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Object Detection of Motor Vehicle Suspension Systems Based on the YOLOv8 Algorithm: Supporting Sustainable Industry and Innovation (SDG 9)

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ABSTRACT

Objective: *To develop an object detection system for identifying motor vehicle suspension system components using the YOLOv8 algorithm. Specifically, this study focused on improving the efficiency and accuracy of undercarriage inspection processes, which are commonly conducted manually and require technical knowledge to recognize suspension components and detect potential damage. This research contributes to automotive inspection innovation and supports the development of sustainable industrial technology in accordance with Sustainable Development Goal 9 (Industry, Innovation, and Infrastructure).* ***Method:*** *The study employed a computer vision-based approach using the YOLOv8 object detection algorithm for recognizing suspension system components in motor vehicles. The dataset consisted of 1000 suspension system images collected from mandatory vehicle inspection activities at motor vehicle testing facilities.* ***Results:*** *The results showed that the YOLOv8-based detection model could identify suspension system components with an accuracy of up to 95%. Furthermore, the trained model successfully detected oil leakage damage on shock absorber components with an accuracy of 92%. The evaluation results indicate that the proposed system can effectively recognize suspension components under different inspection conditions and provide reliable assistance for vehicle undercarriage inspection processes.* ***Novelty:*** *The study provides a novel implementation of the YOLOv8 deep learning algorithm for automated suspension system inspection in motor vehicles by integrating computer vision technology into the vehicle testing process. The developed system contributes to automotive technology innovation and supports the advancement of smart inspection infrastructure in line with SDG 9 (Industry, Innovation, and Infrastructure).*

INTRODUCTION

Transportation is a means used by the community to support daily mobility needs, which continues to grow along with technological advances (Ceder, 2021; Paiva et al., 2021; Ribeiro et al., 2021). The increase in the number of vehicles should require every road user to ensure that the vehicle is roadworthy, prioritized safety and security when drove to reduce the risk of traffic accidents (Abebe, 2022; Ehsani et al., 2023; Organization, 2019). Therefore, to ensure drove safety and security, every road user is required to carry out periodic motor vehicle test (Blomquist, 2012; Feng et al., 2024; Gu et al., 2024). The role of motor vehicle test is carried out to ensure safety, provide a level of comfort, and assess the strength and safety of the vehicle. One of the components of a motor vehicle that has the most significant influence on vehicle comfort and safety is the suspension system (He et al., 2019). The suspension system was an important component in every vehicle that functioned to absorb shocks and vibrations from the road, thereby increased comfort for the driver and passengers (Dogruer, 2022). Damage to the suspension system can disrupt