 

**PROJECT PROPOSAL REPORT**

**Nepal Public Transportation Fare Information and Route Optimization System**

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**Abstract**

In this Final Year Project, I will be developing a "Nepal Public Transportation Fare Information and Route Optimization System." The primary goal of this system is to provide users with accurate and reliable information regarding bus fares, routes, and travel options within Nepal's public transportation system. The system will enable users to easily calculate fares, find the best routes, and access real-time traffic updates. Additionally, it will incorporate features such as fare discounts for students and senior citizens, interactive maps, and personalized notifications to improve the overall travel experience. By integrating AI and machine learning, the system will also offer optimized route suggestions based on user preferences. The implementation of this system aims to enhance the transparency, efficiency, and accessibility of public transportation in Nepal, benefiting both travelers and transport providers.

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**1. Introduction:**

**1.1 Public Transportation Fare Information and Route Optimization System:**

The Public Transportation Fare Information and Route Optimization System is designed to help users navigate the public transport system efficiently by providing accurate fare details and optimized route suggestions. Users can input their starting point and destination, and the system calculates the most cost-effective and time-efficient route, factoring in multiple bus changes, fares, and travel times.

One of the key features of this system is its route optimization capability, which recommends the best possible routes based on user preferences such as the cheapest fare, shortest travel time, or the fewest bus transfers. By considering real-time traffic updates and delays, the system ensures that users always have access to the most up-to-date travel information, helping them make informed decisions and saving time and money.

This system aims to improve the public transport experience in Nepal by addressing common challenges such as unclear fare structures and complicated routes, making it easier for users to plan their journeys and access affordable transportation options.

**1.2 Academic Question:**

* **Will users need to log in or sign up to use the system and access its features?**  
  Yes, users will need to log in or sign up before accessing the system. This is necessary to unlock features such as fare calculation, route searches, saving favorite routes, receiving personalized notifications, and accessing discounts. Signing up ensures that the system can store user preferences, previous route history, and provide customized services, making the experience more efficient and user-friendly.
* **Will this system be simple for your users to use?**  
  Yes, the system is designed with user-friendliness in mind. The interface is straightforward, with easy-to-follow instructions for fare calculations, route searches, and real-time traffic monitoring. It provides clear and concise information, and the system uses color-coded routes and simple maps to enhance usability for all users.
* **How will the integration of AI to suggest optimized routes enhance the user experience, and how will this feature evolve over time?**  
  The AI-powered route optimization feature will enhance the user experience by suggesting the most efficient routes based on historical travel data, traffic conditions, and user preferences. As more users interact with the system, the AI will learn from their choices and adapt, improving the accuracy and relevancy of its suggestions. Over time, the system will become smarter by integrating more data, such as real-time traffic analysis and user behavior, making route recommendations even more precise and personalized.

**2.Aims and Objectives:**

In this project, I will be developing the **Nepal Public Transportation Fare Information and Route Optimization System**, which aims to provide an all-in-one solution for users to easily access accurate information about public transportation fares and routes in Nepal. This system will also optimize travel routes, making it more efficient and cost-effective for daily travelers.

The aims and objectives of this system are as follows:

* **Provide Accurate Fare Information**: The system will allow users to input their starting and destination points to retrieve the correct bus fare, minimizing the chances of overpaying for transportation.
* **Optimize Routes**: The system will suggest the most efficient and cost-effective routes, helping users save time and money, while considering factors like traffic and the number of transfers.
* **Offer Discount Management**: The system will help users apply for discounts (such as for students or senior citizens) by verifying required documents and adjusting fare prices accordingly.
* **Real-Time Traffic Updates**: The system will provide live traffic updates to help users avoid congested areas and optimize their travel routes in real time.
* **Personalized User Experience**: Users will be able to save their preferred routes, receive notifications about important updates, and access routes offline, improving their overall experience.
* **Increase Public Transportation Usage**: By providing users with accessible, reliable, and affordable travel options, the system aims to encourage more people to use public transportation, reducing the dependency on personal vehicles and contributing to a more sustainable transport system in Nepal.

**3.Problem Statements:**

Public transportation in Nepal is facing several significant challenges that hinder both passengers and service providers:

* Passengers often face difficulties in finding accurate information about bus routes and fares.
* Without optimized routes, passengers experience longer travel times and inefficient journeys.
* Students and senior citizens are unable to access discounts due to a lack of verification systems.
* The manual update of fares, routes, and discounts leads to errors and outdated information.
* There is no system in place to provide real-time updates on traffic or route changes.
* Overcrowding and longer travel times occur due to a mismatch between passenger demand and available buses.
* Passengers often struggle to find the most affordable routes, resulting in unnecessary expenses.
* The absence of a user-friendly interface for fare and route information makes it harder for passengers to plan their travel.
* Passengers have no platform to provide feedback, and providers lack a way to track system performance.

These problems create an inefficient, inconvenient, and frustrating experience for daily passengers, which also impacts the overall growth of the public transportation system.

**4.The Project as a Solution:**

The Nepal Public Transportation Fare Information and Route Optimization System addresses the various challenges faced by passengers and transport providers. The system will provide effective solutions to the problems listed above in the following ways:

* The system will offer accurate, real-time information about bus routes, fares, and schedules, making it easier for passengers to plan their travel.
* It will optimize routes using AI, reducing travel times and improving the efficiency of journeys for passengers.
* A user-friendly verification system will allow students and senior citizens to access discounts easily, ensuring they benefit from fare reductions.
* The system will automate the updating of fares, routes, and discount information, minimizing errors and ensuring data is always current.
* Real-time traffic updates and route changes will be provided, allowing passengers to stay informed about any disruptions or changes in their journey.
* The system will optimize bus allocation based on passenger demand, reducing overcrowding and ensuring buses are available where needed most.
* Passengers will be able to find the most affordable routes, with fare and route suggestions based on their preferences and budget.
* A clear, easy-to-use interface will allow passengers to quickly find relevant fare and route information, improving their overall travel experience.
* A feedback mechanism will be built into the system, allowing passengers to share their experiences, while providers can track system performance to identify areas for improvement.

1. **Scope and Limitations:**

**Scope**:

* All public transportation routes, fares, and related information will be accessible in one platform.
* The system will provide optimized route suggestions based on user input, such as preferred routes and budget.
* Real-time updates for bus schedules, traffic, and route changes will be included for accurate planning.
* Admin dashboard for managing fares, routes, and user verification, including discounts.
* Secure login system for users and admin to ensure privacy and data protection.
* Fare and route information will be easily accessible for passengers through a user-friendly interface.
* The system will allow for notifications about discounts, fare changes, and route updates.
* Feedback mechanism will be included to help improve the system and services provided.
* Historical data of routes, fares, and user interactions will be stored for analysis and reporting.

**Limitations**:

* Users will need to create an account to access personalized features such as saving routes or receiving notifications.
* The system depends on real-time data, so inaccuracies may occur if traffic or route information is not updated promptly.
* The system will only support bus routes within Nepal, limiting its use to the national transportation network.
* The system may require periodic updates and maintenance to ensure accuracy and to handle an increasing number of users.
* Users may face limitations in accessing services if they do not have an internet connection or encounter connectivity issues.

**6. Research Paper Review**

This section discusses different research papers and studies related to public transport fare systems, route optimization, and the use of AI and machine learning in transportation. These studies provide valuable insights that are relevant to the development of my project.

#### 6.1 Public Transport Fare Systems

Public transportation systems worldwide often face challenges in managing fares effectively. A study on modern fare management systems highlighted the use of digital payment options and automated fare calculations to simplify the process for both passengers and administrators. These systems enable users to access fare details easily, apply discounts, and make cashless payments, reducing the need for manual processes.

The integration of centralized fare systems allows administrators to quickly update fare structures and ensure accuracy. This reduces errors and ensures passengers always receive up-to-date information. For my project, studying these systems has helped me understand how to implement features like dynamic fare calculations and discount management for students and senior citizens, creating a smoother experience for all users.

#### 6.2 AI and Machine Learning in Transport Systems

Artificial intelligence (AI) and machine learning (ML) are increasingly being used in transportation to improve decision-making and enhance services. A study on AI applications in public transport showed how predictive models can analyze data to forecast traffic patterns, passenger behavior, and demand. This helps administrators plan better routes, schedules, and resource allocation.

For example, AI can be used to suggest alternate routes during peak traffic or recommend the best bus for a specific journey. Machine learning algorithms can also personalize the user experience by learning from past travel preferences. In my project, AI will be used to recommend optimized routes and improve the accuracy of fare and schedule information, making the system smarter and more user-friendly over time.

#### 6.3 Route Optimization in Transportation

Route optimization plays a key role in improving the efficiency of public transport. A study focused on urban transportation highlighted how optimized routes can reduce travel time and fuel costs while improving the overall user experience. By analyzing factors such as traffic conditions, passenger density, and peak hours, transport systems can adjust routes dynamically to meet demand.

Such systems often use algorithms like Dijkstra's Algorithm and GPS-based tracking to identify the best routes in real-time. This ensures that buses and other vehicles operate efficiently and passengers reach their destinations faster. For my project, route optimization will help users find the most efficient and cost-effective routes while minimizing delays caused by traffic or other disruptions.

### Algorithms for Route Optimization

#### ****Dijkstra’s Algorithm****

* Used for finding the shortest path between stops, ensuring efficient route suggestions for users.

#### ****K-Means Clustering****

* This algorithm groups bus stops into clusters based on passenger density, helping to identify areas with high or low demand. By analyzing these clusters, the system can allocate buses and schedule routes more efficiently, reducing overcrowding and ensuring better service coverage.

#### ****Traffic Prediction Algorithm****

* Predicts traffic congestion using real-time data, enabling the system to adjust routes dynamically for better travel times.

#### ****Budget Allocation Algorithm****

* Helps in fare calculation by analyzing operational costs and discount policies, ensuring sustainable pricing for users.

### ****Artifacts in Detail:****

The **Public Transportation Fare Information and Route Optimization System** will be a comprehensive platform designed to streamline public transportation services. This system aims to optimize routes, manage fare structures, and enhance the overall experience for both travelers and transportation providers. The key components of the system will include:

**1. Fare and Route Database:** The system allows for the centralized storage and management of transportation routes, fare structures, and stops. This ensures that fare details, route information, and transportation schedules are easily accessible and can be updated seamlessly when required. It also provides users with up-to-date and accurate data on routes and fares in real-time.

**2. Route Optimization and Management Tool:** This tool helps administrators monitor and adjust routes based on real-time traffic and commuter demand. It allows the system to suggest more efficient routes or modify existing ones to save time and reduce congestion. This feature ensures that transportation services are optimized for efficiency, minimizing delays, and maximizing productivity.

**3. Intuitive User Interface:** The interface is designed to offer an easy-to-navigate and user-friendly experience for both commuters and administrators. The simplicity of the design ensures that travelers can quickly access route and fare information, while administrators can manage and update transportation data effortlessly.

**4. Fare Information Management System:** The system includes a comprehensive fare information management feature that provides travelers with real-time fare calculations based on routes, stop distances, and passenger categories (e.g., student, senior citizen). This tool will enable travelers to easily check fare details for any journey within the public transportation network. It also allows for updates and modifications to fare structures, ensuring that the information remains current and accurate. This feature ensures that travelers can access transparent and up-to-date fare details, helping them make informed decisions about their travel.

**5. Traveler Management System:**  
The traveler management feature stores and organizes traveler information, such as name, contact details, past trips, and fare payments. This system allows for personalized services, such as loyalty programs or targeted discounts for frequent travelers, enhancing traveler satisfaction and retention.

**6. Real-Time Traffic and Route Monitoring:** This functionality allows administrators to monitor traffic conditions, delays, and disruptions in real-time. It offers insights into the performance of each route, enabling the admin to make adjustments or provide updates to commuters when necessary. This helps maintain smooth operations and keeps travelers informed.

**7. Analytics and Reporting Tools:**  
The system includes tools to track and analyze key information like traveler behavior, route performance, and fare details. These insights help improve services and make better decisions for the future.

**8. Notifications and Alerts:** Commuters receive timely updates on route changes, delays, or cancellations through notifications and alerts, keeping them informed about their journeys in real-time. The system also sends alerts to administrators for important tasks, such as system maintenance or fare adjustments.

**9. Project and Service Dashboard:**  
The dashboard shows important information like how well routes are performing, how much fare is being collected, and feedback from travelers. It helps administrators keep track of how the service is running and monitor progress on tasks.

### ****11. Tools and Technologies****

For my **Nepal Public Transportation Fare Information and Route Optimization System**, I will be using the following tools and technologies:

**11.1 Python**

Python is an easy-to-use programming language. It’s great for building the back-end (server-side) of the system, handling tasks like calculating fares, managing routes, and interacting with the database. Python is chosen for its simplicity and wide use in web development.

**Why use Python:**

* Easy to understand and write code.
* Has many libraries that help with tasks like machine learning and web development.
* Has a large community for help and resources.

**11.2 Django Framework**

Django is a web framework that works with Python. It makes it easier to build websites and web apps by providing tools for handling things like databases, user logins, and page routing. I’ll use it to build the public transportation system.

**Why use Django:**

* Provides built-in tools for managing users, databases, and routing.
* Makes it easy to connect to machine learning tools for route optimization.
* Helps create APIs, which can be used for apps or future updates.

**11.3 MySQL Database**

MySQL is a popular database system. It will store important information like bus routes, fares, and user data. MySQL helps manage and organize large amounts of information easily.

**Why use MySQL:**

* Can handle a lot of data, such as bus routes and passenger information.
* Works well with Django to store and retrieve data quickly.
* Ensures that all data is safe and accurate.

**11.4 Google Maps API**

Google Maps API will help show the bus routes, provide real-time travel information, and calculate distances. It will be used to show the best routes and travel times.

**Why use Google Maps API:**

* Helps create interactive maps with bus routes and traffic information.
* Provides real-time updates on travel time and delays.
* Easy to connect with Django for dynamic route display.

**11.5 AI/Machine Learning Techniques**

I will use AI techniques like machine learning to help with route optimization. This includes analyzing traffic and passenger data to suggest the best routes.

**Why use AI/Machine Learning:**

* Helps the system learn and improve route recommendations over time based on real data.
* AI tools can suggest the most efficient routes based on factors like traffic and number of passengers.
* Makes the system smarter and more useful for travelers.

These tools and technologies will help create an efficient and smart transportation system for Nepal, making travel easier and more reliable for everyone.

**12.Reference**