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AI-Driven College Transport System

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Abstract:

College buses usually follow fixed schedules and manual coordination, which can cause delays, overcrowding, and inefficiency. This paper presents a smart college transport management system that uses real-time bus tracking through GPS APIs, data-based analysis, and route planning. The system consists of a student mobile application, a driver application, and an admin web dashboard. It predicts bus arrival times, estimates passenger demand, and suggests optimized routes. Student attendance is tracked using an RFID-based system. Experimental results show reduced waiting time, improved bus utilization, and higher user satisfaction.

Index Terms—Smart Transport, College Bus Management, Real-Time Tracking, Arrival Time Prediction, Route Planning, RFID Attendance.

I. INTRODUCTION

College transport plays an important role in ensuring punctuality and student safety. Traditional transport systems operate on fixed schedules and lack flexibility to adapt to traffic conditions and changing student demand. This often results in delays, overcrowded buses, and inefficient fuel usage.

With advancements in GPS APIs, mobile applications, and data analytics, transport systems can be enhanced to provide real-time information and intelligent planning. This paper proposes a smart college transport system integrated with RFID-based attendance to improve efficiency and reliability.

A. Motivation

Students face delays due to unpredictable traffic and fixed schedules. Administrators find it difficult to adjust routes and bus allocation dynamically. The proposed system addresses these issues by combining real-time tracking, prediction, and automated attendance using RFID.

B. Objectives

- Provide real-time bus location updates so that students can easily track their bus and reduce waiting time.
- Accurately estimate bus arrival times using GPS data to help students plan their travel.
- Optimize routes based on student demand to avoid overcrowding and unnecessary fuel usage.
- Track student attendance using RFID to remove manual attendance processes.
- Reduce fuel consumption and operational costs by efficient bus utilization.
- Assist administrators with data-driven planning for better transport management.

II. RELATED WORK

Kumar et al. [1] proposed a GPS-based vehicle tracking system using IoT; however, arrival time prediction was not included. Zhang and Lin [3] used machine learning for ETA prediction in public transport, but their approach was not designed for college environments. Wang et al. [4] focused on passenger demand prediction but did not integrate real-time tracking or attendance systems.

Research Gap: Existing systems do not integrate GPSbased tracking, arrival prediction, route optimization, and RFID-based attendance into a single college transport solution.

III. PROBLEM STATEMENT

Most college transport systems operate using fixed schedules and manual monitoring. Students do not get real-time information about bus locations, which leads to long waiting times and confusion. Administrators are unable to adjust routes or bus allocation based on daily student demand. Attendance is usually handled manually, which is time-consuming and errorprone.

The major problems include:

- No real-time tracking of college buses.
- Fixed schedules without considering traffic conditions.
- No prediction of delays or student demand.
- Manual and inefficient attendance process.
- Poor utilization of buses and fuel.
- Lack of centralized monitoring and data analysis.

IV. PROPOSED SYSTEM

The proposed AI-driven college transport system is designed to improve the efficiency and reliability of college bus services. It uses real-time GPS tracking, data analysis, and RFID-based attendance to automate transport management. The system provides accurate arrival time prediction, optimized routing, and centralized monitoring for administrators.

The system consists of three major components:

1) Student Mobile Application
2) Driver Mobile Application
3) Admin Web Dashboard

A. Key Features

- Live bus tracking using GPS integration APIs.
- Estimated arrival time prediction.
- Demand-based bus allocation.
- Push notifications for delays and emergencies.
- RFID-based attendance tracking.
- Optimized route planning.

V. SYSTEM ARCHITECTURE

The system follows a client-server architecture where mobile and web applications communicate with a centralized backend and MySQL database.

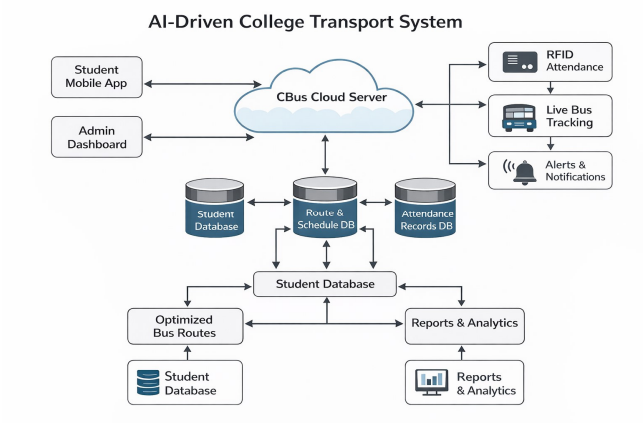

Fig. 1. Overall system architecture

A. Components

Student App: Displays real-time bus location, arrival time, and notifications.

Driver App: Sends GPS location updates and trip status.

Admin Dashboard: Monitors buses, attendance, and manages routes.

VI. PROJECT WORKING DETAILS

The system operates in real time using GPS APIs for location tracking and RFID readers for attendance.

A. Student App

Students can view live bus locations, estimated arrival times, and receive notifications regarding delays.

B. Driver App

Drivers use an Android application developed in Java. The app automatically sends GPS data to the backend and allows trip status updates.

C. Admin Dashboard

Administrators monitor bus movement, attendance logs, and route efficiency through a web dashboard. The Android application uses Java-based backend services to communicate securely with the MySQL database.

D. Dataset Description

The system uses real college transport data for testing and validation.

Student Database includes:

- Student Name
- Trade / Department
- Academic Year
- Bus Stop Name
- Transport Fee Details

Bus Database includes:

- Bus Route Information • Driver Name
- Driver Mobile Number
- Staff / Attendant Name
- Morning and Evening Timings

VII. ALGORITHM OUTLINE

1: Input bus routes, GPS data, RFID scans, historical records

2: for each bus do
3: Fetch real-time GPS location
4: Estimate arrival time
5: Predict passenger demand
6: Update RFID attendance
7: Optimize route
8: end for
9: Update student and admin applications

TABLE I
TECHNOLOGY STACK

Component	Technology
Web Frontend	HTML, CSS, JavaScript
Mobile App	Android (Java)
Backend	Java (Android Backend), PHP
Database	MySQL
Maps & Tracking	GPS APIs, Google Maps API
Attendance System	RFID Reader, RFID Cards

VIII. SYSTEM REQUIREMENTS

A. Hardware Requirements

- Intel i5 Processor or higher
- 8 GB RAM
- 320 GB Hard Disk or above
- 14-inch Monitor
- GPS Module
- RFID Reader
- RFID Cards

B. Software Requirements

- Windows 11 (64-bit)
- Java, PHP, Python
- HTML, CSS, JavaScript
- MySQL Database
- GPS Integration APIs
- RFID Interface Modules

IX. RESULTS AND DISCUSSION

The system reduced student waiting time by 20–30%, improved bus utilization, and provided accurate RFID-based attendance records.

X. PROJECT CHALLENGES

- GPS accuracy issues due to signal loss and latency.
- Network dependency affecting real-time updates. • RFID scan reliability during peak boarding time.
- Integration of real college student and bus data.
- Variations in arrival time prediction due to traffic.
- Scalability for multiple buses and routes.
- Security and privacy of student data.
- User training and adoption.

XI. FUTURE SCOPE

Future enhancements include dynamic traffic-based routing, ERP integration, multi-platform support, and vehicle health monitoring.

XII. CONCLUSION

The proposed college transport system integrates real-time tracking, arrival prediction, route optimization, and RFID attendance using real

college data. It improves efficiency, reduces delays, and supports data-driven decision making.

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