ABSTRAK

Penelitian ini bertujuan untuk merancang dan mengimplementasikan sistem pendeteksian objek berbasis algoritma *You Only Look Once* versi 11 (YOLOv11) sebagai pendukung mekanisme pengereman otomatis dengan aktuator linear 12V. Sistem dikembangkan dengan memanfaatkan kamera vision sebagai sensor input, mikrokontroler Arduino UNO sebagai pengendali, serta aktuator linear 12V yang berfungsi sebagai eksekutor pengereman. YOLOv11 dipilih karena kemampuannya mendeteksi objek secara real-time dengan tingkat akurasi tinggi, sehingga relevan untuk aplikasi keselamatan aktif seperti *Automatic Emergency Braking* (AEB). Metode penelitian meliputi studi literatur, analisis kebutuhan, perancangan perangkat keras dan perangkat lunak, implementasi prototipe, serta pengujian performa sistem. Hasil pengujian menunjukkan rata-rata *frame rate* kamera sebesar 7,77 FPS dengan waktu pemrosesan per frame sekitar 0,1286 detik. Sistem mampu mengestimasi jarak objek dengan tingkat kesalahan rata-rata 2,99% dan menghasilkan rata-rata confidence YOLOv11 sebesar 81,75%. Evaluasi metrik deteksi menunjukkan akurasi 81,25%, presisi 100%, recall 81,25%, F1-score 89,66%, serta *error rate* 18,75%. Berdasarkan hasil tersebut, dapat disimpulkan bahwa sistem pendeteksian objek berbasis YOLOv11 yang terintegrasi dengan Arduino UNO dan aktuator linear 12V mampu mendukung mekanisme pengereman otomatis dengan respons cepat dan akurasi tinggi. Penelitian ini memberikan kontribusi dalam pengembangan prototipe sistem keselamatan aktif yang efisien, terjangkau, dan berpotensi untuk diadaptasi pada kendaraan listrik maupun perangkat otonom lainnya

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Kata Kunci: *Rem Otomatis, YOLOv11, Arduino UNO, Linear Aktuator, Confidence.*

ABSTRACT

This research aims to design and implement an object detection system based on You Only Look Once version 11 (YOLOv11) to support an automatic braking mechanism using a 12V linear actuator. The system is developed by utilizing a vision-based camera as the input sensor, an Arduino UNO microcontroller as the controller, and a 12V linear actuator as the braking executor. YOLOv11 was selected due to its capability to detect objects in real-time with high accuracy, making it highly relevant for active safety applications such as Automatic Emergency Braking (AEB). The research methodology includes literature review, requirement analysis, hardware and software design, prototype implementation, and performance testing. The experimental results show that the average camera frame rate is 7.77 FPS with a processing time of approximately 0.1286 seconds per frame. The system can estimate object distance with an average error of 2.99% and achieves an average YOLOv11 confidence of 81.75%. Evaluation metrics indicate an accuracy of 81.25%, precision of 100%, recall of 81.25%, F1-score of 89.66%, and an error rate of 18.75%. Based on these results, it can be concluded that the YOLOv11-based object detection system integrated with Arduino UNO and a 12V linear actuator is capable of supporting an automatic braking mechanism with fast response and high accuracy. This research contributes to the development of an efficient and affordable active safety prototype system, which has potential to be adapted in electric vehicles and other autonomous platforms.

***Keywords**: Automatic Braking, YOLOv11, Arduino UNO, Linear Actuator, Confidence.*