THE SYSTEM FOR OBTAINING THREE-DIMENSIONAL IMAGES

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Abstract: The current article contains the description of a system for obtaining 3D (stereoscopic) images by means of a lenticular raster. This system consists of the following components: a digital photo camera or a scanner, a specialized stand, a personal computer for codifying the images using the elaborated program, a printer, a laminator and a lenticular raster. Stereo Art software product designed for image codifying, was elaborated on the basis of the algorithm for obtaining 3D images which is described below.

Key words: 3D (three-dimensional) images, raster, lenticular, Stereo Art.

INTRODUCTION

Obtaining 3D images proves to be very important in different areas of human activitiy, such as geodesy, topography, publicity, stereoscopic cinematography, etc. Compared to the usual images, the 3D images only give the impression of a three-dimensional perception of the objects. In reality this is only an illusion based on the human binocular visual perception, which consists in seeing with each eye a little bit different image, under another angle, due to the difference between the bench-mark points of the eyes [1, 2]. This effect can be obtained by means of special equipment and software products created for this very purpose.

This article describes a system for obtaining 3D images decoded by means of a lenticular raster. In order to obtain the stereoscopic effect the object must be photographed from two or several different spots. The pictures must be displaced at a distance of approximately 6.5 cm, because this is the approximate distance between the human eyes (the inter-pupils distance). Another rule to be respected is that the two optical axes corresponding to each eye (lens) must be parallel. Only in case we look at a very close object the two axes become convergent in a point situated on the object. The perception of the relief by the human eye is situated in between much larger limits, starting from a few centimeters up to several hundred meters.

THE STRUCTURE AND THE DESTINATION OF THE SYSTEM COMPONENTS

The structure of the system consists of the following components:

- A digital photo camera or a scanner for transmission of the obtained images into the computer;
- A specialized stand dedicated for moving the photo camera on horizontal in order to obtain the images of the photographed object from several positions of the camera;
- A personal IBM computer compatible for codifying images by means of specialized software;
- A printer with a resolution of at least 600 DPI for a good quality encoded images print;
- A manual or an automatic laminator equipped with either a digital temperature setup (up to 40° C), or a lamination regime for sticking the support with the obtained image to the lenticular raster. The raster is a transparent polymer constituted of semi-cylindrical lenticular, which decodes the image creating the impression of a three-dimensional one.

The components of the system are represented below.

The system for obtaining 3D (stereoscopic) images by means of a lenticular raster

THE DESCRIPTION OF THE STEREO ART SOFTWARE PRODUCT

A specialized software program called Stereo Art was elaborated for codifying the images of the represented object, person or landscape, photographed from different horizontal positions. The initial images needed for codifying can be also obtained by using the graphical redactors: 3D Studio Max, Corel Dream 3D, Win Morph, Adobe Photoshop etc. The program is not limited only to obtaining stereoscopic effect images. The images can be encoded for obtaining other optical effects, such as the morphing effect, the animation effect, the zoom effect and the transposition effect. These effects can be obtained as follows:

The 3D (stereoscopic) effect is obtained as a result of codifying several images of the same object taken from different positions. The 3D perception of the images is due to parallax – a biophysical phenomenon which allows the human eye to percept the surrounding world in three dimensions [3, 4].

The morphing effect is obtained as a result of a gradual transformation of one image into another. The best effect is obtained when the used images have resembling shapes.

The animation effect is the result of codifying several successive static images, when a certain movement (animation) impression is obtained.

The zoom effect is obtained by codifying several images of the same object; every successive image contains the same object enlarged or diminished at a different scale.

The transposition effect is the simplest one and is obtained by transposing two images of different objects or of two persons. The best result is obtained when the transposed images are situated on the same place. This effect can be combined with the 3D effect.

Stereo Art is composed of eight modules having the following destination:

Selecting the parameters of the lenticular raster. At this stage the frequency of the lenticular raster must be indicated in LPI (Lens Per Inch) – the number of micro lenses per inch, which will be further used for decoding the image. The selection of the orientation of the micro lenses is done depending on the type of the image to be obtained:

- **vertical** – for 3D images (the stereo effect);
- **horizontal** – for animated images (the morphing effect).

Selecting the dimensions of the final image for printing. The dimensions of the height and width of the final image are indicated in millimeters, depending on the dimensions of the used raster.

Selecting the resolution of the used printer. One of the possible resolutions of the used printer is to be indicated. The final image is to be printed at the indicated resolution. The number of initial images, needed for codifying the final image is calculated in dependence of the set resolution of the printer and the frequency of the lenticular raster.

Selecting the initial images for processing from a physical support. The wanted images are to be selected from the physical support, in a strict order, starting from left to the right, no matter the order the pictures were taken in. If the number of images is smaller than the number of positions needed for the codifying algorithm, then each image must be successively multiplied until the needed number of images is obtained. The multiplication is to be done so that the images taken from the same position would be neighbors.

Estimating the exit parameters. The process of estimating the exit and the intermediary parameters needed for codifying the images is done immediately after the selection of the initial images: the resolution of the final image in pixels, inches, or centimeters; the total number of lenses; the size of the final image in MB. This process is repeated after each modification of the initial data.

Visualizing the initial images through animation. After the images selection is done, a visualization of the animation on the monitor screen can be done through successive changing of all the positions of the obtained image, in order to see if the images are well arranged on the horizontal or vertical lines and if they need any further reviewing.

Codifying the final image. If the visualization from the previous step proves the expected results, then the codifying algorithm must be started in order to obtain the final image. The codifying time can vary in dependence on the image resolution and the technical parameters of the computer (the RAM memory capacity, the type of the processor, etc.)

Visualizing and stocking the final image on a physical support. At this final stage the encoded image can be visualized and stocked on a physical support in a typical .BMP format. The image is also accompanied by a .TXT type file which contains the information on all the parameters needed for further print of the image by using any graphical redactor.

CONCLUSIONS

The elaborated program is not dependent on the characteristics of the optical raster or on the printers' resolutions. This is why it can encode the images by associating any type of raster with the resolutions of the utilized printers. This is the advantage of this program in comparison with the analog ones.

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