Scopus

Documents

Akbar, H.T.[a] , Ismail, N.[a] , Kumalasari, R.R.[a] , Gunawan, T.S.[b] , Nugroho, B.S.[c] , Yaacob, M.[b]

Rapid and Accurate Type 2 Charging Ports Detection for Electric Vehicles Using YOLOv8

(2024) *Proceeding of the IEEE International Conference on Smart Instrumentation, Measurement and Applications, ICSIMA*, (2024), pp. 30-35.

DOI: 10.1109/ICSIMA62563.2024.10675522

[a] UIN Sunan Gunung Djati Bandung, Department of Electrical Engineering, Bandung, Indonesia
[b] International Islamic University Malaysia, Electrical and Computer Eng. Department, Kuala Lumpur, 53100, Malaysia
[c] Telkom University, School of Electrical Engineering, Bandung, 40257, Indonesia

Abstract
The efficiency and convenience of electric vehicles (EVs) are of the utmost importance as they become more prevalent. The vision system, responsible for precisely detecting charging ports to guarantee proper connector alignment, is a critical element of automatic charging stations. This research focuses on the necessity of a port detection model that is particularly effective for Type 2 charging ports, which are frequently employed in electric vehicles. The objective of the investigation is to improve the precision and efficiency of port detection, a critical step in the development of fully automated charging stations. We annotated the data on the Roboflow website and trained a model with the YOLOv8 algorithm on Google Colab using a dataset of 223 images. The research showed that the optimal performance was achieved with a train-test ratio of 70:30, resulting in a mean Average Precision (mAP) of 99.5%, precision of 99.5%, and recall of 100%. The model can detect Type 2 ports in real-time using a webcam with a less than one second detection speed. The results of this study suggest that the system can be effectively implemented in robotic arms for automated EV charging stations, thereby significantly improving the user experience by reducing the necessity for manual intervention. This research establishes the foundation for future automated electric vehicle charging technology developments. © 2024 IEEE.

Author Keywords
automated charging station; electric vehicle; EV charging automation; real-time detection; Type 2 charging port detection; YOLOv8

Index Keywords
Automated charging station, Automatic charging, Charging station, Critical elements, Electric vehicle charging, Electric vehicle charging automation, Real-time detection, Type 2 charging port detection, Vision systems, YOLOv8; Robotic arms

References

- Bibra, E.M.
(2022) *Global EV Outlook 2022: Securing Supplies for An Electric Future*,
- Vishnuram, P.
A comprehensive review on EV power converter topologies charger types infrastructure and communication techniques
(2023) *Frontiers in Energy Research*, 11, p. 1103093.
- Faddel, S., Youssef, T., Elsayed, A.T., Mohammed, O.A.
An automated charger for large-scale adoption of electric vehicles
(2018) *IEEE Transactions on Transportation Electrification*, 4 (4), pp. 971-984.
- Quan, P., Lou, N.Y., Lin, H., Liang, Z., Wei, D., Di, S.
Research on Identification and Location of Charging Ports of Multiple Electric Vehicles Based on SFLDLC-CBAM-YOLOV7-Tinp-CTMA
(2023) *Electronics*, 12 (8), p. 1855.
- Bang, Y., Lee, Y., Kang, B.
Image-To-image translation-based data augmentation for robust EV charging inlet detection
(2022) *IEEE Robotics and Automation Letters*, 7 (2), pp. 3726-3733.

- Jiang, P., Ergu, D., Liu, F., Cai, Y., Ma, B.
A Review of Yolo algorithm developments
(2022) *Procedia Computer Science*, 199, pp. 1066-1073.

- Pan, M., Sun, C., Liu, J., Wang, Y.
Automatic recognition and location system for electric vehicle charging port in complex environment
(2020) *IET Image Processing*, 14 (10), pp. 2263-2272.

- Tadic, V.
Study on automatic electric vehicle charging socket detection using ZED 2i depth sensor
(2023) *Electronics*, 12 (4), p. 912.

- Gunawan, T.S., Kartiwi, M., Mansor, H., Yusoff, N.M.
Palm Fruit Ripeness Detection and Classification Using Various YOLOv8 Models
(2023) *2023 IEEE 9th International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA*, pp. 193-198.

Correspondence Address
Akbar H.T.; UIN Sunan Gunung Djati Bandung, Indonesia; email: hilmantaufik00@gmail.com

Publisher: Institute of Electrical and Electronics Engineers Inc.

Conference name: 10th IEEE International Conference on Smart Instrumentation, Measurement and Applications, ICSIMA 2024
Conference date: 30 July 2024 through 31 July 2024
Conference code: 202737

ISSN: 26406543
Language of Original Document: English
Abbreviated Source Title: Proceeding IEEE Int. Conf. Smart Instrum., Meas. Appl., ICSIMA
2-s2.0-85208508487
Document Type: Conference Paper
Publication Stage: Final
Source: Scopus