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Privacy-Focused LiDAR for Urban Road Safety

Ensuring road safety for vulnerable road users like pedestrians and bicyclists is particularly challenging in historically disadvantaged communities. Current technology often relies on intelligent sensor and system-based approaches, including cameras, which can compromise privacy and data anonymity. Here, we investigate the use of privacy-preserving Light Detection and Ranging (lidar) sensors that generate robust datasets without capturing identifiable visual information. Using our deployed system, we collected 90 days of continuous data from 13 installed lidar sensors as part of the investigation. The primary purpose of this initiative is to rapidly evaluate interventions aimed at reducing near-misses and crash risks. Our methodological-based approach integrates real-time detection with archived data analytics, supported by community engagement and staff training sessions. Analysis reveals a 75% reduction in unsafe midblock crossings at a high-risk location, a 26–30% decrease in speeding, and an average of 6.1 near-misses detected daily over 84 days. Additionally, the cost-to-benefit ratio stands at approximately 1:4, validated through conservative USDOT crash-type monetized values. The immediate availability of performance insights, including near-misses and crash risk proxies, enabled more timely interventions and countermeasures in accordance with FHWA guidelines. By providing a replicable model for privacy-focused sensor deployment, our work contributes to the broader discipline, advancing equitable transportation planning and demonstrating how real-time data and community feedback can shape Vision Zero strategies in urban areas. Looking ahead, continued development of this process—through more robust implementation, utilization of existing right-of-way infrastructure, and successful integration with transit data—highlights the potential for this approach to be adopted in other settings seeking measurable safety improvements.

Keywords: LiDAR sensors, Near-misses, Crash risk reduction, Real-time detection, Vision Zero, Data anonymity.