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Comprehensive Platform for Product Rentals Optimized Vehicle Service Operations and Seamless Online Booking

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Abstract— This paper presents an AI-integrated smart mobility platform for on-demand vehicle rental and driver booking. The application enables seamless interaction between customers, drivers, and administrators, improving accessibility and efficiency in urban transportation. It simplifies vehicle booking, driver onboarding, and rental management through a unified digital system. Users can select vehicles such as cars, bikes, and scooters with flexible rental plans, supported by intelligent recommendations and secure payments via UPI, QR code, and net banking. A dedicated driver portal allows service providers to register and complete verification through document validation. The system is developed using Flutter and Dart with OpenAI GPT-4o-mini integration, ensuring scalability and intelligent service delivery. Features such as dynamic pricing and AI-assisted onboarding enhance overall platform performance and user experience.

Keywords — Smart Mobility, Vehicle Rental, Flutter, AI Integration, Dynamic Pricing, Driver Booking, On-Demand Transportation

I. INTRODUCTION

Conventional vehicle rental and driver hiring is done primarily through phone-based methods, causing uncertainty in vehicle availability, opacity in pricing, and lack of access to verified drivers. With the rapid growth of mobile technologies, there is a growing demand for an automated digital platform that seamlessly connects customers to vehicles and professional drivers for on-demand transportation services.

The Servexa Mobility Platform proposes a mobile-first application that allows customers to search and select vehicles, choose rental or leasing plans, receive AI-assisted travel recommendations, and complete bookings with dynamic pricing. Customers can also select pickup locations, track booking status, and make payments through QR code, UPI, and Net Banking.

The platform serves three primary users customers, drivers, and administrators. Customers can book vehicles, receive AI-based recommendations, and make digital payments. Drivers can register through a dedicated job portal, upload required documents, and complete onboarding after paying a one-time joining fee. Administrators manage driver approvals, vehicle availability, service delivery, and platform analytics through admin dashboards. The platform is built using Flutter with Dart for the frontend and Google Gemini AI for context-aware assistance throughout the booking and onboarding workflow.

II. LITERATURE SURVEY

Research has been conducted regarding on-demand vehicle services, mobile-based booking platforms, and digital driver management systems. These studies have emphasized the importance of technology in simplifying vehicle booking processes, improving communication between customers and service providers, and ensuring efficient fleet management through integrated digital platforms.

An On-Demand Car Servicing Application was proposed by Zeynep Sagir, Anela Cokovic, and Erna Berbic (2023), published in the CIT Review Journal, International University of Sarajevo. This research focused on a mobile and web-based platform where customers can book vehicle servicing, request pickup and drop-off, and make digital payments. The platform introduced three user types customers, employees, and administrators built using Flutter for mobile and ReactJS for web, demonstrating that centralized booking platforms significantly enhance coordination between customers and service

providers [1].

A research study by Zarak Jahan, Manav Chauhan, Nazia Parween, and Megha Chhabra (2023), published in the International Journal of Performability Engineering, proposed SERIGO: A Peer-to-Peer Self-Driving Car Rental Application using Flutter Framework. This research demonstrated that Flutter's cross-platform capabilities and rich widget ecosystem reduce development time while maintaining a consistent user experience on both iOS and Android, confirming Flutter as a suitable technology for scalable vehicle rental applications such as Servexa Mobility [2].

Similarly, an Online Car Rental System developed by K. Shobhan Babu et al. (2024), published in IJFANS, focused on building a vehicle rental platform with transparent pricing, flexible reservations, and multiple payment methods. The study highlighted the importance of accurate booking and clear pricing mechanisms to prevent charge manipulation core principles adopted in the Servexa Mobility platform [3].

Moreover, a research paper on AI Enhanced Customer Service Chatbot, published in IEEE Xplore (2024), discussed how AI-powered chatbots using NLP provide round-the-clock customer assistance, rapid response times, and personalized service. The study demonstrated how AI chatbots enhance user experiences through proactive and data-driven interactions directly supporting the integration of the AI chat assistant in Servexa Mobility for real-time customer and driver guidance [4].

However, many existing platforms lack AI-assisted driver onboarding validation, real-time vehicle recommendations, integrated AI chat assistance, and multi-modal payment support. The proposed Servexa Mobility AI-Integrated Online Vehicle Rental and Driver Booking System addresses these limitations by integrating OpenAI GPT-4o-mini for vehicle recommendations, driver profile review, and customer chat assistance, along with dynamic pricing and QR code, UPI, and Net Banking payment options.

III.PROBLEM STATEMENT

In many urban areas, accessing reliable vehicle rental and professional driver services remains a significant challenge due to phone-based bookings, lack of pricing transparency, and no real-time availability tracking. Service providers depend on paperwork-based verification to assess driver documents, making it difficult to validate eligibility and manage bookings efficiently. Existing approaches lack automated driver profile validation, AI-powered customer assistance, and flexible digital payment support. The proposed Servexa Mobility Platform addresses these challenges by providing a centralized mobile application for vehicle rental and driver booking with transparent pricing, multi-modal payments, and Google Gemini AI powered assistance

IV.OBJECTIVE

The overall objective of the Servexa Mobility Platform is to develop an efficient AI-integrated mobile application that enables customers to book vehicles and hire professional drivers with intelligent assistance throughout the booking and onboarding process. The platform aims to provide transparent dynamic pricing, real-time booking status tracking, and Role-Based Access Control for Customers, Drivers, and Administrators with secure authentication. It also aims to design and implement AI-assisted driver onboarding validation using Google Gemini AI to review applications and provide actionable feedback before submission, along with AI-powered vehicle recommendations and intelligent chat assistance across hourly, daily, and monthly rental and lease plans. The platform further aims to support multi-modal digital payments including QR code, UPI, and Net Banking, and to deliver a responsive and scalable mobile application built using Flutter with Dart and Google Gemini AI API.

V. SYSTEM DESIGN

I System Flow Diagram

The system flow diagram represents the end-to-end workflow of the Servexa Mobility Platform covering both Customer and Driver processes. The flow begins when a user opens the application, registers or logs in, and selects a role. Customers browse available vehicles, select a rental or lease plan,

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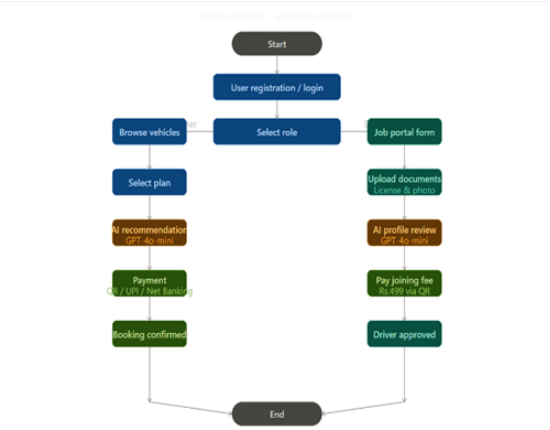
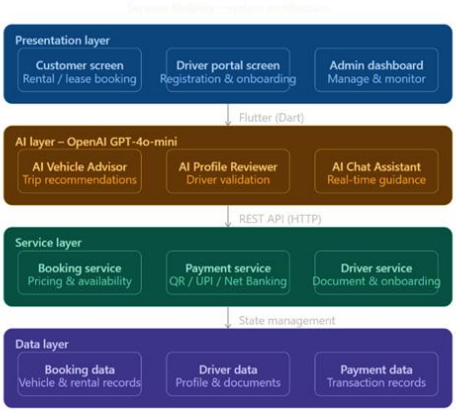
receive AI-powered recommendations through Google Gemini AI, and complete the booking through QR code, UPI, or Net Banking payment.

Drivers register through the job portal by submitting personal details and uploading required documents, receive AI-assisted profile review and feedback, accept the terms and conditions, and complete onboarding by paying a one-time joining fee via QR payment. Both flows conclude with successful booking confirmation or driver onboarding, enabling seamless service delivery within the platform.



[Fig II.I - System Flow Diagram]

III.II System Architecture Diagram



The system architecture defines a four-layer structure that organizes the platform's core functionalities and ensures seamless interaction between components.

Presentation Layer
Built using Flutter and Dart, this layer provides the user interface for Customers, Drivers, and Admins, enabling vehicle booking, driver onboarding, and system monitoring.

AI Layer
Powered by OpenAI GPT-4o-mini, this layer delivers intelligent features including vehicle recommendations, driver profile validation, and real-time chat assistance via API integration.

Service Layer
Handles core operations such as booking management, dynamic pricing, payment processing (QR, UPI, Net Banking), and driver onboarding logic.

Data Layer
Manages storage of booking details, driver information, and transaction records using structured data handling and state management.

III. DATA FLOW DIAGRAM

The data flow diagram illustrates how data moves between the three external entities Customer, Administrator, and Driver and the internal processes of the Servexa Mobility Platform. All three users begin by submitting their credentials through the User Authentication process for registration and role selection. The Customer accesses the Booking and Payment module to select a vehicle and complete payment, while the Driver accesses the Onboarding module to upload documents and pay the joining fee. The Administrator monitors and approves operations through the Admin Dashboard. The AI Assistant powered by Google Gemini returns vehicle recommendations to customers and profile validation feedback to drivers. All data is stored in three data stores D1 Booking Records, D2 Driver Profiles, and D3 Payment Records.

VI. METHODOLOGY

The development of the Servexa Mobility Platform followed a structured Software Development Life Cycle integrating modern agile practices to manage the complexity of multiple service modules and AI integration.

A. Requirement Analysis
The initial phase involved studying the urban vehicle rental and driver booking landscape to identify gaps in digital accessibility, transparent pricing, and AI-assisted onboarding. Requirements

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were gathered for all core modules including vehicle rental, driver job portal, insurance, membership, SOS, and AI chat. This phase resulted in a prioritized feature roadmap focused on a unified super-app architecture where all services coexist within a single authenticated session.

B. System Architecture and Design

A modular architecture was selected to ensure scalability and independent maintainability. The frontend was designed using Flutter's widget-tree architecture with a Glassmorphism UI theme. The backend was designed using an asynchronous Node.js and Express architecture to handle high-concurrency API requests. MongoDB was selected as the database for flexible schema management across multiple service modules.

C. Development and AI Integration

Implementation followed a modular integration strategy. Core infrastructure including the Express server, MongoDB Atlas connectivity, and Flutter base navigation was established first. Service modules were incrementally developed and integrated into the centralized state management system. Google Gemini AI was selected for intelligent chat assistance, vehicle recommendations, and driver profile validation.

D. Testing and Quality Assurance

A multi-tier testing strategy was employed including functional testing of core user journeys such as booking, payment, and driver onboarding, AI validation through prompt engineering to ensure accurate recommendations and profile feedback, security testing to validate session management and API key protection, and cross-platform verification across Android and iOS environments.

VII. METHODOLOGY

The Servexa Mobility Platform was developed using a modular approach integrating Flutter for cross-platform mobile development, Node.js for backend services, MongoDB for data management, and Google Gemini AI for intelligent assistance across booking, driver onboarding, and customer support workflows.

A. Development Environment and Technologies

i. Development Environment: The system was developed on Windows 11 using Visual Studio Code as the primary development environment with Flutter SDK and Dart as the core programming language for mobile application development.

ii. Frontend Technologies: The mobile application interface was built using Flutter with Dart employing a Glassmorphism dark-themed UI. Riverpod was used for centralized state management. QR Flutter was used for QR code generation in payment screens. Image Picker was used for document upload in the driver portal. Geolocator was used for real-time GPS tracking in the Emergency SOS module.

iii. Backend Technologies: Node.js with Express was used as the backend web framework to handle REST API endpoints. Google Gemini AI API was integrated as the AI layer for the chat assistant, vehicle advisor, and driver profile reviewer. MongoDB Atlas was used as the database management system.

VIII. IMPLEMENTATION

The Servexa Mobility Platform is implemented using Flutter with Dart as the core mobile development framework and Google Gemini AI for intelligent assistance.

A. Dashboard Module

i. Home Dashboard: The home dashboard serves as the central navigation hub displaying a personalized greeting, notification bell, and AI Assistant banner. The Explore Services section presents all service modules in a responsive grid with a persistent floating SOS button at the bottom right corner

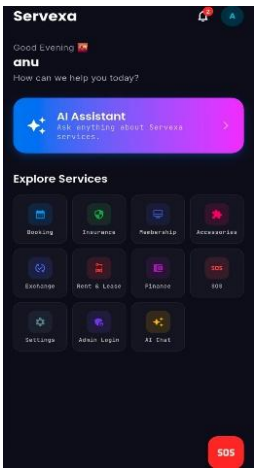

Fig 8.1 - Home Dashboard

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Service Reports: The service reports screen provides customers with a complete history of all previous bookings displaying booking date, vehicle details, service center, duration, total charges, and current status.

B. Booking Module

i. Book Now Screen: The booking module collects customer name, vehicle number, district, service center, mobile number, date, time, and pickup location through a structured form with cascading dropdown selectors. A Drop Service checkbox allows customers to request vehicle pickup and delivery. The customer taps Confirm Booking to submit after all fields are validated.

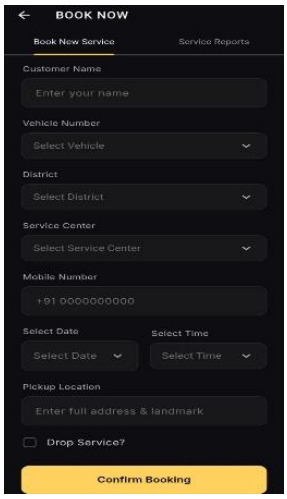

Fig. 8.2 – Book Now Screen

C. Insurance Module

i. Insurance Hub Screen: The Insurance Hub displays active policies with expiry status, available EV insurance products for 2-Wheeler, 3-Wheeler, and 4-Wheeler categories, quick action buttons for Claims, Track Claim, and Garage, and a Pending Renewals section with Pay Now options.

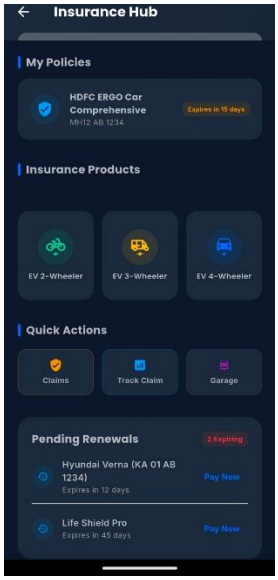

Fig 8.3 – insurance hub

D. Rental and Lease Module

i. Rent and Lease EV Screen: The Rent and Lease EV screen implements a five-step booking workflow where customers select an electric vehicle from available options including Tata Nexon EV at Rs.350 per hour, MG ZS EV at Rs.400 per hour, BYD Atto 3 at Rs.450 per hour, and Mahindra XEV 9e at Rs.500 per hour. Unavailable vehicles are marked with a red badge.

Fig 8.4 -Rental and lease module

E. Membership Module

i. Membership Plans Screen: The Membership screen displays three subscription tiers Silver at Rs.999 per month, Gold at Rs.1999 per month, and Platinum at Rs.3999 per month. The Gold plan is highlighted as the featured tier with an amber design and an embedded Subscribe button. All plans support cancellation at any time.

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Fig 8.5-Membership module

IX. CONCLUSION

The Servexa Mobility Platform provides an efficient AI-integrated digital solution that enables customers to book vehicles and hire professional drivers through a single unified mobile application. Customers can browse available vehicles, select rental or lease plans, receive AI-powered recommendations, and complete payments through QR code, UPI, and Net Banking. By using modern technologies including Flutter, Google Gemini AI, and dynamic pricing logic, users are provided with a fast, efficient, and intelligent booking experience.

Real-time features including GPS-based emergency alerts, AI-assisted driver profile validation, and multi-modal payment processing are integrated into the platform, allowing customers and drivers to complete bookings and onboarding conveniently and securely. The platform also incorporates an Insurance Hub, Membership plans, and a Vehicle Exchange module to provide a comprehensive mobility service ecosystem.

Overall, the Servexa Mobility Platform provides several benefits including improved booking transparency, efficient driver onboarding, intelligent AI-powered assistance, and flexible payment options. Therefore, the platform can be considered a successful example of how modern mobile technologies and AI-integrated solutions can be utilized to support on-demand vehicle rental services and promote smarter, more accessible urban mobility.

X. FUTURE ENHANCEMENT

The AI-Assisted Smart Platform for Environmental Responsibility and Community Cleanliness can be further enhanced by introducing additional features that improve platform functionality and user engagement. In the future, the platform could incorporate advanced artificial intelligence techniques for automated waste classification and improved validation of reported complaints. These enhancements can help authorities identify waste types more accurately and prioritize cleanup activities effectively.

The platform could also include push notifications and alert systems to provide users with real-time updates regarding complaint status and cleanup progress. Additional features such as automated scheduling of volunteer cleanup events and improved environmental analytics could further strengthen community participation. The integration of machine learning models may also support predictive analysis for identifying areas that frequently experience waste accumulation.

Furthermore, the platform could be expanded to support multiple cities and regions, enabling broader adoption of the application across different urban environments. This expansion would allow more communities to participate in environmental responsibility initiatives and contribute to improving overall urban cleanliness.

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