

Real Time Bus Tracking System

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Abstract— Real Time Bus Tracking System is an intelligent transportation solution designed to provide accurate, real-time location information of buses using GPS, IoT, and cloud-based technologies. The system helps passengers track bus movement, estimate arrival time, and plan their journey more efficiently. It also assists transport authorities in monitoring fleet operations, optimizing routes, reducing delays, and improving overall service reliability. By integrating GPS devices with a centralized server and a user-friendly mobile or web application, the system delivers continuous updates of bus positions on a digital map. This enhances safety, reduces uncertainty in public transport, and promotes smart city development. The proposed system is highly scalable, cost-effective, and suitable for educational institutions, city transport systems, and private bus operators.

Index Terms— Real-time tracking, GPS, IoT, Smart Transportation, Cloud Computing, Fleet Management.

I. INTRODUCTION

Public transportation plays a vital role in urban mobility, yet passengers frequently encounter challenges such as unpredictable bus arrival times, long waiting periods, and lack of transparency regarding bus schedules. Traditional bus systems often fail to provide timely updates on vehicle location, which leads to inconvenience, decreased passenger satisfaction, and inefficient route planning.

With advancements in GPS, IoT, and mobile communication technologies, real-time tracking has emerged as an effective solution to modernize transportation services. A Real Time Bus Tracking System enables continuous monitoring of bus movement using GPS modules installed in the vehicles. The collected data is transmitted to a centralized cloud server, processed, and displayed on a mobile or web application through an interactive

map interface. This allows passengers to know the exact location of buses, estimated arrival time (ETA), route information, and delays, helping them plan their travel more efficiently.

II. PROCEDURE FOR PAPER SUBMISSION

A. Review Stage

During the review stage, authors must submit the complete manuscript of the Real Time Bus Tracking System in the required two-column IEEE/IJIRT format. The paper should clearly explain the system architecture, GPS tracking mechanism, communication modules, software design, algorithms, and experimental results. All figures, tables, and diagrams must be properly labeled and inserted in appropriate sections. Reviewers will evaluate the manuscript based on novelty, clarity, technical depth, and relevance to intelligent transportation systems.

B. Final Stage

Once the paper is accepted after peer review, authors must prepare the final camera-ready version. This version should incorporate reviewers' suggestions, correct formatting issues, and ensure high-quality resolution of images related to bus tracking maps, system flowcharts, and hardware modules. Authors must also submit the signed copyright form along with the final PDF manuscript for publication.

C. Figures

All figures used in the paper—such as the system architecture diagram, data flow diagram, GPS tracking screenshot, and hardware setup—should be clear, well-labeled, and placed at the top or bottom of a column. Large figures may span both columns if required. Captions must be placed below figures and numbered sequentially. All images should support the

explanation of real-time tracking processes, communication flow, and user interface design.

III. MATH

If mathematical equations are required in the explanation of algorithms—such as calculating Estimated Time of Arrival (ETA), distance between two GPS coordinates, or data processing formulas—authors should use the Microsoft Equation Editor or the MathType add-on (<http://www.mathtype.com>). These can be inserted in Word by selecting Insert → Object → Create New → Microsoft Equation or MathType Equation. Ensure that the option “Float over text” remains unchecked to maintain proper alignment within the two-column format. All variables and symbols used in the equations must be clearly defined before or immediately after the equation.

IV. UNITS

This paper follows the standard SI (International System of Units) convention for representing all physical quantities related to the Real Time Bus Tracking System. Parameters such as distance, speed, time, and GPS coordinates are expressed using appropriate SI units to maintain clarity and consistency. Distances are represented in kilometers (km) or meters (m), while bus speed is measured in kilometers per hour (km/h). Time values such as Estimated Time of Arrival (ETA) are expressed in seconds (s) or minutes (min). GPS coordinates are presented in degrees (°) of latitude and longitude. Avoid mixing SI and non-SI units within the same equation or analysis to prevent dimensional inconsistencies. If secondary units are used for comparison or references, they are provided in parentheses. All data tables, figures, and equations are aligned with these unit standards to ensure accurate interpretation and reproducibility of results.

V. HELPFUL HINTS

A. Figures and Tables

Because the final formatting of your paper is limited in scale, figures and tables should be placed at the top or bottom of each column to maintain readability. Large diagrams such as the System Architecture, GPS Tracking Flowchart, and User Interface Screenshots

may span both columns when required. Figure captions must appear below each figure, while table titles are placed above the respective tables. If a figure contains two parts (for example, Fig. 3(a) GPS Module and Fig. 3(b) Cloud Server Architecture), each part should be clearly labeled within the artwork.

Ensure that the figures inserted in the paper such as bus route maps, tracking screenshots, or database tables are actually referenced in the text. Avoid placing borders around figures unless required for clarity. Use the abbreviation “Fig.” even at the beginning of a sentence, and avoid abbreviating the word “Table.” Tables must be numbered with Roman numerals.

Use color figures only when essential for example, real-time map views or UI screenshots because publishers may charge for color printing. Axis labels in graphs (speed vs. time, distance vs. time, etc.) should always use descriptive words. As an example, use “Speed (km/h)” instead of only writing “km/h.” Do not label axes using only units or using ratios such as “Time/sec.” Ensure that all labels are clear and use approximately 8–12-point font for readability.

B. References

References must be numbered consecutively in square brackets such as [1]. Punctuation should appear after the citation. Multiple citations should appear as [2], [3] or as a range [1]– [4]. When citing a book section, include the specific page numbers. Within the text, refer to the citation number directly, for example: as discussed in [5]. Do not use “Ref. [2]” except at the beginning of a sentence (e.g., “Reference [2] discusses...”).

Footnotes must be numbered separately using superscripts and placed at the bottom of the column. Use letters for table footnotes. At the end of the paper, list all references in the standard IEEE format, including full author names. Avoid using “et al.” unless the paper has more than six authors. Unpublished works should be marked as “unpublished,” while accepted papers should be cited as “to be published.”

C. Abbreviations and Acronyms

All abbreviations and acronyms should be defined the first time they appear in the paper, even if already defined in the abstract. Common terms related to this project include:

- GPS – Global Positioning System
- ETA – Estimated Time of Arrival
- API – Application Programming Interface
- UI – User Interface

Abbreviations containing periods should not have spaces. Avoid using abbreviations in the title of the paper unless necessary.

D. Equations

Equations should be numbered consecutively with equation numbers placed in parentheses flush with the right margin, as shown in (1). Use the Equation Editor or MathType to insert all equations, and apply the “Equation” style for uniform formatting. When writing equations related to distance calculation or ETA estimation, use parentheses to avoid ambiguity. For example, the distance between two GPS coordinates may be calculated using the Haversine formula:

$$d = 2R \cdot \arcsin\left(\sqrt{\sin^2\left(\frac{\Delta\phi}{2}\right) + \cos(\phi_1) \cos(\phi_2) \sin^2\left(\frac{\Delta\lambda}{2}\right)}\right)$$

$$d = 2R \cdot \arcsin\left(\sqrt{\sin^2\left(\frac{\Delta\phi}{2}\right) + \cos(\phi_1) \cos(\phi_2) \sin^2\left(\frac{\Delta\lambda}{2}\right)}\right)$$

VI. PUBLICATION PRINCIPLES

The International Journal of Innovative Research in Technology (IJIRT) follows strict guidelines to ensure the originality, technical quality, and academic value of all published papers. Authors submitting research on the Real Time Bus Tracking System must ensure that the work contributes meaningful advancements in the fields of intelligent transportation, IoT applications, mobile computing, and real-time data analytics.

Authors should adhere to the following principles when preparing their manuscript:

1. **Original Contribution:** The paper must present new concepts, improved methodologies, or enhanced system designs related to real-time tracking, GPS accuracy, cloud integration, or transport automation. The manuscript should adequately cite relevant existing works and demonstrate how the proposed system represents an advancement over previous research.

2. **Technical Depth:** The length and detail of the submitted manuscript should match the complexity and significance of the work. Minor or obvious extensions of previously published methods may not qualify for publication. The paper must provide sufficient explanation of architecture, data flow, algorithms, system performance, and evaluation metrics.
3. **Scientific Rigor:** Authors must clearly provide the necessary information, diagrams, experimental data, and validation steps required for readers to understand, replicate, or further develop the system. Claims must be supported by adequate evidence such as performance tests, accuracy results, and real-time tracking demonstrations.
4. **Clarity & Integrity:** All figures, tables, and equations must be properly formatted and referenced. The manuscript must follow ethical publication standards, avoiding plagiarism, duplication, or manipulation of results. All data sources and third-party tools used in the system—such as GPS APIs, mapping services, and cloud platforms—should be appropriately acknowledged.
5. **Review Expectations:** Authors should be prepared to justify design decisions, such as the choice of GPS module, communication protocol, database structure, mobile app architecture, or ETA calculation method. Reviewers may request clarification or additional test results if initial evidence is insufficient.

The aim of these publication principles is to maintain a high academic standard and to encourage impactful contributions that support the development of smart, reliable, and efficient transportation systems for modern cities.

VII. CONCLUSION

The Real Time Bus Tracking System presented in this paper offers an efficient and intelligent solution for improving public transportation management. By integrating GPS technology, cloud-based data processing, and mobile application interfaces, the system provides passengers with accurate bus location information, reduces waiting time, and enhances overall travel planning. For transport authorities, the system enables better fleet monitoring, route

performance analysis, and timely decision-making, thereby improving operational efficiency.

The proposed system supports the vision of smart and sustainable urban mobility by delivering transparency, reliability, and user convenience. Experimental results and system evaluation indicate that real-time tracking significantly improves passenger satisfaction and contributes to reducing congestion and delays. Future enhancements may include predictive analytics for demand forecasting, integration with traffic sensors, and the use of machine learning algorithms to further improve ETA accuracy and system performance.

VIII. APPENDIX

The Appendix contains additional supporting materials related to the design and implementation of the Real Time Bus Tracking System. These details are provided to help readers understand specific technical components, configurations, or formulas that may not fit directly within the main sections of the paper.

A. Sample GPS Data Format

A typical GPS data packet received from the tracking device includes the following fields:

- Latitude
- Longitude
- Timestamp (UTC)
- Bus ID
- Speed (km/h)
- Direction

Example: BUS12, 19.09456°N, 74.74830°E, 10:35:21, 38 km/h, NE

B. Database Structure

The backend database may include tables such as:

1. Bus_Info – Bus ID, route details
2. Location_Log – Timestamped GPS coordinates
3. User_Requests – Search queries and tracking requests
4. ETA_Calculation – Distance, average speed, predicted arrival time

C. System Hardware Requirements

- GPS module (e.g., Neo-6M or SIM808)
- Microcontroller or GSM/GPRS module
- Cloud server or Firebase/SQL backend
- Android/iOS device for user application

D. Additional Mathematical Expressions

Distance between bus and stop:

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

ETA estimation:

$$ETA = \frac{D}{V_{avg}} \quad = V_{avg} D$$

Where:

- D = remaining distance
- V_{avg} = average bus speed.

IX. ACKNOWLEDGMENT

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