

ABSTRACT

Overtourism poses significant challenges to tourist destinations, causing environmental stress, safety risks, and diminished visitor experiences, with conventional methods like ticket or vehicle counts lacking real-time adaptability. This research introduces a privacy-preserving, real-time crowd monitoring system for smart tourism, leveraging YOLOv8-based head detection and Centroid Tracking to accurately count visitors in dynamic, crowded settings at Wana Wisata Kawah Putih, Indonesia. Trained on a custom dataset of over 3,000 annotated frames with varied lighting, occlusions, and angles, the system achieves 94.2% accuracy, 95.1% precision, and 90.6% recall, operating at >30 FPS. Results are displayed via a web-based monitoring interface, featuring real-time visitor density visualization, historical data trends, and alerts for overcrowding, enhancing decision-making for tourism management. While robust, the system faces limitations in extreme weather and rapid lighting changes, necessitating further optimization for cross-location applicability and energy efficiency. Future work will focus on predictive analytics for visitor flow and adaptive detection to bolster sustainable tourism management.

Keywords: YOLOv8; Head counting; Crowd Detection; Centroid Tracker; Real-Time Visitor Monitoring; Overtourism Mitigation.