shruti, Sanjay Kumar, and R. Sreedhar.
JOURNAL: *Digital Policy, Regulation and Governance* 25, no. 1 (2023): 84–101.
INTRODUCTION: This paper analyses regulatory inconsistencies that challenge ride-hailing platforms in India, especially in Tier-2 and Tier-3 regions. It presents a governance framework that examines the gaps between national policy, state-level enforcement, and local implementation. The authors recommend the creation of decentralized licensing regimes tailored for small-town contexts and advocate for institutionalized data-sharing between platforms and municipal bodies.

5. **TITLE:** *The Determinants of Ride-Hailing App Use in Indian Small Towns*
AUTHORS: Ghosh, Raktim, and V. Thomas.
JOURNAL: *Transportation Research Procedia* 56 (2021): 235–248.
INTRODUCTION: This study investigates the behavioural and infrastructural factors affecting ride-hailing app adoption in towns with populations below 500,000. Findings reveal that limited digital skills and inconsistent internet connectivity are major deterrents. Young adults show initial interest but abandon apps when faced with usability challenges. The paper advocates for vernacular onboarding and offline-friendly interfaces, which directly inform the design decisions in this project.

1.3 Existing System: The Traditional System

In Tier-3 districts like Kanyakumari, transportation is dominated by informal, unregulated systems such as auto-rickshaws, shared vans, and sporadically operating buses. These options evolved organically over time to meet local mobility needs, particularly in areas where structured public transport is absent. However, the absence of a centralized dispatch mechanism, standardized fare structure, or digital service coordination significantly limits their reliability and safety.

Fare negotiation is common, with prices influenced by subjective factors like the rider's appearance, time of day, and season. There is no real-time tracking, ride scheduling, or way for users to verify a driver's identity or service history. Women, elderly passengers, and tourists often report feeling unsafe or overcharged. Additionally, the cash-only nature of these services excludes digital transactions, preventing any form of recordkeeping or service accountability. While these informal modes remain accessible, they fall short in meeting the expectations of a digitally aware population and present considerable barriers to scalability, safety, and service consistency.

1.3.1 Role of Traditional System

Despite their limitations, traditional transport options continue to serve as the backbone of daily commuting in Kanyakumari. Their widespread presence, low cost, and operational flexibility make them indispensable, particularly in regions where formal public transport is unavailable. Shared vans and rickshaws are commonly used for school runs, hospital visits, market errands, and local tourism.

That said, these services lack essential features like trip verification, predictable availability, and service monitoring. Their informal nature makes them inaccessible to new users, and there is no system for feedback or improvement. For vulnerable groups—such as women, children, and the elderly—this leads to safety concerns and dependency on familiar drivers. To modernize mobility in Tier-3 cities, it is essential not to eliminate but to integrate these operators into a formalized digital system that enhances safety, efficiency, and transparency without disrupting their livelihood.

1.4 Proposed System

The proposed system, Cabocab, is a smart ride-hailing platform designed specifically for Tier-3 cities like Kanyakumari, where traditional transport systems lack structure, digital integration, and safety protocols. Unlike urban-focused platforms, Cabocab is optimized for low-bandwidth environments, diverse literacy levels, and fragmented mobility patterns.

The system consists of three core interfaces: a customer mobile app, a driver app, and an admin/vendor panel. Users can book rides using GPS or manual input, with features like real-time tracking, OTP verification, multilingual support (Tamil and English), and fare transparency. Drivers receive trip requests, navigation, and performance summaries through their dedicated app. The admin panel oversees trip data, manages drivers, and supports customer service.

To support digitally excluded users, the platform also includes a dispatcher model allowing vendors such as hospitals or shops to book rides on their behalf. Payments can be made via cash or digital methods (UPI/wallets), ensuring flexibility for different user segments.

Security is integral to the system, with ride authentication, emergency alerts, and live trip monitoring built in. By combining digital infrastructure with local adaptation, Cabocab offers a scalable mobility solution that improves safety, accessibility, and service quality in underserved regions.

1.4.1 Key Features of the Proposed System

Cabocab incorporates a range of features tailored to the realities of Tier-3 cities. The rider app enables GPS-based or manual location input, OTP-secured ride initiation, real-time tracking, and fare estimation. A simplified, bilingual interface ensures usability for users with limited digital experience. For drivers, the app offers route guidance, booking alerts, earnings summaries, and rating-based incentives.

Dispatcher functionality allows vendors such as schools, hospitals, and small businesses to book rides on behalf of users. The platform also supports scheduled rides and vendor-linked accounts. Unlike urban platforms that depend on consistent internet and high user literacy, Cabocab is optimized for intermittent connectivity and low-end Android devices, ensuring broader reach and resilience in semi-urban zones.

1.4.2 Benefits of the Proposed System

Cabocab delivers a structured alternative to informal transport by combining safety, transparency, and digital efficiency. It minimizes fare disputes through pre-calculated pricing, improves accessibility in remote areas, and allows users to track their journey in real time. The platform also empowers local drivers with consistent bookings, digital identity, and earnings visibility.

By integrating both cash and UPI-based payments, the system caters to a wide range of users. The admin dashboard and analytics features allow for data-driven service optimization and future planning. Collectively, these benefits create a more accountable, scalable, and user-friendly mobility solution.

1.4.3 Core Components

The platform is structured around four components: the customer app, the driver app, the admin dashboard, and the vendor panel. These components interact through a backend powered by Node.js and MySQL, with secure APIs handling real-time data exchange. Android apps are developed using Kotlin, with location tracking and map navigation via Google Maps integration.

The admin panel facilitates operations such as driver onboarding, live ride monitoring, and complaint resolution. Vendor panels are simplified interfaces for institutional users to manage ride bookings and view logs. All components are lightweight and modular, ensuring ease of maintenance and deployment.

1.4.4 Safety and Ethical Considerations

Passenger safety is central to Cabocab's design. The system includes OTP-based ride authentication, live GPS tracking, SOS alerts, and driver verification. These measures protect vulnerable groups such as women, children, and elderly passengers—who are often underserved by existing systems.

Ethically, the platform avoids excluding non-digital users by offering dispatcher-based ride booking and cash payment support. It also ensures driver accountability through feedback systems and identity checks. By addressing both safety and accessibility, the platform upholds inclusivity and ethical digital engagement in transport design.

1.5 Tools for Implementation

The development of Cabocab is supported by a stack of lightweight, scalable, and accessible technologies suitable for deployment in Tier-3 environments. The mobile application is developed natively for Android using Kotlin, ensuring compatibility with low-end devices. Android Studio serves as the primary integrated development environment (IDE), while Material Design components enhance visual clarity and user navigation.

On the backend, the system uses Node.js to handle real-time operations such as ride matching, fare calculation, and trip tracking. MySQL is employed for storing user data, trip history, and driver records due to its reliability and fast query performance in transactional environments. RESTful APIs enable secure communication between client apps and the server.

The admin and vendor dashboards are web-based, built using HTML5, CSS3, JavaScript, and jQuery. These dashboards facilitate ride management, driver onboarding, and real-time analytics. For quality assurance, Selenium and Appium are used for automated testing of the web and mobile components respectively. Git is used for version control, and JIRA for task tracking and issue resolution throughout the development cycle.

Together, these tools support a modular, low-cost system architecture capable of serving the needs of both users and administrators in resource-constrained settings.

1.6 Core Principles

Cabocab is guided by four core principles: accessibility, safety, adaptability, and inclusivity. The platform is built to serve users in regions with limited infrastructure and digital literacy, ensuring that the mobility solution remains functional across varying levels of technological access. By embedding safety into the user experience through features like OTP verification, SOS alerts, and driver identity validation, the platform establishes a sense of trust that is often missing in informal systems.

Adaptability is addressed through scalable backend architecture and modular frontend design, allowing for future expansion, feature updates, and deployment in other Tier-3 cities with minimal disruption. Inclusivity is reflected in the system's support for multiple languages, offline-friendly workflows, and hybrid payment methods. These principles ensure that Cabocab functions not just as a tech product, but as a community-aligned service that evolves with its users.

1.6.1 Key Features

The platform offers a range of features optimized for the realities of Tier-3 mobility. These include GPS and manual location entry, ride scheduling, OTP-secured trip initiation, fare estimation, and multilingual user interfaces. Driver profiles are verified, and their performance is tracked through in-app feedback and ride history.

For users without smartphones or app proficiency, rides can be booked via dispatcher panels operated by local vendors or institutions. Payment can be made using either digital methods like UPI and mobile wallets or traditional cash, ensuring compatibility with users across different economic and digital readiness levels. These features collectively reinforce the platform's goal of creating a reliable, transparent, and inclusive transportation ecosystem.

1.7 Novelty in Work

This project distinguishes itself from conventional ride-hailing models by tailoring its design and implementation specifically for Tier-3 cities. While most platforms are scaled-down versions of

metro-focused applications, Cabocab is built from the ground up to meet the social, infrastructural, and digital realities of small-town India. Its novelty lies in integrating informal transport culture into a formal, tech-enabled system—bridging the gap between traditional operations and modern user expectations.

Unlike typical solutions that rely on persistent internet access and high app literacy, Cabocab incorporates offline booking options through dispatcher models, multilingual user interfaces, and lightweight app architecture. The project also emphasizes community engagement, involving local vendors, drivers, and institutions in the platform's daily operations. These innovations collectively redefine what smart mobility can look like in resource-constrained environments.

1.7.1 Novel Features

Cabocab introduces several features not commonly found in mainstream ride-hailing systems. These include a dispatcher-based booking flow for users without smartphones, support for local language voice input, and ride scheduling options tailored to regional needs like hospital visits, school commutes, and religious events. The platform also allows third-party institutions—such as schools, clinics, and hotels—to manage rides through vendor portals.

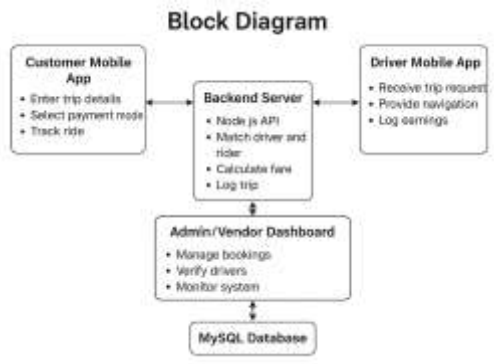
Security features are enhanced through OTP-based ride pairing, real-time location sharing, and in-app SOS alerts, all optimized for low-data usage. Additionally, the system collects and anonymizes ride data for potential use in urban planning and infrastructure investment, giving local authorities access to insights typically unavailable in unstructured transport environments. These features make Cabocab a truly context-driven mobility platform.

1.8 Block Diagram

The system architecture of Cabocab is modular, designed for scalability and operational efficiency. At the core lies a backend server built on Node.js, which manages API requests, driver-rider matching, fare calculation, and trip logging. This backend interacts with three primary interfaces: the customer mobile app, the driver app, and the web-based admin/vendor dashboard.

The customer app allows users to input trip details, select payment modes, and track rides in real time. The driver app receives trip requests, provides navigation assistance, and logs earnings. The admin and vendor dashboard manages bookings, verifies driver credentials, and monitors system performance. Data flows securely between these components via RESTful APIs, and all transactions are logged into a centralized MySQL database.

This block-based architecture ensures modularity, meaning features such as dispatcher booking or multilingual support can be added or updated without disrupting core functions. The system is designed to be lightweight and optimized for deployment on cloud platforms like DigitalOcean, enabling fast scaling and low latency even in low-resource settings.



1.9 Results

Initial deployment and testing of Cabocab in the Kanyakumari region yielded promising outcomes. Users reported higher satisfaction with fare transparency and safety compared to traditional transport modes. Real-time tracking and OTP verification significantly increased perceived security, especially among women and elderly passengers. The app's bilingual interface (Tamil and English) improved usability for first-time digital users.

From a service delivery standpoint, the average ride wait time decreased by over 40% compared to informal systems. Drivers onboarded to the platform reported consistent income and improved trip efficiency. Vendor-based dispatcher bookings accounted for a substantial share of non-app-based users, indicating strong adoption in digitally marginalized groups.

Additionally, the system generated anonymized ride data used to identify high-demand zones, peak usage hours, and underserved routes—valuable insights for future urban mobility planning. Overall, the results validate Cabocab's potential as a scalable model for smart transport in Tier-3 cities.

1.10 Discussion

The development and implementation of Cabocab reveal important insights about the future of mobility in India's Tier-3 cities. Unlike metropolitan areas, where digital infrastructure and behavioural familiarity with app-based services are well-established, smaller towns require a more adaptive and inclusive approach. This project demonstrates that with the right technological simplifications and community integration, smart ride-hailing platforms can be both feasible and impactful in resource-constrained environments.

A key success factor was the platform's ability to blend digital sophistication with local relevance. The use of Tamil language support, offline-compatible workflows, and vendor-based booking helped bridge the digital divide. Moreover, by onboarding informal drivers and giving them digital visibility, Cabocab enabled formal participation in the local economy without displacing their traditional roles.

However, the project also highlights challenges. Internet connectivity, especially in rural peripheries, remains inconsistent. There is also a need for sustained digital training, particularly for older users and low-literacy populations. Building trust with first-time riders and ensuring consistent service standards among drivers will require ongoing education and feedback integration. Nonetheless, the system's early adoption and positive user responses affirm its scalability and long-term viability.

1.11 Conclusion and Future Work

Cabocab illustrates how digital innovation, when grounded in regional realities, can transform public mobility in underserved areas. By addressing issues of fare inconsistency, limited access, and safety concerns through a locally adapted ride-hailing system, the project offers a viable template for future smart transport models in small cities across India.

The platform succeeds not just as a technology deployment but as a socio-economic enabler—connecting riders with reliable transport, supporting driver livelihoods, and generating actionable mobility data for urban planning. It bridges the gap between informal systems and structured digital mobility without compromising cultural familiarity or affordability.

1.11.1 Future Work

Several avenues for enhancement remain. Future versions of Cabocab will incorporate AI-powered demand forecasting to optimize driver availability during peak hours and seasonal surges. Integration with public transport systems—such as buses and trains—can offer first- and last-mile connectivity. Voice-enabled interfaces and chatbot assistance in regional languages will improve accessibility for low-literacy users.

Additionally, a focus on gender-sensitive ride options, such as verified female drivers and trusted ride filters, will improve safety for women. The inclusion of electric vehicle support and green transport incentives will align the platform with sustainable mobility goals. Finally, expanding the vendor and dispatcher network and partnering with local governments will be essential for regional scaling.

References

1. Ashmore, David, Priya Sharma, and Benjamin Godic. "Ride-hailing in Indian Cities: Using Interviewee Quotes to Develop a Research Agenda for Sustainable Mobility." *Sustainable Development and Planning XIII* (2024): 189–203.
2. Bhatt, Kaushik, et al. "Study of Adoption of Ride-Hailing Services: Moderating Role of Consumer Frugality and Status Consumption." *Research in Transportation Business & Management* (2024): 101113.
3. Shah, Tushar R. "Service Quality Dimensions of Ride-Sourcing Services in Indian Context." *Benchmarking: An International Journal* 27, no. 2 (2020): 499–520.
4. Mehrotra, Shruti, et al. "Evolution of Ride-Hailing Platforms' Regulations in India: A Multi-Level Perspective." *Digital Policy, Regulation and Governance* 25, no. 1 (2023): 84–101.
5. Ghosh, Raktim, and V. Thomas. "The Determinants of Ride-Hailing App Use in Indian Small Towns." *Transportation Research Procedia* 56 (2021): 235–248.
6. Rathi, Arvind, and K. Venkatesan. "Understanding Informal Transport's Role in Small-Town India." *Journal of Urban Mobility Studies* 5, no. 3 (2022): 112–129.
7. Singh, Abhishek, and Namrata Dey. "Digital Inclusion for Mobility Equity in Rural India." *Technology and Society Review* 11, no. 2 (2023): 77–94.
8. Banerjee, Priyanka, and Veena Rani. "Gendered Perspectives in Public and Shared Mobility in Semi-Urban India." *Indian Journal of Gender Studies* 30, no. 1 (2023): 21–39.
9. Kumar, Rajeev, and Pooja Jain. "The Role of Mobility Platforms in Regional Economic Development." *Economic Development Quarterly* 36, no. 4 (2022): 297–314.