

## ***AI-Powered Traffic Violation Detection System for Pedestrian Crossing Violations***

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As cities become smarter, public safety is enhanced and traffic is managed more efficiently. One area that needs attention is traffic violations at pedestrian crossings, which are a major cause of urban accidents. This under recognized yet urgent issue is tackled by our project through the creation of a cutting-edge system to detect these violations. It was discovered that not stopping at pedestrian crossings ranks as the second most common traffic offence worldwide, and the number of related accidents is expected to rise. A robust system has been developed using the latest in computer vision technology, leveraging YOLOv8 for detailed identification of pedestrians and vehicles. Then, their movements are monitored by an advanced tracking algorithm called ByteTrack. A custom model using the XGBoost algorithm, known for its precision and durability, was implemented for detecting violations. To ensure reliable detection even if the surveillance camera moves, an automatic correction mechanism for the pedestrian crossing positions is included in our system. In real-world tests, a remarkable 99% accuracy in detecting traffic violations was achieved by our system, which is able to perform the detection run in real-time at 30-35 frames per second, even on low-powered GPUs. For scalability, multiple instances of our system have been containerized, enabling them to run efficiently on a centralized server. This setup allows various urban areas to be monitored simultaneously, ensuring consistent and reliable performance across different locations. The key takeaway from our study is that urban surveillance can be significantly enhanced by computer vision. By automating the detection of traffic violations at pedestrian crossings, constant human oversight is reduced, accident rates are lowered, and better driving habits are enforced. Ultimately, our project is not just about improving immediate traffic safety but also about advancing the broader adoption of smart city technologies.

**Keywords:** Traffic Violations, Pedestrian Crossing, Computer Vision, Deep Learning, Yolov8, Bytetrack, Xgboost

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