Real Time Public Transport Tracking System

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Abstract - For small cities where traditional GPS hardware solutions are expensive, this project presents a software-based real-time public transport tracking system. A driver's smartphone is used by the system to send real-time location data to a cloud backend, where an ETA engine analyzes movement patterns and distance to forecast arrival times. Through a mobile interface, passengers can instantly view bus movement and ETA updates. Accuracy, affordability, and instantaneous data synchronization via real-time databases are the project's main goals. The improved ETA computation model, which employs interval-based computations, speed smoothing, and geographic distance formulas to produce reliable forecasts appropriate for small-scale transport environments, is the work's high point.

Key Words :
Real-time tracking
- **Public transport monitoring**
- **ETA prediction**
- **Mobile-based GPS**
- **Cloud computing**

1.INTRODUCTION

In small cities, poor information flow and inconsistent timings are common problems with public transportation. The lack of real-time bus visibility causes passengers to wait longer than necessary. Technologies used in metropolitan systems are expensive, require special GPS hardware, and are difficult to maintain. This project aims to provide a practical alternative by using smartphones as tracking devices and cloud-based computation for ETA delivery. Users can instantly view bus movement thanks to real-time communication between the driver app and passenger interface. This strategy reduces expenses, improves user experience, and facilitates effective fleet management. The system shows how small-city transportation operations can be transformed by contemporary mobile and cloud technologies.

By utilizing smartphones as tracking devices and cloud-based computation for ETA delivery, this project seeks to offer a workable substitute. Users can instantly view bus movement thanks to real-time communication between the driver app and passenger interface. This strategy reduces expenses, improves user experience, and facilitates effective fleet management. The system shows how small-city transportation operations can be transformed by contemporary mobile and cloud technologies.

2. Body of Paper

A. Overview of the System

The Driver Application, the cloud-based Backend Engine, and the Passenger Interface are the three primary parts of the system. Real-time GPS coordinates and status updates are shared via the Driver App. This data is processed, stored, ETA computation is applied, and passenger updates are broadcast by the backend. Real-time listeners are used by the Passenger App to obtain this data, guaranteeing instantaneous map updates. System security is maintained and user roles are separated by a thin layer of authentication. The entire architecture is made to provide high responsiveness at a low cost of deployment. Through dynamic location mapping and smooth communication, the workflow guarantees continuous tracking, consistent ETA accuracy, and an enhanced passenger experience.

1. Real-Time Location Acquisition:

The system continuously collects GPS coordinates from the driver’s smartphone, capturing latitude, longitude, speed, and status. This ensures accurate and frequent updates for backend processing.

2. Centralized Cloud Processing & ETA Engin

All incoming location data is processed by a cloud backend, which stores the information, calculates distance, applies speed smoothing, and generates ETA predictions using optimized formulas.

3.Passenger Information & Live visualize

The processed data is instantly delivered to passengers through a mobile/web interface. They can view live bus movement, ETA updates, routes, and bus status, enhancing travel planning and user convenience**.**

B. Existing System

Existing systems in small cities depend on fixed timetables or manual announcements, which rarely reflect real-time bus positions. The costly hardware-based GPS units found in buses frequently malfunction as a result of inadequate maintenance or network problems. Passengers must rely on guesswork, and transport authorities cannot monitor buses effectively. Basic map apps are used in some cities, but they don't have live synchronization, automated updates, or ETA prediction. Additionally, real-time corrections, crowding updates, and driver authentication are not supported by older systems. These systems' shortcomings impact dependability, lengthen passenger wait times, and keep authorities from enhancing fleet scheduling or route performance.

C. Proposed System

The suggested system uses a smartphone-driven solution that records and uploads GPS coordinates in real time in place of hardware GPS trackers. This data is received by a cloud backend, which then processes it and determines the ETA for passenger display. Role-based access is used by the system to differentiate between drivers and passengers. To guarantee immediate synchronization, data is arranged in real-time collections. Stable arrival predictions are produced by the ETA module using geographic computation and smoothed speed estimation. Passengers get real-time information on trip status, crowding, and map markers. Overall, the proposed system is economical, easy to deploy, and capable of delivering modern transit features without large infrastructure investments.

D. Methodology

The steps listed below are how the system functions in its entirety:

The process starts with the driver's smartphone continuously collecting GPS data. Latitude, longitude, speed, and timestamp are all included in each location packet. An improved version of the spherical distance formula is used to calculate the distance to the next stop: $D = R \times \arccos(\sin(lat_1)\sin(lat_2) + \cos(lat_1)\cos(lat_2)\cos(\Delta lon))$, where $R = 6371$ km. Weighted smoothing is used to stabilize speed: $V\_s = (0.6 \times V\_previous) + (0.4 \times V\_current)$. ETA is computed in minutes using the formula $ETA = D / V\_s$.

To prevent overload, calculations are carried out at predetermined intervals thanks to a timed update cycle. Passengers receive the results via real-time listeners, guaranteeing immediate visibility on the map.

Table -1: Sample Table format

Evaluation Parameter	Existing System	Proposed System
Tracking Method	No real-time tracking or uses costly hardware GPS devices	Uses smartphone-based GPS, low-cost and easy to deploy
Passenger Information	No live bus location; passengers wait blindly	No live bus location; passengers wait blindly
Infrastructure Cost	High (hardware + maintenance)	Very low (software-only approach)
Data Updates	Manual or delayed	Instant live updates using cloud database
Reliability	Inaccurate timings	Accurate ETA with distance + speed smoothing formulas
User Roles	No separate roles	Role-based access for driver & passenger

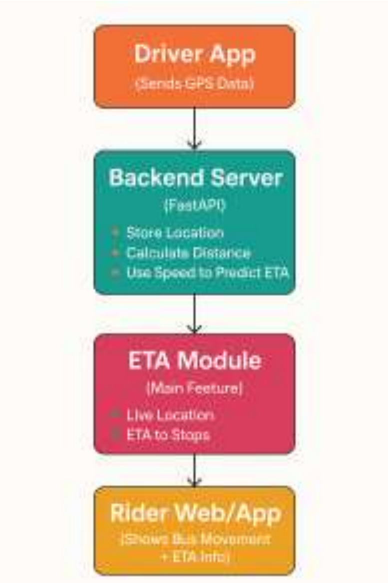

Fig -1: Figure

MAP

3. CONCLUSIONS

For small cities, this project offers a workable and reasonably priced real-time public transport tracking solution. The system avoids expensive GPS hardware while giving passengers precise, real-time bus information by using smartphones as tracking devices and cloud-based ETA computation. To guarantee accurate forecasts, the highlighted ETA module incorporates geographic formulas and smoothed speed estimation. Real-time updates help authorities monitor the fleet, boost transportation planning, and increase commuter satisfaction. Future expansion into traffic prediction, machine learning-based ETA enhancements, and multi-route integration is made possible by the system's modular design. All things considered, the project offers a productive digital upgrade appropriate for cities with constrained resources and infrastructure.

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REFERENCES

1. Assael, Y.M., Shillingford, B., Whiteson, S., and de Freitas, N. (2016). *LipNet: End-to-End SentenceLevel Lipreading.* arXiv:1611.01599.
2. Chung, J.S., Senior, A., Vinyals, O., and Zisserman, A. (2017). *Lip Reading Sentences in the Wild.* Procee the IEEE Conference on Computer Vision and Pattern Recognition (CVPR).
3. Wiles, O., Koepke, A., and Zisserman, A. (2018). *Self-Supervised Learning of a Facial Attribute Embedding from Video.* British Machine Vision Conference (BMVC).
4. King, D.E. (2009). *Dlib-ml: A Machine Learning Toolkit.* Journal of Machine Learning Research (JMLR), 10, 1755–1758.

5. He, K., Zhang, X., Ren, S., and Sun, J. (2016). *Deep Residual Learning for Image Recognition.* Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR).
6. Goodfellow, I., Bengio, Y., and Courville, A. (2016). *Deep Learning.* MIT Press.
7. Zhang, K., Zuo, W., Chen, Y., Meng, D., and Zhang, L. (2017). *Beyond a Gaussian Denoiser: Residual Learning of Deep CNN for Image Denoising.* IEEE Transactions on Image Processing.