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Real-Time College Bus Tracking and Management System: A Software-Based Approach

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Abstract: *Transportation management is an important component of educational institutions to ensure student safety and operational efficiency. Many colleges still rely on manual tracking systems or hardware-based IoT solutions, which are expensive and difficult to maintain. This paper presents a Real-Time College Bus Tracking and Management System developed using a purely software-based approach. The system utilizes smartphone GPS technology, Flutter-based mobile applications, Node.js backend services, and MySQL database management to provide real-time tracking, attendance monitoring, and emergency alerts. Students and parents can view live bus locations, drivers can manage trips and attendance, and administrators can monitor fleet operations through a centralized dashboard. The proposed system reduces dependency on external hardware devices and minimizes operational cost. Testing results indicate stable real- time performance, reliable trip monitoring, and improved communication between stakeholders. Overall, the system provides a scalable, cost-effective, and user-friendly transportation management solution for educational institutions.*

Keywords: Bus Tracking System, GPS Monitoring, Flutter Application, Node.js, Real-Time Communication, Transportation Management

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