

ANALYSIS OF FEATURES IN THE DESIGN OF SMALL-DIMENSIONED ROBOTS

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Annotation: Analysis of features in the design of small-sized robots reveals key aspects related to their mobility, energy efficiency and flexibility. The design of such robots requires weight and size optimization, which allows them to be used in narrow spaces and difficult conditions. This opens up new opportunities for the use of small-sized robots in specialized industries where high maneuverability and precision are required.

Key words: Industry 4.0, small robots, feature analysis, design.

The analysis of features in the design of small-sized robots is an important aspect of modern robotics, which opens up new opportunities for their use in various fields of industry, medicine and research. Small-sized robots have advantages in mobility, maneuverability and flexibility, which allows them to be used in narrow spaces and hard-to-reach places. They are often used for tasks that require high precision, such as inspection, repair or data collection in difficult environments. The design of small-sized robots implies a reduction in weight and size, which necessitates the use of more compact components and energy-efficient solutions. It is also important to consider the balance between performance and autonomy, which affects the choice of energy sources and control systems. Unlike classic robots, which are focused on performing large tasks in large-scale industrial processes, small-sized robots have a smaller lifting capacity, but at the same time provide greater flexibility and adaptability. Table 1 shows a comparison of the main features in the design of small-sized and classical robots.

Table 1 – Comparison of the main features in the design of small-sized and classic robots

Parameter	Small works	Classical works
Size and weight	Compact, light	Big, heavy
Maneuverability	High	limited
Carrying capacity	low	High
Energy efficiency	Priority	Not always a priority
Field of application	Narrow spaces, research	Large-scale production
Energy source	Compact, autonomous	Powerful, stationary
Flexibility in setting	High	Average

Analysis of the comparison table of compact and classic robots reveals several key differences in their design features. Small-sized robots have a significant advantage in their mobility and maneuverability, which allows them to be used in difficult conditions and limited spaces. At the same time, their lower load capacity and limited energy resources can reduce efficiency in performing heavy industrial tasks, which is an advantage of classic robots. Classic robots, with their high productivity and ability to work in large-scale processes, are better suited for large production lines, but are inferior to small-sized robots in flexibility and adaptability. Small-scale robots require energy-efficient solutions due to limited power options, while classic robots can rely on more powerful, stationary power sources. In general, each type of robot has its strengths and weaknesses, which determines their optimal application depending on the specific requirements of the task.

CONCLUSIONS. The conclusions of the analysis of features in the design of small-sized robots indicate the importance of optimizing size and weight to ensure mobility and maneuverability in narrow spaces. The design of such robots requires the use of energy-efficient solutions and the use of compact components, which allows to increase their autonomy and reduce energy consumption. Although small-sized robots are inferior to classic robots in terms of carrying capacity, their flexibility and adaptability make them indispensable in tasks that require work in limited space or difficult conditions. In addition, an

important aspect is finding a balance between performance and compactness to ensure efficient performance of tasks with minimal dimensions. Design solutions for small-sized robots must take into account the specifics of tasks where classic robots cannot provide the required level of mobility or precision. Thus, small-sized robots find their place in specialized industries, where their compactness and flexibility are key advantages.

References:

1. Yevsieiev, V., Abu-Jassar, A., Maksymova, S., & Gurin, D. (2024). Human Operator Identification in a Collaborative Robot Workspace within the Industry 5.0 Concept. *Multidisciplinary Journal of Science and Technology*, 4(9), 95-105.
2. Yevsieiev, V., & Gurin, D. (2023). Comparative analysis of the advantages and disadvantages of collaborative robot control methods within Industry 5.0.
3. Attar, H., Abu-Jassar, A. T., Yevsieiev, V., Lyashenko, V., Nevliudov, I., & Luhach, A. K. (2022). Zoomorphic mobile robot development for vertical movement based on the geometrical family caterpillar. *Computational intelligence and neuroscience*, 2022(1), 3046116.
4. Abu-Jassar, A. T., Attar, H., Amer, A., Lyashenko, V., Yevsieiev, V., & Solyman, A. (2024). Development and Investigation of Vision System for a Small-Sized Mobile Humanoid Robot in a Smart Environment. *International Journal of Crowd Science*.
5. Maksymova, S., Yevsieiev, V., Nevliudov, I., & Uluhan, N. (2024). CONSTRUCTING AN OPTIMAL ROUTE FOR A MOBILE ROBOT USING A WAVE ALGORITHM. *Journal of Natural Sciences and Technologies*, 3(1), 282-289.
6. Nevliudov, I., Yevsieiev, V., Maksymova, S., Demska, N., Kolesnyk, K., & Miliutina, O. (2023, September). Mobile Robot Navigation System Based on Ultrasonic Sensors. In *2023 IEEE XXVIII International Seminar/Workshop on Direct and Inverse Problems of Electromagnetic and Acoustic Wave Theory (DIPED)* (Vol. 1, pp. 247-251). IEEE.
7. Nevliudov, I., Yevsieiev, V., Maksymova, S., & Chala, O. (2023). *A Small-Sized Robot Prototype Development Using 3D Printing* (Doctoral dissertation, FACULTY OF MECHANICAL ENGINEERING BIALYSTOK UNIVERSITY OF TECHNOLOGY).
8. Yevsieiev, V., Starodubcev, N., Maksymova, S., & Stetsenko, K. (2023). A Small-Scale Manipulation Robot a Laboratory Layout Development.
9. Gurin, D., Yevsieiev, V., Abu-Jassar, A., & Maksymova, S. (2024). Using the Kalman Filter to Represent Probabilistic Models for Determining the Location of a Person in Collaborative Robot Working Area. *Multidisciplinary Journal of Science and Technology*, 4(8), 66-75.
10. Gurin, D., Yevsieiev, V., Maksymova, S., & Alkhalailah, A. (2024). MobileNetv2 Neural Network Model for Human Recognition and Identification in the Working Area of a Collaborative Robot. *Multidisciplinary Journal of Science and Technology*, 4(8), 5-12.
11. Maksymova, S., Abu-Jassar, A., Gurin, D., & Yevsieiev, V. (2024). Comparative Analysis of methods for Predicting the Trajectory of Object Movement in a Collaborative Robot-Manipulator Working Area. *Multidisciplinary Journal of Science and Technology*, 4(10), 38-48.
12. Yevsieiev, V., Abu-Jassar, A., Maksymova, S., & Gurin, D. (2024). Human Operator Identification in a Collaborative Robot Workspace within the Industry 5.0 Concept. *Multidisciplinary Journal of Science and Technology*, 4(9), 95-105.
13. Yevsieiev, V., & Uskov, S. (2024, July). SECTION: AUTOMATION AND ROBOTICS DEVELOPMENT OF THE LAYOUT CONCEPT OF A SMALL-DIMENSIONED MOBILE ROBOT WITH INCREASED ACCESSIBILITY. In *XXXI International scientific and practical conference «Scientific Research in the Conditions of Rapid Development of Information Technologies»(July 17-19, 2024) Helsinki, Finland. International Scientific Unity, 2024. 201 p. ISBN 978-617-8427-23-8* (p. 33).