

ANALYSIS OF TOOLS FOR CREATING GRAPHIC IMAGES BASED ON 2D AND 3D MODELS

Antation. The study analyzes and defines the current state of technologies in creating graphic images and outlines the main problems that need to be solved. Key aspects of working with 2D and 3D graphics are highlighted, and the features of their combination are determined. Modern IT solutions in this area are analyzed, which makes it possible to assess the available technologies and their limitations. In particular, it was found that most existing software products are focused mainly on 2D graphics, while the integration of 3D elements remains insufficiently implemented or difficult for non-programmer users. The analysis identified the main shortcomings of the current technologies, including limited use of 3D objects in 2D compositions, insufficiently effective graphic layer management tools, and the lack of a centralized search and reuse mechanism for materials. To solve these problems, possible ways of improvement were considered, including implementing a web application with extended support for 3D graphics, intuitive interfaces, and an integrated resource search system.

Keywords: tools for creating graphic images, 2D and 3D graphics, graphic layer management tools, software for non-programmers.

Introduction. Graphic visualization is an important area in digital technologies, covering creating, editing, and manipulating two- and three-dimensional images. Modern IT solutions are actively used to automate the processes of image construction, which finds application in a wide range of professional fields, including art, design, education, and scientific research. For example, in interface design, users can use graphic editors to create layouts of websites or mobile applications. Using intuitive tools, they can easily add, modify, and place various interface elements.

Recently, there has been a trend of developing and improving tools that provide a wide range of opportunities for users who do not have deep programming knowledge. For example, the well-known application Procreate, which has found application in digital illustration and is known to many precisely for its tools for 2D graphics [1], now allows you to draw on a 3D surface [2]. Also, with the increasing influence of artificial intelligence on modern software solutions, many applications integrate graphics with the capabilities of neural networks. In particular, the well-known application Canva [3], which has found its purpose in creating various graphic documents, from presentations to resumes, now allows you to create images based on text [4].

Materials and methods. Computer graphics is a vast field that encompasses a multitude of areas and applications. It is used in various fields, including entertainment (films, video games), design (graphics, architecture, industrial), medicine (medical imaging), science (data visualization), etc. The field is constantly evolving due to advances in hardware (e.g., graphics processors), software, and algorithms. Modern technologies such as ray tracing, virtual and augmented reality are expanding the capabilities of computer graphics [5].

Since computer graphics are used in various fields, it is worth choosing one of them to be able to better analyze its state and find possible problems. Next, we propose to consider methods of content creation that can be used by users without special programming skills.

2D graphics have become widely used in modern programs and user tools, providing convenient opportunities for content creation. One of the key advantages is accessibility and ease of use - tools for working with 2D graphics have a low entry threshold compared to 3D graphics, which allows even users without technical experience to easily create images, edit graphic materials and design documents. Among the main areas of application of 2D graphics are the creation of publications for social networks, the development of presentations and infographics, photo editing, the creation of digital illustrations, logos, brand design, and visual content of digital documents.

Without this, 2D graphics are effective visual communication, allowing users to convey information through files, diagrams, and designs.

However, recently there has been a growing interest in integrating 3D models in various industries. This is facilitated by the rapid development of technology, the growing demand for three-dimensional content and the desire of users to work with universal tools. This is especially noticeable in the design, architecture, advertising, and education industries. Programs such as Adobe Dimension and Figma have begun to support 3D elements alongside 2D graphics, allowing designers and artists to create more realistic mockups and interactive projects.

Analysis of similar solutions on the market. Today, there are a number of software products that allow you to process 2D and 3D graphics. The field of graphics processing is developing rapidly due to the growth of computing power, the use of artificial intelligence and the improvement of visualization algorithms. Modern IT solutions cover a wide range of approaches to processing graphic images.

Raster graphics, which can be represented in various file formats, are widely used in photography and digital painting. For example, they have found applications in the advertising industry to create banners and visual materials.

Vector graphics, which provide scalability without loss of quality, are used in the field of branding and typography, for example, for the development of logos and iconography in UI/UX design [6].

3D modeling is actively used in architectural design, where specialists create detailed virtual models of buildings and urban spaces for presentations and visualization.

Machine learning and computer vision algorithms allow you to automate image analysis, extract key features, and classify objects without human intervention. They are used in

many areas where fast and accurate processing of visual data is important. For example, in medicine, these technologies are used to analyze medical images.

The combination of web tools with graphics technologies expands the possibilities of working with images without the need to install special software. Thanks to modern web APIs and integration with graphics libraries, users can create, edit, and analyze graphic content directly in the browser.

For example, online graphic design platforms allow teams to collaborate on projects in real-time, editing layouts, illustrations, and 3D models directly in the browser.

However, many of these solutions are difficult for non-specialists to use or require in-depth knowledge of the software tools. In addition, they often do not provide the ability to integrate photos and 3D models into a single environment without additional processing.

Another issue is cross-platform support. Many graphic editors are focused on only one platform, which can be a problem for users who work on different operating systems or mobile devices.

Most modern software solutions are focused on creating content within a certain area, which necessitates their adaptation to specific tasks. This requires additional settings, plugins, or even separate programs for each use case.

Another significant drawback is the need to search for materials on third-party resources. For example, users who create presentations or graphic layouts are forced to search for appropriate images and models outside the environment in which they work. This increases time consumption and complicates the process of integrating different types of content.

Many modern software solutions lack seamless integration with other tools or platforms, making it difficult to share data and collaborate. This can create additional difficulties for teams or individual users who want to use multiple tools at the same time.

One significant problem can be high licensing and subscription costs. Many software solutions have high licensing costs or require regular subscriptions, which can be expensive for small businesses or individual users who do not have the opportunity to spend a lot of money on software.

Another problem is the limited documentation and training resources. For new or non-professional users, it is difficult to find accessible and understandable instructions or training materials. This can reduce the effectiveness of software solutions and increase the time required to master the tools.

Since there are currently many different applications for working with 2D and 3D graphics on different platforms, for convenience, we focused only on web applications. Two applications were chosen for comparison: Canva [3] and VistaCreate [7]. These applications are popular online graphic design platforms that aim to make design accessible to everyone, especially those without professional design experience.

These applications are focused on using 2D tools and do not provide for the addition of 3D models. For a significant number of cases, this is not a problem, but there are situations where using a 3D model can be much more convenient and save time. Also, in many tasks, it

would be desirable to have more tools for manipulating layers, in particular the ability to control the visibility and transparency of a layer.

Results and discussion. To reduce the threshold for entry for non-programmers, it is necessary to create more intuitive interfaces with adaptive learning and prompts, as well as implement artificial intelligence algorithms to automate routine tasks.

Additionally, cross-platform compatibility should be improved by developing web versions of applications that will work independently of the operating system and using cloud computing to be less dependent on the power of the device.

To reduce the need to search for materials on third-party resources, it is worth adding built-in libraries of photos, 3D models, textures and other resources, as well as integrating with search engines and stock platforms. Using AI content generators will allow you to create missing elements directly in the application.

To improve compatibility with other tools, open data exchange standards should be used and popular formats such as glTF, SVG, PSD or AI should be supported. The ability to export to formats that are easily opened in other programs and the implementation of APIs for integration with platforms such as Figma, Blender, or Photoshop would also be useful. All these improvements will contribute to making graphic tools more accessible, convenient, and effective for a wide range of users. An approximate diagram of the use cases is shown in the figure.

Conclusions. Considering the general provisions of the subject area in creating graphic images allowed us to highlight key aspects of working with 2D and 3D graphics and determine the features of their combination. The analysis of modern IT solutions made it possible to assess the available technologies and their limitations. In particular, it was found that most existing software products are focused mainly on 2D graphics, while the integration of 3D elements remains insufficiently implemented or difficult for non-programmer users.

The analysis identified the main shortcomings of the current state of technology, including limited use of 3D objects in 2D compositions, insufficiently effective graphic layer management tools, and the lack of a centralized search mechanism and reuse of materials. To solve these problems, possible ways of improvement were considered, including implementing a web application with extended support for 3D graphics, intuitive interfaces, and an integrated resource search system.

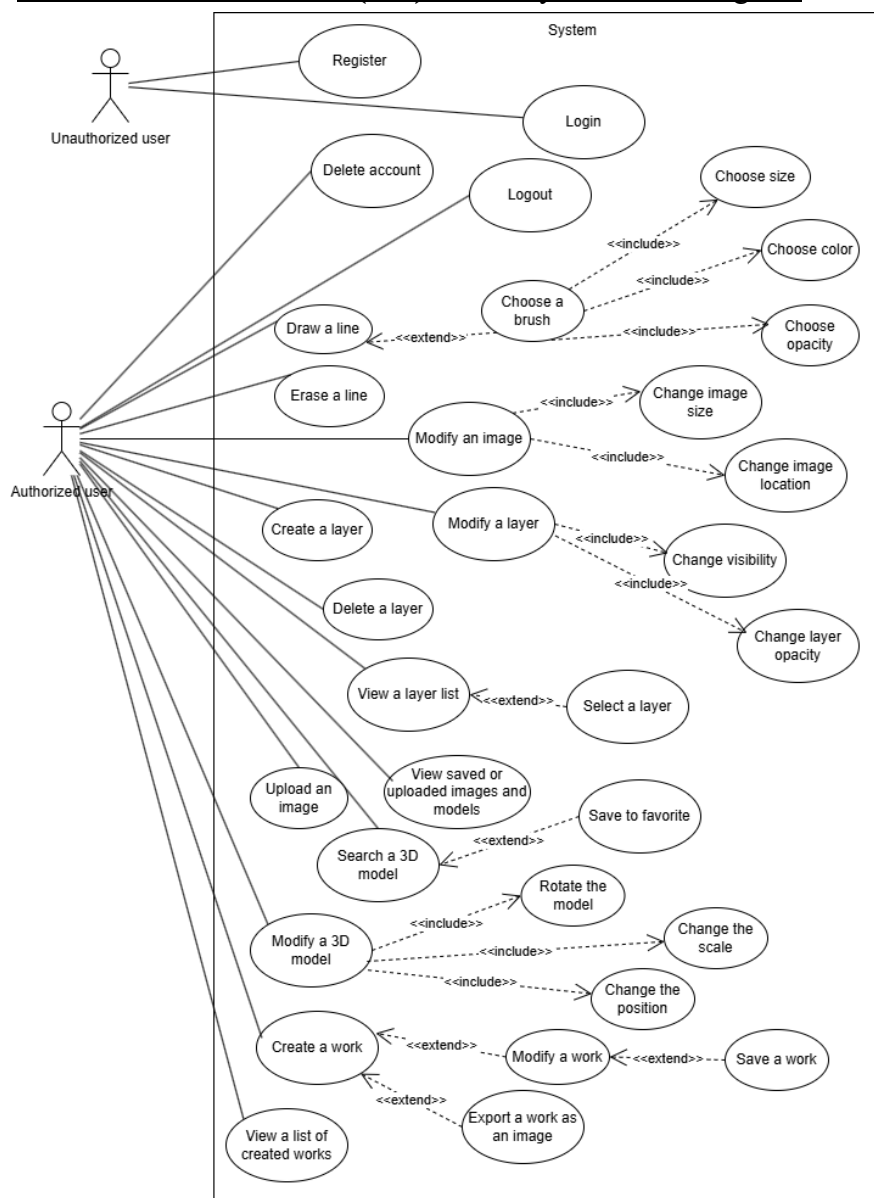


Figure 1

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Received 14.05.2025.
Accepted 19.05.2025.

Аналіз інструментів для створення графічних зображень на основі 2D- та 3D-моделей

У роботі проведено аналіз та визначено поточний стан технологій у сфері створення графічних зображень, а також окреслено основні проблеми, які потребують вирішення. Виділено ключові аспекти роботи з 2D- та 3D-графікою та визначено особливості їх поєднання. Проаналізовано сучасні IT-рішення у цій сфері, що дало змогу оцінити доступні технології та їхні обмеження. Зокрема, виявлено, що більшість існуючих програмних продуктів орієнтовані переважно на 2D-графіку, тоді як інтеграція 3D-елементів залишається недостатньо реалізованою або складною для користувачів-непрограмістів. У ході аналізу було ідентифіковано основні недоліки поточного стану технологій, серед яких: обмеженість у використанні 3D-об'єктів у 2D-композиціях, недостатньо ефективні інструменти керування графічними шарами, а також відсутність централізованого механізму пошуку та повторного використання матеріалів. Для вирішення цих проблем було розглянуто можливі шляхи покращення, включаючи впровадження вебзастосунку з розширеною підтримкою 3D-графіки, інтуїтивно зрозумілих інтерфейсів та інтегрованої системи пошуку ресурсів.

Ключові слова: інструменти для створення графічних зображень, 2D- та 3D-графіка, інструменти керування графічними шарами, програмне забезпечення для користувачів-непрограмістів.

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