DESIGN OF A GENDER-AWARE BUS SEATING ALLOCATION SYSTEM TO REDUCE SEXUAL HARASSMENT AND ACCIDENTAL CONTACT IN CROWDED PUBLIC TRANSPORT: A SRI LANKAN STUDY

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Abstract

Sexual harassment and unwanted physical contact are common on Sri Lankan buses, and on long-distance routes such as Route 87 (Colombo to Jaffna) unacquainted passengers of opposite gender often sit side by side for hours. Existing measures react after incidents, and seat allocation models optimize cost or seat use, not safety. This study aimed to design, develop and evaluate SafeBoard, a mobile booking system in which an explainable, rule-based artificial intelligence engine decides each passenger's seat at the time of booking. Following the Design Science Research Methodology, requirements were derived from an online survey of 40 adult Route 87 passengers (23 women, 17 men), recruited through purposive and convenience sampling between April and September 2026 and analyzed descriptively by gender. The engine divides a 70-place bus into Priority, General and Limited zones and applies four rules: Priority seats go first to passengers with a mobility need, pregnancy or a safety preference, with the last two reserved for physical need; a hard filter removes every seat beside an unacquainted passenger of the opposite gender; otherwise the nearest free seat is given, so nobody is refused because of gender; and groups travelling together may sit together. Every decision is logged and explained. The engine was implemented in Flutter and Firebase with a linked conductor application and evaluated through automated tests and 16 000 simulated journeys against random seating. Of the respondents, 87.5% had felt uncomfortable beside their neighbor, 73.9% of women reported unwanted contact, mostly while seated, and 85.0% supported gender-aware seating. All 224 tests passed, and the engine reduced opposite-gender adjacency from about 50% to 6.5-16.0% while raising Priority-seat fulfilment from about 23% to 82.8-100% ($p < 0.001$). Transparent rule-based allocation thus offers a practical, low-cost and inclusive way to reduce a condition linked to harassment on buses.

Keywords: Gender-aware seat allocation, Rule-based artificial intelligence, Public transport safety, Sexual harassment, Design science research