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GPS Based Real-Time Seat Availability & Location Updation Using IoT

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ABSTRACT: To develop a real-time bus tracking and seat availability system by leveraging GPS technology and a web-based platform. The system integrates a GPS module to obtain real-time location data of buses, which is dynamically updated in a centralized database for user access. Seat count is automatically updated at every stop through an IoT device that calculates the number of passengers boarding and alighting. Seat availability is managed via a web application that records boarding and alighting points, ensuring up-to-date seat status at each stop. Passengers can access this information through a mobile application, enabling them to plan their journeys more effectively. Additional features such as emergency alerts and live notifications further enhance passenger safety and experience. By implementing this GPS-based bus tracking system, public transportation can become more efficient, reliable, and user-friendly encouraging greater adoption, reducing private vehicle usage, easing traffic congestion, and promoting sustainable urban mobility.

KEYWORDS: GPS Module, Raspberry pi, Wi-Fi Module, Seat availability, IoT.

I. INTRODUCTION

Public transportation plays a crucial role in the daily lives of millions, yet it continues to face persistent challenges that impact efficiency and user satisfaction. The current system primarily relies on static schedules and manual tracking methods, often resulting in limited real-time visibility, longer wait times, and unpredictable travel experiences. Seat management is also handled manually, making it difficult for commuters to anticipate seat availability leading to discomfort and overcrowding. Additionally, traditional ticketing systems depend on cash or physical cards, which can be inconvenient and error-prone. These inefficiencies discourage potential users and hinder the wider adoption of public transit as a reliable means of transportation. To address these challenges, this project proposes a smart, IoT-enabled transportation management system that leverages modern technologies to enhance service reliability, improve passenger convenience, and optimize resource utilization. By integrating GPS-based bus tracking, real-time seat monitoring, and automated seat count updates during each stop, the system aims to transform public transport into a more responsive, accessible, and user-friendly experience.

II. LITERATURE SURVEY

[1] The system titled "Real Time Bus Tracking System" proposes an Android application designed to address the challenges faced by commuters in bustling metropolitan cities like Mumbai. Often, passengers lack accurate information about bus routes, timings, and real-time locations, leading to inconvenience and wasted time. This application aims to overcome these issues by integrating GPS technology and a user-friendly interface. Commuters can access live updates on the location of their selected bus, the estimated time of arrival, and the distance to their current position. The Google Maps API and distance matrix algorithm are employed to provide real-time updates and ensure a seamless user experience.

[2] The study "A Field Study of Internet of Things-Based Solutions for Automatic Passenger Counting" focuses on improving urban transport systems through the implementation of Automatic Passenger Counting (APC) technologies. With the growing need for efficient and sustainable public transport services, the study evaluates four APC

solutions: video, floor-based sensing, Wi-Fi, and infrared technologies. Each method was tested through a seven-day field study in Sydney, Australia, under real operating conditions. Each APC method achieved over 70% accuracy in specific scenarios, but the study highlighted variations based on conditions like weekend trips and weekday distances between stops.

[3] The method titled "Bus Arrival Time Prediction Based on LSTM and Spatial-Temporal Feature Vector" focuses on addressing the complexities in predicting bus arrival times, which is essential for improving public transportation efficiency and alleviating urban traffic congestion. The authors propose a hybrid prediction model combining Long Short-Term Memory (LSTM) networks and Artificial Neural Networks (ANN), utilizing temporal and spatial feature vectors. By analyzing historical data through temporal feature vectors and integrating real-time spatial data, the model aims to balance the challenges of long-term dependencies and short-term unpredictabilities in traffic conditions.

[4] Another significant contribution focuses on predicting passenger numbers in public transit systems. The paper introduces a hybrid forecasting approach that integrates historical Automated Passenger Counting (APC) data with real-time occupancy observations. The methodology involves a two-step process: a baseline predictor trained on historical trends, followed by a real-time adjustment model that refines predictions based on observed deviations. This approach significantly improves prediction accuracy, especially for short-term forecasts, by capturing emerging travel patterns in real time.

III. METHODOLOGY

3.1 IoT Integration and Real-Time Monitoring

IoT-enabled sensors are deployed to monitor seat occupancy, passenger movement, and bus stop locations. A GPS module is integrated to continuously transmit real-time bus location data to a centralized cloud server, ensuring dynamic synchronization of updates. RGB LED indicators are used within the bus to visually display seat availability, enhancing transparency for passengers. Additionally, voice-assisted stop announcements are implemented to improve accessibility, particularly for differently-abled passengers, while also reducing the operational workload on the bus crew.

3.2 Web and Mobile Interface Development

A centralized, web-based platform serves as the system's user interface, delivering real-time data on bus routes, locations, and seat availability. The platform is accessible through both web and mobile applications, offering a user-friendly experience across devices. Passengers can track buses, receive live alerts, and monitor journey progress, thereby minimizing uncertainty and aiding efficient travel planning.

3.3 Smart Ticketing and Digital Fare Collection

The system incorporates QR code-based ticketing and UPI-enabled digital fare collection to streamline the boarding and payment process. Fares are automatically calculated based on the passenger's travel distance, eliminating the need for manual fare management. All transactions are securely stored in a cloud database, allowing transportation authorities to remotely monitor operations, ensure data security, and manage fare systems more efficiently.

IV. SYSTEM ARCHITECTURE

The System Architecture Diagram illustrates IoT-based smart transportation solution that integrates GPS tracking, cloud data storage, and real-time user interfaces to optimize bus transportation services. The core components include Raspberry Pi devices, GPS modules, cloud databases, and web-based user interfaces. The primary goal is to provide passengers and depot administrators with real-time bus location and seat availability data, enhancing public transport efficiency and reliability.

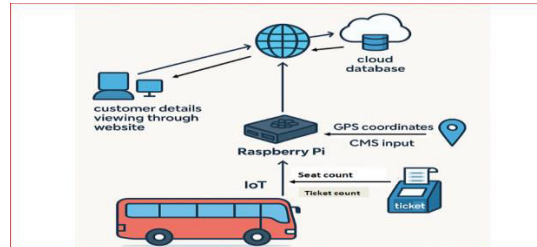


Figure -1: Architecture Diagram

4.1 IoT Integration in Smart Bus

The bus is equipped with IoT-enabled sensors to track seat count and ticket issuance. These devices continuously monitor passenger flow and operational data, sending real-time updates to the Raspberry Pi for processing. This ensures automated data collection and improves overall efficiency and accuracy in managing onboard passenger information.

4.2 Raspberry Pi as Edge Controller

Raspberry Pi functions as the central edge controller, receiving input from bus IoT devices. It gathers GPS coordinates, seat count, and ticket data, processes it locally, and forwards relevant data to the cloud database. It acts as a smart gateway between the physical bus system and cloud-based infrastructure.

4.3 Cloud Database for Centralized Storage

The processed data from Raspberry Pi is transmitted to a cloud-based database. This database securely stores all relevant data, including GPS locations, seat availability, ticket transactions, and CMS inputs. It enables data analytics, remote access, and seamless synchronization with customer-facing platforms for real-time transportation insights.

4.4 Customer Web Portal for Live Updates

Users can access a web portal to view live bus tracking, available seats, and other ticketing information. This portal retrieves real-time data from the cloud database, allowing customers to plan trips better. It enhances user experience with accurate travel insights, improving convenience, transparency, and satisfaction in public transportation.

V. DATA FLOW DIAGRAM

The data flow diagram represents the workflow of a bus tracking application. It starts with a splash screen, leading to a homepage where users can choose to search for a bus, enter a bus number, or view nearby buses. Based on the selected option, the system retrieves and displays relevant information such as bus routes, available buses, or nearby buses. For enhanced user experience, it also provides a live tracking feature, showing the real-time location of the selected bus on a map, helping users plan their travel efficiently.

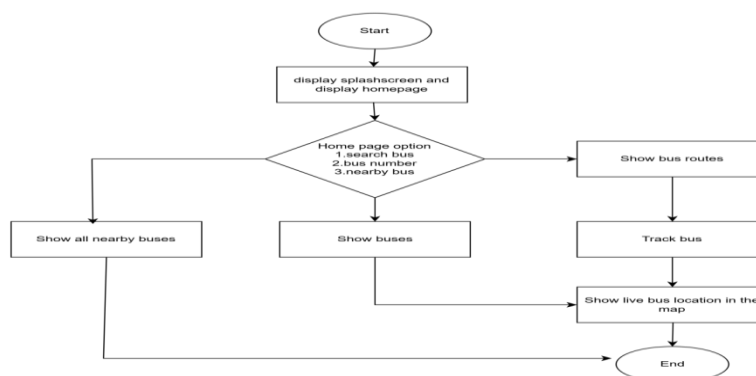


Figure -2: Data Flow Diagram

5.1 Application Initialization and Homepage Display

The application begins by launching a splash screen, followed by loading the homepage. This initial phase ensures branding visibility and system readiness. It sets up the interface for users to interact with various bus tracking features, offering a smooth and informative entry point into the application.

5.2 Homepage Navigation Options

The homepage presents users with three main options: searching a specific bus, entering a bus number, or checking nearby buses. This design allows flexible interaction, catering to both regular commuters and new users seeking route or proximity-based information for better travel planning and decision-making.

5.3 Nearby Bus Display Function

When a user selects the nearby bus option, the system fetches and displays all buses within a predefined geographic radius. This helps users quickly find buses close to their location, enhancing convenience and enabling faster commuting choices based on real-time location tracking data.

5.4 Bus Search and Route Information

Choosing to search by bus number displays a list of buses associated with that input. Users can then view the selected bus route, including all stops and destinations. This feature supports route planning and enables passengers to make informed decisions before starting their journey.

5.5 Live Bus Tracking Feature

Once a specific bus is selected, the system allows the user to track its live location. The map interface displays real-time bus movement, using GPS data. This feature helps passengers monitor bus progress, avoid delays, and improve time management by providing precise bus positioning on the map.

VI. SYSTEM REQUIREMENTS

- Programming Languages (Python, HTML, CSS): Used for backend processing, web interface design, and frontend development.
- Flask Framework: A lightweight web framework for building the backend and managing requests between the application and database.
- MySQL or Firebase Database: Stores real-time bus tracking data, seat availability, and ticketing information securely.
- JavaScript: Enhances the web application's interactivity, enabling dynamic content updates.
- Google Maps API: Provides real-time bus tracking and navigation features, improving route visibility.


VII. RESULT

The image displays a bus schedule search interface along with available bus options. It lists three buses (TN4806, Route 48AD) traveling from Arapalayam to Thirumangalam. The buses depart at 6 a.m., 9 a.m., and 12:30 p.m. with respective seat availability of 28, 8, and 45. The table is color-coded based on seat count, helping users quickly identify seat availability.

Search Bus Schedules

From:

To:

Time (24-hour format):
 

Search

Available Buses:











Bus No	Route No	From	To	Departure Time	Seat Count
TN4806	48AD	Arapalayam	Thirumangalam	6 a.m.	28
TN4806	48AD	Arapalayam	Thirumangalam	9 a.m.	8
TN4806	48AD	Arapalayam	Thirumangalam	12:30 p.m.	45

Figure -3: Seat Availability

The image shows a booking list with five entries, detailing passenger names, travel schedules, seat counts, payment amounts, and statuses. Most bookings are marked "Paid," while one remains "Pending." Each entry also includes view and delete action buttons for management.

List of Bookings

Show 10 entries Search:

# ↑	Booked By	Schedule	Seats	Payable	Status	Action
1	Mark Cooper	2022-03-25 09:00 AM 1001 Non-Stop	3	1,050.0	Paid	 
2	test	2022-03-25 09:00 AM 1001 Non-Stop	1	350.0	Paid	 
3	Sample	2022-03-25 01:00 PM 1001 Non-Stop	2	750.0	Paid	 
4	Clairy Blake	2022-03-24 03:00 PM 1002 Economy	2	350.0	Paid	 
5	Mark	2022-03-25 01:00 PM 1001 Non-Stop	3	1,125.0	Pending	 

Showing 1 to 5 of 5 entries Previous 1 Next

Figure -4: List of Bookings

VIII. CONCLUSIONS

The proposed intelligent transportation system offers a transformative upgrade to conventional public transit by integrating real-time tracking, IoT-based seat monitoring, and automated seat count updation during ticket purchases. With the incorporation of GPS modules and a centralized database, passengers gain accurate visibility of bus locations and receive live updates, reducing uncertainties and improving journey planning. IoT sensors facilitate dynamic seat occupancy management, minimizing overcrowding and ensuring optimal space utilization. The real-time updating of seat availability upon each ticket transaction enables passengers to make informed decisions, ultimately enhancing their overall travel experience. In summary, this system effectively addresses the limitations of current public transportation

infrastructure and fosters the evolution of a connected, data-driven, and passenger-centric transit ecosystem. By leveraging smart technologies, the project contributes to a more efficient, reliable, and sustainable urban mobility solution that aligns with the growing expectations of modern commuters.

IX. FUTURE ENHANCEMENTS

- UPI Payment Module: Enables secure and seamless online ticket booking, reducing reliance on cash transactions.
- Smart Traffic Signal Integration: AI-powered traffic signal synchronization to prioritize public transport at intersections and reduce travel time.
- Voice-Based Assistance: NLP-driven interactive commands and alerts to assist visually impaired passengers in navigating bus schedules and ticket bookings.
- Blockchain-Based Ticketing: Secure, tamper-proof blockchain transactions to prevent fraud and enhance ticket validation.

REFERENCES

1. Akshay Sonawane, Ankeet Bhanushali, Kushal Gogri, Milind Khairnar, "Real Time Bus Tracking System." International Journal of Engineering Research & Technology (IJERT), vol. 9, no. 6, June 2020, IJERT.
2. Chris McCarthy, Irene Moser, Premprakash Jayaraman, Hadi Ghaderi, Adin Ming Tan, Ali Yavari, Ubaid Mehmood, Matthew Simmons, Yehuda Weizman, Dimitrios Georgakopoulos, Franz Konstantin Fuss, and Hussein Dia, "A Field Study of Internet of Things-Based Solutions for Automatic Passenger Counting," IEEE Open Journal of Intelligent Transportation Systems, vol. 2, 2021, pp. 384-392. DOI: 10.1109/OJITS.2021.3111052.
3. Hongjie Liu, Hongzhe Xu, Yu Yan, Zaishang Cai, Tianxu Sun, and Wenli, "Bus Arrival Time Prediction Based on LSTM and Spatial-Temporal Feature Vector," IEEE Access, vol. 8, 2020, pp. 11917-11923. DOI: 10.1109/ACCESS.2020.2965094.
4. F. Schwinger, J. Hoppe, J. Wernz, M. Jarke, H. Haeger, "Improving the Prediction of Passenger Numbers Public Transit Networks by Combining Short-Term Forecasts With Real-Time Occupancy Data," IEEE Open Journal of Intelligent Transportation Systems, vol. 4, pp. 153-158, Mar. 2023. DOI: 10.1109/OJITS.2023.3251564.
5. R. Alizadeh, Y. Savaria, and C. Nerguizian, "Characterization and Selection of WiFi Channel State Information Features for Human Activity Detection in a Smart Public Transportation System," IEEE Open Journal of Intelligent Transportation Systems, vol. 5, pp. 55-61, Jan. 2024. DOI: 10.1109/OJITS.2023.3336795.
6. O. D. Jimoh, L. A. Ajao, O. O. Adeleke, and S. S. Kolo, "A Vehicle Tracking System Using Greedy Forwarding Algorithms for Public Transportation in Urban Arterial," IEEE Access, vol. 8, pp. 191706-191725, Oct. 2020. DOI: 10.1109/ACCESS.2020.3031488.
7. Yuan Cao, Shuangshuang Zhang, Guizhi Yang, Tao Wen, "Research on High Precision Tracking Method of Guided Transport Vehicle Based on Autonomous Combination Positioning." Chinese Journal of Electronics, Vol. 29, Issue 4, July 2020, pp. 779-785.



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