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ABANG: A MOBILE APP BASED REAL-TIME TRACKING AND NAVIGATION FOR SJJDO TRANSECO MODERN JEEPNEYS

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In Partial Fulfillment
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BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

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APPROVAL SHEET

This capstone project proposal entitled "**ABANG: A MOBILE APP BASED REAL-TIME TRACKING AND NAVIGATION FOR SSJDO MODERN JEEPNEYS** prepared and submitted by **MIKE JORDAN B. LALUCES, MARK TRISTAN S. MOGA, JOHN MARK C. TACTACAN** in partial fulfillment of the requirements for the degree BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY, has been examined and is hereby endorsed.

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ABSTRACT

Modern jeepney commuters in Nueva Ecija continue to face challenges such as long waiting times, unpredictable arrivals, and limited access to real-time information about available modern jeepneys. These issues lead to daily inconvenience, inefficient travel, and missed trips. To address these problems, Abang: A Mobile App-Based Real-Time Tracking and Navigation for SSJDO Modern Jeepneys was developed as a mobile solution aimed at enhancing the commuting experience. The system was developed using the Agile Software Development Life Cycle (SDLC), allowing for iterative development and continuous user feedback. The application features real-time jeepney tracking, enabling passengers to view the current location and estimated arrival time of incoming vehicles. It also provides information on seat availability, helping commuters make informed travel decisions. For operators and administrators, the system offers centralized monitoring of trip data, vehicle activity, and ridership patterns, enabling more efficient service delivery. Additionally, the system is capable of generating comprehensive reports that support decision-making, operational analysis, and performance evaluation. Abang serves as an example of how a mobile application can improve public transport systems by replacing manual guesswork with real-time, data-driven solutions—benefiting passengers, drivers, and transport operators alike.

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CHAPTER I

INTRODUCTION

Background of the Study

Nueva Ecija's economy registered a 5.5 percent growth in 2023, highlighting its continuous progress and development (De Guzman, 2024, as cited in PSA, 2024). This economic growth also leads to have a growing demand for public transportation. As home for different commuters, Nueva Ecija relies on efficient public transportation to facilitate daily commutes to schools, works, and other destinations.

As the government recognizes the growing demand of public transportation, they launched the Public Utility Vehicle Modernization Program (PUVMP) to enhance public transportation. (Soriano, 2021). Commuters in Nueva Ecija who prefer the safety, air-conditioning, and accessibility features of modern jeepneys often face a daily challenge because there are far fewer modern units on the road than traditional ones and none of them provide real-time location updates. Even as the demand for modern transportation increases, passengers still face challenges, mainly the limited number of units operating. As a result, commuters struggle to locate and access modern jeepneys which leads to long waiting times and uncertainty.

In response to this challenge, developers from the Department of Information and Technology proposed a solution to address this issue. The developers will create a mobile application named Abang, which aims to enhance the commuting experience of passengers who wants to use modern jeepneys. This project is designed to enhance the commuting experience by providing passengers with real-time information on modern jeepney. Abang solves the problems faced by commuters, such as unpredictable arrivals and long waiting times. By utilizing real-time GPS (Global Positioning System) tracking, this application ensures that passengers are updated and can manage their travel schedules effectively. Furthermore, the application will also benefit drivers and operators by gaining more passengers, and reduced waiting times that results on higher daily earnings.

PROBLEM STATEMENT

General Problem

The general problem of this study is the lack of real-time location tracking for modern jeepneys. This includes the absence of location and seat availability data, resulting in unpredictable arrival times, long average waiting periods of 17 minutes, inconvenience for passengers, and challenges for operators in monitoring and managing their units efficiently.

Specific Problems

1. Passengers have no means of accessing real-time updates on the location of modern jeepneys along the route between San Jose City and Cabanatuan City, making it difficult to track arrivals.
2. There is no available system for passengers to view real-time seat availability in modern jeepneys.
3. Operators lack access to real-time location data of modern jeepneys, preventing them from effectively monitoring trip status and route completion.

OBJECTIVES

General Objective

The objective of this study is to design, develop, and implement a real-time tracking and navigation system for SJJDO TRANSECO Modern Jeepneys operating between San Jose City and Cabanatuan City, aimed at providing passengers with accurate location and seat availability information, and assisting operators in efficiently monitoring and managing their units.

Specific Objectives

1. To provide real-time tracking of modern jeepneys, the project will utilize GPS technology on both the driver/conductor and passenger devices, enabling users to view the exact location and estimated arrival time of each jeepney.
2. To automatically show real-time seat availability to passengers.
3. To provide real-time updates on whether the jeepneys are on their route or have completed their trips.

SCOPE AND LIMITATION

The system offers several key features designed to enhance the commuting experience between Cabanatuan and San Jose. These features include real-time location tracking of modern jeepneys, seat reservation, automatic fare computation, trip activity monitoring, and summary report generation. The users of the system include passengers, drivers, conductors, operators, and administrators.

Each feature has specific capabilities that contribute to the system's overall functionality. The real-time tracking feature allows users to monitor the exact location of modern jeepneys through GPS. Seat reservation enables passengers to book available seats in advance, ensuring a more organized boarding process. The fare computation feature automatically calculates travel costs based on the selected destination. Trip activity monitoring allows ongoing trips to be tracked for better coordination. Summary report generation compiles trip and system usage data, supporting performance evaluation and management tasks.

Its geographical coverage is restricted to modern jeepneys operating specifically between Cabanatuan and San Jose, Nueva Ecija. The system is developed exclusively for modern jeepneys under SJJDO TRANSECO and will not support or cater to other transport cooperatives, traditional jeepneys, or other forms of public transportation. The application's performance depends on the availability of stable internet connectivity and GPS signals within the service area.

SIGNIFICANCE OF THE STUDY

This capstone project is significant for its ability to address several critical challenges faced passengers and modern jeepney drivers.

For Passengers. Abang improves the commuting experience for passengers by providing real-time location information of modern jeepneys. This feature helps reduce long waiting times and allows passengers to manage their schedules more efficiently, ensuring timely arrivals at their destinations. It also contributes to a more convenient and stress-free commute. Additionally, the real-time tracking enhances passenger safety by allowing them to wait in secure and populated areas, minimizing the risks associated with waiting in isolated or unsafe locations.

For Drivers and Conductors. Abang offers key benefits for drivers by making it easier to connect with more passengers, which can lead to a higher number of trips each day. It helps minimize the time spent waiting for passengers, allowing drivers to use their time more effectively. With better trip efficiency and steady passenger flow, drivers have the opportunity to earn more and make the most out of their daily operations.

For Operators. The system also holds value for operators by supporting the overall productivity and profitability of their units. With the improved visibility and accessibility that the application provides, modern jeepneys are more likely to operate at full or near-full capacity. This can lead to better revenue generation and reduced idle time for units. Furthermore, the system enables operators to monitor usage patterns and trip activity, providing them with useful insights for evaluating the performance of their vehicles and making informed business decisions.

DEFINITIONS OF TERMS

This section provides clear and concise definitions of key terms used throughout the study to ensure a common understanding of the concepts related to the Abang application and its functions.

Abang. The name of the mobile application developed in this study, designed to provide real-time tracking, seat availability, and navigation for passengers and administrators of modern jeepneys in Nueva Ecija.

Administrator. An authorized user of the Abang system responsible for monitoring modern jeepney operations, including real-time locations and trip status, to ensure efficient transport service.

Android. The operating system on which the Abang mobile application will be developed and used. The app is currently limited to Android smartphones.

Data Dependency. A limitation of the Abang system referring to its reliance on stable internet and GPS signal for accurate tracking and functionality.

Estimated Arrival Time (ETA). The projected time a modern jeepney will reach a specific location or stop based on its current position. The Abang application displays this information to help passengers manage their schedules.

GPS (Global Positioning System). A satellite-based navigation system used in the Abang application to determine and display the real-time location of modern jeepneys, helping both passengers and administrators track movements along the route.

Modern Jeepney. An upgraded version of traditional jeepney under the PUV Modernization Program.

PUVMP (Public Utility Vehicle Modernization Program). A government program to modernize public utility vehicles in the Philippines by upgrading old jeepneys with modern jeepneys.

Real-Time Tracking. The primary feature that the Abang offers to the users allowing passengers, operators, and admins to see the real-time location of modern jeepneys.

San Jose City – **Cabanatuan City Route**. The specific geographical area where the Abang application will be implemented, serving commuters traveling between these two key cities in Nueva Ecija.

Seat Availability. A feature in the Abang app that displays the number of remaining seats in a modern jeepney, allowing passengers to decide whether to board or wait for the next ride.

Trip Efficiency A performance metric enhanced by the Abang system, referring to optimized driver routes, fewer empty trips, reduced idle time, and improved passenger flow.

CHAPTER II

REVIEW OF RELATED LITERATURE

To support and emphasize this study, the developers gather data from related literature and websites that contain related information about the topic of this study. The findings are presented below.

Foreign studies have contributed to the understanding of real-time tracking systems by showcasing the use of mobile applications, GPS technology, and cloud-based analytics. Based on the study of Kushal (2020), a Bus Tracking System for MSRTC buses was developed using GPS technology to address commuter concerns such as route uncertainty and the absence of real-time updates. Their system included features like real-time tracking, ticket booking, and a central server to ensure accurate bus location and arrival time information, significantly enhancing the commuter experience. Similarly, a Smart Bus Tracking System using an Android-based client-server model and Open-Route Service (ORS) was implemented to provide live updates and manage bus records. This highlights the relevance of integrating ORS with real-time tracking, which aligns with the goals of the proposed system.

In another study, Gadade et al. (2024) created an IoT-based Smart School Bus and Student Tracking System using GPS modules, RFID readers, and cloud storage. The system supported real-time monitoring of bus locations and student attendance while enabling coordination among schools, parents, and students. This study is significant to the proposed system as it demonstrates the effective use of mobile applications to present real-time data to users. Furthermore, Vyas et al. (2023) examined an AI-based real-time institutional vehicle tracking system. It used IoT, artificial intelligence, and GPS data to provide real-time bus location and passenger load estimates. Through a mobile app and cloud-based analytics, the system offered visual updates and enhanced decision-making. This is relevant to the proposed system for its use of cloud-based analytics in generating reports.

Local studies provided insights into how real-time tracking technologies are adapted within the Philippine context. Baluyot et al. (2021) developed a web-based real-time bus monitoring and tracking system using GSM (Global System for Mobile Communications) to transmit GPS data. The system included separate modules for administration, bus units, and users, and featured alerts for traffic conditions through color-coded signals. Though effective, it was limited by its reliance on GSM and web-based platforms. This study is significant to the proposed system as it supports the idea of using a centralized admin panel to oversee transport operations.

Ascueta et al. (2021) introduced BusTap, a real-time Android application that addressed the lack of accurate bus information for Victory Liner passengers in Baguio. The app used GPS to display vehicle locations and enhance transport reliability. While BusTap focused primarily on real-time tracking, the proposed system expands upon this by including data analytics to ensure more accurate and responsive updates. This supports the use of GPS-enabled mobile apps for public transportation tracking.

Another study by Santiago et al. (2023) developed HATID, a real-time shuttle tracking platform used at NAIA Terminal 3 in partnership with HM Transport Inc. The system utilized Firebase for real-time synchronization and provided passengers with timely vehicle location and ETA updates. Although HATID is web-based, it shares similarities with the proposed system through its use of Firebase for GPS tracking and real-time data management. The proposed system builds upon this by adding data analytics to evaluate trip efficiency and passenger flow.

Existing Alternatives

Shahila et al. (2021) developed the "Web Based Real Time Bus Monitoring and Tracking System UNIMAS," a web-based platform that enables real-time tracking of UNIMAS buses. The system allows users to monitor live bus locations, routes, and estimated arrival times, while also providing updates on bus schedules and other relevant transportation information. The system highlights a web-based system that enables users to monitor buses live. The system also provides necessary information such as estimated time arrival and trip schedules

In the study of Balani et al. (2023), developed the "Bus Tracking System in the Internet of Things (IoT)," which uses IoT technology to enable real-time bus tracking through a web-based platform integrated with Google Maps. The system features an interactive map showing live bus locations, routes, and schedules, along with driver details such as name, contact information, bus number, and shift schedule. It also includes a QR code scanning feature at bus stops for quick access to transportation information. By combining IoT and web technologies, the system ensures seamless data transmission and improves user access to public transportation updates.

The study of Elijah et al. (2023) highlights the use of Bluetooth Low Energy (BLE) in their project titled “Transforming Urban Mobility with Internet of Things: Public Bus Fleet Tracking Using Proximity-Based Bluetooth Beacons”. This system uses Bluetooth Low Energy (BLE) beacons to enable real-time tracking of bus units. This system uses Raspberry Pi (RPi) Zero devices placed in the terminals for deploying the BLE proximity beacons on buses. Whenever bus stops, the signals from BLE are gathered and transmitted to the cloud for the estimation of arrival times.

This existing alternative, as described by Hing et al (2024) developed the project “Development of Bus Tracking System Using Radio Frequency Identification (RFID)” which applied Radio Frequency Identification (RFID) technology to enable real-time bus location tracking. The system integrates ultra-high frequency RFID tags installed on buses, detected by an RFID reader module at designated checkpoints. The collected data is processed and uploaded to the Blynk cloud platform via a WeMos D1 microcontroller, allowing students to access live bus location updates.

Vijayaraghavan, T. (2025) introduced the project “Intelligent Travel Assistance for Bus Passengers” which harnessed Artificial Intelligence (AI) to enhance real-time travel assistance for bus passengers. The system integrates AI-driven predictive analysis with geo-fencing and GPS technologies to provide personalized and adaptive notifications as passengers approach their destinations. By learning from real-time traffic conditions and historical travel data, the AI component refines notification accuracy and dynamically adjusts alerts based on route diversions. The system, developed in Java and incorporating the Google Maps API, ensures a seamless user experience while leveraging AI to optimize travel efficiency. Additionally, AI-powered data processing enhances the reliability of bus tracking and passenger assistance, making the system more responsive to changing travel conditions.

Gaps in Existing Literature

Table 1. Gaps in Existing Research

Research Title	Key Findings	Gaps/Limitations	Current Project Solutions to these gaps
AI based Real Time Institutional Vehicle Tracking System through Mobile Application	AI enhances tracking accuracy, ensuring reliable transport information through real-time data visualization.	Relies on AI and IoT-based sensors, which may require additional infrastructure and investment.	Our system uses a mobile app-based solution with GPS tracking, ensuring accessibility without requiring IoT hardware and AI.
Bus Tracking System	Uses GPS and a central server for real-time bus tracking and estimated arrival times.	The system lacks data analytics for optimizing routes and service efficiency.	Integrates data analytics with GPS tracking for better efficiency and responsiveness.
IoT-Based Smart School Bus and Student Tracking System	IoT technology enhances real-time school bus tracking and student monitoring.	The system depends on IoT hardware, making it costly and complex to maintain.	Abang uses a mobile-based GPS tracking system, eliminating IoT hardware for a simpler and cost-effective solution.
Web-Based Real-Time Bus Monitoring and Tracking System	A web-based system integrates GSM and GPS to provide real-time bus tracking and traffic condition alerts.	The system relies on GSM and a web-based interface, limiting accessibility and responsiveness.	Abang eliminates the need for GSM modules by providing real-time tracking through a mobile-based application, ensuring better accessibility and user experience.
BusTap: A Real-Time Bus Tracking Android Application	A GPS-based bus tracking system enhances public transport reliability by providing real-time location updates.	The system lacks data analytics for improving data accuracy and optimizing transport efficiency.	Abang integrates data analytics to improve estimated arrival times and optimize transport efficiency.
HATID: A Real-Time Tracking of the Shuttle Bus System Using Geolocation API and Firebase Database	A web-based tracking system uses Firebase for real-time data synchronization to improve shuttle service efficiency.	The system is web-based, limiting accessibility and convenience for mobile users.	Abang ensures a more user-friendly and accessible platform for commuters,

Web-Based Real-Time Bus Monitoring and Tracking System UNIMAS	A web-based system that enables real-time tracking of UNIMAS buses, allowing users to monitor live bus locations, routes, estimated arrival times, and schedule updates.	Limited accessibility for mobile users as it relies on a web-based platform.	Abang is a mobile-based solution, ensuring direct accessibility and real-time tracking for modern jeepneys through a user-friendly mobile application.
Bus Tracking System in the Internet of Things (IoT)	A web-based system integrating IoT and Google Maps for real-time bus tracking. Features include an interactive map displaying live bus locations, routes, schedules, driver details, and a QR code scanning feature for quick access to transport information.	System relies on IoT-based tracking and web interface, which may require additional hardware and internet connectivity for efficient operation.	Abang provides a mobile-based solution, eliminating the need for IoT infrastructure while offering real-time tracking through an accessible mobile application.
Transforming Urban Mobility with IoT: Public Bus Fleet Tracking Using Proximity-Based Bluetooth Beacons	Utilizes Bluetooth Low Energy (BLE) beacons and Raspberry Pi (RPi) Zero devices for real-time tracking of buses at selected stops. BLE signals are transmitted to the cloud for arrival time estimation.	BLE beacon-based tracking is limited to specific stops where Raspberry Pi devices are installed, restricting real-time updates outside these locations.	Abang ensures real-time tracking throughout the entire route using a mobile-based application, allowing continuous updates on modern jeepne
Development of Bus Tracking System Using Radio Frequency Identification (RFID)	RFID technology enables real-time bus tracking by using ultra-high frequency RFID tags on buses, detected by RFID readers at designated checkpoints. The data is uploaded to the Blynk cloud platform for live location updates.	RFID-based tracking is dependent on designated checkpoints, meaning real-time updates are not available between these points.	Abang provides continuous real-time tracking through a mobile application, ensuring accurate location updates for modern jeepneys along their entire route.
Intelligent Travel Assistance for Bus Passengers	Uses AI-driven predictive analysis, geo-fencing, and GPS to provide adaptive travel notifications based on real-time traffic conditions and historical travel data. Developed in Java with Google Maps API integration.	AI-based predictive analysis requires extensive data collection and processing, making it more complex and resource-intensive.	Abang focuses on a mobile-based tracking system without AI, ensuring real-time updates without the need for extensive data processing while maintaining accessibility and efficiency.

The development of the Abang system responds to persistent issues in public transportation that have not been fully addressed by existing tracking systems. Many of the reviewed solutions utilize technologies such as AI, IoT, RFID, GSM modules, or web-based platforms to enhance the commuting experience. However, these systems often require expensive infrastructure, rely on hardware-specific installations, or limit user access to web-only interfaces, reducing convenience for mobile users. Some also fail to provide continuous tracking, especially when location updates are dependent on fixed checkpoints or signal beacons.

By reviewing these studies, the development team was able to identify recurring limitations across several systems. These include the high cost and maintenance needs of IoT and AI technologies, limited accessibility due to web-based platforms, the absence of real-time continuous tracking along routes, lack of data analytics for optimizing operations, and the lack of transport systems specifically designed for provincial areas and modern jeepneys. Recognizing these gaps allowed the developers to reevaluate which features were necessary, cost-effective, and sustainable within the context of Nueva Ecija's public transport network.

In response to these limitations, Abang was designed as a mobile-based application built with GPS tracking and Firebase to provide real-time location updates, improve commuter access, and operate without the need for costly IoT hardware. The system also integrates data analytics to enhance trip efficiency and estimated arrival times. Most importantly, it is tailored specifically for modern jeepneys under SJJDO TRANSECO, ensuring that the solution fits the structure, needs, and routines of the local commuting public.

CHAPTER III

METHODOLOGY

For the development of this study, which focuses on the real-time tracking and navigation of modern jeepneys in Nueva Ecija, the developers utilized a combination of the Systems Development Life Cycle (SDLC) and Agile methodology to ensure the successful implementation of the Abang application. The process followed is illustrated in Figure 1, which presents the SDLC Agile Approach used throughout the system development.

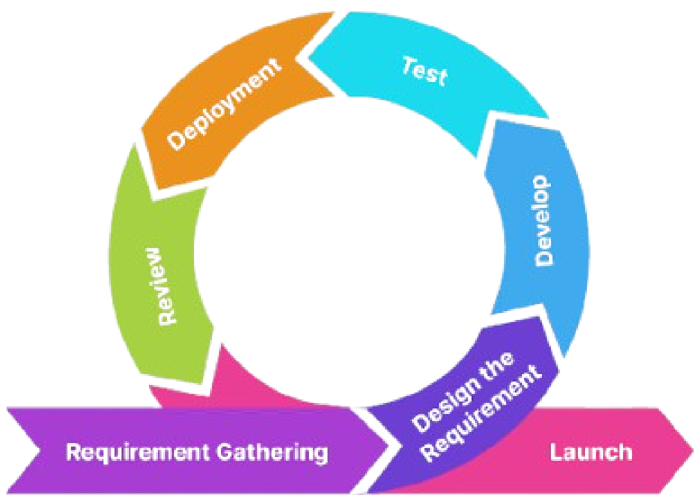

Figure 1. SDLC Agile Approach (Ahmad, 2024)

A. Requirement Gathering

The developers will begin by thoroughly observing the challenges faced by commuters and operators in tracking modern jeepneys in Nueva Ecija. The developers will focus on understanding the difficulties passengers encounter when locating and accessing modern jeepneys, as well as the challenges operators face in ensuring efficient fleet management. To gain insights, developers will conduct interviews and surveys with commuters, drivers, and operators, asking key questions to identify issues and improve the Abang mobile application.

The following are the list of questions to be asked for the passengers.

General Questions:

- Can you describe your daily commuting experience?
- What challenges do you face when trying to locate modern jeepneys?
- How do you determine which jeepney to take and how long you have to wait?
- What are the peak hours for modern jeepney ridership?
- How do you think real-time tracking could improve your commute?

Tracking and Waiting Time:

- How do you currently estimate the arrival time of modern jeepneys?
- Can you share an experience when you had to wait long for a jeepney without any real-time information?
- In what ways do you think notification feature for incoming modern jeepneys be helpful?

The following are the list of questions to be asked for drivers, conductors and operators.

Driver, Conductor and Operator Perspective:

- How do you currently manage and track your jeepney operation?
- What challenges do you face in communicating with drivers regarding route updates?
- How do you think live location tracking could improve your operations and coordination with drivers?

The following are the list of questions to be asked for all of the users.

Technology Familiarity:

- Can you describe your experience using mobile applications for transportation?
- How would you describe your preference when it comes to app interfaces—do you value simplicity or advanced features?

Project Features:

- What specific features do you think are essential for a jeepney tracking app?
- How important do you think estimated arrival times and passenger capacity updates are in a commuter app?
- What types of personalized features, such as saving favorite routes or receiving alerts, would you find helpful?

Expectations:

- Do you have any specific design preferences for the app?
- Can you describe what an ideal tracking system would look like for you?
- What are your expectations for this project in terms of convenience and efficiency?
- How do you see this system improving your daily commute or operations?

Based on the gathered requirements and insights, the developers initially drafted a Product Backlog to outline all the essential features and tasks needed to build the Abang system. This initial draft serves as the foundation for development planning, particularly for the design phase. The product backlog will be continuously updated throughout the Agile process to reflect new insights, user feedback, and evolving project priorities.

The developers will conduct a feasibility study covering technical, operational, and financial aspects. The technical feasibility study will determine if users have the necessary devices, internet connectivity, and infrastructure to support the proposed system. It will also assess whether the current technology environment can accommodate the system's requirements without the need for significant upgrades. The developers will use Operational Feasibility Assessment to assess if the users meet the requirements in using the system. If the user passes the criteria, then the project will be operationally feasible as the user can use it, and will provide benefits to them. The financial feasibility study will assess the total costs involved in developing, deploying, and maintaining the system. It will ensure that the projected benefits outweigh the investment and provide long-term value to the organization.

In the feasibility study phase, the main deliverables include both functional and non-functional aspects of the system. Functional deliverables describe what the system will do, such as real-time location tracking, seat reservation, and report generation. These features outline how users like passengers, drivers, operators and admins will interact with the system. Non-functional deliverables focus on how the system should perform, including speed, security, ease of use, reliability, and compatibility with different devices and platforms. These help to ensure the system will not only work but also work well for all users.

At the end of this phase, the developers will prepare a Software Requirements Specification (SRS) that outlines all system requirements. This document will serve as a guide for the design and development stages.

B. Design

Designing the recommended system involves creating a Unified Modeling Language (UML) that meets the documented requirements. The developers will create a use case diagram to outline the interactions between users and the system, a context level diagram to present the workflow of operations, data flow diagram to present how data moves through the system and an entity relationship diagram and a relational diagram for data modeling (see in appendix A). This phase also involves designing the systems interface through wireframing, layout, and navigation flow (see in appendix C). Wireframes serve as a visual guide, ensuring a user-friendly experience for commuters, drivers, and administrators. Additionally, the Product Backlog, which was initially drafted during the Requirement Gathering phase, is further refined during the design stage. It is used to prioritize and plan the design of features, user stories, and tasks that will be implemented in future sprints. This ensures that the design aligns with both user needs and the development roadmap defined in the Agile process.

C. Development

In this phase, the developers will begin coding the proposed system using Flutter for the user-side mobile application and React.js with Laravel for the admin dashboard. The application will use Firebase for the backend, while the admin side will use PostgreSQL as its primary database. Both the user and admin interfaces will utilize an open-source map API for real-time location tracking. The team will follow an Agile development process, beginning with Sprint Planning to define user stories and prioritize tasks from the product backlog. The development will proceed in Sprint Iterations, where specific features are implemented, tested, and refined within a fixed time frame. After each sprint, a Sprint Review will be conducted to evaluate progress and gather feedback from stakeholders. Updates will be regularly assessed to ensure alignment with project goals and user needs, enabling continuous improvement throughout the development cycle.

D. Testing

In this phase, the developers will conduct testing to ensure that the system is working properly. Test cases will be used in testing the system (see Appendix B) to ensure that every specification is functioning seamlessly. These test cases will be performed to validate each component, such as GPS tracking, database synchronization, and user interface responsiveness. The developers will primarily use functional testing to verify that all features of the system perform according to the specified requirements. Additionally, different types of testing will be implemented, including unit testing to validate individual modules, integration testing to ensure smooth interaction between components, system testing to confirm the overall system behavior, and user acceptance testing (UAT) to validate the system from the end-user's perspective. These tests aim to ensure the accuracy, reliability, and usability of the application before full deployment.

E. Deployment

In this phase, the developers will upload the system through web hosting. The deployment involves uploading the system through the web hosting platform named DigitalOcean, which was chosen for its reliability, scalability, and developer-friendly environment, including efficient server management and performance. This process includes uploading the backend and database. The developers will then distribute the mobile application through the Google Play Store for Android users and the App Store for iOS users.

F. Review

Throughout the development process, sprint reviews are conducted at the end of each sprint to assess progress, gather feedback, and make necessary adjustments. These reviews help ensure that each module aligns with project goals and user expectations. However, a formal system evaluation will be conducted only after the final sprint and before the official launch. This evaluation includes a user-centered assessment using structured questionnaires, such as the System Usability Scale (SUS) and Likert-scale surveys, to measure functionality, reliability, efficiency, usability, and user satisfaction. In parallel, IT experts will evaluate the system using a checklist based on the ISO 25010 software quality model, assessing maintainability, performance efficiency, compatibility, security, and portability. This ensures the system is both user-friendly and aligned with software quality standards.

G. Launch

After the evaluation and any final refinements, the system will move to the launch phase. This includes the formal transfer of the system to clients and stakeholders, supported by complete documentation, training, and continuous support. Knowledge transfer sessions and established support channels will ensure users are well-prepared to operate and maintain the system effectively, maximizing its impact in daily operations.

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APPENDICES

Appendix A. Proposed Designs

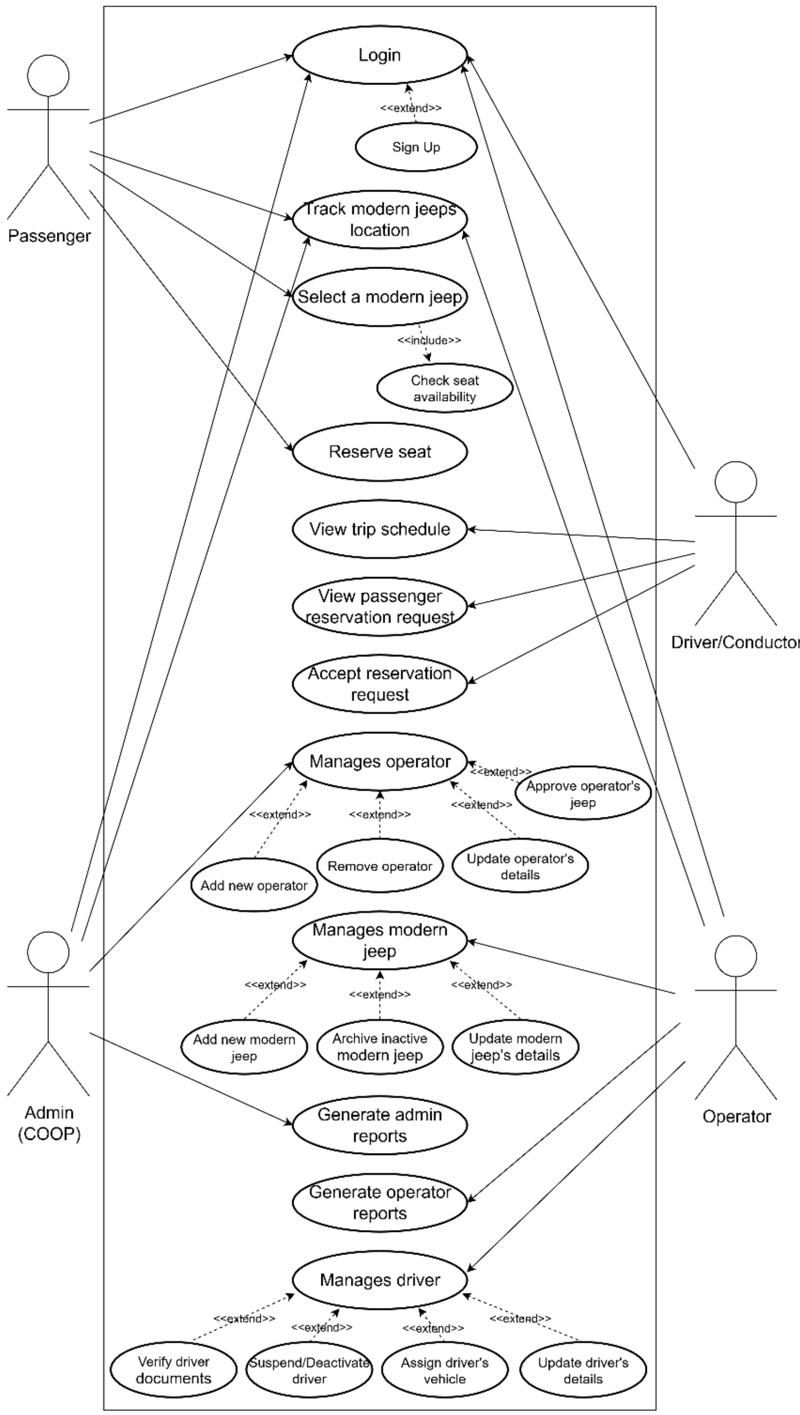

Figure 2. Use Case Diagram

As illustrated in Figure 2, the diagram presents the interactions between the system's four primary actors—Passenger, Driver, Administrator, and Operator and their respective roles. The Passenger can sign up, log in, search for available modern jeeps (including seat availability), and make reservations. The Driver or Conductor has the ability to log in, view their trip schedule, monitor potential passengers, and respond to reservation requests. The Administrator (COOP) can also login and is responsible for tracking modern jeep locations, manages new operator and generate admin reports. Meanwhile, the Operator manages his own modern jeeps. This includes adding or removing modern jeeps, tracking their real-time locations, generating reports of operation, and managing drivers which involves verifying driver documents, suspending or deactivating drivers when needed, and assigning or updating vehicles and driver's details.

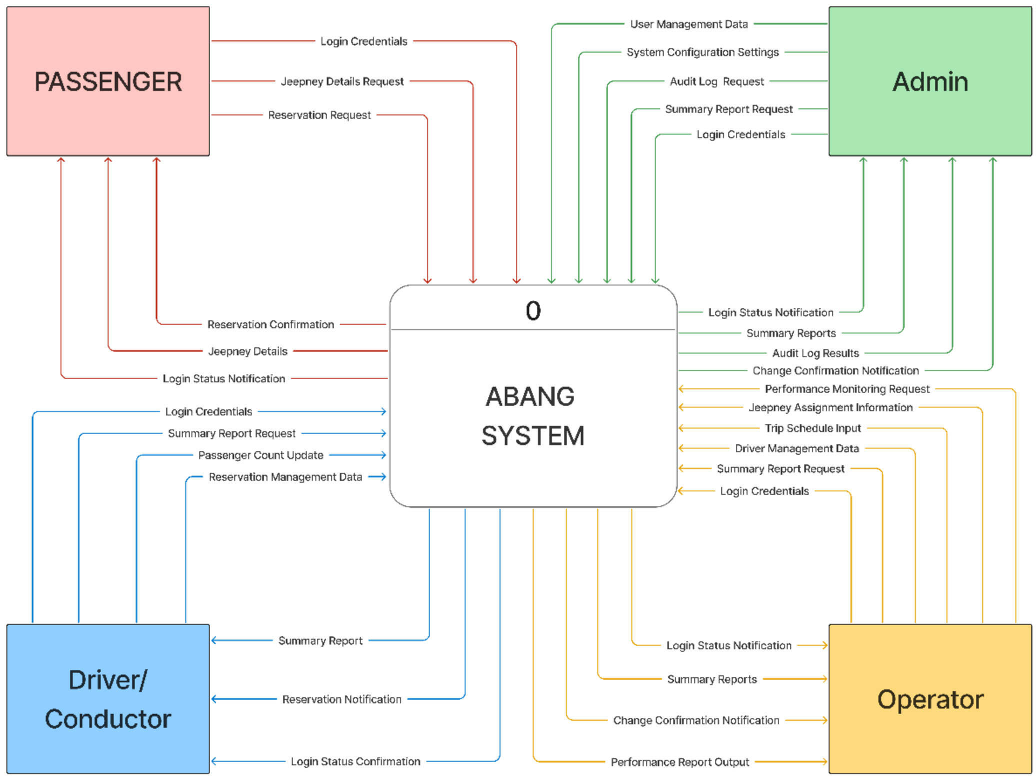

Figure 3. Context Level Diagram

The Context Level Diagram of Abang: A Mobile App Based Real-Time Tracking and Navigation for SSJDO TRANSECO Modern Jeepneys (ABANG) illustrates how the system acts as a central platform connecting four main users—Passengers, Drivers, Operators, and Admin. Passengers interact with the system to track jeepney locations in real time, view route and availability information, and make seat reservations. Drivers receive reservation notifications, update passenger counts, and submit trip data. Operators manage jeepney assignments, monitor trip performance, and generate reports. Admins oversee the entire system by managing user accounts, configuring system settings, and accessing system logs for auditing purposes. Overall, ABANG streamlines communication and coordination among users, ensuring efficient and organized modern jeepney operations.

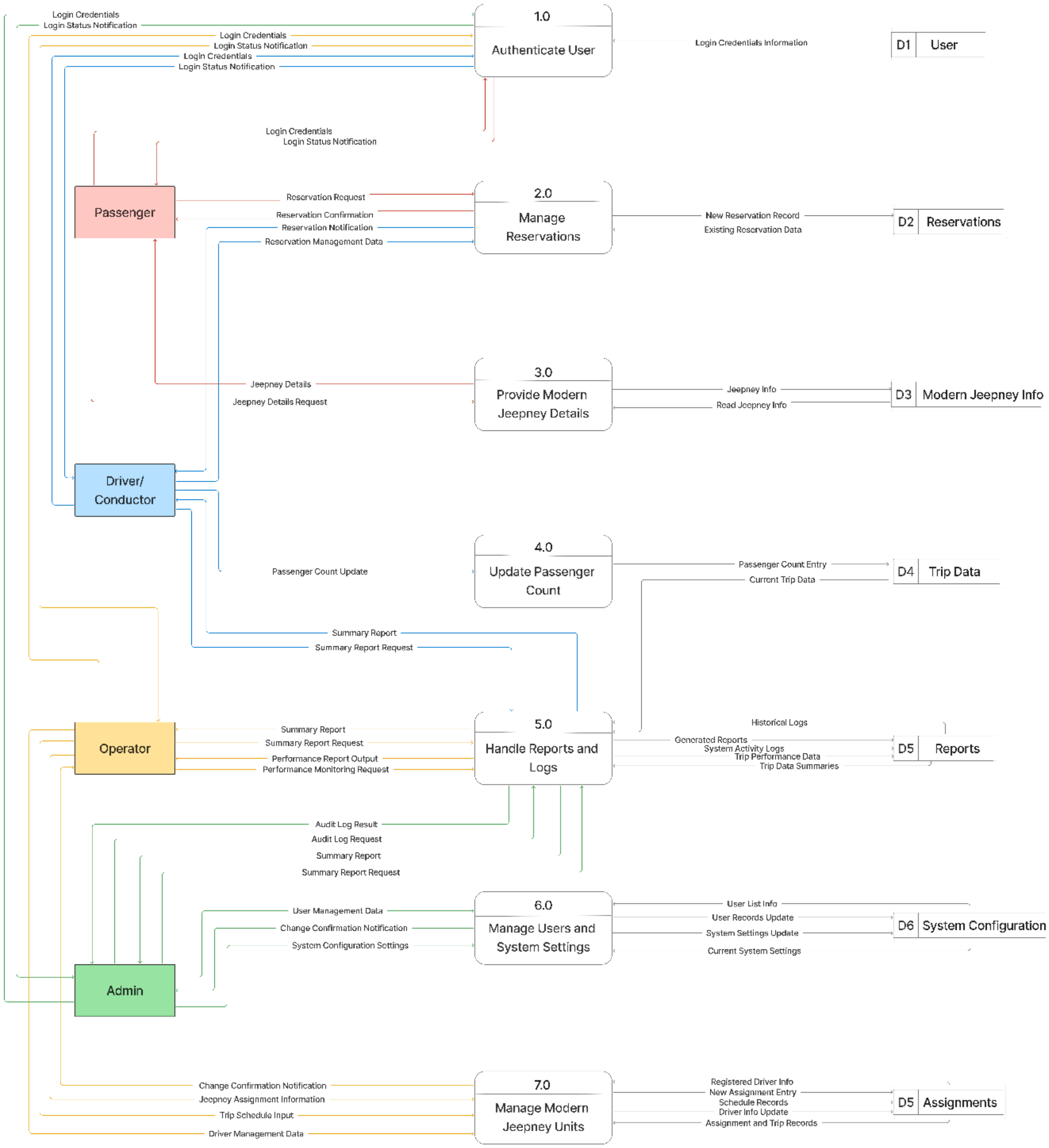

Figure 4. Data Flow Diagram

The Data Flow Diagram (DFD) of Abang: A Mobile App Based Real-Time Tracking and Navigation for SSJDO TRANSECO Modern Jeepneys (ABANG) provides a detailed view of how data moves through the system to support its core functions. It outlines the interaction between users—Passengers, Drivers, Operators, and Admin—and the internal processes of the application. The DFD highlights key processes such as user authentication, reservation management, jeepney detail retrieval, passenger count updates, report handling, user and system settings management, and trip assignment. Each process communicates with designated data stores like user accounts, reservations, jeepney information, trip data, reports and logs, system configurations, and assignments. For example, when a passenger submits a reservation request, the system validates and stores the data in the Reservations data store, while notifying the driver. Similarly, trip data submitted by drivers is used later in generating performance and summary reports. This interconnected setup ensures that every action within the system results in an organized flow of accurate data, supporting ABANG's goal of providing real-time, efficient, and data-driven transportation management.

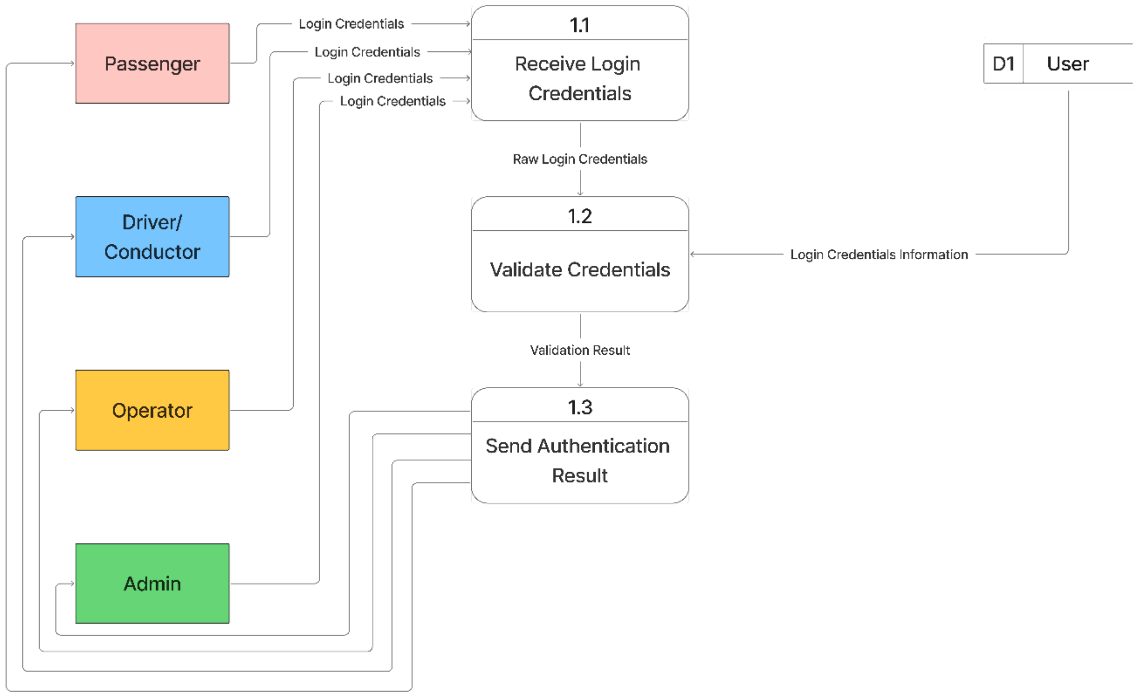

Figure 5. Exploded Data Process 1

This process is responsible for verifying the identity of the user attempting to access the system. It receives login information from external entities such as the passenger, driver, operator, or admin. The system then validates the credentials by accessing stored user credential records from the data store D1: User Accounts. After checking if the credentials match, the system sends a login status notification back to the respective user. This ensures that only authorized users are allowed access to their appropriate system features.

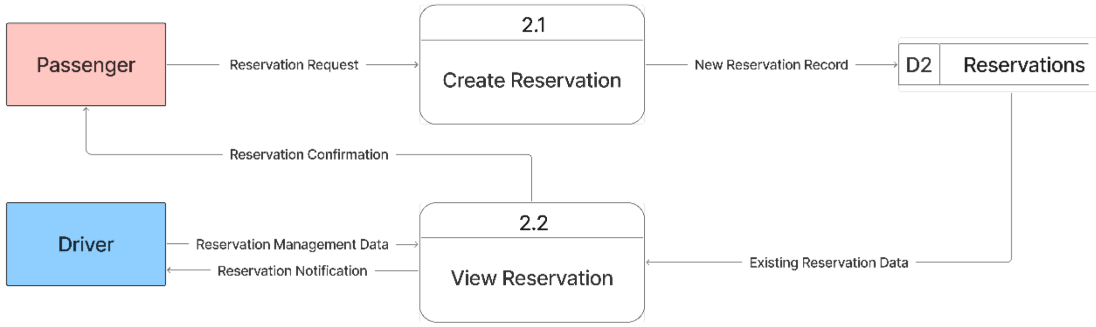

Figure 6. Exploded Data Process 2

This process allows passengers to place a reservation for a modern jeepney trip. It begins when a passenger sends a reservation request. The system processes this request by checking against existing data in D2: Reservations to avoid conflicts or overlaps. Once verified, a new reservation record is added to the data store. The system then sends a reservation confirmation back to the passenger and a reservation notification to the driver so that they are aware of upcoming passengers. This process ensures a smooth and organized reservation experience for both commuters and drivers.

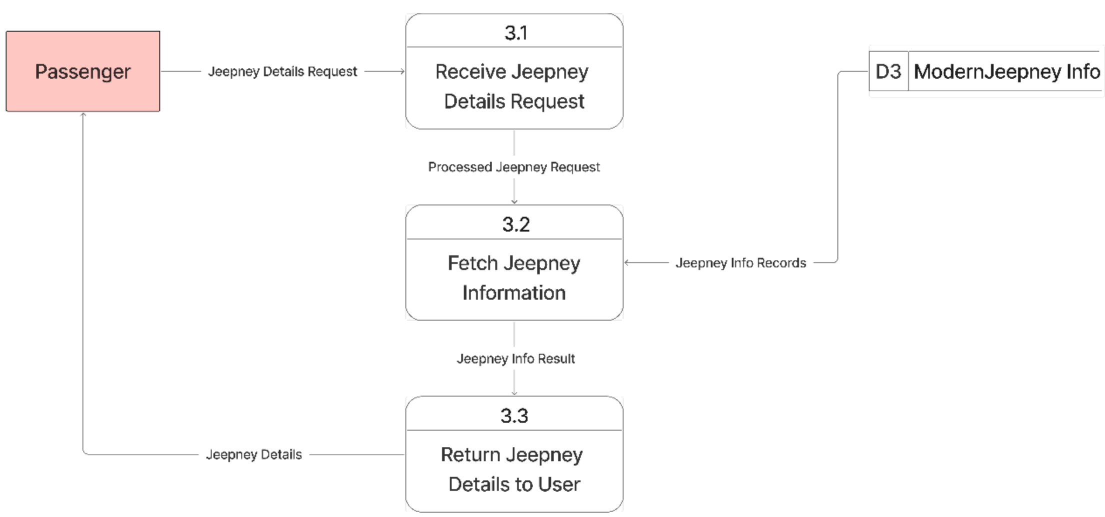

Figure 7. Exploded Data Process 3

This process handles requests from passengers who want to view available jeepneys. When a request is sent, the system retrieves jeepney route information, availability, and capacity from D3: Jeepney Info. Since the data store is read-only in this context, the system does not modify any data — it only reads and presents it to the user. The output is sent back to the passenger as jeepney details, allowing them to make informed choices about their trip options.

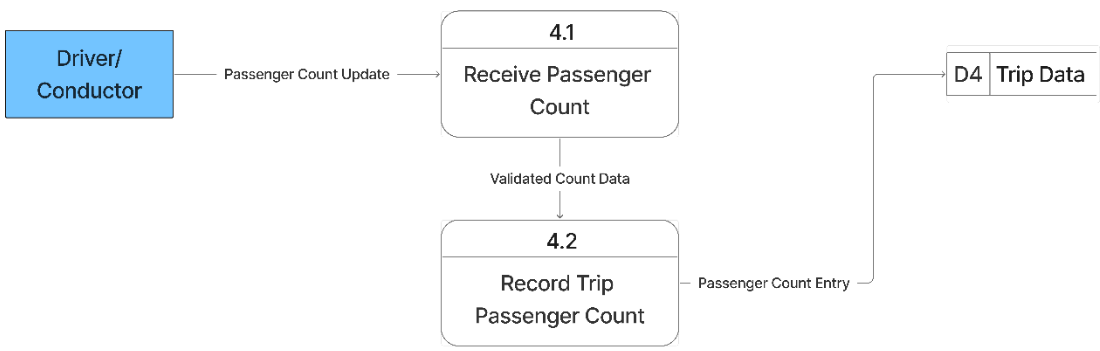

Figure 8. Exploded Data Process 4

This process is triggered by the driver when updating the number of passengers on board. The updated passenger count is recorded in D4: Trip Data, which is essential for monitoring trip occupancy and for generating performance or efficiency reports later. This process does not generate any external output, but it plays a key role in maintaining accurate trip data within the system, especially for analytics and report generation.

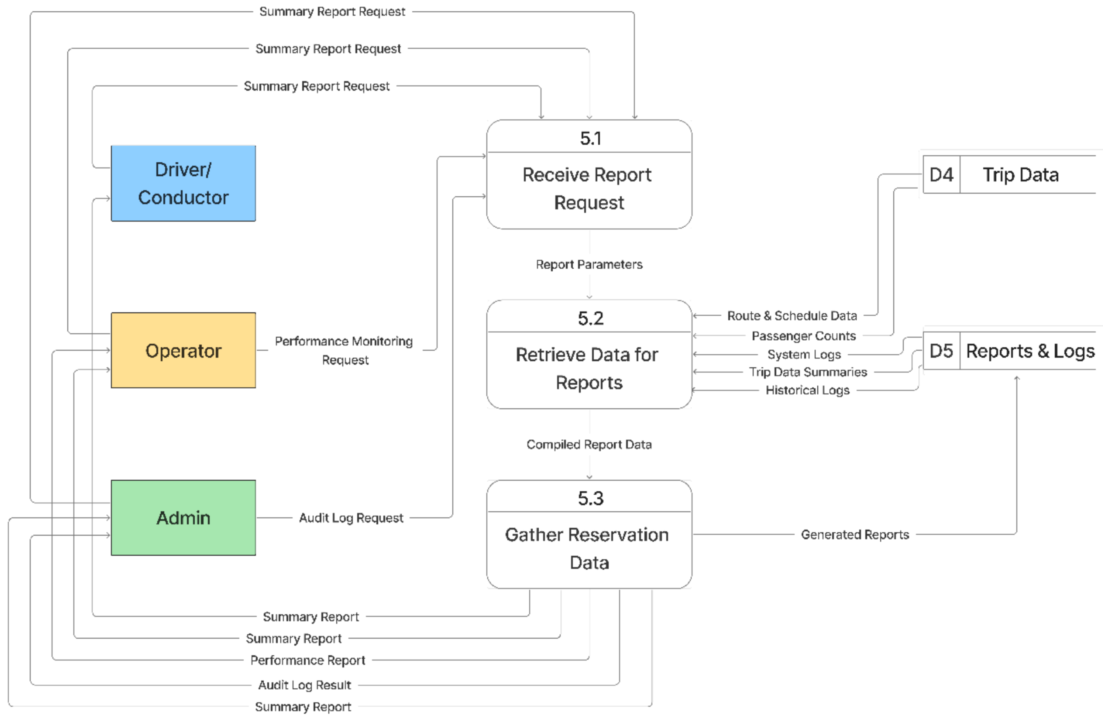

Figure 9. Exploded Data Process 5

This process handles requests for various reports submitted by the driver, admin, or operator. It begins when a request for a summary report, audit log, or performance monitoring is received. Based on the request, the system gathers the necessary compiled data from D5: Reports & Logs and also reads trip-related data from D4: Trip Data to enrich the reports. The collected data is processed to generate a specific report depending on the user's role. The final output is returned to the requester, such as a summary report for drivers, an audit log for the admin, or a performance report for the operator.

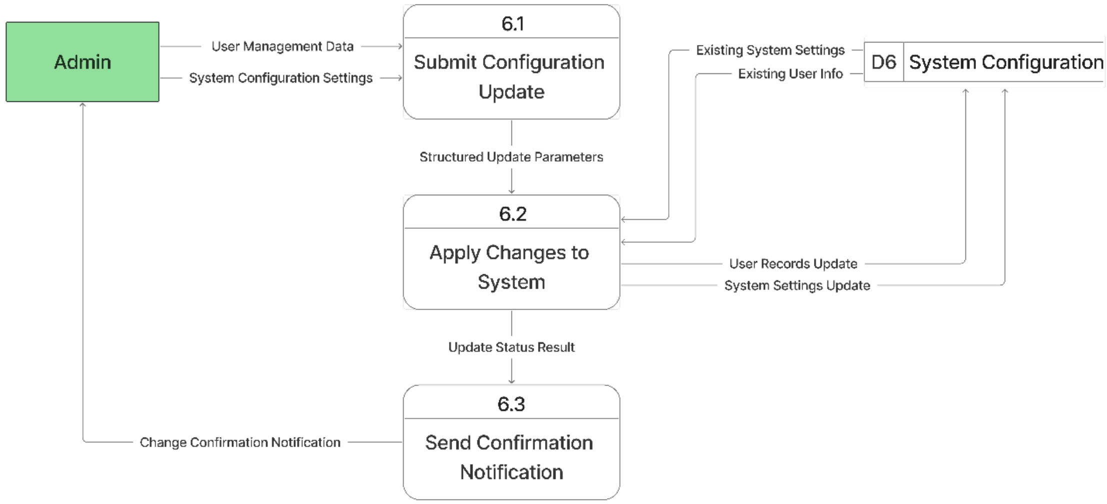

Figure 10. Exploded Data Process 6

This process is used by the admin to manage user accounts and system configuration settings. When the admin sends updates such as user account changes or system preference adjustments, the system processes the request and stores the updated records in D6: System Config. The system then confirms the changes by sending a change confirmation notification back to the admin. This process ensures that both user access and platform behavior can be properly maintained and customized as needed.

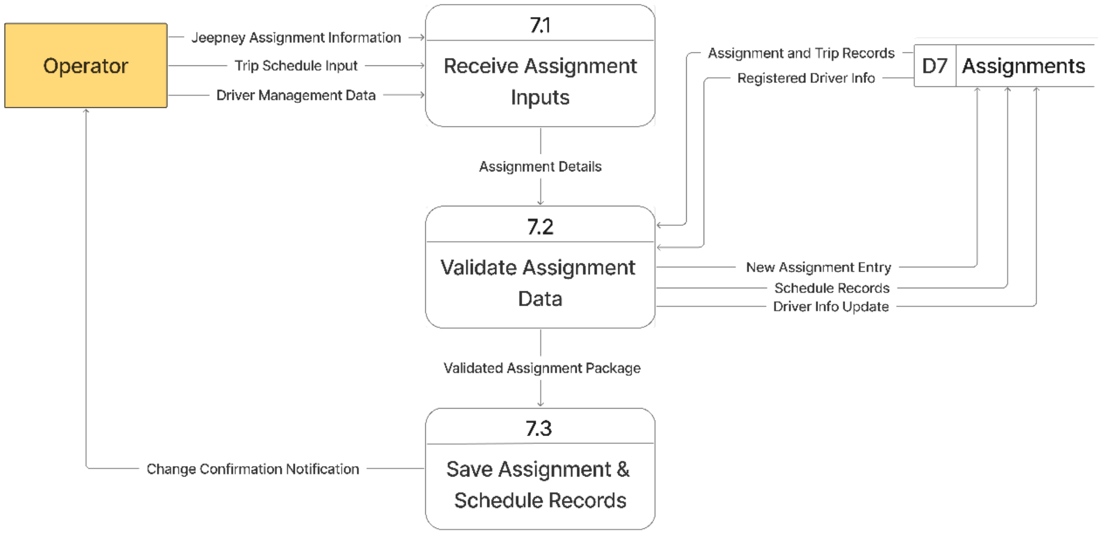

Figure 11. Exploded Data Process 7

This process allows the operator to manage how jeepneys and drivers are assigned to trips. The operator sends jeepney assignment information, trip schedules, or driver-related updates. The system processes these updates and stores them in D7: Assignments. After successfully updating the records, the system notifies the operator that the changes have been made. This ensures that jeepney deployment and scheduling are properly coordinated within the system.

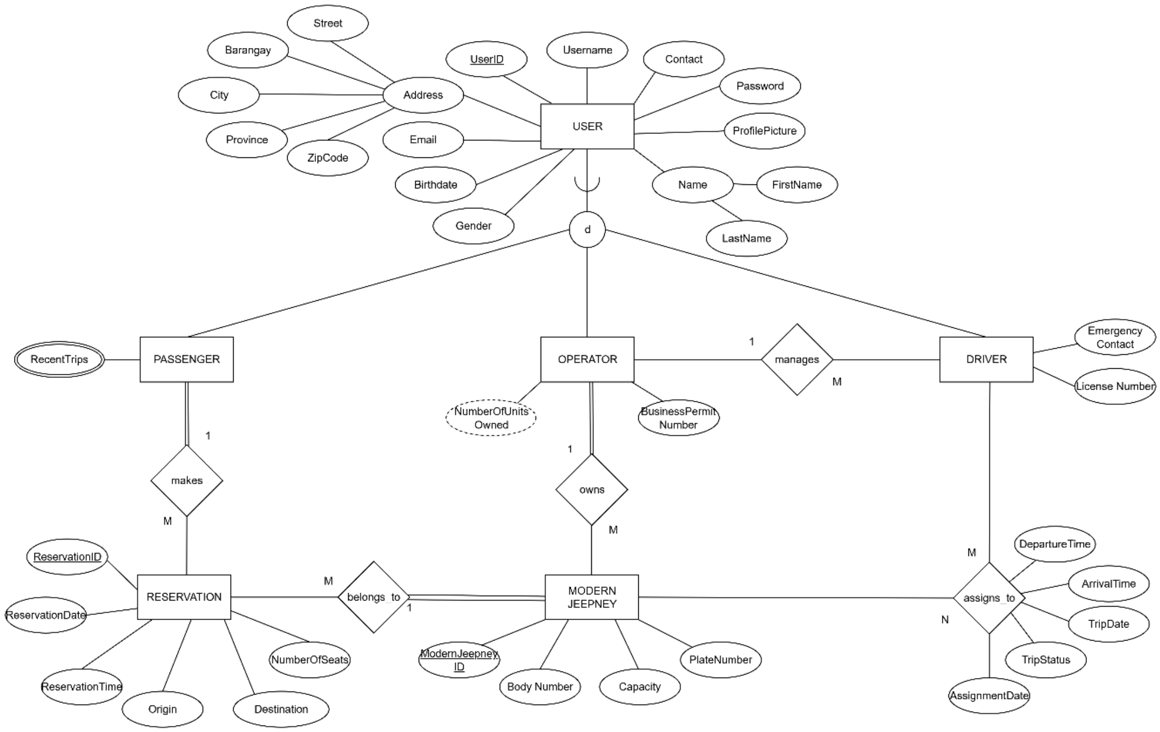

Figure 12. Enhanced Entity-Relationship Diagram

As illustrated in Figure 10, it is the enhanced entity-relationship diagram (EERD) outlining the main entities in the system. The Passenger, Reservation, Modern Jeep, Driver, Admin, and Operator. All users share common details through a general User entity, but each role Passenger, Operator, or Driver includes specific information and functions except for Admin because it does not have any exclusive attributes and therefore inherits all its details from the general User entity. Passengers can book multiple reservations; each connected to a Modern Jeep that's assigned to a Driver. Admins are authorizing operators, while Operators handle the management of their own vehicles and drivers.

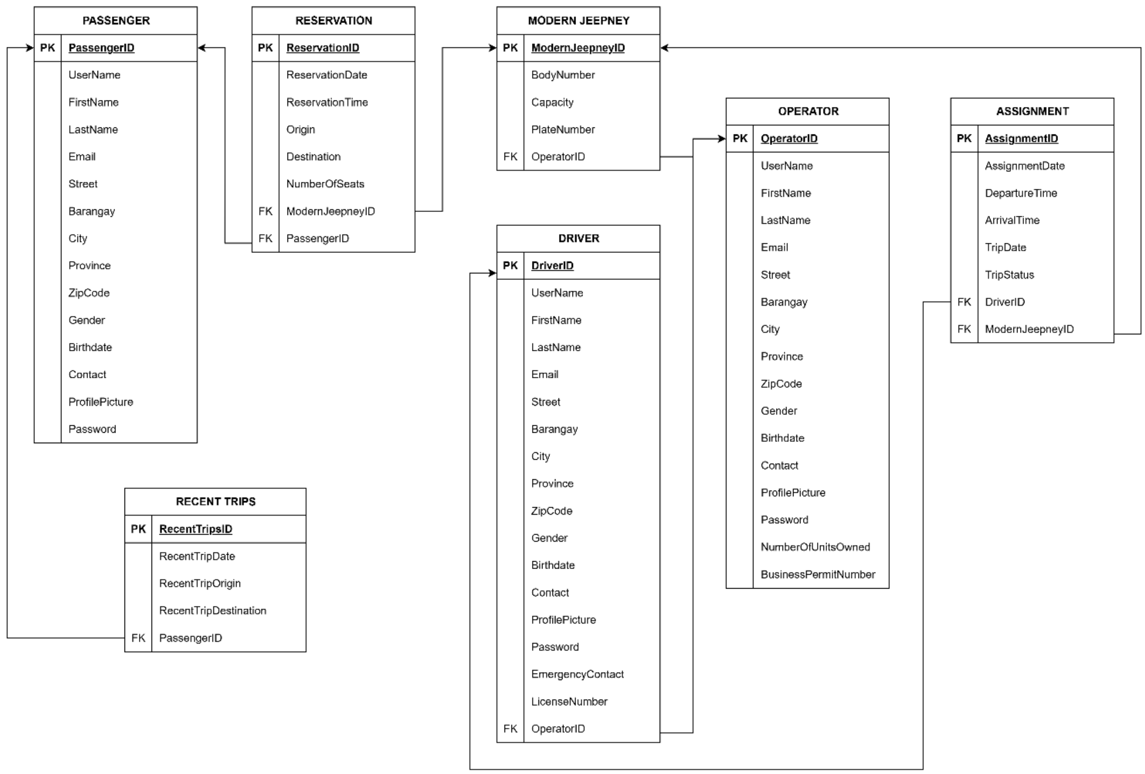

Figure 13. Relational Data Model

As the figure shows how different parts of the system are connected using a Relational Data Model, including the Passenger, Reservation, Modern Jeepney, Driver, Operator, and Admin. In the system, each Passenger has a Reservation, which is linked using a foreign key. The Reservation is also connected to a Modern Jeepney, meaning the passenger's booking is assigned to a specific jeepney. A Driver can be assigned to different jeepneys over time, a separate table is used to manage these assignments. Each Driver is supervised by an Operator, who manages both the drivers and the modern jeepneys. Lastly, the Admin is responsible for approving and managing the Operators in the system.

Appendix B. Test Cases

Table 2. Test Case 1

Test Case No.: 1 **Module Name:** Sign-Up Module **Test Title:** Verify New User Account Creation **Description:** Confirm new users can sign up with required details.			**Test Designed by:** Mark Tristan S. Moga **Test Designed Date:** May 1, 2025 **Test Executed by:** **Test Execution Date:**	
Steps	**Test Steps**	**Expected Results**	**Actual Result**	**Status (Pass/Fail)**
1	Navigate to the sign-up page	The sign-up page loaded successfully, showing all required input fields		
2	Enter username, password, and email	User was able to enter valid details with no validation errors		
3	Submit the registration form	User was shown the success alert and asked to check email		
4	Open the verification email and click the link	User clicked the link and was redirected to the login page		
5	Verify the successful redirection	User was redirected to login page with the success message		

Table 2 is the test case where the developers identified if the Sign-up Module is working properly. The table above shows every step of what they have done when testing, including the expected results and actual results after the said tests. After that, they will identify the testing phase if it will pass or fail

Table 3. Test Case 2 Sign-Up Module

Test Case No.: 2 **Module Name:** Authenticate Passenger **Test Title:** Login with Valid Credentials **Description:** Verify that a passenger can log in using valid email and password.			**Test Designed by:** Mark Tristan S. Moga **Test Designed Date:** May 1, 2025 **Test Executed by:** **Test Execution Date:**	
Steps	**Test Steps**	**Expected Results**	**Actual Result**	**Status (Pass/Fail)**
1	Go to the login page through the app's welcome screen.	The login form should load with email and password input fields.		
2	Enter a valid registered email and correct password.	The system accepts the input without showing validation errors.		
3	Tap the login button below the input fields.	The user is redirected to the passenger dashboard page.		
4	Observe the dashboard interface.	The dashboard displays user-specific data and trip options.		
5	Try accessing a protected page from the menu.	Access is allowed since the user is already authenticated.		

Table 3 is the test case where the developers identified if the Authenticate Passenger module is working properly. The table above shows every step of what they have done when testing, including the expected results and actual results after the said tests. After that, they identified if the test had passed or failed, which in this case means that all of the steps had passed and provided the expected results.

Table 4. Test Case 3 Real-Time Tracking Module

Test Case No.: 3 **Module Name:** Real-Time Tracking Module **Test Title:** Display Jeepney's Live Location **Description:** Verify the app updates and shows the current jeepney location on the map.			**Test Designed by:** Mark Tristan S. Moga **Test Designed Date:** May 1, 2025 **Test Executed by:** **Test Execution Date:**	
Steps	**Test Steps**	**Expected Results**	**Actual Result**	**Status**
1	Launch the app and open the map or tracking section.	The app launches successfully and navigates to the home/map screen		
2	Turn on GPS and internet connection	The app request location permission if not yet granted		
3	View the map interface	The map loads and shows the user's current location		
4	Wait for nearby modern jeepneys to appear	Jeepneys within proximity are shown as markers on the map		
5	Verify the successful redirection	A popup appears showing modern jeepney details and ETA		

Table 4 presents the test case created by the developers identified as Real-Time Tracking Module. It outlines each step taken during the testing process, along with the expected and actual results. Based on these results, the developers then determine whether each test case passes or fails.

Table 5: Test Case 4 Seat Reservation

<table>
<tr><td colspan="3">Test Case No.: 4
Module Name: Seat Reservation
Test Title: Reserve Seat Successfully
Description: Verify the user can reserve a seat on a jeepney with availability.</td><td colspan="2">Test Designed by: Mark Tristan S. Moga
Test Designed Date: May 1, 2025
Test Executed by:
Test Execution Date:</td></tr>
<tr><th>Steps</th><th>Test Steps</th><th>Expected Results</th><th>Actual Result</th><th>Status</th></tr>
<tr><td>1</td><td>Log in as a passenger using valid credentials.</td><td>The user dashboard is displayed showing available jeepneys.</td><td></td><td></td></tr>
<tr><td>2</td><td>Tap on a jeepney and select Reserve Seat.</td><td>The reservation form opens showing current seat availability.</td><td></td><td></td></tr>
<tr><td>3</td><td>Confirm the reservation by tapping the reserve button.</td><td>A confirmation message is shown that the seat is reserved.</td><td></td><td></td></tr>
<tr><td>4</td><td>Go back to the jeepney list or map.</td><td>The reserved jeepney shows one seat less available.</td><td></td><td></td></tr>
<tr><td>5</td><td>Open the user’s reservation history.</td><td>The new reservation is listed with details and time.</td><td></td><td></td></tr>
</table>

In Table 5, the developers identified as Seat Reservation Module documented the test case. It details every step taken during testing, showing both the expected and actual results. The results are then evaluated to decide if the test phase is successful or not.

Table 6: Test Case 5 Estimated Time of Arrival (ETA)

<table>
<tr><td colspan="3">Test Case No.: 5
Module Name: Estimated Time of Arrival (ETA)
Test Title: Show ETA and Current Location
Description: Validate if the app shows accurate ETA and live jeepney information.</td><td colspan="2">Test Designed by: Mark Tristan S. Moga
Test Designed Date: May 1, 2025
Test Executed by:
Test Execution Date:</td></tr>
<tr><th>Steps</th><th>Test Steps</th><th>Expected Results</th><th>Actual Result</th><th>Status</th></tr>
<tr><td>1</td><td>Launch the app and view the map</td><td>Map loads and shows available modern jeepneys</td><td></td><td></td></tr>
<tr><td>2</td><td>Tap on a modern jeepney icon</td><td>Modern jeepney detail card shows estimated arrival time</td><td></td><td></td></tr>
<tr><td>3</td><td>Wait as modern jeepney moves</td><td>ETA updates dynamically based on location changes</td><td></td><td></td></tr>
</table>

In Table 6, the test case documented by the developers identified as Estimated Time of Arrival Module shows every step performed during testing, along with the expected and actual results. The developers then evaluate the results to decide if the testing phase is marked as pass or fail.

Table 7: Test Case 6 Admin Dashboard – Modern Jeepney Monitoring

Test Case No.: 6 **Module Name:** Admin Dashboard – Modern Jeepney Monitoring **Test Title:** Monitor Real-Time Jeepney Status **Description:** Verify that the admin can view and monitor the real-time status, activity, and location of all modern jeepneys on the dashboard.			**Test Designed by:** Mark Tristan S. Moga **Test Designed Date:** May 1, 2025 **Test Executed by:** **Test Execution Date:**	
Steps	**Test Steps**	**Expected Results**	**Actual Result**	**Status**
1	Log in as an admin using valid credentials.	The admin dashboard loads successfully, displaying summary widgets and monitoring panel.		
2	Navigate to the "Jeepney Monitoring" section from the sidebar menu.	The system loads a map interface showing jeepney locations in real time.		
3	Click on a jeepney marker or icon on the map.	A popup appears showing jeepney ID, driver name, location, status (active/inactive), and estimated speed.		
4	Observe the jeepney marker's movement for 30 seconds.	The marker smoothly updates based on the live GPS feed, indicating continuous movement.		

5	Filter jeepneys by route or status using the dashboard filter tools.	The map updates to show only jeepneys that match the selected filter		

Table 7 contains the test case created by the developers known as Admin Dashboard – Modern Jeepney Monitoring Module. The table displays all steps of the testing process, including the expected results and actual results. Based on the comparison, they identify if the test has passed or failed

Table 8: Test Case 7 Generate Summary Report

Test Case No.: 7 **Module Name:** Generate Summary Report **Test Title:** Generate Trip Summary Report **Description:** Verify the user can generate and export a trip summary report.			**Test Designed by:** Mark Tristan S. Moga **Test Designed Date:** May 1, 2025 **Test Executed by:** **Test Execution Date:**	
Steps	**Test Steps**	**Expected Results**	**Actual Result**	**Status**
1	Log in as an admin, operator, or driver and access the dashboard.	The dashboard loads with access to the reports section.		
2	Go to the reports tab and choose a date range.	The page updates to filter the data by selected dates.		

3	Click the "Generate Report" button.	The system processes and prepares a summary report.		
4	Open the downloaded file in your viewer.	The report includes trip info, dates, and reservation and other data.		

The test case shown in Table 8 was prepared by the developers identified as Generate Summary Report Module. Each step of the testing is listed, along with the corresponding expected and actual results. Afterward, the testing phase is classified as either a pass or fail depending on the results.

Appendix C. Wireframe

Login Module (Passenger Side)

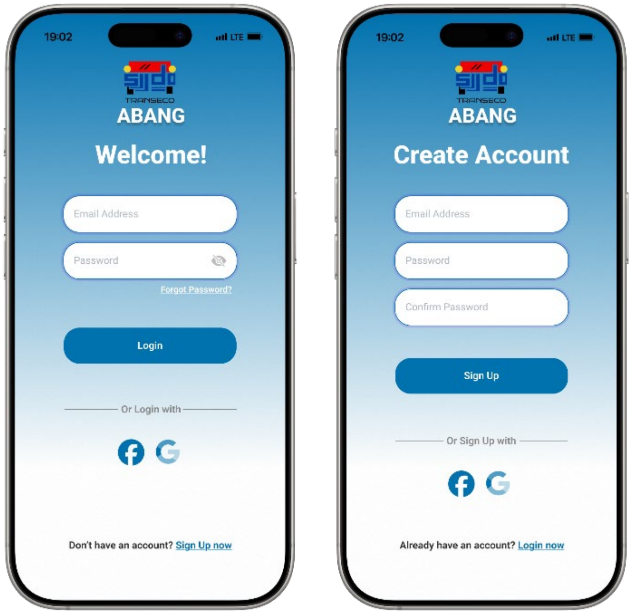

Figure 14. Login/Signup for Passengers

This figure showcases an user-friendly login and signup page designed for passengers. Before accessing the app's features, passengers are required to log in or create an account, ensuring secure and personalized access to the system.

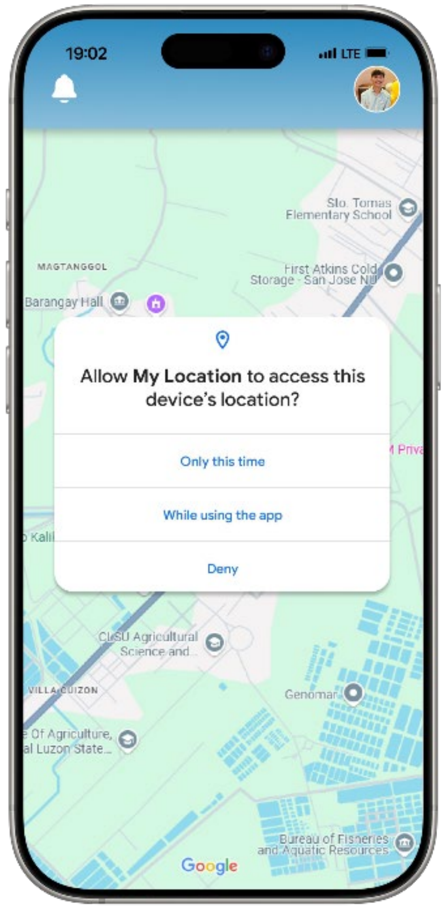

Figure 15. Location Permission Passengers Side

This figure displays a simple interface where the system requests the user's permission to access their location. Granting this permission enables the app to accurately show nearby modern jeepneys.

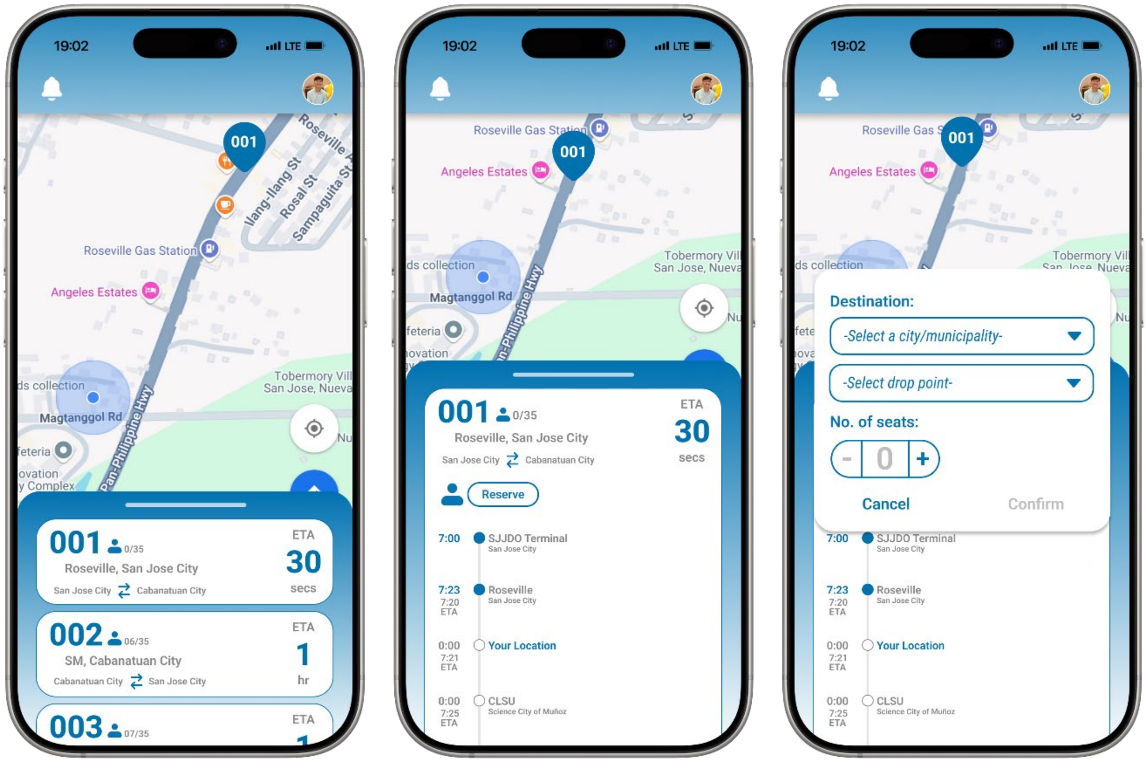

Figure 16. Homepage Passengers Side

This figure illustrates the homepage of the ABANG app, designed with a user-friendly layout. It serves as the main dashboard for passengers, featuring an interactive map that displays real-time tracking of modern jeepneys. This allows users to easily view nearby modern jeeps, monitor their movement, and make reservations by tapping the button and will proceed to a selection of destination and reserve a seat for as many as seats as needed. Once the reservation is approved by the driver, it will notify the passengers.

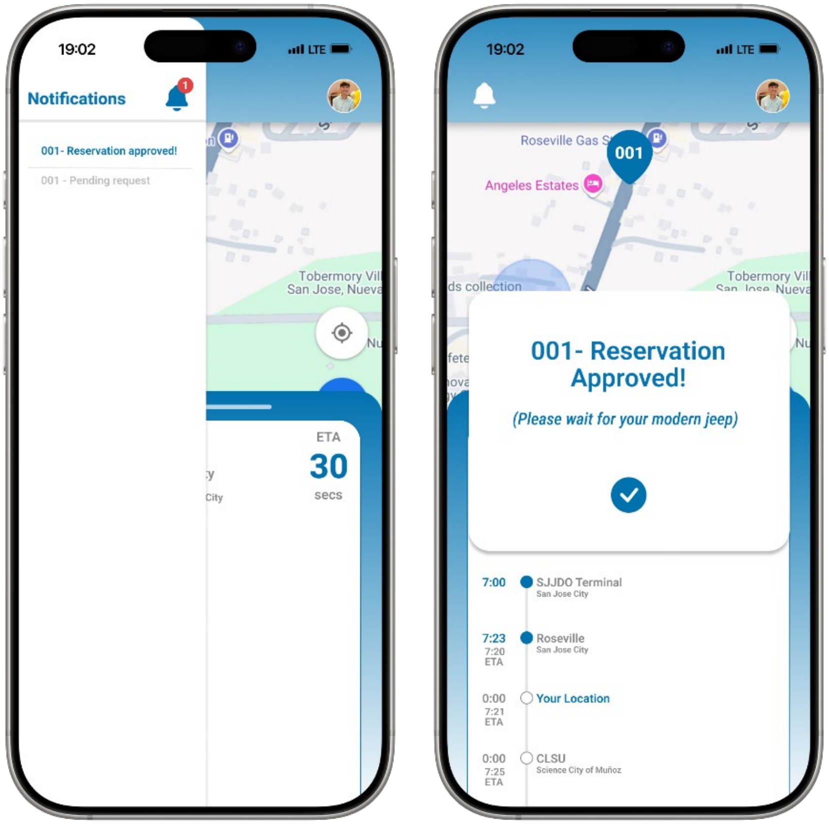

Figure 17. Left Navigation Bar Passengers Side

This figure shows the notification bar, which provides real-time and relevant updates. It enhances the user experience by keeping passengers informed about the status related to their selected jeepneys.

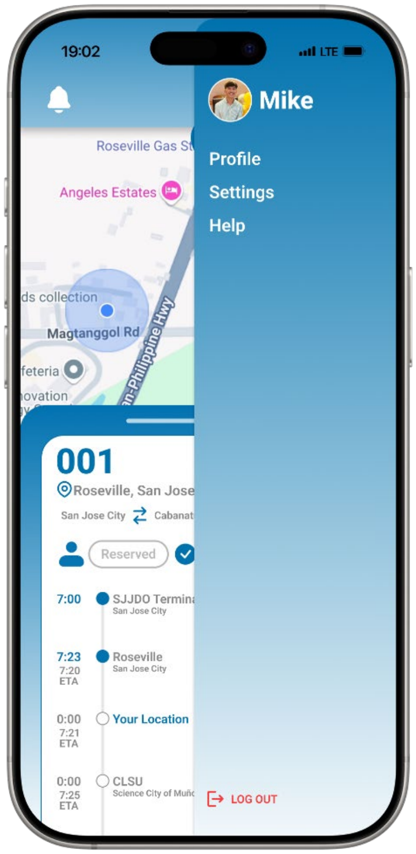

Figure 18. Right Navigation Bar Passengers Side

This figure presents a easy-to-navigate profile bar. It allows passengers to manage their account settings, access help resources, and securely log out of the app.

Driver Side

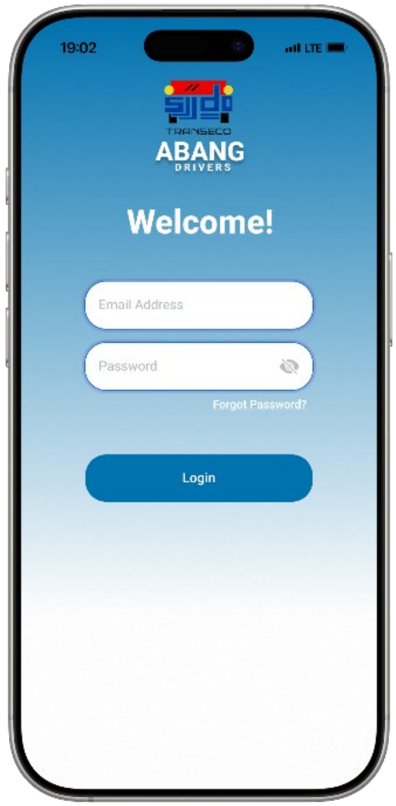

Figure 19. Login for Drivers Side

This figure showcases an user-friendly login page designed for driver. Before accessing the app's features, driver are required to log in their account provided by their operator

.

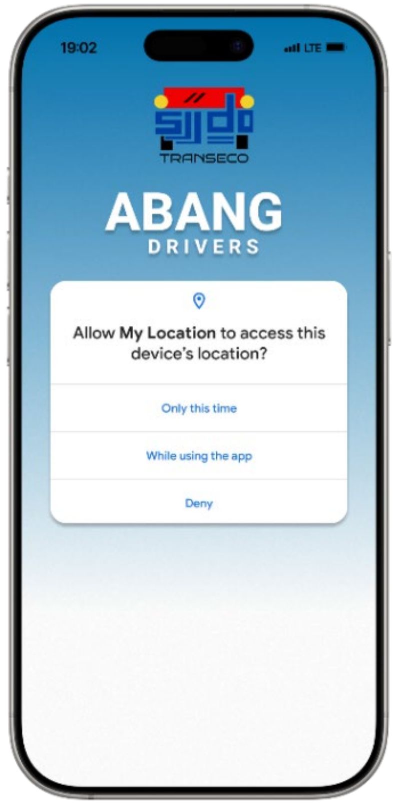

Figure 20. Location Permission for Drivers Side

This figure displays an interface where the system requests the driver's permission to access their location during their first-ever login. Granting this permission allows the app to accurately display nearby passengers who have made reservations.

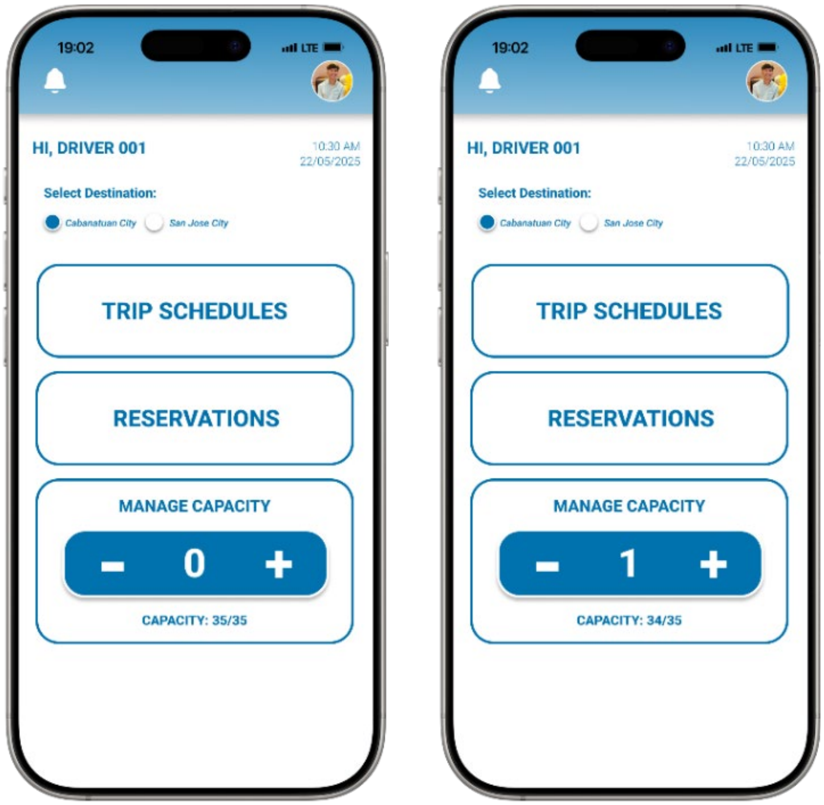

Figure 21. Driver's Dashboard

This figure shows the driver's user-friendly dashboard. Drivers can select their destination during operation, check trip schedules, view reservations, and manage slot or seating capacity. Any updated made are reflected on the passenger's end, keeping them informed of the avaialble capacity in real time.

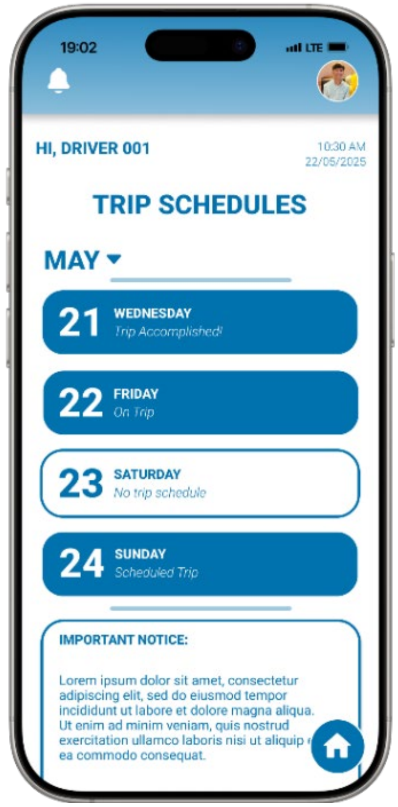

Figure 22. Driver's Trip Schedules

This figure shows the driver's trip schedule. They can view their upcoming trips, unscheduled trips, and even the accomplished ones. An important notice section is also displayed at the bottom, where the operator can post announcements related to the schedules.

Figure 23. Driver's Reservation Module

This figure shows reservations made by passengers. Drivers can accept or decline them depends on seat availability.

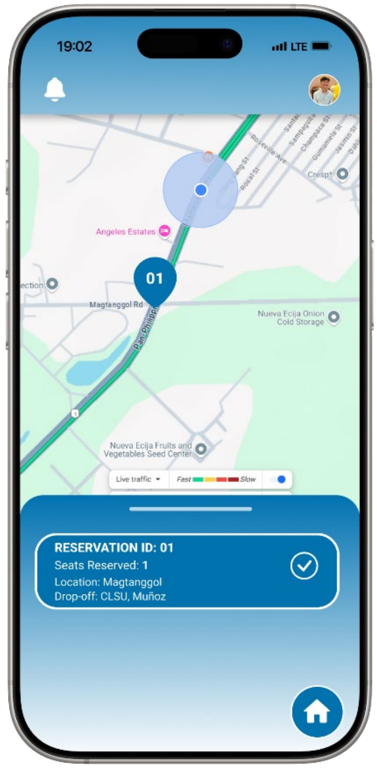

Figure 24. Passenger's location to the Driver

This figure shows the real-time location of the reserved passenger, allowing the driver to track them.

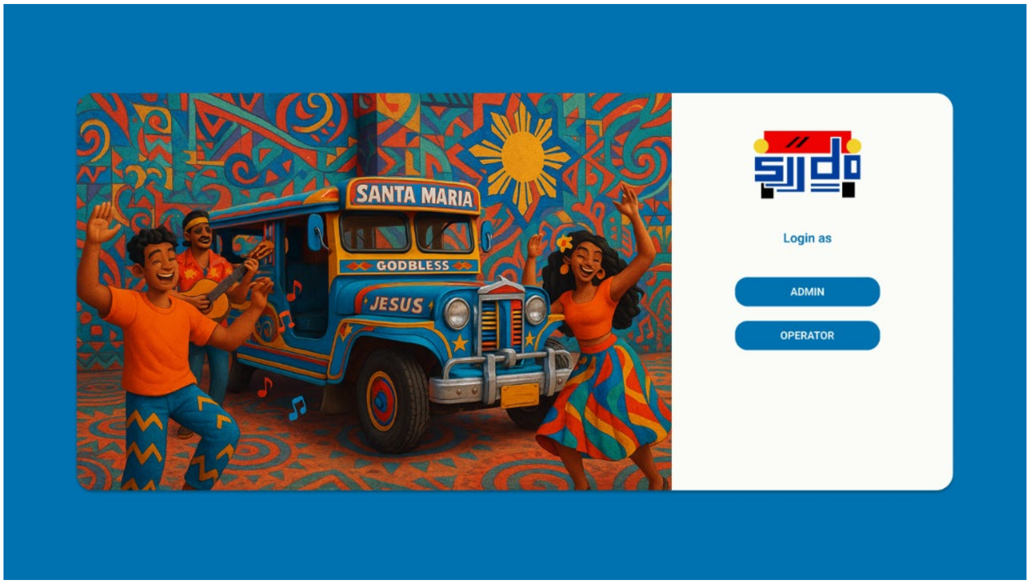

Figure 25. Login page with option for admin/operator

The user will be presented with an option to choose their desired role during the login process. They can select either the "Admin" or "Operator" role. Depending on the role selected, the corresponding permissions and access levels will be applied once they successfully log in.

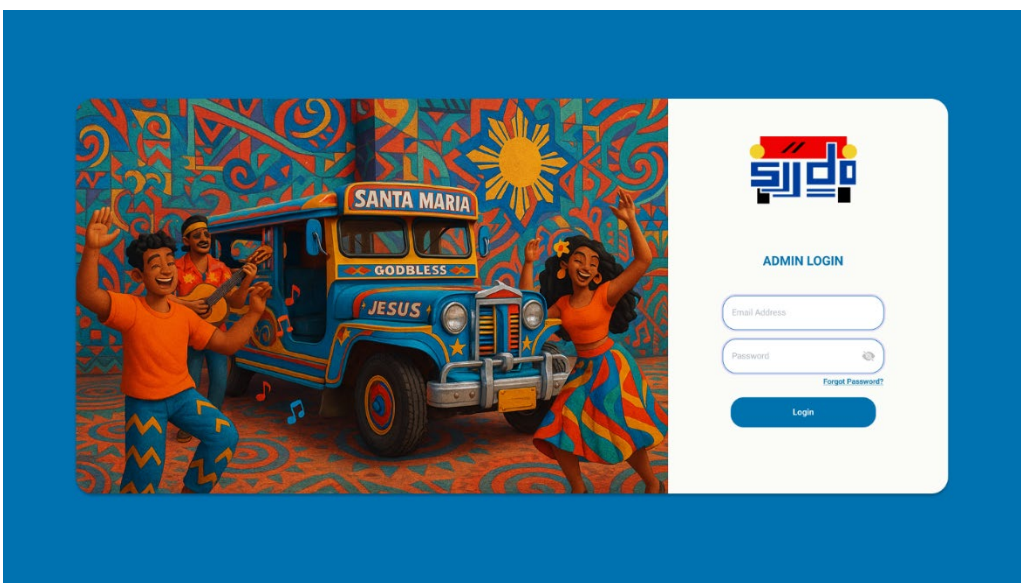

Figure 26. Login page for admin

The administrator will give you login credentials. Use these credentials to access the dashboard.

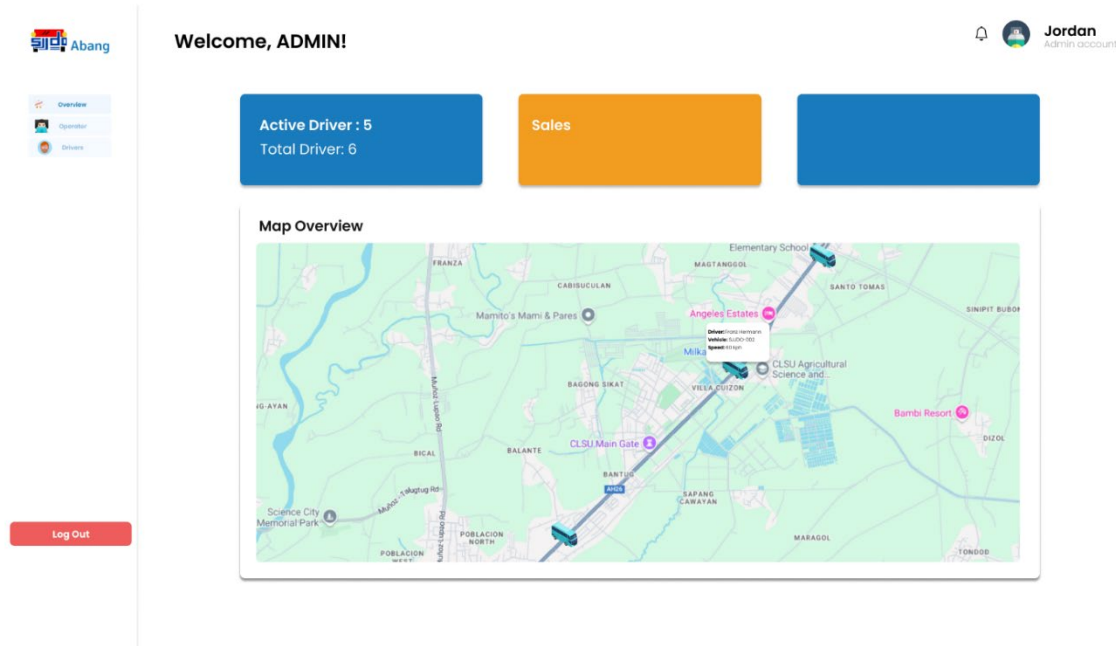

Figure 27. Admin Dashboard

After logging in, the administrator will see the overview page. This page displays the locations of all Modern jeepneys, other relevant information, the total number of drivers, and the number of active drivers.

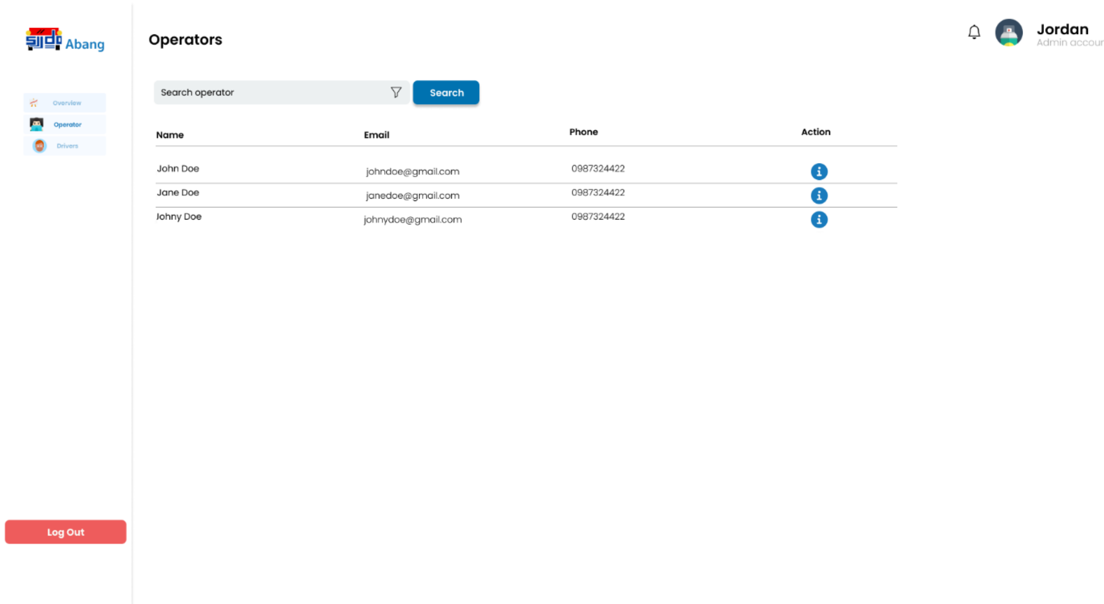

Figure 28. Operators' List tab

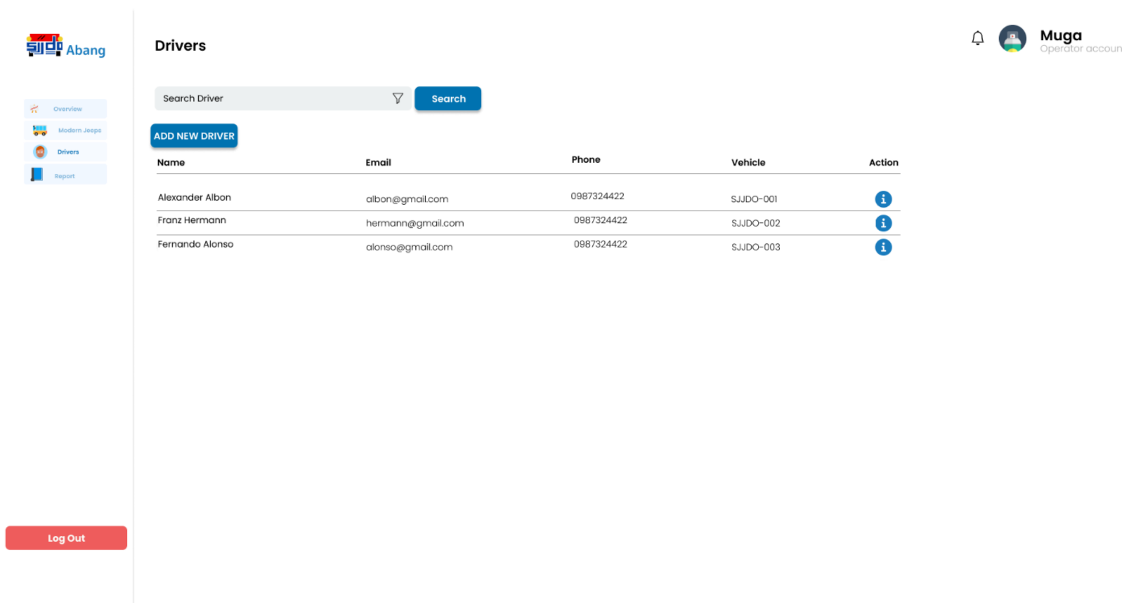

Figure 29. Drivers' List tab

The administrator has access to a dedicated section within the dashboard where they can view a comprehensive list of all operators and drivers registered in the system. This list includes important details such as the names, contact information, assigned vehicles, current status (active or inactive), and other relevant data for each operator and driver. The admin can use this feature to monitor the operator and driver as needed, ensuring smooth operations and effective oversight of all personnel involved in the transport system.

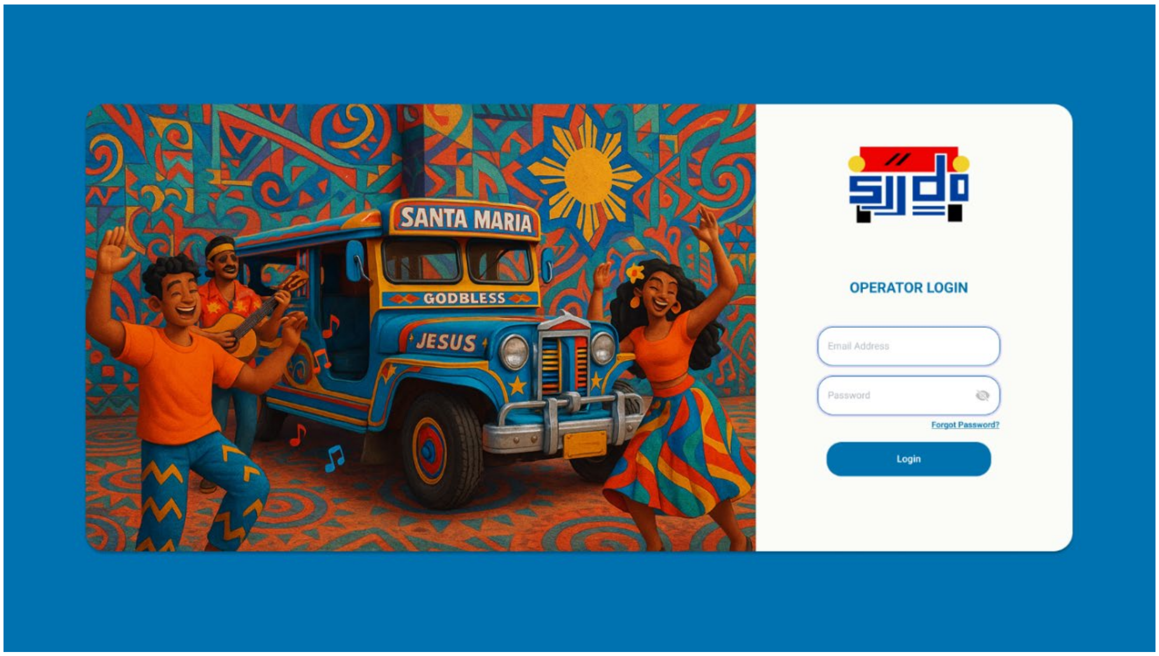

Figure 30. Login page for Operator

The operator will give you login credentials. Use these credentials to access the dashboard.

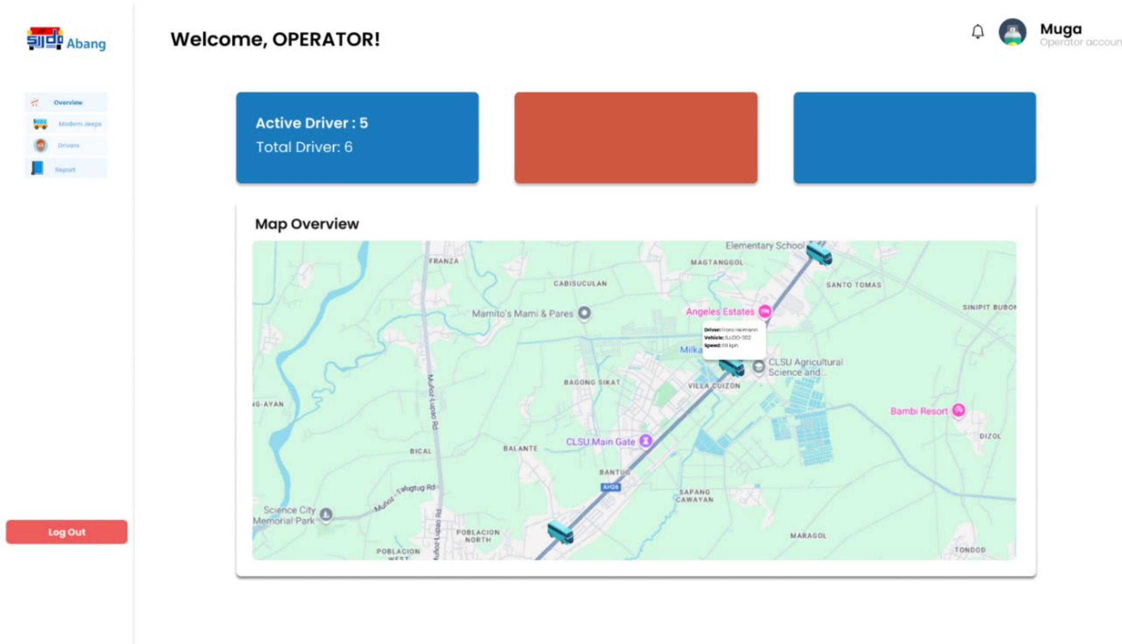

Figure 31. Dashboard Operator Side

After logging in, the operator sees an overview page showing the real-time locations of all their registered jeepneys, key information, the total number of drivers, and how many are currently active.

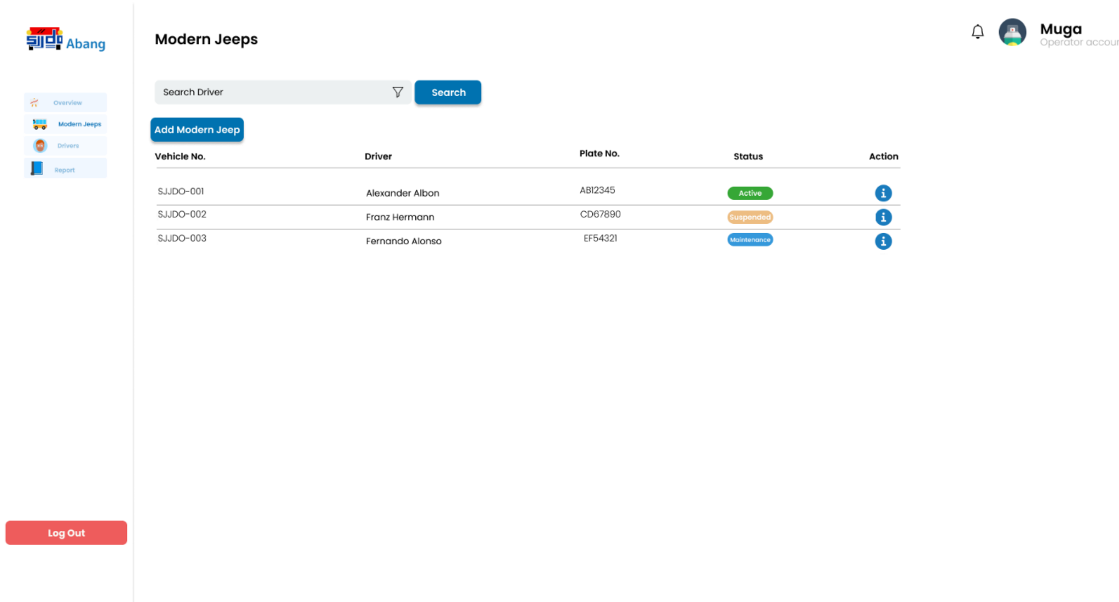

Figure 32. Modern Jeepneys Units Tab

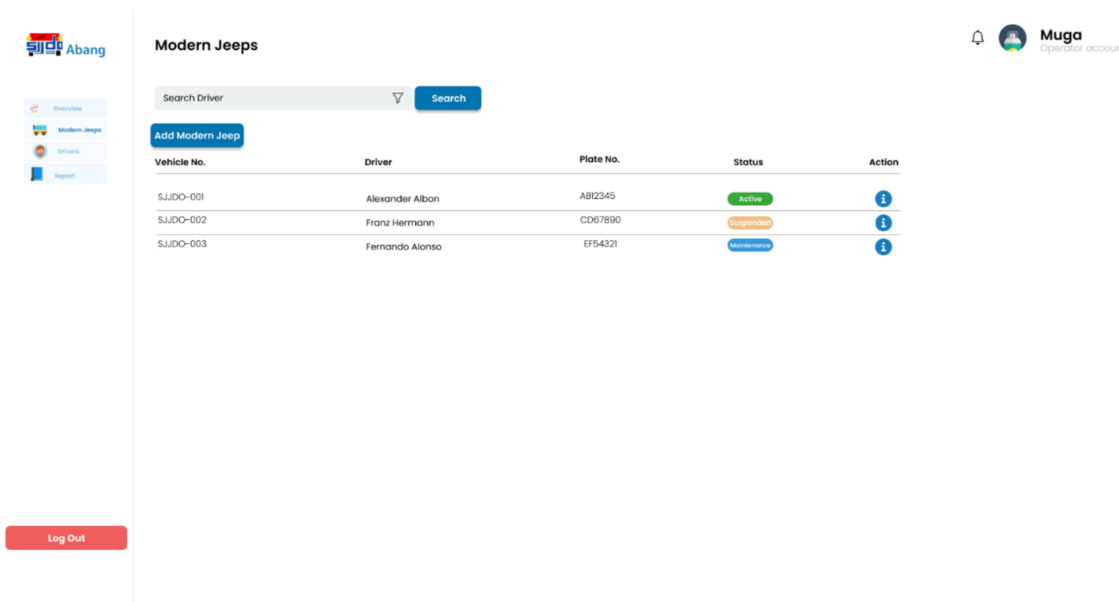

Figure 33. Drivers' Tab

There is a dedicated page for managing modern jeepneys and drivers. This page allows the operator to oversee and manage their fleet and driver assignments, making it easier to update vehicle and driver information as needed.