MAPÚA MALAYAN COLLEGES MINDANAO

JRoute: Commuting Mobile App for Jeepneys In Davao

By:

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A Research Synopsis in Partial Fulfillment of the Requirements for the IT102: Object-Oriented Programming

Bachelor of Science in Computer Science

Submitted to:

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Course Instructor

Background of the Study

Transportation is a crucial aspect of citizens' lives, determining access to education, employment, medical care, and other essential social services. Commuting has always been a popular issue for urban dwellers, especially in cities like Davao. Congestion, confusion, and inefficiency in the mobility sector have all been caused by the population increase, growth in vehicle ownership, and the lack of transportation information systems (Asian Development Bank, 2019). Commuters often find themselves unable to determine the jeepney routes, waiting times, and traffic conditions.

The number of digital tools implemented to address transport-related issues across the globe has increased. Developed countries use apps such as Google Maps, Citymapper, or Moovit to integrate real-time transport schedules and navigation (Smith and Jones, 2022). These tools guarantee commuting time as being less stressful. However, in most developing countries, particularly in the urban centers such as Davao, commuters are still resorting to the traditional means, such as inquiring passersby, memorizing route,s or even relying on word of mouth. This is a hindrance to first-time travelers, students, and even the local workers, who also need an effective and reliable mode of transportation.

These problems are met at the local level. In our case, as commuters in Davao, we experienced confusion when using jeepney routes, particularly when changing lanes to arrive at the destination. Indicatively, when we tried to join the right jeepney to the university, we had to repeat ourselves to drivers or passengers at the road. Such unstructured information wastes time and may be overwhelming to tourists or first-time visitors in the city. These obstacles emphasize the significance of a digital platform that offers real-time and direct commuting data, which accommodates the system of jeepneys of Davao.

Therefore, the proponents propose to implement JRoute, the mobile application that would target commuters in the city of Davao. The app will provide the introduction of a complex system of navigation, mapping of all jeepneys, and real-time information to make transportation efficient, accessible, and convenient.

Sustainable Development Goals (SDGs)

The proposed **JRoute mobile application** supports several United Nations Sustainable Development Goals by addressing issues of mobility, accessibility, and sustainability in Davao City. Primarily, it aligns with **SDG 11: Sustainable Cities and Communities**, as it promotes efficient and inclusive urban transportation, making commuting safer and more convenient for both residents and visitors. Lastly, by reducing wasted commuting time and improving access to economic opportunities, JRoute supports **SDG 8: Decent Work and Economic Growth**.

Problem Statement

Commuters in Davao City are also faced with numerous challenges because informational transport systems are not available. These include a lack of clarity in determining right and wrong jeepney routes, a lack of real-time updates on traffic, as well as delays and limited digital resources that cater specifically to local transport systems. This often results in wasted time, unnecessary cost, and stress to commuters.

Without a major commuter-specific platform, the city is in a dilemma to address the problem of accessibility and efficiency within the public transportation sector to its fullest potential. For newcomers and tourists, navigating the jeepney system is much more complicated with the lack of signage and route clarity. Therefore, a need for a mobile solution arises that combines route mapping, real-time tracking, and simplified navigation to improve the commuting experience.

Project Goals and Objectives

- **To develop a user-friendly commuter application** tailored to Davao's jeepney system, allowing easy navigation for both locals and visitors.

- **To provide real-time route guidance and estimated travel times**, helping commuters plan their trips more effectively.

- **To integrate GPS-based navigation and mapping** for jeepney routes to reduce confusion and errors in commuting

- **To encourage public transportation usage** as a cost-effective and eco-friendly alternative to private vehicles.

- **To support sustainable urban mobility initiatives** of Davao City by promoting innovation and digital infrastructure in the transport sector.

Conceptual Framework

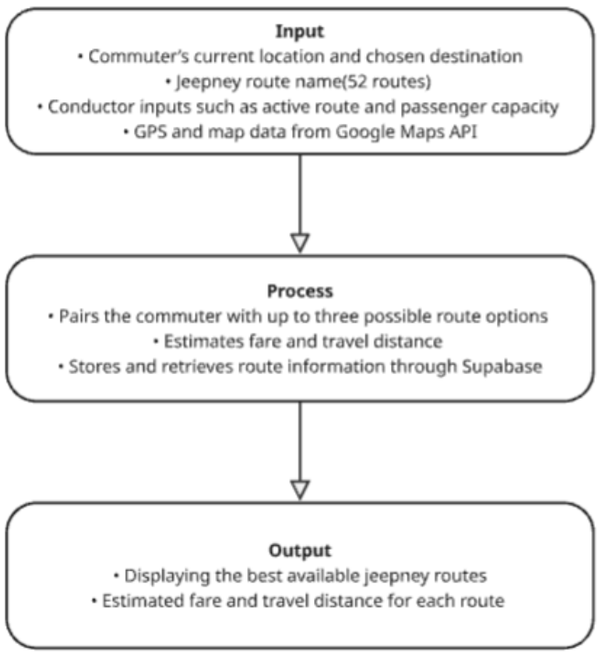

Figure 1

Target Market

The JRoute mobile application target market mainly consists of people who use jeepneys regularly in Davao City. This has a broad demographic base that includes students, employees, tourists, and residents who use public transport to meet their daily mobility requirements.

Primary Users

- Students – From universities and colleges across Davao who commute daily and often struggle with unfamiliar jeepney routes.
- Employees – Particularly those working in urban districts such as downtown, Bajada, or Matina, who aim to save time and plan more efficient routes to and from work.
- Tourists and First-Time Visitors – Individuals visiting Davao who are unfamiliar with the city's jeepney system and routes.

Secondary Users

- Jeepney Drivers and Operators – who may use the app to monitor passenger flow, improve coordination, and identify high-demand routes.
- Local Government Units (LGUs) – particularly the City Transport and Traffic Management Office (CTTMO), which can utilize aggregated data to plan transport improvements.

The JRoute app thus caters to both commuters seeking convenience and stakeholders promoting urban mobility efficiency, contributing to a more connected and commuter-friendly Davao City.

Similar Applications

	Google Maps	Moovit	Citymapper	Sakay.ph	JTransit	Jroute
Real-Time Tracking	✅	✅	✅	✅	✅	✅
Jeepney Route Mapping	⛔	⛔	⛔	✅	✅	✅
Estimated Travel Time	✅	✅	✅	✅	✅	⛔
Offline Navigation	✅	⛔	✅	⛔	✅	⛔
Fare Calculation	✅	✅	✅	✅	⛔	✅
Multiple Route Options	✅	✅	✅	✅	⛔	✅

Figure 2

Scope and Limitations

The JRoute application is a jeepney routing application developed by the city of Davao, which aims to popularize cultural and sustainable ways of transportation (instead of taxis and cars). The project mainly aims at building a mobile application that will have two primary user roles, namely Commuter and Conductor. The Commuter interface assists people with the closest available jeepney routes, the estimated cost and distance to travel, and a maximum of three different route patterns that they could use to get to their destination. At the same time, the Conductor interface enables jeepney drivers to display their active routes and their passenger capacity. The front-end and cross-platform development is based on Flutter, a cloud database on Supabase, and mapping and navigation with the help of Google Maps APIs. They will also be confined to the 52 established jeepney routes in Davao City, which include key locations such as Bajada, Matina, Poblacion, and Toril.

The existing system has a number of limitations. The accuracy of the application relies on the strength of the GPS signal, the connection of the mobile data, and manually placed route data, which is not always the case in the real world through one-way roads or obstacles. The nearest-route detection algorithm is based on geometric approximation and cannot recognize wrong routes in compactly dense regions. The app is also not yet optimized to work with iOS and is currently only available to Android users. The system lacks real-time tracking because jeepneys in the Philippines are not yet equipped with IoT devices for location monitoring. Additional improvements can be made in the future through the implementation of GeoJSON route mapping, IoT-enabled real-time tracking, more accurate routing algorithms, the addition of other transport modes (e.g., tricycles and buses), and the mapping of the UI/UX to make the navigation easier. In spite of these

limitations, JRoute provides a solid ground on how urban mobility can be transformed with the help of digital innovation and data-driven management of public transport.

Project Definition (Tools, Frameworks, Libraries)

Platform & Language

- Frontend & shared logic: Dart / Flutter (cross-platform UI framework).
- Backend / Database: Supabase (Postgres + Auth + storage).
- Mapping & geocoding: Google Maps Platform (Maps SDK / Places API / Geocoding).
- Version control/repo: GitHub.

Key Libraries / Packages

- flutter (UI & navigation)
- google_maps_flutter (map widget)
- google_place / google_maps_webservice (places & geocoding)
- supabase_flutter (auth, realtime, database client)
- geolocator (device GPS/location)
- flutter_riverpod or provider (state management — choose one)
- flutter_map (optional alternative mapping)
- json_serializable / freezed (data models, immutability & (de)serialization)
- dio or http (network requests)
- mapbox_gl (optional alternative)

Development Tools

Android Studio / VS Code, Flutter CLI, Postman for API/DB testing, QGIS (recommended for future GeoJSON route prep).

OOP and GUI Implementation Details

OOP Implementation:

JRoute uses **Object-Oriented Programming principles** for structured and maintainable code. Key classes include:

- **Commuter** – Handles input of origin and destination, displays nearby routes, and shows fare/distance estimates.
- **Conductor** – Inputs current route, maximum passengers, and shares location for pairing with commuters.
- **Route** – Represents each jeepney route with attributes such as routeID, routeName, stops, and distance.
- **MapService** – Manages GPS integration, route calculations, and nearest-route suggestions using Google Maps API.
- **DatabaseService** – Interfaces with Supabase to store route and ride data.

Key OOP concepts

- **Encapsulation**: Route and ride data are private with public getters/setters.

- **Inheritance**: Commuter and Conductor share base behaviors for interacting with routes.
- **Polymorphism**: Methods like displayRoute() are customized for each user type.
- **Abstraction**: Map and database operations are encapsulated into service classes for reusability.

GUI Implementation:

The **Flutter UI** provides:

- **Home Screen** – Allows selection of Commuter or Conductor role.
- **Commuter Page** – Origin/destination input, map view of nearby routes, fare and distance info.
- **Conductor Page** – Input active route and max passengers, view route info.
- **Navigation Controls** – Quick access to route suggestions and map interaction.

Database Schema

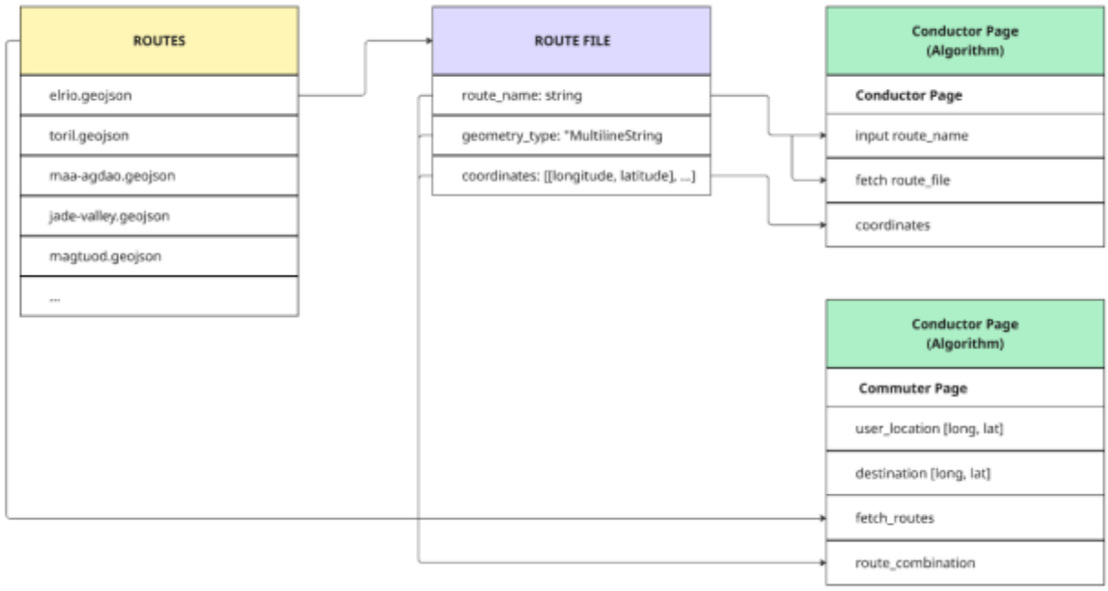

Figure 3

CRUD Functionalities

The fundamental processes that control the system's data flow are represented by the CRUD functions (Create, Read, Update, Delete). Through the use of local caching and effective rendering techniques to maximize performance, these actions in our application guarantee the seamless handling of map and route data.

- **Create** – This function primarily handles map rendering, which involves loading and displaying route data on the map interface. Instead of traditional data entry, the system displays visual routes dynamically, allowing users to see available jeepney routes in Davao City.
- **Read** - The Read operation retrieves data from a cloud database and caches it locally to reduce redundant data retrieval. This allows for faster access to route information and enhances performance, particularly when examining many routes in a short period of time.
- **Update** - The update procedure involves real-time map rendering and route change.

When users interact with or change the map, the displayed information is dynamically updated to reflect the most recent cached data.

- **Delete** - This function trims or segments GeoJSON data, deleting old or unneeded features. This guarantees that the system has only relevant and up-to-date information, hence ensuring efficiency and data correctness.

Prototyping Screenshots

.NET Maui prototype:

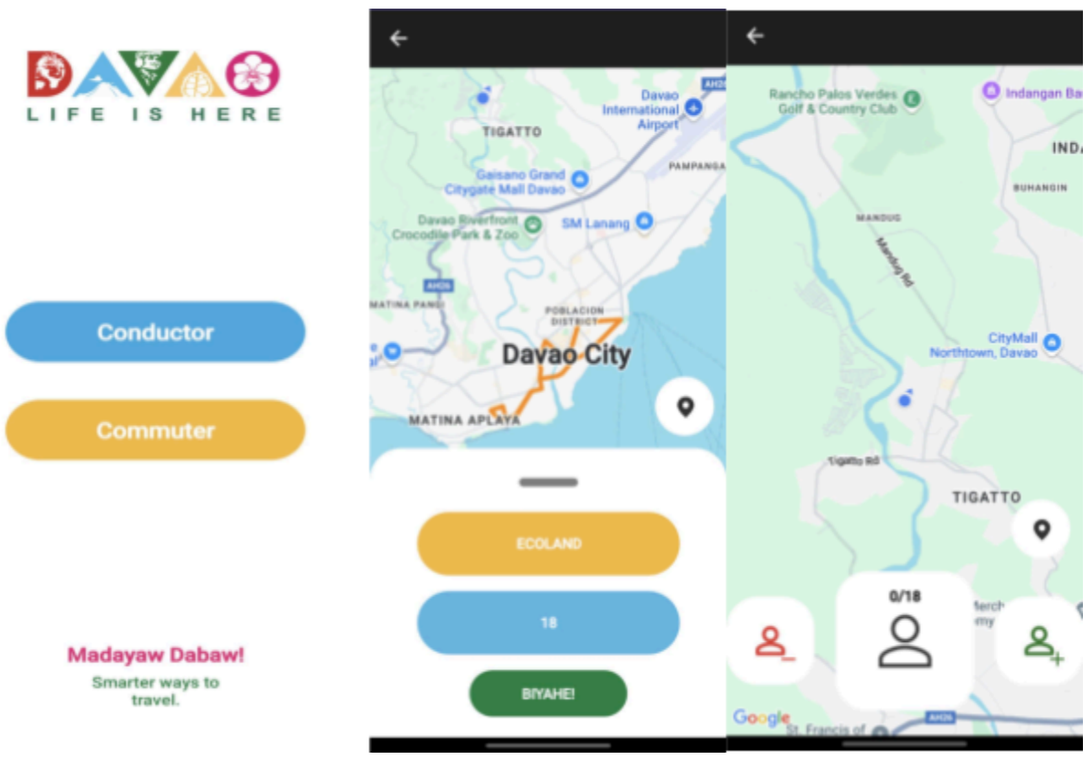

Figure 4

Sample Input/Output

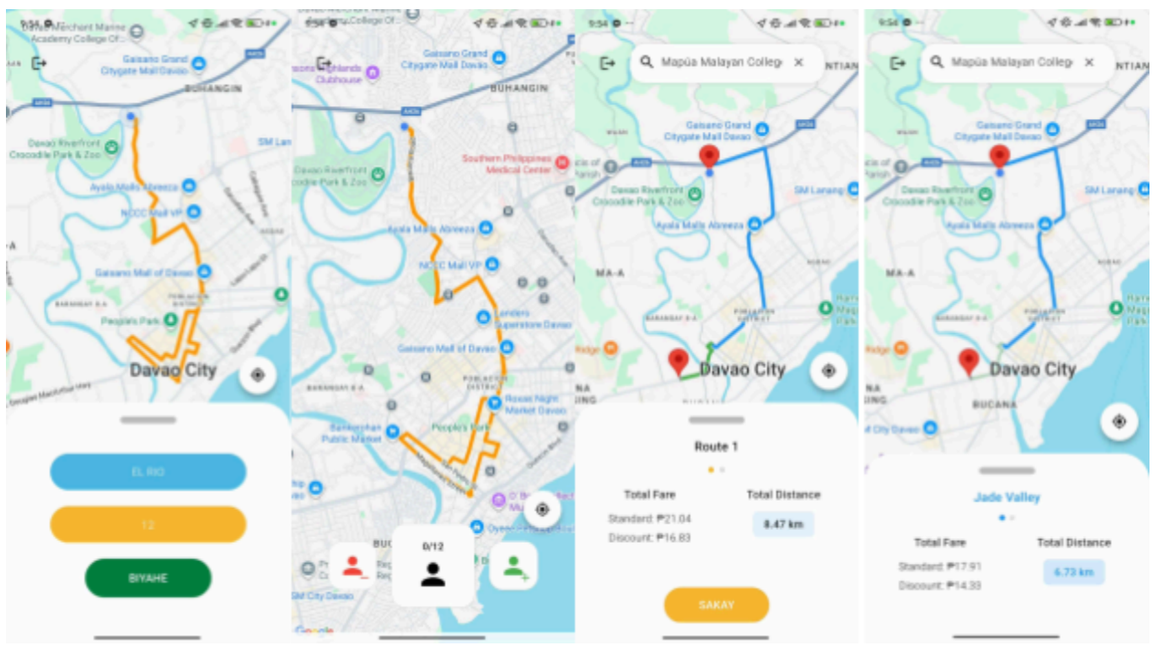

Figure 5

Review of Related Literature

Public transportation is a critical component of urban mobility, and digital applications have increasingly played a key role in improving efficiency and accessibility. Mobile

applications provide real-time information on public transport, enabling users to plan journeys more efficiently and respond to changes in service conditions (Santos & Nikolaev, 2021). Commuters also benefit from improved accessibility and reduced waiting times when public transport is integrated with digital journey-planning tools (Santos & Nikolaev, 2021). In terms of design and usability, all interviewees in a Citymapper case study used at least one app to help plan their journey (Google Maps, Apple Maps, CityMapper, or Moovit), though limitations were mentioned for every single one (Viola, 2023).

In the Philippine context, commuting students face traffic congestion, long travel times, safety issues, and factors that affect stress levels and academic engagement (Morales, Arellano, & Giron, 2024), demonstrating the need for efficient, real-time digital solutions. Applications designed for public transport also support sustainable development by improving efficiency, convenience, and sustainability, while reducing traffic congestion, air pollution, and greenhouse gas emissions (Shukirillaeva & Tokhirov, 2023). Despite these benefits, challenges persist in developing cities where many still lack fit-for-purpose regulation for app-based mobility services (Ireland, Combe, & Montasser, 2024). These studies collectively highlight the need for localized digital tools that enhance commuting, reduce stress, and promote sustainable urban transport, supporting the development of solutions like *JRoute* for Davao City.

Results and Discussion

Test Cases	Origin (Control Variable)	Destination	Suggested Route	Correct Routes Found	Accuracy (%)
1	**El Rio**	4U Grocery **(Bacaca Road)**	**1**	**1**	**100%**
2	**El Rio**	University of Southeastern Philippines **(Obrero)**	**2**	**2**	**100%**
3	**El Rio**	SM Lanang **(Lanang)**	**2**	**2**	**100%**
4	**El Rio**	Mapua Malayan Colleges Mindanao **(Gen. Douglas MacArthur Hwy)**	**2**	**2**	**100%**
5	**El Rio**	Crocodile Park **(AH26)**	**1 (Fallback Route)**	**1**	**100%**
6	**El Rio**	Tito Nat's Super Balbacua Maa **(Ma-a Road)**	**1 (Fallback Route)**	**1**	**100%**
7	**El Rio**	Lyceum of the Philippines Davao **(C.P. Garcia Highway)**	**1**	**1**	**100%**

Figure 6

The table's results show that the algorithm is quite effective at identifying correct and optimal routes from the origin site, El Rio. Across all seven test cases, the algorithm maintained a 100% accuracy rate, indicating that the suggested routes consistently matched the correct routes discovered. This consistency indicates the trustworthiness of the routing algorithm as well as the efficiency of the program's data-fetching and caching methods.

However, during testing, certain destinations, such as Crocodile Park (AH26) and Tito Nat's Super Balbacua Maa (Ma-a Road), were discovered to be accessible via existing routes, but the algorithm failed to display these routes correctly. This problem stems from the GeoJSON data being saved in a multiline format, which complicates how the system parses and shows the routes. These issues can be resolved by parsing the GeoJSON data into a more appropriate data format, guaranteeing that all reachable destinations are correctly presented in subsequent cycles. Despite this slight constraint, the algorithm continues to provide accurate and efficient jeepney route suggestions in Davao City, with room for improvement.

Conclusion

JRoute mobile app is a solution that is able to solve the problems of commuters in the jeepney network of Davao City. The testing of the prototypes and the feedback provided by the users prove that the app delivers precise route recommendations, real-time travel details, and user-friendly navigation, contributing to the minimization of confusion, the time spent by the commuters, and the stress levels of the conductors. Its easy-to-use interface enables those local and first-time travelers to plan their trips effectively, and the incorporation of GPS-based route maps makes it more accessible in the whole city. Although there was route inaccuracy and device incompatibility, the final output is that JRoute is a feasible and realistic digital tool to enhance urban mobility. These could serve as evidence of the possibilities of localized transport applications to improve the commuter experience, encourage the use of public transport, and to allow increasing sustainable urban mobility in Davao City.

Recommendations

- Route Data Accuracy: Integrate GeoJSON mapping and QGIS to refine route geometries and increase nearest-route detection accuracy.

- Real-Time Updates: Implement IoT or live GPS tracking for conductors to provide more precise real-time information.

- UI/UX Improvements: Optimize the interface for clarity, especially for first-time users or tourists unfamiliar with local jeepney routes.

- Device Testing: Expand testing to iOS devices and additional Android models to ensure performance consistency.

- Future Features: Include multiple vehicle types (tricycles, buses) and advanced route recommendations considering real-world obstacles and traffic conditions.

References

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Viola. (2023). Improving public transport with design thinking: A Citymapper case study. *Medium.* https://medium.com/design-bootcamp/improving-public-transport-with-design-thinking-a-citymapper-case-study-70e849bf7e3f

Appendices

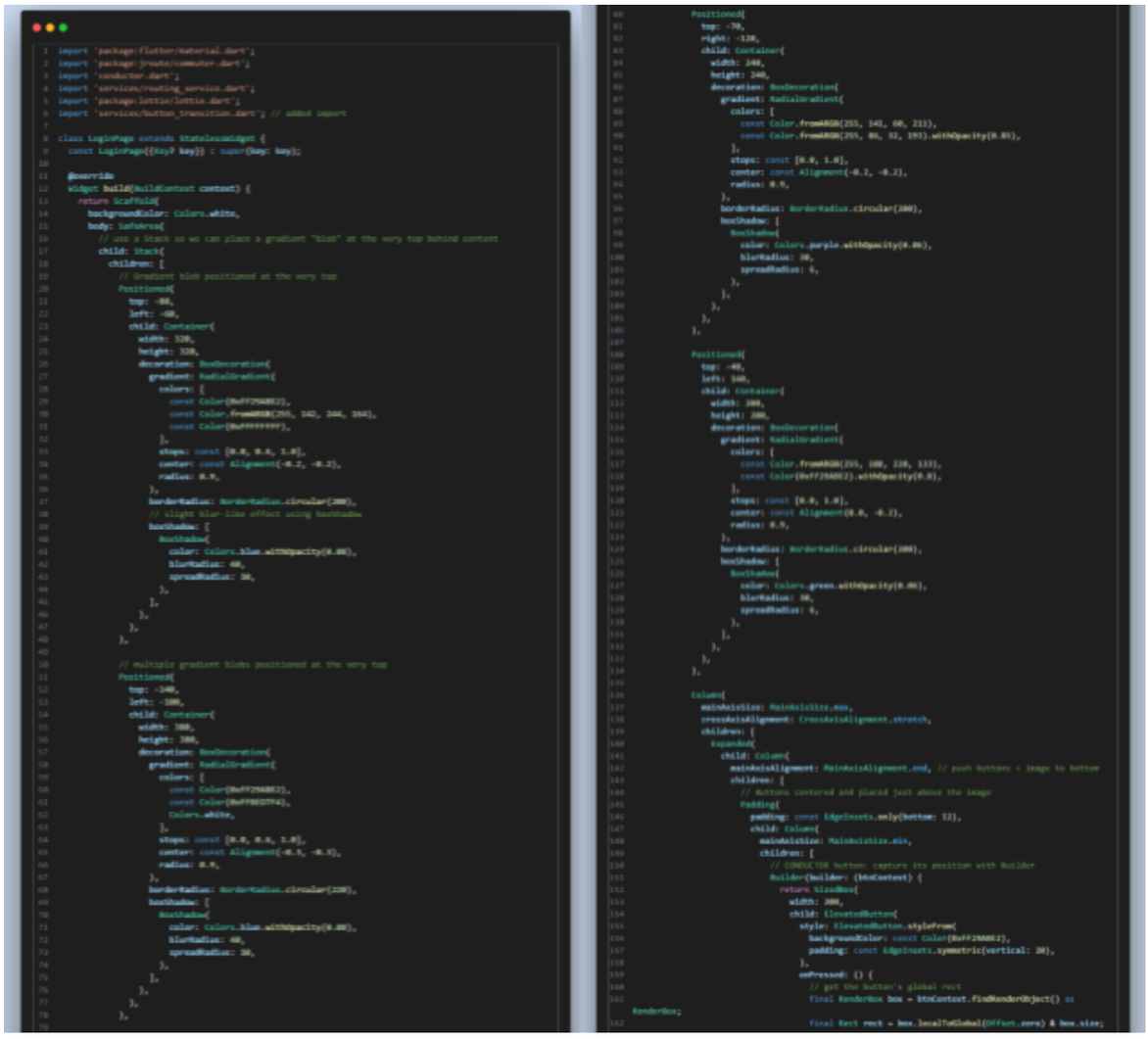
Figures:

Source Code

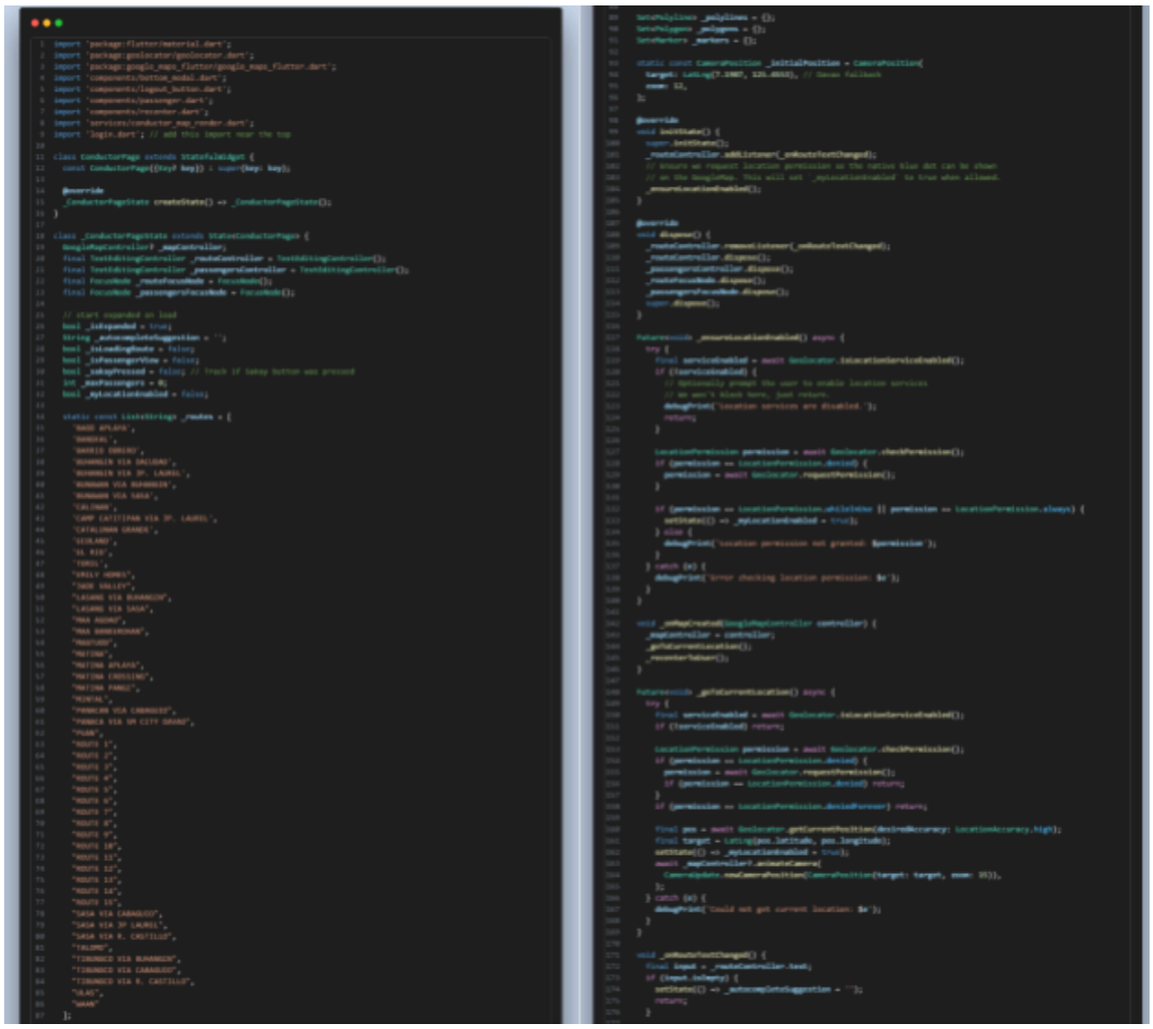
Main.dart

```dart
import 'package:flutter/material.dart';
import 'package:flutter_dotenv/flutter_dotenv.dart';
import 'login.dart';
import 'package:supabase_flutter/supabase_flutter.dart';


Future<void> main() async {
  WidgetsFlutterBinding.ensureInitialized();
  await dotenv.load(fileName: '.env');
  await Supabase.initialize(
    url: dotenv.env['SUPABASE_URL']!,
    anonKey: dotenv.env['SUPABASE_ANON_KEY']!,
  );

  runApp(const MyApp());
}

class MyApp extends StatelessWidget {
  const MyApp({super.key});

  @override
  Widget build(BuildContext context) {
    return MaterialApp(
      title: 'J Route',
      debugShowCheckedModeBanner: false,
      theme: ThemeData(primarySwatch: Colors.blue),
      home: const LoginPage(),
    );
  }
}
```

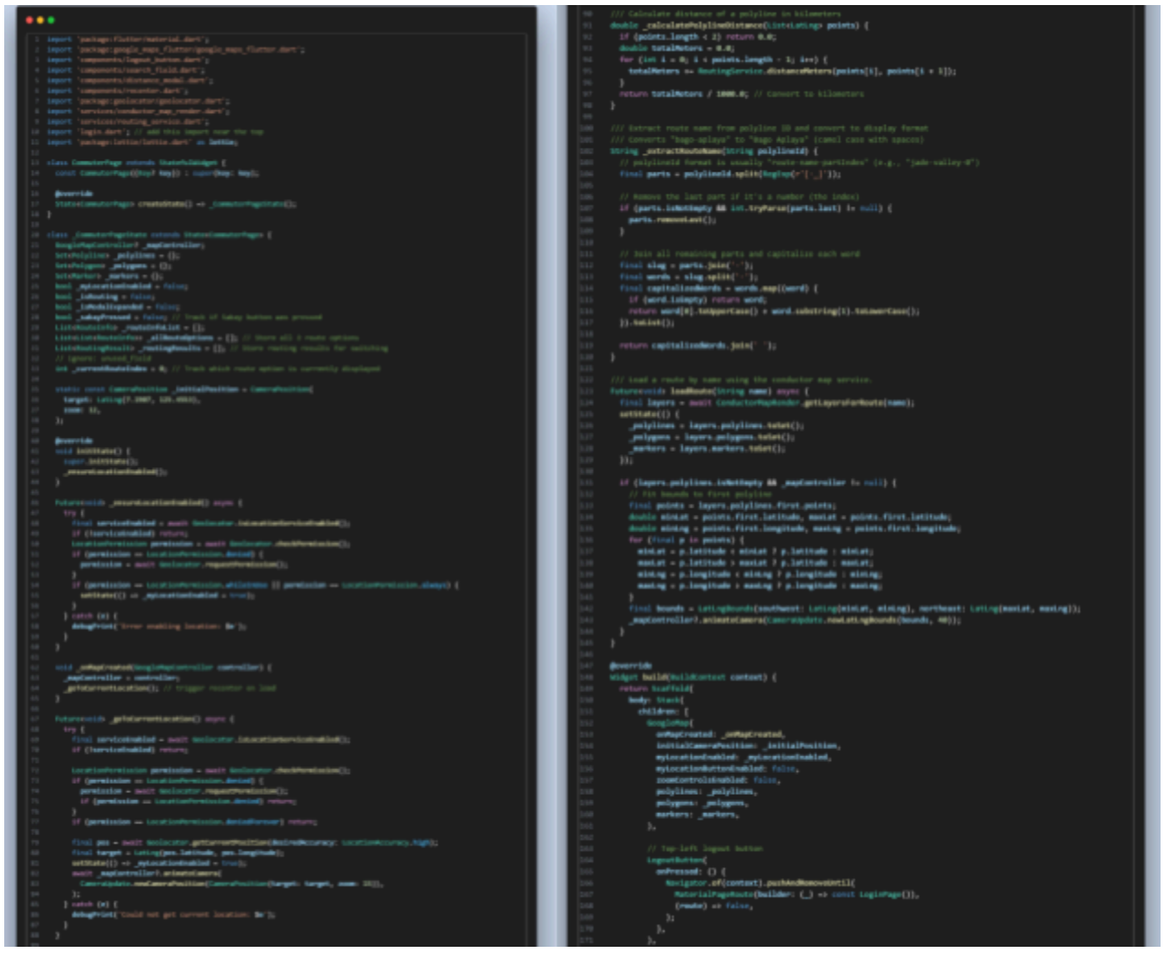
Login.dart



Conductor.dart



Commuter.dart



Curriculum Vitae

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Personal Statement

I am a recent graduate of Mapúa Malayan Colleges Mindanao with a Bachelor of Science in Computer Science, I am excited to apply my knowledge, creativity, and commitment to a workplace. My academic path has provided me with strong technical skills in programming, research, and software design, a profound understanding of the importance of teamwork, and constant improvement. I am now looking for a place where I can use what I've learned, develop as a young professional and make a meaningful contribution to a progressive enterprise. Motivated, flexible, and technology enthusiast, I am willing to contribute from day one.

Skills

Programming Languages
Skilled in Python, Java, and C++, having worked on building academic projects and solving real-world problems using code. Familiar with procedural and object-oriented programming styles.

Software Tools
Proficient with Visual Studio Code for coding and debugging, and Microsoft Office applications for developing professional reports, presentations, and documentation.

Soft Skills
Team oriented and communicative, effective in group projects. Organized and able to manage time to meet deadlines and handle several tasks at a time.

Education Attainment

2024 – 2028 **Mapúa Malayan Colleges Mindanao**
Bachelor of Science in Computer Science
Davao City, Philippines

2022 – 2024 **Colegio de San Ignacio**
Senior High School (STEM Strand)
Davao City, Philippines

2018 – 2022	**Colegio de San Ignacio** Junior High School Davao City, Philippines

Work Experience

2022-2022	Activations Advertising Inc. Davao City Freelance Encoder
2024-2025	Coding Organization for Digital Excellence (C.O.D.E.) Mapúa Malayan Colleges Mindanao Head of Operations Officer
2024-2025	Computing Students Society (CSS) Mapúa Malayan Colleges Mindanao Project Development Committee Member

Certifications

2024	C++ Lab: Crafting Code in the Digital Age Certificate of Participation
2025	Visual Studio Code Workshop Certificate of Participation

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Personal Statement

I am a recent Computer Science graduate from Mapua Malayan Colleges Mindanao with knowledge and experience in data analysis, statistics, and programming. I am eager to join All-Around Business, Inc. as a Data Analyst to help turn data into clear and useful insights. I am dedicated, detail-oriented, and always willing to learn and improve.

Skills

Problem Analysis

Able to break down complex issues into smaller, manageable parts to identify effective and logical solutions. Skilled in recognizing patterns, root causes, and dependencies to guide problem-solving with clarity and purpose.

Simplifying Complexity

Capable of understanding intricate systems or data and presenting them in a clear, accessible way. Adept at translating complex concepts for better communication, collaboration, and decision-making across teams.

Team Collaboration

Works well in group settings by contributing ideas, sharing responsibilities, and supporting team goals.

Educational Attainment

2024 - 2027	Bachelor of science in Computer Science Mapua Malayan Colleges Mindanao McArthur Highway, Matina, Davao City
2022 - 2024	STEM Strand Graduate University of Immaculate Conception Bajada, Davao City
2018 - 2022	STEM Strand Graduate Digos City National High School Makar Road, Digos City

Work Experience

2024 - Present	Newwave Davao City Social Media Manager
	Newwave Davao City App Developer/Technical Assistant
2022 - 2023	Office of Dr. Jean Diar R. Llorente Davao City Secretary

Certifications

2025	CODECHUM: C++ Programming 1
2024	C++ Lab: Crafting Code in the Digital Age Blockchain Campus Conference
	First Line of Defense: AWS Account Security 101 with IAM
	Champion, Research Poster Defense