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Journal of Current Studies in SDGs
Homepage : https://journal.i-ros.org/index.php/JOCSIS
Email : jocsis@i-ros.org

e-ISSN 3089-7564
Vol.3, No.2, June 2027

Artificial Intelligence Based Detection of Over Dimension and Overload (ODOL) Vehicles Using the YOLO Algorithm for Sustainable Transportation Infrastructure (SDG 9)

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DOI : https://doi.org/10.63230/jocsis.3.2.193

Sections Info

Article history:
Submitted: March 3, 2026
Final Revised: May 29, 2026
Accepted: July 3, 2026
First Available Online: July 25, 2026
Publication Date: June 27, 2027

Keywords:
Artificial Intelligence;
Computer Vision;
Deep Learning;
ODOL Vehicle Detection;
Smart Transportation System;
Sustainable Infrastructure;
YOLO Algorithm.

ABSTRACT

Objective: *To develop an artificial intelligence-based detection system for identifying Over-Dimension and Overload (ODOL) vehicles using the YOLO algorithm. Specifically, this study focused on improving the efficiency of ODOL vehicle monitoring, which is important for maintaining road safety, reducing infrastructure damage, and supporting effective transportation regulation. This research contributes to the development of smart transportation systems and sustainable infrastructure innovation in accordance with Sustainable Development Goal 9 (Industry, Innovation, and Infrastructure).* ***Method:*** *The study employed a computer vision-based approach using YOLOv8m and YOLOv10n algorithms for ODOL vehicle detection. The dataset consisted of vehicle images containing over-dimension vehicles, normal vehicles, and trucks collected from digital image sources.* ***Results:*** *The experimental results showed that YOLOv8m achieved better performance compared with YOLOv10n in detecting ODOL vehicles. YOLOv8m obtained a confusion matrix value of 78%, a precision-recall curve value of 81.7%, precision of 91.6%, and recall of 90%. Although YOLOv10n achieved a higher recall value of 93%, its overall detection performance was lower, with a confusion matrix value of 59%, precision-recall curve value of 72.3%, and precision of 89.9%. The implementation of YOLOv8m into an IoT-based detection system successfully enabled real-time data transmission and storage in a database, demonstrating its capability for practical ODOL vehicle monitoring applications.* ***Novelty:*** *The study provides a novel implementation of YOLO-based artificial intelligence technology for real-time ODOL vehicle detection by integrating deep learning, computer vision, and IoT infrastructure. The developed system supports the advancement of intelligent transportation infrastructure and contributes to sustainable innovation in transportation management in line with SDG 9 (Industry, Innovation, and Infrastructure).*

INTRODUCTION

Along with increasing population, manufacturer's goods distribution requirements to consumers increases (Alverhed et al., 2024; Chandan et al., 2023; Chopra et al., 2022). Rapid and safe distribution demands become challenges by logistic companies (Ogedengbe et al., 2024; Rushton et al., 2026; van Beusekom–Thoolen et al., 2024). Logistic efficiency is crucial to intensify people purchase power and it is crucial for a nation to compete on international trading (Akter et al., 2022; Ding et al., 2022; Y. Zhao et al., 2023). In the logistics and goods distributions, trucks take an important role as main transportation and become the backbone of logistics system (Ali, 2026; Sarder, 2025; Skiba, 2024). Therefore, logistics companies should have strategies to achieve their defined target. To facilitate Indonesia's logistics delivery fluently, the government focusing on sustainable infrastructure construction, including road constructions those connect among villages, cities, and provinces. However, not long after those road constructions completed, several sections of the road were found to be in a damaged condition. According to Transportation Observer, Djoko Setijowarno from Indonesian Transportation Society (Masyarakat Transportasi Indonesia / MTI) said that in 2023 road infrastructure construction was imbalance, with 52% of the roads are in an unfit