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Development of a cost-effective real-time commuter counting system for public transportation in Sri Lanka

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The use of smart systems in public transportation is relatively new in the Sri Lankan context. This study introduces a cost-effective solution for accurately counting the number of bus passengers at any given time. Current passenger counting systems in Sri Lanka often suffer from inaccuracies and inefficiencies, hindering the effective management of public transportation and addressing problems including long bus queues, ticketing fraud, long waiting times, etc. Precise passenger count is essential for optimising services and resources, ultimately enhancing the efficiency of public transportation in the country. The proposed system is designed to be installed in buses and includes an online platform where users can enter the bus number and check the passenger occupancy in real-time. The proposed system comprises several key components: two input sensors, a microcontroller, a wireless connectivity module, an in-built display, an input panel, and an output display. The two sharp IR sensor modules employed as input sensors are connected to a microcontroller. An inbuilt display connected to the microcontroller provides output information, including passenger count, number of vacant seats, GPS signal strength, and data transmitting capability. Data is wirelessly sent to a cloud database for storage, retrieval, and processing, enabling users to access relevant information via a web application. The algorithm employed in this system ensures precise passenger count by detecting specific sequences of readings from the two IR sensors. To increment the passenger count, the system requires the following sequence: "0-0, 1-0, 1-1, 0-1, 0-0." This sequence corresponds to the detection of a passenger boarding the bus. Each step in the sequence represents the state of the two IR sensors, with "0" indicating no obstacle and "1" indicating an obstacle (i.e., the presence of a passenger). The algorithm recognizes this sequence as an entry event and increments the passenger count accordingly. Conversely, the algorithm relies on the following sequence to accurately decrease the passenger count when a passenger exits the bus: "0-0, 0-1, 1-1, 1-0, 0-0." This sequence represents a passenger leaving the bus. The algorithm reduces the passenger count by monitoring the sensor readings and identifying this sequence. These specific sequences in the algorithm ensure reliable and accurate passenger counting. By requiring a particular order of sensor readings, false positives or negatives caused by noise or temporary obstacles are minimised, leading to a more precise passenger count. The online platform allows users to access passenger occupancy in a particular bus, which aids in real-time service optimization for public transportation management. The system achieves precise real-time passenger occupancy tracking using two Sharp IR sensors and a finely tuned algorithm. Tested results of the pilot system show that data empowered public transportation management in Sri Lanka by optimising routes, efficiently allocating resources, and significantly improving the overall commuter experience. In conclusion, the combination of affordability, reliability, and user-friendliness makes this proposed solution suitable for efficiently managing public transportation systems.

Keywords: Commuter counter, Passenger counting, public transportation, Sharp IR sensors