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Diagnostics of Electric Vehicles Using OBD-II: Principles, Capabilities, and Prospects

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Abstract. Problem. *The increasing number of electric vehicles necessitates effective diagnostic methods, as traditional approaches developed for internal combustion engine (ICE) vehicles are not always suitable for electric transport. One of the key diagnostic tools is OBD-II, which allows for obtaining information about the state of a vehicle's electrical systems. However, the accuracy and limitations of this method require detailed analysis.* ***Objective.*** *To explore the possibilities of using OBD-II for diagnosing electric vehicles by analyzing their functional potential, features of data reading and interpretation, and assessing the limitations of this method in comparison with other diagnostic approaches.* ***Methodology.*** *An analysis of the functional capabilities of OBD-II for diagnosing electric vehicles was conducted. An experimental assessment of the accuracy of data obtained using OBD-II in real-time was performed. Diagnostic parameters of the high-voltage battery, inverter, and electric motor were analyzed, as well as the efficiency of energy consumption and regenerative braking.* ***Results.*** *The study confirmed that OBD-II allows obtaining important diagnostic data about an electric vehicle, particularly regarding the state of the battery, electric motor, and other components. However, limitations were identified related to the incompleteness of certain parameters, especially concerning battery cell balancing. This can affect the accuracy of assessing the condition of the high-voltage battery and its remaining capacity.* ***Originality.*** *The article provides a comprehensive analysis of the application of OBD-II for monitoring electric vehicles, differing from traditional approaches focused on ICE vehicles. The possibilities of diagnosing major electrical systems in real-time are evaluated.* ***Practical Value.*** *The results may be useful for electric vehicle owners who wish to independently monitor the technical condition of their vehicles, as well as for auto service centers that use OBD-II in their practice. Integrating OBD-II with more accurate data processing algorithms can improve the efficiency of electric vehicle diagnostics.*

Keywords: *electric vehicle diagnostics, OBD-II, battery condition, real-time monitoring, Car Scanner ELM OBD-II, error codes, energy consumption.*

Introduction

The development of electric vehicle (EV) transport requires effective methods for diagnosing their technical condition. Traditional diagnostic approaches used for internal combustion engine vehicles are not always suitable for electric transport. Key components of an electric vehicle, such as the high-voltage battery, traction motor, inverter, and charging system, require specialized diagnostic methods [1–3].

One of the popular tools for assessing vehicle condition is the Car Scanner ELM OBD-II. This device allows for real-time monitoring of electrical systems, reading of fault codes, and tracking of key vehicle parameters. Its use enables the detection of malfunctions, optimization of energy consumption, and improvement of overall EV performance [4, 5].

The battery is a crucial component of an electric vehicle, and its condition significantly affects the performance and longevity of the vehicle. Diagnostic methods based on battery parameter analysis allow for determining the State of Health (SOH) and remaining useful life [6, 7]. The use of OBD-II scanners for evaluating SOH and other critical parameters is becoming increasingly relevant. Research shows that real-time data analysis obtained via OBD-II can be an effective way to detect anomalies in the operation of an electric vehicle's systems [8].

Despite the widespread use of OBD-II scanners, their effectiveness for electric vehicles requires further investigation. It is important to assess the accuracy of the data obtained, the range of parameters available for monitoring, and how this information can be used for diagnostics. Additionally, the capabilities of the Car Scanner ELM OBD-II should be evaluated in comparison with other EV diagnostic methods [9].

Analysis of publications

Diagnosis of electric vehicles is a crucial component of their efficient operation and maintenance. Key diagnostic targets include the high-voltage battery (HVB), electric drive system, inverter, and other control systems, which differ significantly from those in conventional internal combustion engine (ICE) vehicles [10–12]. As such, modern diagnostic methods must account for the specific characteristics of electric transport and ensure high accuracy in the results obtained.

Since the battery is the primary energy source of an electric vehicle, its condition directly affects driving range and overall vehicle performance. In [10], a method for assessing the technical condition of HVBs in compact urban electric vehicles is proposed, based on analysis of operational parameters. The authors highlight degradation level of battery cells, depth of discharge, and temperature conditions during use as key indicators for estimating battery life.

Further studies confirm the importance of State of Health (SOH) as a key metric in battery diagnostics. In [11], the feasibility of evaluating HVB SOH under real-world operating conditions is examined, taking into account driving style and changes in charging parameters. The proposed method is based on analyzing current and voltage during battery operation and employs machine learning algorithms to predict degradation with high precision.

The continued development of diagnostic systems involves the use of artificial intelligence (AI) and automated data analysis algorithms. In [12], modern battery condition monitoring methods are explored, including SOH, State of Safety (SOS), Remaining Useful Life (RUL), and predictive models for estimating battery lifespan. The authors highlight the potential of cloud computing and AI integration to improve battery diagnostics accuracy.

In addition to monitoring HVB status, identifying malfunctions in EV systems is also a critical aspect of diagnostics. In [13], a classification of HVB failures is presented based on mechanical, electrical, thermal, and operational characteristics. Methods are proposed for detecting anomalies from both mechanistic and symptomatic perspectives, enabling more accurate identification of degradation causes.

Recently, interest has grown in the use of deep learning methods for analyzing the operation of EV electrical systems. Study [14] demonstrates the potential of using Long Short-Term Memory (LSTM) models for real-time fault prediction. This approach allows for effective analysis of parameter changes and early detection of potential failures.

Ensuring EV reliability also depends on robust control strategies for electrical components. In [15], fault-tolerant control algorithms aimed at improving EV safety are discussed. Methods for detecting unstable electrical processes and optimally balancing system reliability and implementation cost are proposed.

Many modern diagnostic methods are based on the use of OBD-II (On-Board Diagnostics), which provides detailed information on vehicle operation. Study [16] outlines the history of OBD-II development, its standardization, and its adaptation for modern transport systems.

Within this research area, particular attention is given to expanding the functional capabilities of OBD-II. In [17], the parameters available for monitoring are analyzed, including data on the battery, inverter, and other EV electronic systems. It is noted that OBD-II data can serve as the foundation for automated diagnostic systems.

A promising direction is the integration of OBD-II scanners with mobile applications, making diagnostic data more accessible to users. Study [18] describes the development of a mobile application that remotely receives diagnostic information via an OBD-II adapter, making vehicle condition analysis accessible to a wide range of users.

Further development of this technology involves the Internet of Things (IoT) and machine learning. In [19], an IoT-based solution is proposed that integrates OBD-II with AI methods for predictive diagnostics and maintenance recommendations. In [20], the possibility of integrating OBD-II with cloud services is considered for automated real-time diagnostic data processing and analysis.

The literature review demonstrates the relevance of using OBD-II scanners for diagnosing modern electric vehicles. Studies confirm the ability to obtain detailed real-time data on battery health, electrical systems, and power components, significantly simplifying diagnostics and maintenance.

However, current methods do not yet provide fully automated diagnostics and require improved data analysis algorithms. Moreover, further research is needed to assess the accuracy of parameters obtained via OBD-II scanners and to compare their effectiveness with other diagnostic methods.

In this context, a detailed evaluation of the capabilities of the Car Scanner ELM OBD-II and its effectiveness in diagnosing electric vehicles is highly warranted.

Purpose and Tasks

The aim of this study is to explore the potential use of OBD-II for electric vehicle diagnostics by analyzing its functional capabilities, data reading and interpretation features, as well as assessing the limitations of this method compared to other diagnostic approaches.

To achieve this goal, the following objectives must be addressed:

– Analyze modern diagnostic methods for electric vehicles, particularly the approaches for monitoring the condition of key technical components such as high-voltage batteries, inverters, and electric drives;

– Investigate the functional capabilities of OBD-II scanners and their ability to retrieve and process data from electric vehicle systems;

– Assess the advantages and limitations of using OBD-II for monitoring key operational parameters of electric vehicles;

– Conduct experimental testing of electric vehicle diagnostics using OBD-II and evaluate the accuracy of the results obtained;

– Compare the effectiveness of OBD-II diagnostics with other methods and develop recommendations for improving its application.

Capabilities and Functionality of OBD-II in Electric Vehicle Diagnostics

Modern vehicles have a significantly more complex electronic structure compared to those of previous decades. The number of electronic control units (ECUs) in today's cars is approximately ten times greater than in an average vehicle from the 1990s. This advancement allows for a broader and more detailed analysis of a vehicle's technical condition by collecting real-time data from numerous sensors and detecting faults at early stages. A key component in this process is the use of On-Board Diagnostics (OBD-II) scanners, which connect to the vehicle's diagnostic port and transmit information about the status of its systems [21].

One of the most popular tools for basic diagnostics is the Car Scanner ELM OBD-II. This device enables users to monitor the vehicle's technical condition, read fault codes, and track the main parameters of the powertrain and electrical systems. Its accessibility for ordinary users is particularly valuable, as it allows significant savings in time and cost by enabling users to analyze data independently.

Operating Principle and Functionality of OBD-II Scanners

OBD-II scanners collect information from a vehicle's electronic systems via a special diagnostic port (Fig. 1). This data includes:

– Diagnostic Trouble Codes (DTCs);

– Real-time operating parameters of the engine, battery, and other components (voltage, current, temperature, speed, pressure, etc.);

– Sensor status and their compliance with factory specifications;

– History of stored errors, which are not always displayed on the vehicle's dashboard.

Fig. 1. Types of some modern OBD-II scanners

Diagnostic trouble codes (DTCs) are registered when certain parameter values exceed acceptable limits or when a sensor stops responding. More advanced models of OBD-II scanners not only read data but also perform additional service functions such as resetting service messages, activating special modes, and even coding electronic control units.

Since 1996 in the United States and 2004 in Europe, OBD-II has become a mandatory standard for all new vehicles. This has ensured the unification of diagnostic systems, allowing the use of the same devices to read data across a wide range of vehicles.

Types of OBD-II Scanners and Their Features

The modern market offers a wide range of OBD-II scanners that differ in functionality, price, and compatibility with vehicles.

1. Basic OBD-II Readers (Entry-Level Segment)

Basic OBD-II readers connect to a smartphone or tablet via Bluetooth or Wi-Fi, making them convenient to use. They are the most affordable option among diagnostic tools, often costing just a few hundred hryvnias. The primary functionality of such scanners includes reading trouble codes and basic real-time vehicle parameters. Due to their simplicity, they are an optimal choice for regular drivers who want to independently monitor changes in vehicle parameters while driving.

2. Advanced OBD-II Scanners (Semi-Professional Level)

Advanced OBD-II scanners offer an extended set of features, including error code resetting, parameter graph viewing, and sensor testing. These devices enable a deeper analysis of a vehicle's electronic systems, providing more detailed diagnostics compared to basic models. The cost of such scanners starts at UAH 3000–4000 (as of early 2025), making them an accessible solution for car enthusiasts and service technicians. One of the popular representatives of this category is the Launch X431 Pro3S OBD-II, shown in Fig. 2 [22].

Fig. 2. Launch x431 Pro3S OBD-II multi-brand car scanner

3. Professional Diagnostic Systems

Professional OBD-II scanners are typically used in auto service centers and by certified dealers, as their functionality extends far beyond basic diagnostics. These devices not only read error codes but also allow modifications to the electronic control unit (ECU) settings, key programming, sensor calibration, and other advanced operations. The use of such tools requires specialized knowledge and appropriate training, as improper interference with a vehicle's system can lead to malfunctions. Due to their high functionality and professional focus, their cost is significantly higher—starting from tens of thousands of hryvnias.

Thus, devices like the Car Scanner ELM OBD-II represent an accessible and user-friendly solution for vehicle diagnostics at home, whereas professional diagnostic tools are intended for deeper system analysis and require additional expertise.

Electric Vehicle Diagnostic Algorithm Using OBD-II

The functionality of diagnostic devices may vary depending on the model, but the core principle remains the same [21].

1. Connecting the Scanner. All modern vehicles are equipped with a standard OBD-II port, typically located under the steering column or on the center console (see Fig. 3). In some models, this connector may be hidden behind a plastic cover, which must be removed before connecting the scanner.

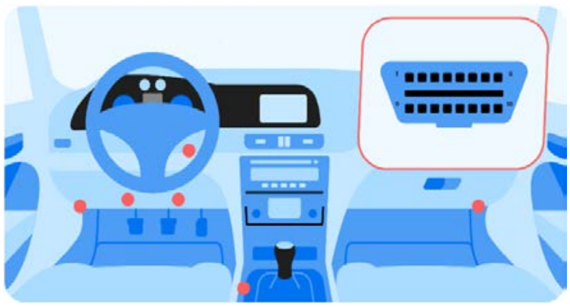


Fig. 3. OBD-II port locations in cars [21]

Many modern diagnostic devices use wireless connectivity via Bluetooth or Wi-Fi, significantly simplifying the interaction process with a smartphone or tablet. Before starting, it is important to ensure that the relevant communication module is enabled on the mobile device and that the appropriate software for working with the scanner is installed.

2. Switching on the vehicle. To allow the scanner to access the electronic control units (ECUs), the vehicle must be turned on. For traditional internal combustion engine (ICE) vehicles, it is usually sufficient to turn the key to the "ignition" position without starting the engine.

In the case of electric or hybrid vehicles, the vehicle should be set to "Ready" mode.

To avoid excessive load on the electrical system during diagnostics, it is recommended to turn off auxiliary energy consumers such as headlights, audio systems, and air conditioning.

3. Vehicle identification. After establishing the connection between the OBD-II scanner and the vehicle, it is necessary to select the make, model, and configuration of the vehicle. This allows the software to properly detect available electronic units and correctly interpret diagnostic data.

Many modern scanners support automatic reading of the VIN (Vehicle Identification Number), which greatly simplifies the identification process. If automatic detection fails, the user can enter the VIN manually.

4. Performing diagnostics and reading error codes. At this stage, the software offers a choice of scanning mode. Some scanners allow analysis of individual control units (e.g., only the engine or battery system), while others support full scanning of all accessible electrical systems.

The scanning process may take from a few seconds to several minutes, depending on the vehicle's make and model. Upon completion, the screen displays DTCs (Diagnostic Trouble Codes) that indicate identified faults.

Error codes can vary in severity:

– Temporary faults – may disappear after restarting the engine;

– Permanent faults – indicate serious issues requiring correction;

– Stored faults – contain information about previously occurred malfunctions.

5. Analyzing the results. The DTCs obtained during the scan must be interpreted correctly, as the same error may have different root causes. Some codes indicate a specific faulty component, while others require further analysis.

For example, if the scanner reports an oxygen sensor fault, it doesn't necessarily mean the sensor is broken. It may result from damaged wiring, an exhaust leak, or a faulty catalytic converter. Therefore, for more accurate diagnostics, it is necessary to additionally check the sensor's real-time operating parameters.

6. Real-time parameter monitoring. In addition to reading error codes, most OBD-II scanners support viewing live data from the vehicle. This includes:

– Battery charge level;

– Voltage and current in various power circuits;

– Temperature of electrical system components;

– Operating pressure in braking and air conditioning systems.

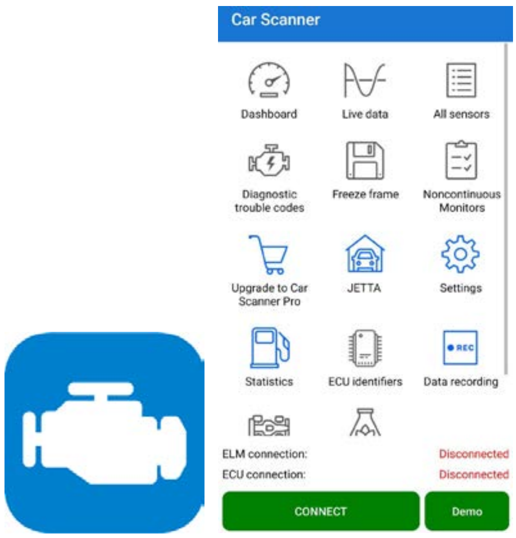
Such monitoring helps detect hidden faults that have not yet triggered error codes but may affect vehicle performance. For instance, if an electric vehicle loses power and the scanner shows no active faults, it is advisable to check the high-voltage battery voltage and the inverter temperature.

7. Error correction and result verification. After diagnostics and elimination of detected faults, it is necessary to clear the DTCs. This helps determine whether the problem has been resolved or if the error will reappear after some driving time.

If the codes do not reappear after being cleared, the vehicle is functioning correctly. If the same fault reoccurs, diagnostics should be repeated, and hidden causes investigated.

Analysis of the operation of Car Scanner ELM OBD-II in diagnosing electric vehicles

Car Scanner ELM OBD-II is a mobile application designed for diagnosing and monitoring the condition of a vehicle using a smartphone or tablet (Fig. 4).



a b

Fig. 4 – Car Scanner ELM OBD-II application: a – app icon; b – main menu interface

It works in combination with OBD-II adapters based on the ELM327 chip, which connect to the car's diagnostic port. The app supports a wide range of features that allow users not only to obtain basic information about the technical condition of the vehicle but also to perform in-depth analysis of the vehicle's electronic systems [23].

The application offers an extensive set of features that significantly expand vehicle diagnostic capabilities. The main functions include:

– Customizable dashboard – users can personalize the interface by adding needle gauges, text values, or graphs;

– Additional sensor support – enables the display of parameters not shown on the standard vehicle dashboard;

– Expanded DTC and freeze frame database – includes a large library of diagnostic trouble codes (DTC) with descriptions and explanations, as well as the ability to view sensor data at the moment the fault occurred;

– Self-diagnostics of ECUs – allows data retrieval from the main control modules of the vehicle and monitoring of their operation;

– Compatibility with OBD-II-compliant vehicles – works with most modern cars that support the OBD-II standard;

– Preconfigured connection profiles for various car brands – simplifies setup for specific car models;

– Trip computer functionality – Car Scanner can act as a trip computer, showing fuel or energy consumption data;

– Emission analysis – assesses the level of pollutant emissions;

– Head-Up Display (HUD) mode – allows dashboard data to be projected onto the windshield for more convenient driving visibility;

– Bluetooth and Wi-Fi adapter support – provides flexibility in choosing a connection method.

In addition to its core features, the app also offers enhanced functions that make diagnostics more convenient and efficient:

– Flexible interface customization – users can create multiple pages with custom indicator sets and define their appearance;

– Advanced features for specific car brands – some connection profiles provide extended functionality for Toyota, Mitsubishi, GM, Opel, Vauxhall, Chevrolet, Nissan, Infiniti, Renault, Hyundai, Kia, Mazda;

– Real-time monitoring – enables tracking of all key indicators on a single screen, including voltage, current, pressure, temperature, and other critical parameters;

– Freeze frame analysis – allows viewing of sensor data at the time a fault occurred;

– Diagnostic session logging – users can review the history of checks and analyze changes in vehicle parameters over time.

Since the range of available parameters depends on the specific vehicle model and its ECU, the app's capabilities may vary. For the most accurate analysis, it is recommended to use compatible ELM327-based adapters and verify function support for the specific car model.

Conclusions

The conducted research confirmed that the use of OBD-II for electric vehicle diagnostics is effective but has certain limitations. This technology enables the acquisition of important diagnostic information and monitoring of the condition of key vehicle components; however, it requires further improvement to enhance the accuracy of the obtained data. In the future, integrating OBD-II with more precise data processing algorithms and combining it with other diagnostic technologies may significantly improve the quality of technical condition monitoring for electric vehicles.

Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

1. Zoryna, T. G., Aliaksandrovich, S. A., Valeeva, Y. S., Kalinina, M. V., Ilikova, L. E., & Suvonovich, E. Y. (2022, June). *Measures to stimulate the development of electric transport as a tool for the development of the territory*. In 2022 8th International Conference on Energy Efficiency and Agricultural Engineering (EE&AE) (pp. 1-7). IEEE.
2. Plakhtii, O., Prokhorova, V., Bagach, R., Zhuchenko, O., Yermilova, N., & Perets, K. (2023, October). *Research of Accumulator Blocks of Electric Vehicles and Charging Station Based on Current Source Rectifier*. In 2023 IEEE 4th KhPI Week on Advanced Technology (KhPIWeek) (pp. 1-6). IEEE.
3. Arhun, S., Migal, V., Hnatov, A., Hnatova, H., & Ulyanets, O. (2020). System Approach to the Evaluation of the Traction Electric Motor Quality. *EAI Endorsed Transactions on the Energy Web*, 7(26). doi: 10.4108/eai.13-7-2018.162693.
4. Arhun, S., Migal, V., Hnatov, A., Ponikarovska, S., Hnatova, H., & Novichonok, S. (2020). Determining the Quality of Electric Motors by Vibro-Diagnostic Characteristics. *EAI Endorsed Trans. Energy Web*, 7(29), e6. doi: 10.4108/eai.13-7-2018.164101.

5. Borodenko, Y., Arhun, S., Hnatov, A., Kunicina, N., Bisenieks, M., Migal, V., & Hnatova, H. (2023). Diagnostics of electric drive Electric vehicle with Valve Motor. *Przegląd Elektrotechniczny*, 99(6). DOI 10.15199/48.2023.06.07.
6. Migal, V., Arhun, S., Hnatov, A., Ulianets, O., & Shevchenko, I. (2024). Requirements for vibroacoustic methods of the quality assessment of vehicles traction electric motors. *Noise & Vibration Worldwide*, 55(4-5), 210-219. https://doi.org/10.1177/09574565241243390
7. Borodenko, Y., Ribickis, L., Zabasta, A., Arhun, S., Kunicina, N., Zhiravetska, A., ... & Kunicins, K. (2020). Using the method of the spectral analysis in diagnostics of electrical process of propulsion systems power supply in electric car. *Przeglad Elektrotechniczny*, 96(10), 47-50. doi:10.15199/48.2020.10.08.
8. Mygal, V., Arhun, S., Hnatov, A., Ulianets, O., Kunicina, N., & Ribickis, L. (2022, May). Diagnostics of Tractor Transmissions by Vibration Levels. *In 2022 IEEE 7th International Energy Conference (ENERGYCON)* (pp. 1-4). IEEE. DOI: 10.1109/ENERGYCON53164.2022.9830506.
9. Аргун, Щ. В., Гнатов, А. В., & Ульянець, О. А. (2016). Екологічний та енергоефективний атомобільний транспорт та його інфраструктура. № 2 (77), 18–27. Argun, Sh. V., Hnatov, A. V., & Ulyanets, O. A. (2016). Ekolohichnyi ta enerhoefektyvnyi avtomobilnyi transport ta yoho infrastruktura [Ecological and energy-efficient automobile transport and its infrastructure]. No. 2 (77), 18–27.
10. Małek, A., & Toccani, R. (2021). Innovative approach to electric vehicle diagnostics. *Archiwum Motoryzacji*, 92(2), 49-67.
11. You, G. W., Park, S., & Oh, D. (2017). Diagnosis of electric vehicle batteries using recurrent neural networks. *IEEE Transactions on Industrial Electronics*, 64(6), 4885-4893. DOI: 10.1109/EEAE53789.2022.9831360.
12. Zhao, J., & Burke, A. F. (2022). *Electric vehicle batteries: status and perspectives of data-driven diagnosis and prognosis*. Batteries, 8(10), 142. https://doi.org/10.3390/batteries8100142
13. Hong, J., Liang, F., Yang, J., & Du, S. (2024). An exhaustive review of battery faults and diagnostic techniques for real-world electric vehicle safety. *Journal of Energy Storage*, 99, 113234. https://doi.org/10.1016/j.est.2024.113234
14. Kaplan, H., Tehrani, K., & Jamshidi, M. (2021). A fault diagnosis design based on deep learning approach for electric vehicle applications. *Energies*, 14(20), 6599. https://doi.org/10.3390/en14206599
15. Wu, C., Sehab, R., Akrad, A., & Morel, C. (2022). Fault diagnosis methods and Fault tolerant control strategies for the electric vehicle powertrains. *Energies*, 15(13), 4840. https://doi.org/10.3390/en15134840
16. Rybitskyi, O., Golian, V., Golian, N., Dudar, Z., Kalynychenko, O., & Nikitin, D. (2023). Using OBD-2 technology for vehicle diagnostic and using it in the information system. Bulletin of National Technical University "KhPI". Series: System Analysis, *Control and Information Technologies*, (1 (9), 97–103. https://doi.org/10.20998/2079-0023.2023.01.15
17. Rimpas, D., Papadakis, A., & Samarakou, M. (2020). OBD-II sensor diagnostics for monitoring vehicle operation and consumption. *Energy Reports*, 6, 55-63. https://doi.org/10.1016/j.egyr.2019.10.018
18. Iskandar, K., Tambayong, A., Mulya, M. R. F., Elfanlie, S. C., & Herlina, M. G. (2023). Mobile-Based Car Diagnostic Application Using Onboard Diagnostic-II Scanner. ComTech: *Computer, Mathematics and Engineering Applications*, 14(2), 129-141. https://doi.org/10.21512/comtech.v14i2.9138
19. More, A., Khane, S., Jadhav, D., Sahoo, H., & Mali, Y. K. (2024, June). Auto-shield: Iot based OBD Application for Car Health Monitoring. In 2024 *15th International Conference on Computing Communication and Networking Technologies* (ICCCNT) (pp. 1-10). IEEE. DOI: 10.1109/ICCCNT61001.2024.10726186
20. Kezia, M., & Anusuya, K. V. (2023, December). IoT-based Web-Integrated OBD-II Telematics for Real-Time Vehicle Health Monitoring System. In 2023 *International Conference on Intelligent Technologies for Sustainable Electric and Communications Systems* (iTech SECOM) (pp. 91-96). IEEE. DOI: 10.1109/iTechSECOM59882.2023.10435307
21. Як користуватися сканером OBD2? https://www.carvertical.com/ua/blog/yak-korystuvatysya-skanerom-obd2. Yak korystuvatysia skanerom OBD2? (n.d.). *Yak korystuvatysia skanerom OBD2?* [How to use an OBD2 scanner?]. Retrieved from https://www.carvertical.com/ua/blog/yak-korystuvatysya-skanerom-obd2.
22. Arhun, S., Borodenko, Y., Hnatov, A., Popova, A., Hnatova, H., Kunicina, N., ... & Ribickis, L. (2020). Choice of parameters for the electrodrive diagnostic system of hybrid vehicle traction. *Latvian Journal of Physics and Technical Sciences*, 57(4), 3-11. DOI: 10.2478/lpts-2020-0017
23. Car Scanner ELM OBD2 https://pdalife.com.ua/car-scanner-elm-obd2-android-a31553.html

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Діагностика електромобілів за допомогою OBD-II: принципи, можливості та перспективи

Анотація. Проблема. *Зростання кількості електромобілів вимагає ефективних методів їхньої діагностики, адже традиційні підходи, розроблені для транспортних засобів із двигунами внутрішнього згоряння (ДВЗ), не завжди підходять для електротранспорту. Одним із ключових інструментів діагностики є OBD-II, який дозволяє отримувати інформацію про стан електросистем автомобіля. Проте точність та обмеження цього методу потребують детального аналізу.* ***Мета.*** *Дослідити можливості використання OBD-II для діагностики електромобілів шляхом аналізу його функціонального потенціалу, особливостей зчитування та інтерпретації даних, а також оцінки обмежень цього методу у порівнянні з іншими діагностичними підходами.* ***Методологія.*** *Проведено аналіз функціональних можливостей OBD-II для діагностики електромобілів. Виконано експериментальну оцінку точності даних, отриманих за допомогою OBD-II, у режимі реального часу. Проаналізовано діагностичні параметри високовольтної батареї, інвертора та електродвигуна, а також оцінено ефективність енергоспоживання та рекуперативного гальмування.* ***Результати.*** *Дослідження підтвердило, що OBD-II дозволяє отримувати важливі діагностичні дані про електромобіль, зокрема про стан батареї, електродвигуна та інших компонентів. Однак виявлено обмеження, пов'язані з неповнотою деяких параметрів, особливо щодо балансування осередків батареї. Це може впливати на точність оцінки стану високовольтної батареї та її залишкової ємності.* ***Оригінальність.*** *У статті проведено комплексний аналіз застосування OBD-II для моніторингу електромобілів, що відрізняється від традиційних підходів, орієнтованих на автомобілі з ДВЗ. Оцінено можливості діагностики основних електросистем у реальному часі.* ***Практична цінність.*** *Результати можуть бути корисними для власників електромобілів, які бажають самостійно контролювати технічний стан транспортного засобу, а також для автосервісів, що використовують OBD-II у своїй практиці. Інтеграція OBD-II з більш точними алгоритмами обробки даних може покращити ефективність діагностики електромобілів.*

Ключові слова: *діагностика електромобілів, OBD-II, стан батареї, моніторинг у реальному часі, Car Scanner ELM OBD-II, коди помилок, енергоспоживання.*

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