Design of a Smart Bus Tracking System and a Passenger Counting System to Enhance the Efficiency of Public Transportation

D.D. Meegahathenna and I.W. Kularathne*

Faculty of Engineering, University of Peradeniya, Peradeniya, 20400, Sri Lanka
iwk@eng.pdn.ac.lk

It is a timely requirement to implement a smart bus tracking and a passenger counting system to trace the vacant seats using a mobile app in Sri Lanka to enhance the efficiency of public transportation. This research is about the design and implementation of a smart bus tracking system and a passenger counting system using a mobile app. This system integrates real-time GPS tracking, precise passenger counting through IR sensors, Firebase Realtime Database, and a user-friendly mobile app that has been developed using a Flutter Framework. The hardware component involves the integration of an ESP8266 microcontroller with a Neo 6M GPS module, addressing challenges related to power stability. The passenger counting mechanism utilizes IR sensors strategically placed near bus entrances, with fine-tuned ESP8266 code ensuring accurate counting. Firebase Realtime Database serves as the central hub for storing and synchronizing real-time data between the bus and the mobile app. The embedded part with the passenger counting mechanism and IR sensors should be placed on the side of a door in the bus. The latest installation version, named the ".apk" file should be installed on any smartphone with an Android operating system and iOS. An active internet connection is required to synchronize the mobile phone and the embedded part of the bus. Accordingly, any passenger who is waiting for a bus can track the location of the bus as well as the passenger count to get an idea about vacant seats using the mobile app. The outcome of this research contributes to the introduction of smart transportation systems, emphasizing the potential for technology-driven solutions to revolutionize public transport services due to the key differentiators of Smart Bus Tracking Systems with a novel feature of precise real-time passenger count data using IR sensors. This feature is not available in any current systems in Sri Lanka. The Smart Bus Tracking Systems is specifically designed to meet the needs of Sri Lanka's public transportation, where no integrated solution for bus location and passenger count currently exists. It is developed with a user-friendly mobile app with Flutter for an intuitive, cross-platform experience for easy use by any passenger.

Keywords: Bus tracking, passenger counting, transportation, integration, mobile app