

SECTION: AUTOMATION AND ROBOTICS

DEVELOPMENT OF THE LAYOUT CONCEPT OF A SMALL-DIMENSIONED MOBILE ROBOT WITH INCREASED ACCESSIBILITY

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The relevance of the development of new concepts of layouts of small-sized mobile robots with increased cross-country ability is due to a number of modern challenges and trends in various fields. First, in the context of increasing urbanization and the increasing number of urban objects, such as steps, stairs, and uneven surfaces, high-traffic mobile robots can be effectively used to perform tasks in a variety of environments. Secondly, in connection with the expansion of the application of robotics in autonomous systems, for example, in the field of transport, medicine and research, the appearance of small-sized mobile robots becomes an integral part of this development. The ability to penetrate hard-to-reach places and move in conditions of limited space allows them to perform tasks that are difficult to solve using traditional methods. Third, in the context of increasing requirements for the efficiency and speed of task performance in various fields, including production and maintenance, the development of high-traffic mobile robot layouts can greatly facilitate routine operations and ensure more efficient use of resources. Summarizing, the development of new concepts of layouts of small-sized mobile robots, oriented to increased traffic, meets the requirements of modern society and opens up wide opportunities for improving autonomous systems in various industries [1-4].

Currently, there are the following types of running systems, an analysis of their advantages and disadvantages is given in Table 1.

Table 1 – Comparative analysis of types of running systems for small-sized mobile robots

Types of rolling stock	Application	Advantages	Disadvantages
1	2	3	4
Wheel system	Wheeled systems are suitable for working on flat surfaces and paths	High speed on flat areas, energy efficiency	Limited passability in uneven conditions
Tracked system	Tracked systems are ideal for uneven, soft or partially passable surfaces	High passability, stability on uneven areas, ability to maneuver	May be less effective on smooth or hard surfaces

Continuation of table 1

1	2	3	4
Combined running system	Uses a combination of wheels, tracks or other elements to improve versatility and performance in different conditions	Combines the advantages of different systems for optimal use in specific scenarios	Can be more complex and difficult than other systems
A leg with a hexagonal running system	Simulates the natural movements of animals, allows robots to overcome impassability in difficult conditions	Flexibility, the ability to adapt to different terrain conditions	More complex design and management, lower speed

In summary, combined mobile robot locomotion systems can be the optimal choice for those scenarios where it is necessary to combine the advantages of different types of locomotion mechanisms to efficiently perform various tasks.

Based on the conducted analysis, it is proposed to use a combined scheme of the chassis system within the framework of this study. The concept of the implementation of the combined scheme of the chassis system for a small-sized mobile robot is presented in Figure 1.

The description of the basic elements of the mobile robot presented on the concept is as follows: 1 – MG995 Tower Pro 360° or Futaba 3003 type servomotors (modified for continuous rotation; 2 – wheels; 3 – mobile robot body; 4 – Caterpillar sealing rings (thickness 3 mm, diameter 60 mm and 124 mm) According to the developed concept, the robot has the following possibilities of movement when the body is on top (fig. 2.a) and below (fig. 2.b).

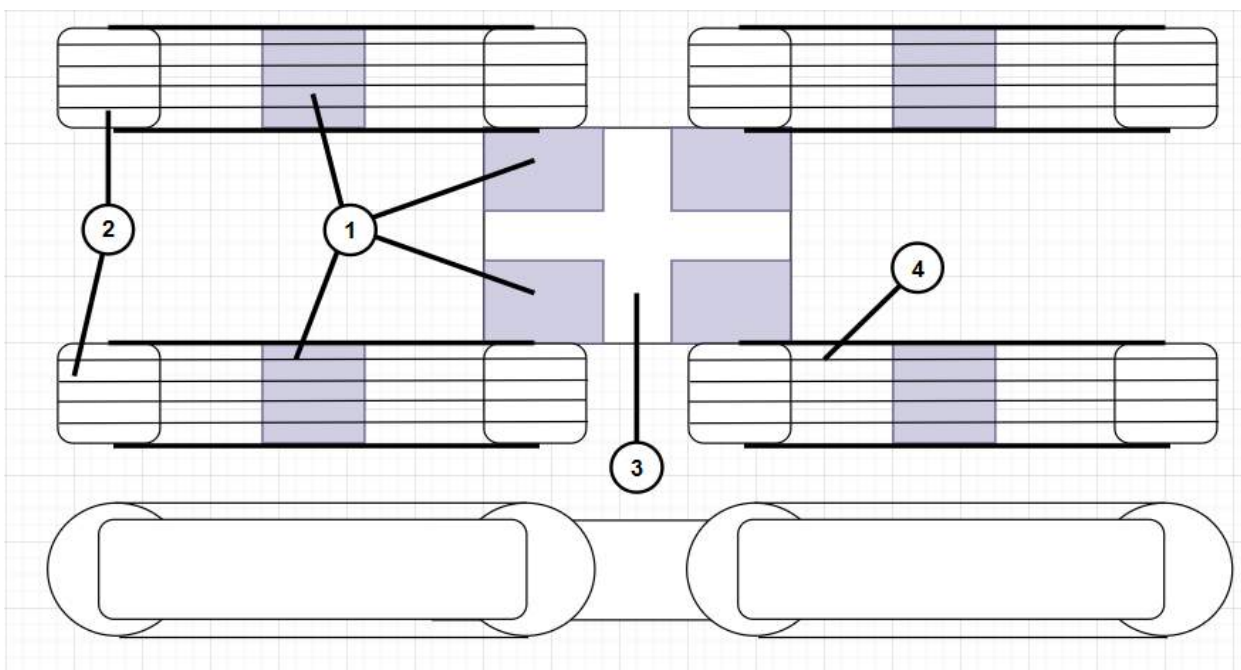
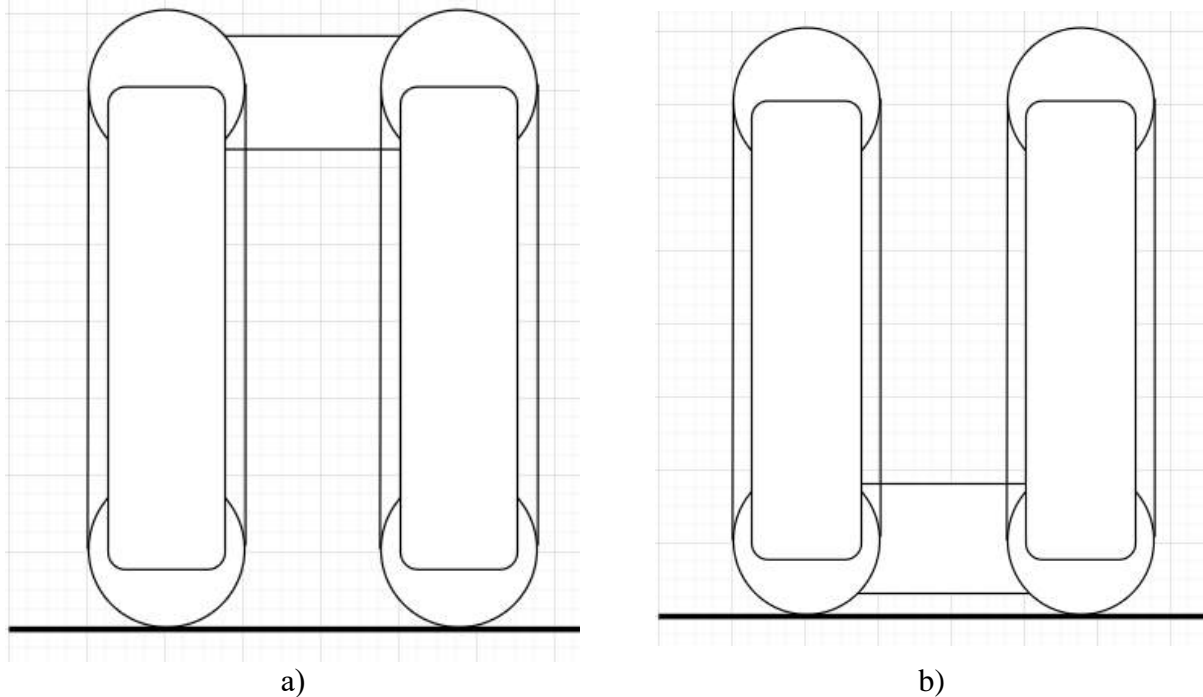


Figure 1 – Concept of implementation of the combined scheme of the chassis system for a small-sized mobile robot



a)

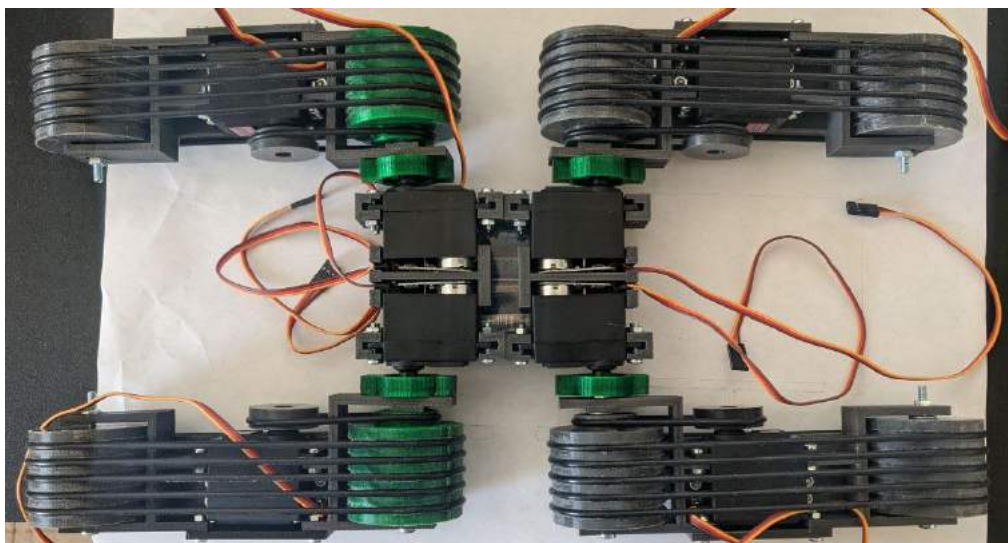
a) the body of the mobile robot is located on top;

b) the body of the mobile robot is located below

b)

Figure 2 – Concept of implementation of the combined scheme of the chassis system for a small-sized mobile robot

Based on the proposed concept in Figures 1 and 2, in the Autodesk fusion 360 environment, a 3D model of the mobile robot structures was developed from the combined scheme of the chassis system, and the main elements of the structures were printed on a Fnet F8 3D printer using PLA plastic. The general view of the experimental layout of the mobile robot with increased cross-country ability is presented in Figure 3.



a)



b)

a) top view;

b) side view

Figure 3 – General view of the experimental layout of a mobile robot with increased traffic without a control system

Conclusions: As part of the conducted research, a comparison table of types of running systems for small-sized mobile robots was built, their advantages and disadvantages during application were revealed. On the basis of the obtained results, a combined running system was chosen to solve the tasks of developing the concept of a small-sized mobile robot. As a result, the concept of implementing a combined scheme of the running system for a small-sized mobile robot was developed, which, according to the author's idea, provides an opportunity to improve patency in difficult conditions. A 3D model of structures was developed in the Autodesk fusion 360 environment, and an experimental layout of a mobile robot with increased traffic without a control system was assembled.

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