ABSTRACK

The advancement of autonomous vehicle technology necessitates a reliable visual perception system, particularly for real-time traffic sign recognition. This study aims to develop a traffic sign detection system based on computer vision using the YOLOv8 algorithm and implement it on a miniature autonomous vehicle prototype using Duckiebot DB21. The system is designed to recognize eight classes of traffic signs, including stop signs, no-entry signs, and traffic lights, which are constructed in miniature form and tested under various operational conditions. A custom dataset was collected, consisting of 1,232 images and augmented to 3,696 images using seven image transformation techniques. The model was trained using YOLOv8n for 87 epochs in Visual Studio Code. The final training achieved a precision and recall of 91.3%, with a mean Average Precision (mAP@0.5) also reaching 91.3%.

The system was evaluated in both static and dynamic scenarios, under bright and dim lighting conditions, as well as in integrated track environments. In bright conditions, the system achieved a detection tingkat keberhasilan *of 90.0%, while performance dropped significantly to 48.9% in low-light environments. During dynamic tests, the robot responded to detected signs with an execution accuracy of 83.3%. These results indicate that the proposed system is capable of recognizing and responding to traffic signs accurately and in real-time, making it a viable solution for small-scale autonomous navigation research and applications.*

Keywords: *traffic sign detection, YOLOv8, Duckiebot, autonomous vehicle, computer vision, miniature robot.*