IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

E-TRANSIT

Revolutionizing Public Transport through Sustainable Technology

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Abstract: The E-Transit Platform is designed to enhance bus services in rural areas by leverage the General Transit Feed Specification (GTFS) for improved route and schedule planning. By utilizing real-time data, the platform ensures that bus operations are more efficient and cost-effective. It facilitates seamless communication between buses, stops and central management system, which guarantees reliable and timely services. Passengers benefit from a user-friendly interface that allows them to easily track bus locations and schedules, making their commuting experience more convenient and accessible. This platform not only optimizes operational efficiency but also enhances the overall quality of public transportation in rural regions, promoting better connectivity and accessibility for residents.

Index Terms – General Transit Feed Specification, Transit Information.

I. INTRODUCTION

In today's fast-paced world, efficient and reliable transportation is essential for ensuring smooth mobility and accessibility. While urban areas have benefitted from advanced transit systems, transit system, rural regions still face major transportation challenges, including irregular schedules, lack of real-time tracking, and unreliable arrival times. To bridge this gap, we introduce an E-Transit Platform, an innovative solution designed to transform the rural transportation experience by leveraging modern GPS technology and the General Transit Feed Specification (GTFS).

Safety is a key priority, and real-time tracking helps passengers feel more secure, knowing the exact location of their buses. This feature is particularly beneficial for students, elderly travellers, and individuals commuting in remote areas. The core idea behind this project is to develop a data-driven transit system that collects and processes information about buses, drivers, and bus stations. The system will create multiple routes covering different sets of bus stops. While buses operate along their designated routes, they will continuously transmit their location data to the system, along with the route details.

By utilizing GPS, GTFS feeds our system processes this data in real-time to provide passengers with precise arrival time estimate and expected wait times bus stations. This approach enhances transit efficiency, making it easier for rural commuters to plan their journeys with greater accuracy.

A critical objective of the E-Transit Platform is to optimize location tracking by building a robust system that collects and analyzes comprehensive data about buses, drivers, and bus stations. The platform facilitates the creation of distinct bus routes, each encompassing various sets of bus stations. As buses traverse their designated routes, they continually transmit location data along with route-specific information to the central system. This data-driven approach allows for precise monitoring of bus movements, enabling the system to provide users with accurate predictions regarding bus arrivals at their chosen stations.

Safety, a paramount concern for passengers, is seamlessly addressed through the platform's real-time tracking capabilities. By offering live updates on bus locations, the system fosters a sense of security among

passengers, ensuring they are always informed about their transit journey. This focus on safety is particularly impactful in rural areas, where unpredictable transit schedules often pose challenges for commuters. Apart from convenience and efficiency, **safety is another critical aspect** of the E-Transit Platform. With real-time tracking, passengers can feel more secure, knowing the exact location of their buses at any moment. This is especially important for **students, senior citizens, and women travelers**, who may feel vulnerable while waiting at isolated bus stops. This mechanism not only helps passengers plan their travel efficiently but also enables transport authorities to monitor fleet operations, optimize routes, and enhance overall service management. By utilizing predictive analytics, the system can also estimate wait times and travel distances, making public transportation more reliable and user-friendly.

1.1 Aim and Scope of work

To provide real-time bus tracking and transit information for rural passengers using GPS, GTFS, and third-party APIs to enhance efficiency, reliability, and safety in public transportation.

Key Objectives:

1. Implement route mapping and predictive algorithms to calculate and display expected arrival times at bus stops.
2. Develop an intuitive mobile and web-based platform for seamless access to bus schedules, routes, and live tracking.
3. Provide a user-friendly interface for easy navigation and interaction.
4. Integrating real time tracking and alert mechanism to improve security.
5. Utilize GPS and GTFS to provide real-time location updates of buses.

1.2 Scope of Work

For this study secondary data has been collected. From the website of KSE the monthly stock prices for the sample firms are an E-Transit Platform is designed to enhance rural transportation by leveraging GPS technology and GTFS (General Transit Feed Specification) to provide real-time bus tracking and estimated arrival times. The platform aims to improve efficiency, safety, and accessibility for passengers, offering seamless travel experiences with minimal delays. The following outlines the scope of work for this project.

1. User Registration and Profile Creation:

- User registration and login functionality.

- User profiles with details such as name, preferred routes, and travel history.

2. Data Collection and Aggregation:

- Gathering and organizing bus schedules, routes, stops, and real-time location data from GPS, GTFS, and third-party APIs.

- Collecting passenger travel patterns to optimize route planning.

3. Real-Time Bus Tracking System:

- Implementing a GPS-based system to track buses in real-time.

- Displaying bus locations on a map interface for passengers and administrators.

4. Route and Schedule Management:

- Creating and managing bus routes, stops, and schedules.

- Dynamically updating routes based on traffic conditions or delays.

5. Passenger Information System:

- Providing passengers with real-time updates on bus locations and expected arrival times.

- Sending notifications for schedule changes, route diversions, or delays.

2.1 Literature Survey

A literature survey on E-Transit Platforms highlights the increasing focus on utilizing GPS and GTFS-based systems to enhance public transportation services, particularly in rural areas. Researchers have explored various aspects of real-time bus tracking, route optimization, estimated arrival time predictions, and passenger safety improvements. Below is an overview of some key studies related to this domain:

1. Real-Time Bus Tracking System Author: Mr. S. Kumar, R. Singh. **Published:** 21 June 2020

This paper presents a real-time bus tracking system using GPS and GSM modules to provide location updates to passengers. The study emphasizes the importance of real-time tracking in reducing passenger waiting times and improving public transportation efficiency.

2. Title: Enhancing Public transport with GTFS and Mobile Application
Author: A. Patel, M. Sharma

Published: September 2018

This research explores how GTFS feeds can be utilized to structure public transport data and improve mobile applications. It discusses the integration of third-party APIs to provide accurate ETA (Estimated Time of Arrival) and route information for better user experience.

3. Title: Review of Intelligent Transport systems for smart cities
Author: P. Mehta, R. Gupta
Published: March 2021

This paper provides an overview of intelligent transportation systems (ITS), focusing on how GPS-based bus tracking and predictive analytics can enhance public transit services. It highlights the importance of data-driven decision-making in optimizing routes and schedules.

4. Title: Enhancing Public transport with GTFS and Mobile Application
Author: A. Patel, M. Sharma

Published: September 2018

This research explores how GTFS feeds can be utilized to structure public transport data and improve mobile applications. It discusses the integration of third-party APIs to provide accurate ETA (Estimated Time of Arrival) and route information for better user experience.

3.1 Existing System

Several existing systems are currently used for public transportation tracking, providing real-time information to passengers. These systems primarily utilize GPS, GTFS. Below are a few notable examples:

Google Maps Transit: - Google Maps Transit is one of the most well-known platforms for travel recommendations. It provides user-generated content, including reviews, ratings and trips of Buses, restaurants and attractions, to help passengers make informed decisions.

Disadvantage: One common disadvantage of systems like TripAdvisor is that they often rely heavily on user-generated content and reviews. While this can provide valuable insights

4.1 Methodology

In the E-Transit Platform, the core methodology revolves around real-time bus tracking, arrival time prediction, and route optimization using GPS, GTFS, and third-party APIs. The system utilizes various data processing and machine learning techniques to enhance the accuracy and reliability of transit services for rural areas.

4.1.1 GPS and GTFS Integration

- Global Positioning System (GPS): Used for real-time tracking of buses by continuously updating their location coordinates.
- General Transit Feed Specification (GTFS): A standardized format for storing transit schedules and route data, enabling smooth integration with mapping services.
- GTFS-Realtime (GTFS-RT): Extends GTFS to provide real-time updates on vehicle positions, trip updates, and service alerts.

4.1.2 Real-Time Bus Location Tracking:

- Data Collection: The system collects real-time GPS data from buses, updating their location at frequent intervals.
- Data Processing: The location data is processed and mapped onto the predefined routes stored in the GTFS dataset.
- Live User Display: Passengers can view buss locations, estimated arrival times, and routes via a mobile app or web Platform.

4.1.3 Arrival Time Prediction:

- Route Matching: The system maps live GPS data to existing GTFS routes, ensuring accurate tracking.
- Traffic & Delay Considerations: Uses historical trip data and real-time traffic API integration to refine arrival time estimates.
- Live User Display: Passengers can view buss locations, estimated arrival times, and routes via a mobile app or web Platform.

4.2. Techniques Developed The system is proposed to have the following modules along with functional requirements.

1. Data
2. Data Pre-processing
3. Scoring Rule
4. Select Best Features
5. Classification
6. Performance Analysis

1. **Data:** The entities such a s agency, routes, trips and other represent data elements of the system. Managing and storing data from these entities is a foundational requirement

2. Data Pre-processing: In this module selected data is formatted, sampled. The data pre-processing includes following steps:

2.1 The entities in the system such as agency, routes and trips are interlinked through unique identifiers like. agency_id and route_id. preprocessing becomes essential to organize these datasets systematically, ensuring connection between identifiers are accurately mapped.

2.2 Beyond organization, cleaning the datasets eliminates duplicates, errors, or irrelevant information that might hinder system functionality. Additionally, transformation is carried out to convert raw data into formats that align with the system's requirements, making it easier to analyze and utilize for subsequent processes.

3. Scoring Rule: Scoring rules are critical to enhancing system performance by ranking or prioritizing different components based on data-driven insights. Vehicle position accuracy may be scored by analysing deviations from expected routes or timeliness. These scoring rules provide a structured way to optimize decisions and allocate resources efficiently, ensuring the system operates effectively under varying conditions.

4. Select Best Features: Extracting key features is pivotal to refining the system's functionality and boosting overall performance. For instance, identifying critical attributes like stop locations, trip timings, or alert severity levels allows for efficient data processing. Ensures more accurate analysis, resulting in smoother

operations and higher reliability.

5. Classification: Classifying data into meaningful categories. For instance, trips could be categorized by time, vehicle type, or frequency; alerts could be grouped by severity.

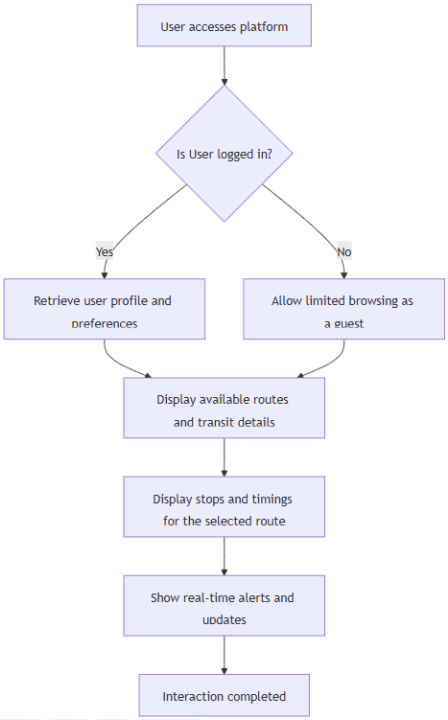


Fig. 1 Flowchart shows user interaction

1. User provide input and preferences.
2. The system collects and analyses user data.
3. This system is used to generate trips using GTFS.
4. The systems filters recommendations based on your preferences.
5. A list of trips available.

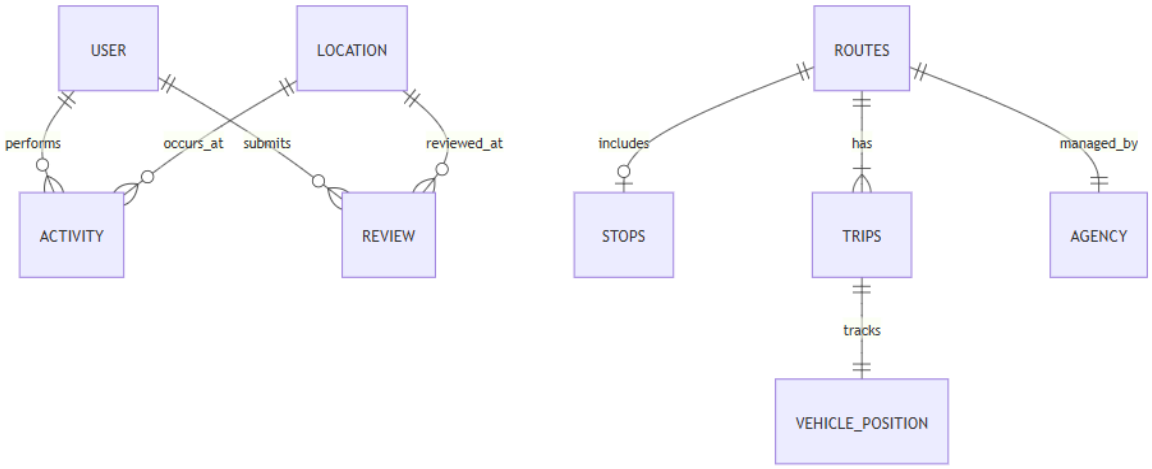
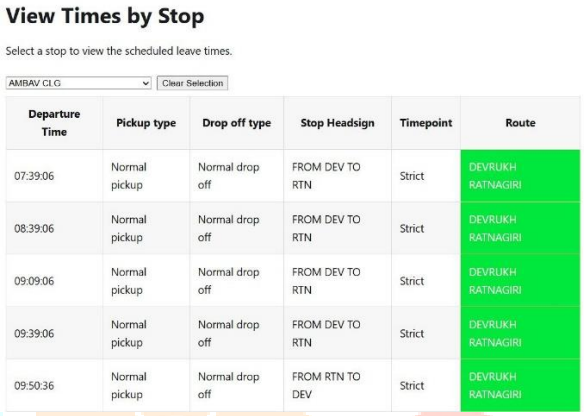


Fig. 2 ER Diagram of System

Creating a comprehensive Entity-Relationship (ER) diagram for a E-Transit system would require careful consideration of the specific requirements, but here's a simplified representation to give you an idea:

1. User
2. Location
3. Activity
4. Review
5. Routes

5. Information about GTFS:



View Times by Stop

Select a stop to view the scheduled leave times.

AMBAV CLG Clear Selection

Departure Time	Pickup type	Drop off type	Stop Headsign	Timepoint	Route
07:39:06	Normal pickup	Normal drop off	FROM DEV TO RTN	Strict	DEVRUKH RATNAGIRI
08:39:06	Normal pickup	Normal drop off	FROM DEV TO RTN	Strict	DEVRUKH RATNAGIRI
09:09:06	Normal pickup	Normal drop off	FROM DEV TO RTN	Strict	DEVRUKH RATNAGIRI
09:39:06	Normal pickup	Normal drop off	FROM DEV TO RTN	Strict	DEVRUKH RATNAGIRI
09:50:36	Normal pickup	Normal drop off	FROM RTN TO DEV	Strict	DEVRUKH RATNAGIRI

Fig 3.: GTFS Information

Table 4.1 displayed a GTFS Information for a E-Transit Platform visually represents the interactions and flow of activities among various components or actors within the system. Here's a brief description of the key elements and their interactions in a sequence diagram for such a system:

1. User:
The user starts by interacting with the platform through a web or mobile application to search for transit options or routes.

2. Agency:
The platform retrieves information about transit agencies, including schedules, stops, and vehicle details, to provide accurate recommendations.

3. Data Collection:
Data is continuously gathered from multiple sources, including user preferences, historical usage data, current transit schedules, and real-time updates like vehicle positions and delays.

4. Location:
Location-based information is utilized to refine recommendations, suggesting routes, nearby stops, or points of interest that match the user's location and travel needs.

5. Recommendation Engine:
Based on the collected data and user preferences, the recommendation system generates personalized options for transit routes, alternative travel methods, or relevant alerts.

6. User Interface:
The personalized recommendations are presented to the user in an interactive and intuitive interface, allowing them to make informed decisions or explore further.

6.1 Experimental Setup

6.1.1 Endpoints: We have imported libraries and we have read the csv file and then checked first five records.

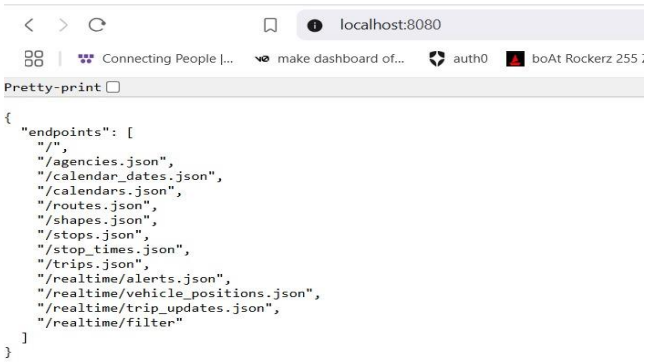


Fig 4.1: Endpoints

6.1.2 Data Pre-processing:

Data Pre-processing involves cleaning, transforming and organizing data to improve its quality and suitability for the system.

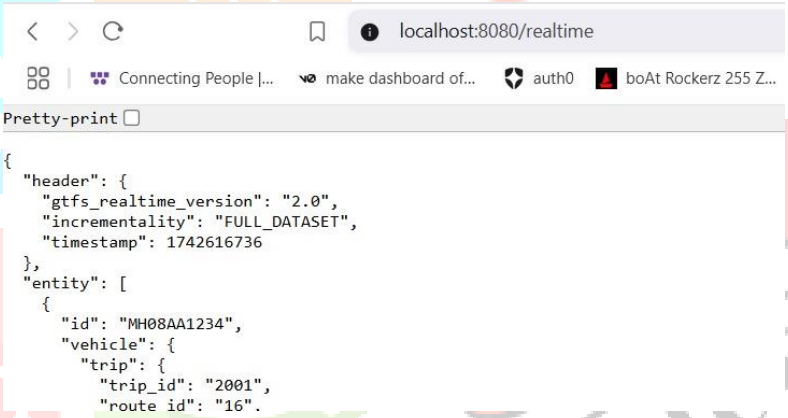


Fig 4.2: Endpoints

6.1.3 Overview Page: The "Overview Page" page of a E-transit Platform provides an overview of the platform's mission, team, and commitment to delivering personalized and reliable travel experiences.

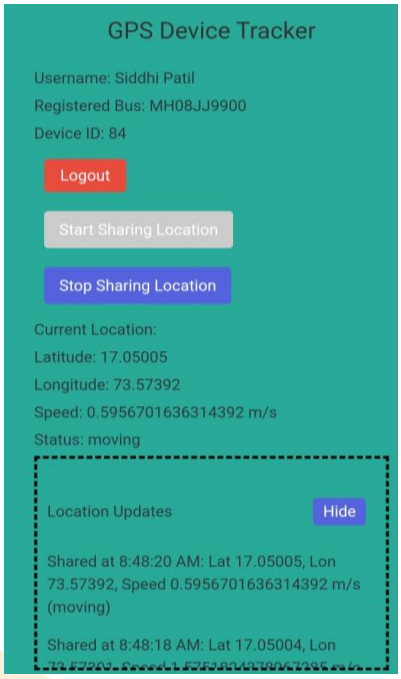


Fig 4.3: Overview page

6.1.4 Mapping Page: A tourism recommendation system destination page presents curated information, user reviews, and personalized suggestions for a specific travel location.

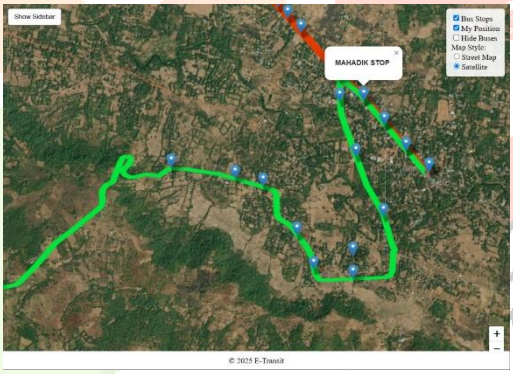


Fig 4.3: Mapping page

6.1.5 Route: This page of a E-Transit Platform provides a platform for users to reach out for inquiries, support, or feedback regarding their travel experiences or the platform's services.

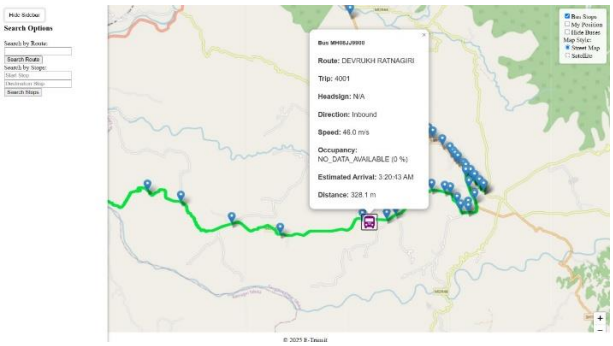


Fig 4.4: Route Information page

7. **Test Cases**

Test Case ID	**Test Case Description**	**Input**	**Expected Output**	**Pass/Fail**
TC-01	Mapping Bus Stops in Devrukh	City: Devrukh	List of Buses Used in Mapping Ratnagiri	Pass
TC-02	Mapping Bus Stops in Devrukh	Location: Ratnagiri	List of Frequently used buses in The route	Pass
TC-03	Mapping Bus Stops in Devrukh	User preferences: Efficient Service	Tailored trips based on preferences	Pass
TC-04	Handling invalid input	Location: Null	Error message: "Invalid location entered"	Pass
TC-05	Testing search functionality	Keyword: Statue of Moving	Relevant search results displayed	Pass
TC-06	Testing sorting functionality	Sort by: Bus Stops	Frequently Used buses listed in order of popularity	Pass

7. Conclusion and Future Scope

The development of an E-Transit Platform for rural transportation addresses key challenges in accessibility, efficiency, and safety by leveraging GPS and GTFS technologies.

By integrating real-time bus tracking, estimated arrival times, and safety features, the platform enhances the commuting experience for rural populations. The system improves operational efficiency for transit authorities while offering travelers accurate and reliable information, reducing wait times and uncertainty. The use of GTFS-Realtime ensures seamless data updates, providing up-to-date transit information and enabling better decision-making for both users and operators.

The future scope of the E-Transit Platform lies in enhancing rural transportation with AI-driven predictive analytics, real-time data integration, multi-modal connectivity, and advanced safety features. By integrating real-time bus tracking, estimated arrival times, and safety features, the platform enhances the commuting experience for rural populations. The system improves operational efficiency for transit authorities while offering travelers accurate and reliable information, reducing wait times and uncertainty. These advancements will improve efficiency, accessibility, and user experience, transforming public transit in underserved areas.

- Personalization and Context-Aware Recommendations
- Seamless Transportation
- Mobile Application and User-Centric Features
- Enhanced Safety and Security Measures

REFERENCES

[1] Phadatare Suraj, The “Real Time Bus Tracking System” 5(3): 10.48175/IJARSCT-3224

[2] Kumbhar, Manini, Survase, Meghana, Mastud, Pratibha, and Salunke, Avdhut. "Real Time Web Based Bus Tracking System." *International Research Journal of Engineering and Technology (IRJET)*, vol. 3, no. 2, Feb. 2016. 33(3): 663-682.