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Geographic information systems and virtual reality

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Abstract. In this paper, we present the development of three-dimensional geographic information systems (GISs) and demonstrate how we can move beyond this to depict GIS to virtual reality. This paper will discuss the utilization of a series of techniques to aid the choice of location for a network of mini-recycling centers. These virtual generated maps and computer model can be used to clearly demonstrate possible catchment areas, environmental problems and potential aesthetic impacts before construction begins and also during the operation of the waste management facilities.

Introduction. In the last few years, research projects that Geographical InfoGIS) with Virtual Reality (VR) systems gain more and more popularity. Virtual reality (VR) is a word that applies to computer-generated environments that can simulate spaces in the real world as well as in fantasy worlds. The term 'Virtual Reality' (VR) was initially coined by Jaron Lanier, founder of VPL Research (1989) [1].

"Virtual Reality: A computer system used to create an artificial world in which the user has the impression of being in that world and with the ability to navigate through the world and manipulate .VR is stimulating the user's senses in such a way that a computer generated world is experienced as real. In order to get a true illusion of reality, it is essential for the user to have influence on this virtual environment. objects in the world." [1].

In the beginning of 1990's, 3-D simulations with the grid size of *O(*1003*)* became to be not rare. We familiarized ourselves with newly introduced visualization technology at that time; it was a combination of visualization software and graphic workstations (GWS). We could zoom in, rotate, color the objects, and change the isosurface levels, via graphical user interface with the

mouse. By the interactive manipulation through the GWS's screen, we could grasp 3D structure of the numerical data [2, 3].

VR is an environment that is simulated by a computer, trying to imitate the real thing. Most virtual reality environments are primarily visual experiences [3].

- Displayed either on a computer screen, through special stereoscopic displays or other displays;
- Some simulations include additional sensory information;
- Limited tactile feedback.

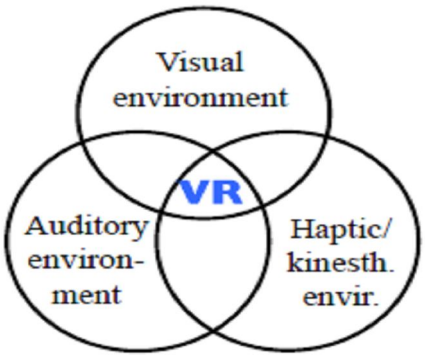

Fig. 1. Block structure of virtual reality.

Methodology and results. Increasing the perceptionb of three-dimensional depth in a scene is important in many applications.

There are two basic types of depth perception cues used by the eye-brain system: monocular and binocular, depending on whether they are apparent when one or two eyes are used. The principal monocular cues are: Perspective (convergence of parallel lines); movement parallax (when the head is moved laterally; near objects appear to move more against a projection plane than far objects); relative size of known objects; overlap (a closer object overlaps and appears in front of a more distant object) [3, 4].

The principal binocular cues are the convergence angles of the optical axes of the eyes and the Retinal disparity (the different location of objects

projected on the eye's retina is interpreted as differences in distance from the eye).

We created a 3D model of the river “Mesta”. We convert a GIS model in 3D format. We used a computer programs ArcMap 9.1 and ArcScene.

After that we modified a 3D model with computer programs 3Ds Max and Blender [2, 4].

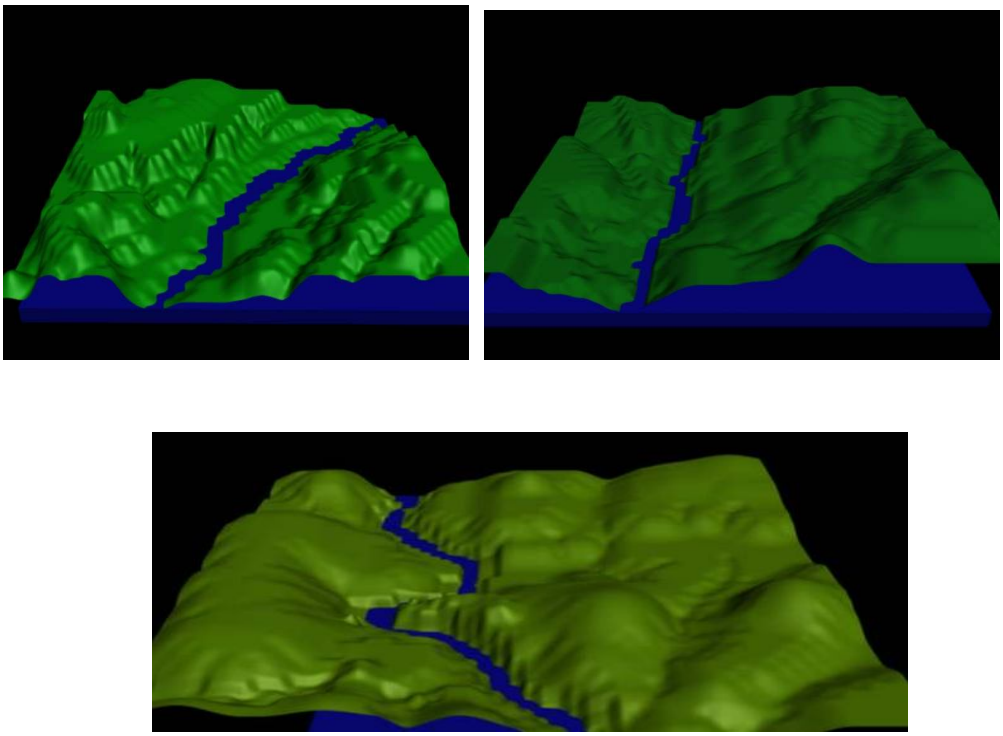

Fig.2. 3D model of the river “Mesta”

3D virtual worlds are created out of 3D polygons, usually triangles or squares arranged in 3D space to form 3D surfaces that comprise more complex objects[6, 7]. The simplest polygon and the most efficient to represent, process, and visualize with current graphics hardware is a triangle. A triangle is defined by specifying the three points or vertices that compose it [6, 7, 8].

Acknowledgements

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