Automated Bus Scheduling and Route Management System for Smart Campus Transportation with Real-Time Tracking

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Abstract: *Transport coordination within educational institutions is often managed manually, which leads to scheduling conflicts, miscommunication, and inefficient resource utilization. To overcome these challenges, this study presents an Automated Bus Scheduling and Route Management System (ABSRMS) designed to streamline the daily and special transportation needs of colleges and universities. The system automates bus and driver assignments based on route and time availability while ensuring every scheduled stop is covered. Developed using a Flask-based backend and a MySQL database, it provides a robust administrative web interface built with React and mobile applications developed in Flutter for students and drivers. Key modules include route management, scheduling automation, real-time GPS tracking via OpenStreetMap, push notifications using Firebase Cloud Messaging (FCM), and special-trip scheduling for events such as industrial visits. The implementation demonstrates improved accuracy in scheduling, reduced administrative workload, and enhanced communication between students, drivers, and transport administrators. The proposed system offers a cost- effective, open-source solution suitable for scalable adoption across educational institutions.*

Keywords: Bus scheduling, Route management, Flask, MySQL, React, Flutter, Firebase, Transport automation, educational institutions