

## PAPERS IN ENGLISH

## RECORDS

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RASTER AND VECTOR FORMATS OF ELECTRONIC DOCUMENT  
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## ABSTRACT

The article describes the electronic document management systems of technical documents. With the help of scanning, high-quality digitization of documents is carried out and an electronic database of drawings is created. The methods of displaying graphic images are shown, according to which the formats of files containing graphic data differ. The number of bits to store the color of each pixel of a bitmap using a combination of bits is called the bit depth or color depth. Here's how to save and edit a three-dimensional image. The advantages of raster graphics are listed and their effective methods and benefits for use in various fields are discussed. A schedule for the conversion of a large number of technical documents into electronic form has been developed, which provides the characteristics of electronic documents.

## АННОТАЦИЯ

В статье описаны системы электронного документооборота технических документов. С помощью сканирования осуществляется качественная оцифровка документов и создается электронная база чертежей. Показаны способы отображения графических изображений, в соответствии с которыми различаются форматы файлов, содержащих графические данные. Количество битов для хранения цвета каждого пикселя растрового изображения с использованием комбинации битов называется битовой глубиной или глубиной цвета. Вот как сохранить и отредактировать трехмерное изображение. Перечислены преимущества растровой графики и обсуждаются их эффективные методы и преимущества для использования в различных областях. Разработан график перевода большого количества технических документов в электронный вид, в котором приведены характеристики электронных документов.

**Keywords:** scanners, electronic libraries, photographs, drawings, graphics, raster images.

**Ключевые слова:** сканеры, электронные библиотеки, фотографии, рисунки, графика, растровые изображения.

**Introduction.** Professional equipment is used to digitize a large volume of documentation. Simple flatbed scanners can take a long time to work and do not always provide the desired quality.

Sheet-fed documents up to A3 are usually scanned on long-term document scanners, which, depending on the model, can digitize from 200 to 460 pages per minute. It is quite possible to convert up to 30 thousand documents a day into electronic form on one scanner, and professional equipment allows you to work with old and damaged documents.

Stapled documents, books, drawings, large-format documents, volumetric objects are scanned on planetary scanners. In these devices, the scanned original is stationary and is located face up at a considerable distance from the optical system and the scanning line array of the scanner. This type of scanning avoids contact with the scanning elements and ensures that the originals are preserved. With the help of planetary scanners, high-quality digitization of documents is carried out, which is especially important, for example, when creating electronic libraries of drawings.

**Method.** There are two ways to represent graphic images: raster and vector. Accordingly, a distinction is made between raster and vector formats of graphic files containing graphic image information.

**Raster formats** are used for images with complex scales of colors, shades and shapes (pictures, graphics, scanned data).

A **raster graphic** is a graphic image on a computer or other digital form, consisting of an array of grids of pixels, or dots of different colors, that have the same size and shape.

A raster, or raster array, is a collection of bits located on a grid field. The bit can be on (state 1) or off (state 0). Bit states can be used to represent black or white, by combining multiple bits to produce a vision of black and white dots. The raster figure resembles a sheet of checkered paper, on which each cell is painted over with black or white, together forming a pattern. The basic element of a bitmap is a pixel. Several concepts are distinguished under this term:

- 1) a separate element of the bitmap image;
- 2) a single point on the monitor screen;
- 3) a single point in the image printed by the printer.

The color of each pixel of the bitmap is stored using a combination of bits. The more bits – the more shades of colors for each pixel can be obtained. The number of bits a computer uses to store information about each pixel is called bit depth, or color depth. The simplest type of bitmap consists of pixels that have two possible colors – black and white. These types of pixels require one bit in computer memory, so images made up of these types of pixels are called 1-bit images. The main disadvantage of bitmap graphics is that each image requires a lot of memory to store it. To solve the problem of processing volumetric images, 2 main methods are used:

- increasing the computer memory;
- compression of images.

Another disadvantage of the bitmap representation of images is that the figure quality decreases when scaling.

Raster graphics advantages:

- Raster graphics provide the ability to create any images without paying attention to the complexity of their execution, in difference to vector illustrations, which is unable to deliver a good transition of colors from one to another.
- Wide range of applications – raster graphics today have found wide application in various fields, from small images (icons) to large (posters).
- Very high processing speed of images of varying complexity, provided that there is no need to scale them.
- Bitmap graphics are native to most devices and graphics techniques.

Disadvantages of bitmap graphics:

- Large file size with simple bitmaps.
- The image cannot be scaled up without loss of quality.
- Outputting an image when printing to a plotter is difficult.
- Good picture quality requires a significant amount of disk space to store files.

**Results and discussion.** Based on the above disadvantages, it is recommended to store simple drawings not in compressed raster graphics, but to use vector graphics. The characteristics of the conversion of large volumes of technical documentation into electronic form are given in table 1.

*Table 1.*

**Features of electronic documents**

<b>Characteristics</b>	<b>Raster graphics</b>	<b>Vector graphics</b>
Elementary object	Pixel (point)	Circuit and lines
Picture	Collection of dots (pixels)	Set of objects described mathematically
Photographic quality	Yes	No
Memory size	Very big	Small
Scaling	Undesirable	Yes
Formats	JPG, BPM, PSD, GIF, TIFF	CDR, WMF
Editors	Adobe Photoshop, Paint	Adobe illustrator, Corel Draw

Characteristics	Raster graphics	Vector graphics
Using	Used for storing photos, artwork, interface elements	Used store drawings, business graphic, fonts, drawings with clear circuit
Advantages	High image quality, the volume depends on the image size, realism of images, natural colors, photographic quality images, the ability to obtain images using special devices	Small image files, the volume does not depend on the size of image, but on the number of objects in it, maintaining quality when scaling, ease of image modification.
Disadvantages	Large amount of data, loss of image quality when zooming in or out, difficulty in editing individual image elements.	The schematic of the image, unnatural colors when reproducing real objects, do not give the opportunity to accurately convey the transition from one color to another.

**Vector graphics** are a list of all elements (lines, models, etc.) that make up a vector image, each of the items in the image is determined to which of the object classes it belongs to and belongs to, certain parameters for controlling the object are also given.

Vector representation, unlike bitmap figures, defines the depiction of an image in the form of lines and shapes, possibly with filled areas filled with a solid or gradient color. Vector graphics use combinations of computer instructions and mathematical formulas to describe elements. This allows various computer devices, such as a monitor and a printer, to calculate where the actual points should be placed when drawing these elements.

Vector graphics are often referred to as object-oriented or drawing graphics. There are a number of simple objects, or primitives: ellipse, rectangle, line. These primitives and their combinations are used to create more complex images. The main advantage of vector graphics is that the representation of an object is simple and takes up little memory. Simplicity of image scaling without deterioration of its quality; independence of the amount of memory required for storing the image, from the selected color model.

The disadvantage of vector images is their certain show, which contains in the fact that any image must be divided into a limited firm of basic that make it up. Raster

and vector graphics do not exist in isolation from each other. So, vector images can include raster figures. Moreover, vector and raster images can be converted to each other – in this case, we are talking about converting graphic files to other formats. Converting vector images to raster images is quite simple. Conversion of raster graphics into vector is not always feasible, since for this the raster image must contain shapes that can be identified by the conversion program as vector primitives. This applies, for example, to high-quality photographs, when each pixel is different from its neighbors.

**Conclusion.** Electronic methods of technical documentation are effective and useful in all areas. It was found that the efficiency of working with documents can be significantly increased by scanning technical documents in paper format and converting them to electronic form. This process makes it simpler to swiftly explore information in technical documentation and store it in high quality. The main benefit of this system is that the description of the object is simple and memorable. By studying the properties of an electronic document, the system of vector and raster graphs provides all the connections. Their strengths and weaknesses make the system interconnected. Keeping your data in high quality is one of the biggest achievements.

#### References:

1. Elmurod Astanaliev. Formalization of electronic technical document management of railway automatics and telemechanics. *International Journal of Engineering and Information systems (IJEAIS)*. Volume 4, issue 12., 2020.
2. Gattullo M. et al. Towards Next Generation Technical Documentation in Augmented Reality Using a Context-Aware Information Manager // *Applied Sciences*. – 2020. – T. 10. – №. 3. – C. 780.
3. Baratov D.Kh., Aripov N.M., Boltaev A.Kh. Functional features of an automated accounting and control system for signaling, centralization and blocking devices // *Bulletin of TSTU*. - 2019. - No. 2. - S. 38-43.
4. Brunner L. et al. The ETH Zurich CMIP6 next generation archive: technical documentation // *ETH Zürich, Zürich*. – 2020. – T. 10.
5. Dilshod Baratov, Elmurod Astanaliev. Minimization of the automatic machine structure process of accounting and control of railway automation and telemechanics devices. *E3S Web of Conferences* 244, 08024, Published by EDP Sciences, 2021.
6. Adams P., Dixon J., Horridge J. The Victoria University Regional Model (VURM): Technical Documentation, Version 1.0. – Centre of Policy Studies (CoPS), Victoria University, 2015.
7. Elmurod Astanaliev. The formalization of the electronic document in railway automatics and telemechanics on the basis of simulation modeling. *European Scholar Journal (ESJ)*. Vol. 2 No. 3, ISSN:2660-5562, 2021.
8. Zakoldaev D.A. et al. Computer-aided design of technical documentation on the digital product models of Industry 4.0 // *IOP Conference Series: Materials Science and Engineering*. – IOP Publishing, 2019. – T. 483. – №. 1. – C. 012069.