

1. INTRODUCTION:

Efficient public transportation is important for present day towns to control congestion, lessen pollution, and ensure accessibility for all residents. The Public Transportation Tracker is designed to revolutionize the manner humans engage with and gain from public transportation systems. This document outlines the product's class, purpose, scope, and its description, along with a assessment between the present gadget and the proposed machine.

1.1 Category:

The Public Transportation Tracker falls below the class of transportation technology solutions. It combines factors of actual-time facts evaluation, GPS monitoring, cell programs, and communicate systems to create an incorporated platform that enhances the general enjoy of the usage of public transportation.

1.2 Product Purpose:

The purpose of the Public Transportation Tracker is to improve the performance, comfort, and accessibility of public transportation systems for each commuters and transportation government. By imparting accurate real-time information, optimizing routes, and facilitating conversation, the product pursuits to draw extra riders, reduce ready times, and in the end make contributions to extra sustainable and nicely-related towns.

- Real-time Information: Provide users with instant, accurate, and location-specific updates on bus and train arrivals, departures, and route information.
- Improved Planning: Enable passengers to plan their journeys more efficiently, select optimal routes, and make informed decisions based on real-time data.
- Seamless Navigation: Offer turn-by-turn navigation, guiding users from their current location to their desired destination using integrated mapping services.
- Personalization: Allow users to customize their experience by setting preferences, saving favorite routes, and receiving relevant notifications.

- **Promote Public Transportation:** Encourage greater utilization of public transportation services by making the experience more reliable, convenient, and user-friendly.

1.3 Product Scope:

The product's scope encompasses several key features that beautify the public transportation revel in:

- Real-time monitoring and location updates for vehicles
- Route planning and optimization for customers
- Instant service alerts and updates
- Electronic fare charge integration
- Data collection and analysis for transportation authorities
- Direct communication channels between users and authorities

1.4 Product Description:

A. Existing System:

Traditionally, public transportation structures have depended on fixed schedules displayed at stops and stations. These schedules are frequently challenge to delays due to site visitors, weather, or other unexpected occasions, inflicting frustration and inconvenience for commuters. Limited conversation channels between transportation authorities and customers further exacerbate those issues, making it difficult to deal with disruptions promptly.

B. Proposed System:

The Public Transportation Tracker seeks to conquer the limitations of the existing device thru innovative generation answers:

- **Real-time Tracking:** GPS devices set up on vehicles offer correct real-time vicinity records. Users can access this records via cell packages or net interfaces, permitting them to plan their trips based on up to date updates.
- **Route Planning:** The system utilizes real-time facts to signify the most advantageous routes for customers, considering elements together with traffic congestion and car availability. This reduces tour times and encourages extra usage of public transportation.
- **Service Alerts:** Users get hold of immediately alerts concerning service disruptions, delays, or other essential updates. This empowers them to adjust their journey plans and make informed choices.
- **Electronic Fare Payment:** The integration of digital fee systems enables users to pay their fares seamlessly thru the platform, lowering the need for bodily coins and paper tickets.
- **Data Analysis:** The system collects records on passenger float, famous routes, top tour instances, and more. Transportation authorities can use this statistics to optimize routes, allocate sources efficaciously, and enhance average carrier first-rate.

2. FUNCTIONAL REQUIREMENTS

- **User Registration and Authentication:**
 - Users have to be capable of create accounts with their private data.
 - Users must be able to log in securely the use of credentials or different authentication strategies.
- **Real-Time Vehicle Tracking:**
 - The machine have to music the real-time location of all public transportation motors.
 - Users ought to be able to view the modern place of automobiles on a map.

- **Route Planning and Optimization:**
 - Users should be capable of input their beginning and vacation spot to obtain optimized routes.
 - The system should keep in mind real-time traffic facts, vehicle availability, and user options for course tips.

- **Service Alerts and Notifications:**
 - Users ought to acquire on the spot indicators concerning provider disruptions, delays, and essential updates.
 - Transportation government must be capable of send notifications to users about planned protection or unexpected incidents.

- **Electronic Fare Payment Integration:**
 - The device need to facilitate electronic fare payment through diverse methods, together with credit/debit playing cards or mobile wallets.
 - Users must be capable of view their charge records and transaction details.

- **Data Collection and Analysis:**
 - The machine have to gather records on passenger go with the flow, famous routes, top travel instances, and greater.
 - Transportation government must have get admission to to data analysis tools to make informed choices approximately path optimization and useful resource allocation.

- **User Profile Management:**
 - Users should be capable of update their profiles, together with touch information, preferences, and price techniques.
 - Users must have the option to customize notification settings based totally on their possibilities.

- **Vehicle and Route Information:**
 - Users should be capable of get right of entry to statistics approximately individual cars, inclusive of car kind, capability, and present day occupancy.

- **Performance Monitoring:**
 - Transportation government ought to have access to a dashboard that displays key performance metrics, inclusive of on-time performance, ridership traits, and service reliability.
- **System Security and Privacy:**
 - User information need to be securely saved and encrypted to defend privacy.
 - The gadget should have measures in location to save you unauthorized access and statistics breaches.
- **Multi-Platform Compatibility:**
 - The platform should be accessible through cellular packages (iOS and Android) and internet interfaces to cater to a wide variety of users.
- **Integration with Payment Gateways:**
 - The machine have to seamlessly integrate with diverse payment gateways to facilitate secure digital fare payments.
- **User Feedback and Ratings:**
 - Users have to be capable of provide feedback and ratings for their journey experiences.
 - Transportation authorities must be able to overview and deal with consumer comments.
- **Regular System Updates and Maintenance:**
 - The system should go through normal updates and maintenance to make sure most advantageous overall performance, safety, and feature enhancements.

3. NON FUNCTIONAL REQUIREMENTS:

- **Performance:** Provide real-time updates with minimal latency, manage excessive traffic without slowdowns.
- **Reliability:** Maintain as a minimum 99.Nine% uptime, face up to server disasters or unexpected spikes in customers.
- **Security:** Encrypt user records, put into effect steady authentication, and make certain facts transmission encryption.
- **Scalability:** Handle growing consumer numbers and records, scale each vertically and horizontally.
- **Usability:** Intuitive interface for customers of varying tech degrees, responsive cell app revel in.
- **Accessibility:** Adhere to accessibility requirements, provide capabilities for users with disabilities.
- **Compatibility:** Work across gadgets, OS versions, browsers; assist older variations in which needed.
- **Data Integrity:** Prevent facts corruption or loss, carry out everyday information backups.
- **Response Time:** Promptly reply to user interactions, ensuring easy usage.
- **Internationalization and Localization:** The app shall support multiple languages, starting with English and expanding to include additional languages based on user demand.
- **Battery Efficiency:** The app shall be designed to minimize battery consumption, optimizing location services and background updates.
- **Network Resilience:** The app shall provide offline access to cached data, ensuring that users can view previously accessed information without an active internet connection.

4. SOFTWARE TOOLS :

- **Programming Languages:** Java
- **Database Management:** PostgreSQL
- **Web and Mobile Development:** Flutter.
- **Backend Development:** Express.js
- **Real-Time Communication:** Socket.IO.
- **Cloud Services:** AWS
- **Payment Integration:** Stripe
- **Data Analytics:** Tableau
- **API Development:** Swagger.
- **UI Design:** Figma
- **Deployment:** Docker

5. HARDWARE SPECIFICATION:

- **Server Hardware:** Multi-core processors, ample RAM (4GB+)
- **Database Server:** High-capacity storage, fast and reliable drives.
- **GPS Tracking Hardware:** GPS modules in vehicles, cellular/satellite communication.
- **Mobile Devices:** iOS and Android smartphones for users.
- **Network Infrastructure:** High-speed internet, load balancers.
- **Data Backup:** AWS.
- **Security:** Firewalls, SSL certificates.

6. DESIGN CONSTRAINT:

- **Real-Time Data Updates:** The system must provide accurate real-time vehicle tracking and updates to users, requiring robust data synchronization and minimal latency.
- **Mobile Device Compatibility:** The user interface must be optimized for various mobile devices and operating systems (iOS and Android), ensuring a consistent and user-friendly experience.
- **Data Security:** User information, payment details, and tracking data must be encrypted and securely stored to protect privacy and prevent unauthorized access.
- **Accessibility:** The user interface should adhere to accessibility standards to ensure users with disabilities can navigate and use the system effectively.
- **Network Reliability:** The system's availability relies on a stable internet connection; measures should be in place to handle network disruptions.
- **Data Accuracy:** GPS tracking should provide accurate location data to ensure reliable route planning and vehicle tracking.
- **Data Privacy:** The system must comply with data protection regulations to safeguard user privacy and prevent misuse of personal information.
- **User Experience:** The user interface and interactions should be intuitive, minimizing the learning curve for users of varying technical backgrounds.
- **Performance Load:** During peak hours, the system must handle increased user activity without slowdowns, requiring efficient resource management.
- **Budget Constraints:** Development, maintenance, and infrastructure costs must align with the allocated budget for the project.

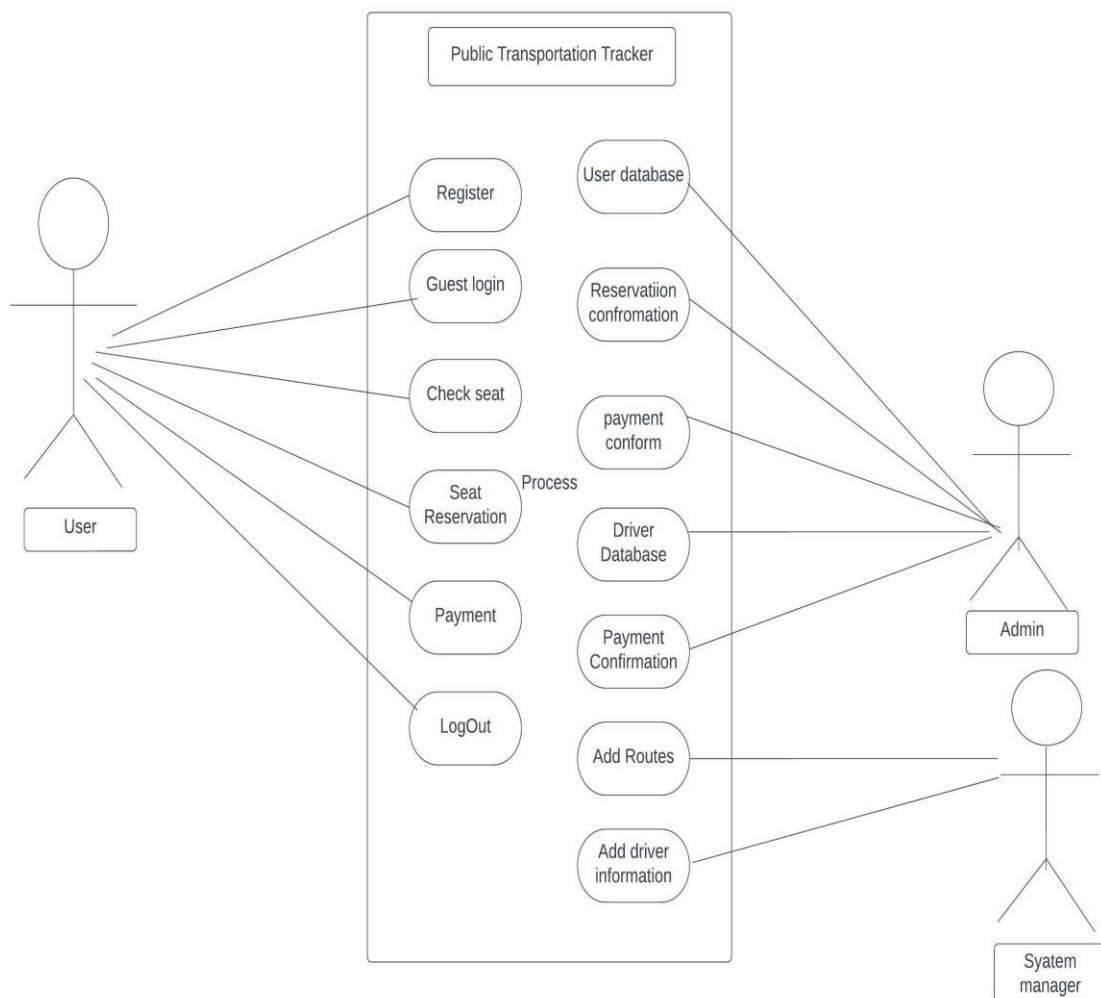
7. INTERFACE REQUIREMENT:

- **User Interface (UI):**
 - Intuitive, consistent UI across web, iOS, Android.
 - Touch-friendly controls, responsive design.
- **Real-Time Tracking Map:**
 - Real-time vehicle map with zoom and interaction.
 - Differentiated markers for vehicle types.
- **Route Planning Form:**
 - User-friendly form for easy origin-destination input.
 - Real-time suggestions, auto-completion.
- **Service Alerts Display:**
 - Prominent display of service alerts and disruptions.
- **Payment Integration:**
 - Secure payment interface with methods and history.
- **User Profile Management:**
 - Editable profiles, contact, payment details.
- **Communication Channels:**
 - User-friendly messaging for inquiries, feedback.
- **Admin Dashboard:**
 - Comprehensive dashboard for vehicle, route management.
- **Data Analytics Visualizations:**
 - Clear visualizations for informed decisions.
- **Notification Center:**
 - Centralized notifications for real-time updates.

- **Feedback Form:**
 - Easy feedback submission and issue reporting.
- **Navigation Menus:**
 - Clear menus for easy section switching.

8. SYSTEM DESIGN AND ARCHITECTURE:

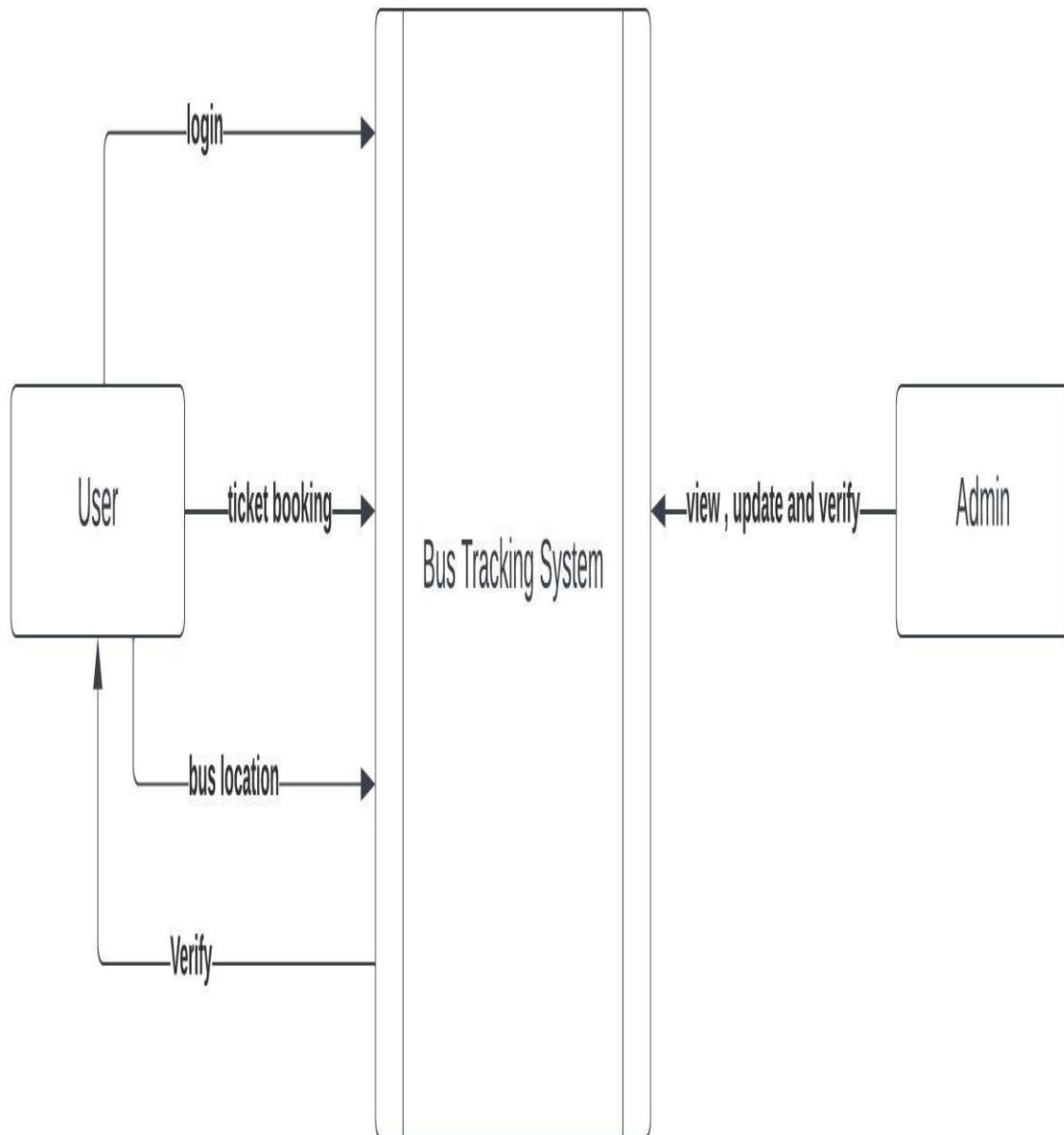
1. Use Case Diagram:



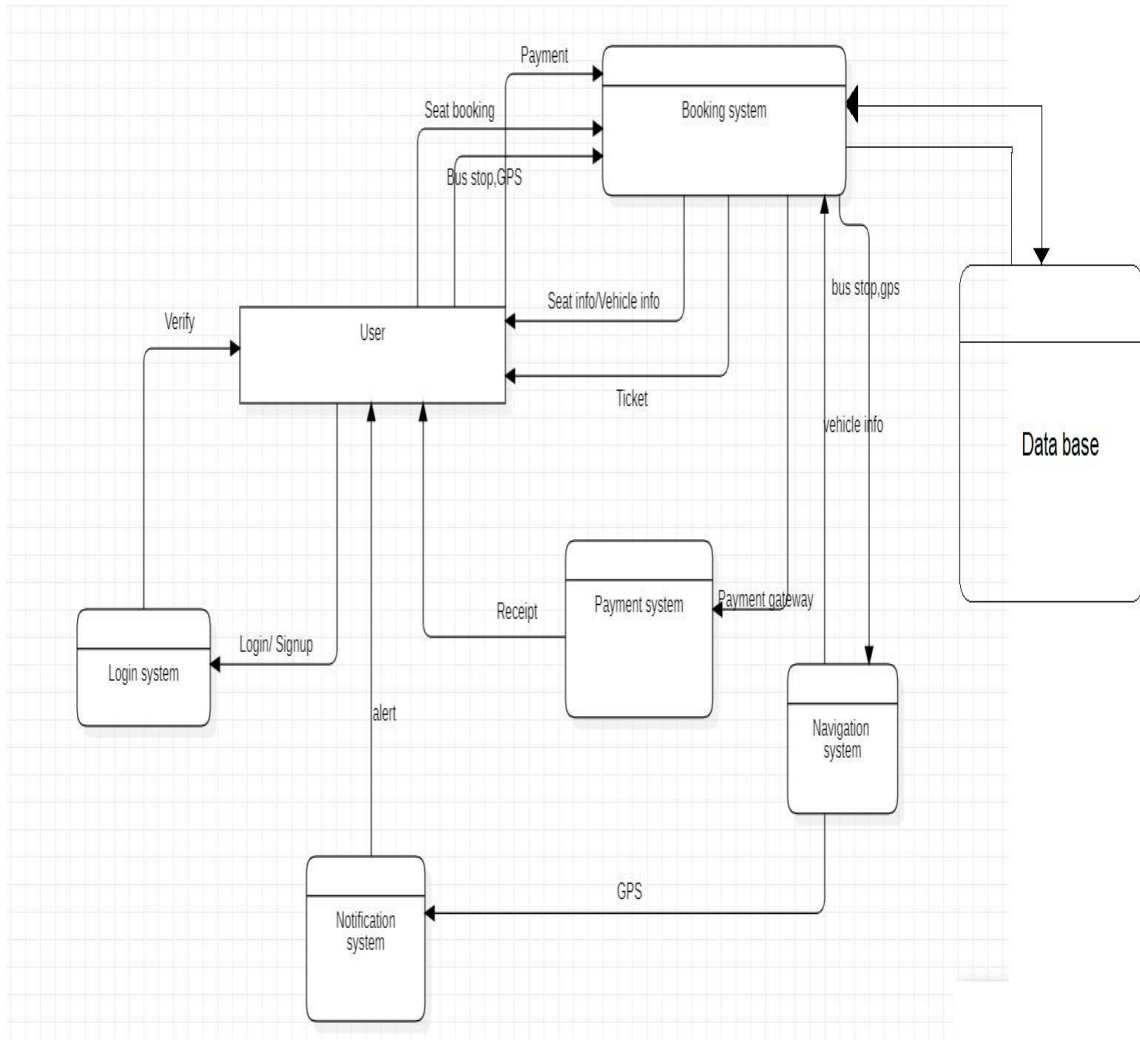
Public Transportations Tracker

2. Data Flow Diagram (DFD):

a. DFD LEVEL 0:



b. DFD LEVEL 1:



9. PRELIMINARY SCHEDULE AND BUDGET:

1. Project Phases and Timeline:

Phase 1: Project Initiation and Planning

Duration: 2 weeks

Activities:

- Define project scope, objectives, and deliverables.
- Gather requirements from stakeholders and users.
- Plan development approach, technologies, and tools.
- Create initial wireframes and design concepts.
- Develop a preliminary project schedule and budget.

Phase 2: Design and UI Development

Duration: 4 weeks

Activities:

- Finalize user interface designs and interactions.
- Develop app mockups and prototypes.
- Review and iterate on design concepts based on feedback.
- Define data models and database schema.
- Create a design documentation detailing UI elements and flows.

Phase 3: Frontend and Backend Development

Duration: 12 weeks

Activities:

- Implement frontend components using Java and Android SDK.
- Integrate with third-party APIs (Google Maps, Firebase, etc.).
- Develop backend services for real-time data updates and user management.

- Implement user authentication, data retrieval, and caching.
- Perform unit testing and integration testing for each component.

Phase 4: Testing and Quality Assurance

Duration: 4 weeks

Activities:

- Conduct comprehensive testing, including UI testing and real-time data validation.
- Address and fix bugs, performance issues, and usability concerns.
- Collaborate with beta testers to gather user feedback and insights.
- Perform compatibility testing on different Android devices and versions.

Phase 5: Deployment and Launch

Duration: 2 weeks

Activities:

- Finalize app branding, icons, and marketing materials.
- Prepare app store listing, screenshots, and descriptions.
- Perform final testing and validation of app functionality.
- Publish the app to the Google Play Store for public release.

2. Budget Allocation:

1. Development Team:

- Android Developers (2): 2 weeks
- UI/UX Designers (1): 1 weeks
- Backend Developers (1): 2 weeks
- Quality Assurance (1): 1 weeks

2. Tools and Licenses:

- Android Studio and JDK licenses
- Third-party API usage fees (Google Maps, Firebase, etc.)

3. Marketing and Launch:

- a. App store registration and publishing fees
- b. Graphic design for app icons, screenshots, and promotional materials

4. Miscellaneous Expenses:

- a. Testing devices (if not already available)
- b. Internet and communication costs

Total Estimated Budget: \$1,120 (USD)

10. APPENDICES

A. DEFINITIONS

- UI/UX: User Interface / User Experience
- IDE: integrated development environment
- GPS: Global Positioning System
- API: Application Programming Interface
- SDK: Software Development Kit
- RESTful: Representational State Transfer
- BaaS: Backend-as-a-Service
- HTTPS: Hypertext Transfer Protocol Secure
- CRUD: Create, Read, Update, Delete
- MVC: Model-View-Controller

11. REFERENCES:

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