Virtual Reality Technology in Computer–Aided Production Engineering

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INTRODUCTION

After applications of virtual reality (VR) in the realm of flight simulators and computer games a need to exercise these technologies in industry is rising significantly. Nowadays one of the typical domains of using a virtual reality is designing and prototyping in automotive and air industry. A practical solution for a virtual model is using a virtual reality modeling language (VRML) that supports the distribution of three-dimensional models over the Internet. Web based virtual reality technology offers possibilities for sharing virtual models for supporting collaborative work and concurrent engineering.

There are more standardized tools for virtual reality technology distributing 3D models by VRML. Another possible solution for exploiting an Internet environment through VRML is using a non-standard software package on PC basis created for 3D simulation and programming of automated workplaces, robots and other peripheral devices. The article is describing procedures for implementation of VRML 2.0 into software ROANS, which has been created in another programming language than VRML versions.

BACKGROUND

The term virtual reality was possibly pronounced by Jaron Lanier in 1989 and became generally accepted since 1992 together with establishing of the National Academy of Sciences/National Research Council Committee on virtual reality research and development. The second historical milestone in virtual reality acceptation was connected with creation of the VRAIS conference and the IEEE Symposium on virtual reality research and development in 1993 (Bryson, 2001).

Currently virtual reality represents broad developed technological field, which can be in generally defined as “A computer system used to create an artificial world in which the user has the impression of being in that world and the ability to navigate through the world and manipulate objects in the world.” (Manetta & Blade, 1995). Common alternatives to the term virtual reality include such concepts as artificial reality, simulated reality, virtual environments, virtual worlds, interactive visual simulation, cyberspace, interactive 3D, Web3D, real-time 3D, spatial visualization and others.

Virtual reality systems can be divided by ways of communication with user to the following groups:

1. **Window on world systems**: conventional computer monitors are used for displaying the virtual world. This system is also called desktop virtual reality, but usually it is called as window on world (WoW).
2. **Video mapping**: This system is modification of WoW system, where the silhouettes of human body could be displayed in 2D. User could see themselves on monitors in interaction with environment.
3. **Immersive systems**: Virtual reality systems, which enables user to be in virtual environment. The feeling of “being inside” is created by head mounted displays (HMD). This is a helmet or a face mask that holds the visual and auditory displays. The helmet may be free ranging, tethered, or it might be attached to some sort of a boom armature (Isdale, 1998)
4. **Telepresence**: Attached to a high-speed network, virtual reality takes telepresence to next level. Participants can be thousand of kilometers apart and yet feel as if they are all standing in the same virtual office or laboratory, with their product, design, or experiment right in front of them not only talking about it, but interacting with it, change it etc. This technology connects sensors, which are apart in real world. All the sensors could be placed on robot or on presented tool.
5. **Mixed reality**: Display systems in which real objects and virtual objects are displayed together (Milgram, 1994).
6. **Fish tank virtual reality**: System created in Canada. It is a combination of stereoscopic monitors and tracking system that measures position and orientation of a hand.
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