

APPLICATION OF VIRTUAL REALITY IN THE DESIGN OF PRODUCTION SYSTEMS AND TEACHING

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Abstract: The content of the contribution is a description of the virtual reality use in the design of production processes and in the teaching process. The aim of the article is to describe the methodology for 3D virtual design of production systems as well as a description of the creation of interconnectors for simulation tools Siemens Tecnomatix, Simio, AutoCAD and Dassault systems by using the moreViz tool. The use in the design of production systems lies precisely in the ability to realize the projected space on a scale of 1:1, which will allow maximum use of space and its orientation. The effect in teaching lies in a better understanding of the elements that can be displayed in fully immersive virtual reality, which helps to teach faster and engage spatial imagination.

1 Introduction

The exponential growth of technology in the world is getting to the point where expensive technologies have become conventional in the past [1]. Virtual reality is one such technology. Virtual reality is already commonly used in many sectors such as design, medicine, education, design [2]. Simulation is beginning to play an important role in the design of manufacturing and logistics systems [3]. The art of creating simulation models depends not only on defined scheduling rules but also on the spatial imagination of the designer [4]. However, in some cases, it is impossible to estimate the exact size of objects and distances as the design takes place on a scaled-down scale. Virtual reality currently appears to be the most helpful here. The potential of virtual reality is enormous and may represent a pre-jumper for hologram technologies that are currently the subject of many researches, such as Brigham young university [5] or Kyungpook National University [6]. The use of virtual reality devices allows us to create arbitrarily large objects that the human brain interprets as 3D. With appropriate programs, the commonly used CAD software work environment necessary for designing production systems can be converted to a virtual model that is on a 1:1 scale display device. In its content, the post describes the methodology for the virtual 3D design of production lines as well as the description of the creation of a virtual bridge between Siemens Tecnomatix,

AutoCAD, Dassault systems and SIMIO tools using the moreViz tool for design as well as teaching.

2 Methodology

The virtual 3D design methodology consists of 7 modules. These are modules that represent the whole process of system design, including model verification and validation as well as optimization. Figure 1 Displays the methodology for the virtual 3D design of production systems.

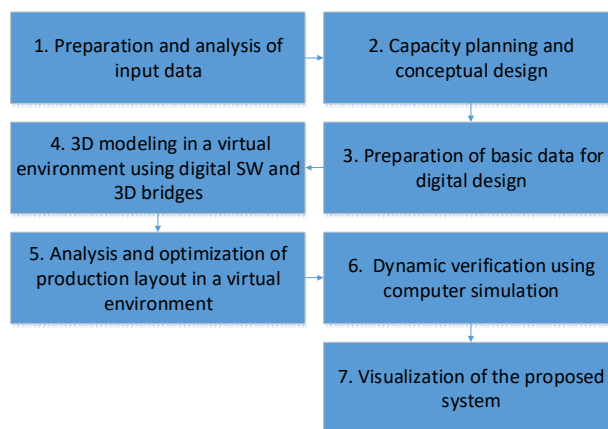


Figure 1 Methodology for virtual 3D design of production lines and creation of interconnectors bridges

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1. An important aspect of any design activity is the collection of data, which are subsequently analysed. This data serves as an input into the model, if the data and its scope are correct, the simulation model is valid with a real system or with a planned idea. On such models, it is then possible to conduct simulation experiments to gain consequences for the modelled system.
2. The next step is to determine the required requirements for outputs, on the basis of which the capacities on the machines, their number, resource requirements, operation, etc. are determined. This step is realized when it comes to designing a new production system.
3. At this point, the data obtained necessary for real system modelling shall be compiled, where appropriate, in the new design of the number of sources and equipment and other data obtained from the capacity requirements plan and conceptual design.
4. If we have data collected, modelling of an optimized production system or a proposed new system can be realized. Gradually, all entities that represent real elements in the production system are added. In this module, it is convenient to use the input to fully immersive virtual reality, where we can get a visual and spatial idea of the modelled system and model correctness. At the end of the modelling activity, verification and appropriate, validation are carried out.
5. If the simulation model is designed correctly, its parts may be optimised, as the logical correctness of the model guarantees an effect when applied to the real system. Here it is possible to use the cooperation of various workers from different departments, who use the bridge to fully immersive virtual reality to get a better visual idea. With their comments, they finalise the simulation model to meet the targets and to suit stakeholders in future production.
6. The simulation model created shall be verified using appropriate computing power. If the model is verified, we can say that it is logically correct and the information from such a system has a telling value.
7. In the last module, the simulation model is ready for use in practice for visualization needs and ideas about the behaviour of the future system and for the needs of conducting experiments that can bring real benefits to the system. In this module, it is also possible to enter virtual reality and get a visual and spatial idea of the future system.

3 Results and discussion

3.1 Creation of connecting bridges for Oculus Rift S - Siemens Tecnomatix, AutoCAD or Dassault systems

First of all, it is necessary to have installed one of the software (Siemens Tecnomatix, AutoCAD, Dassault systems). Then it is necessary to download moreVIZ software, which in the next process will serve as the creator

of a 3D virtual model based on the model that we want to virtualize for glasses. SteamVR software is then downloaded. It will serve as under the application on which the created 3D virtual model will run. The above example is for working in Oculus Rift S virtual reality glasses. After installing this software, the video card driver is updated, which is a very important step, otherwise, you will not be able to connect between the PC and the eyewear hardware. If all files are installed, we can go to the software setting up. MoreVIZ Server Control is set up first so that the software correctly connects the desired program. The setting shows Figure 2.

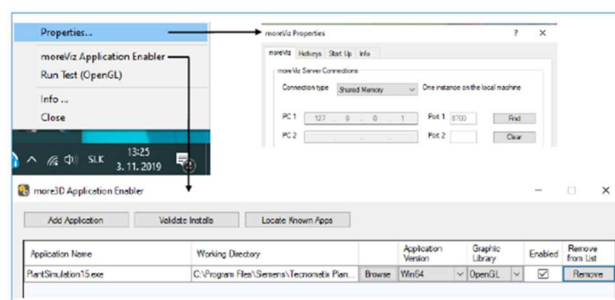


Figure 2 Setting moreVIZ Server Control

After this step, the moreVIZ Client is running, where the type of goggle link is set (the program also allows you to link to the Cave display method). The setting shows Figure 3.

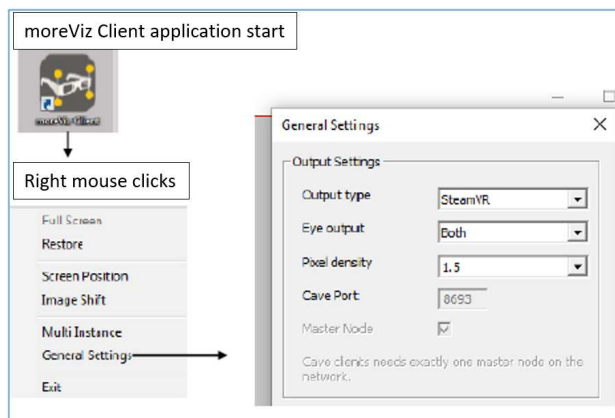


Figure 3 Setting up of moreVIZ Client

After this step, we close both moreVIZ Client and Server Control and run Tecnomatix Plant Simulation or other software and set the values in the settings as shown by Figure 4. The OpenGL 1.5 (Vertex buffer objects) value must be set.

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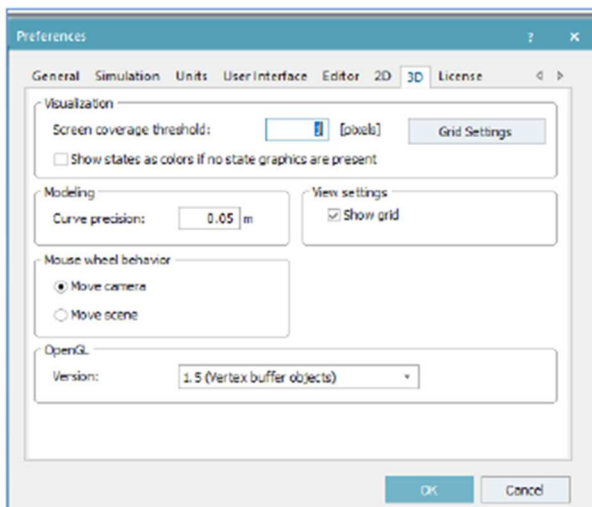


Figure 4 Working software Tecnomatix Plant Simulation set up

We can then proceed to work in software and connect to fully immersive virtual reality. Programs must be run in order as shown in Figure 5.

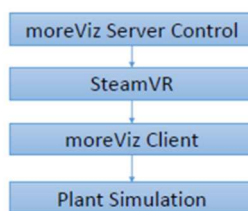


Figure 5 Link step sequence

After running Oculus Rift S glasses, we turn on desktop sharing with your PC. In this environment, we can work on a simulation model, change elements, add them, run simulations, and more. Such a work environment depicts Figures 6 and 7.

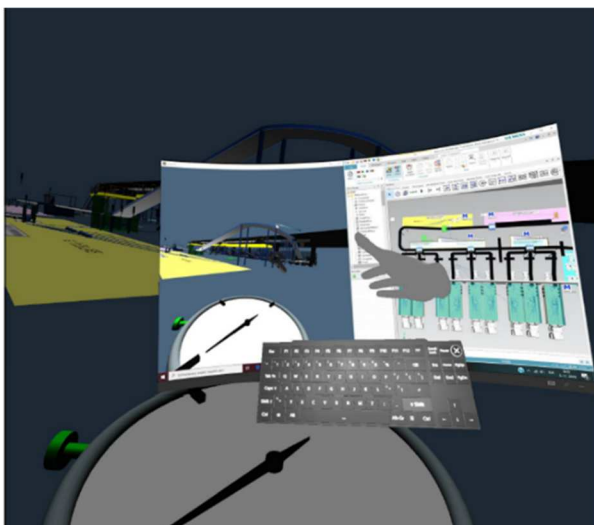


Figure 6 Example of Oculus Rift S virtual working environment in goggles

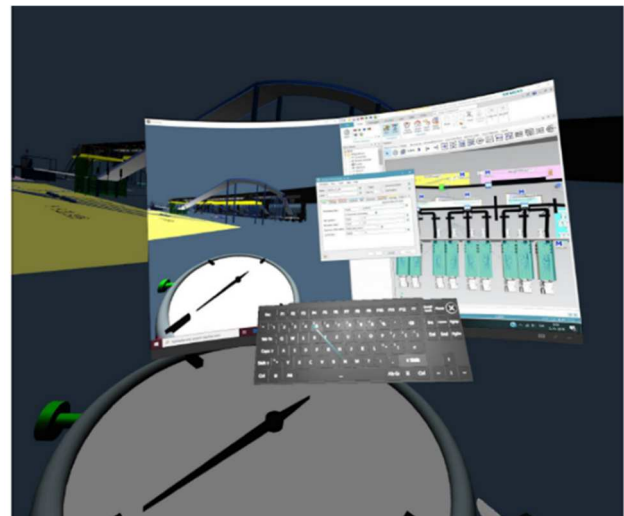


Figure 7 Example of defining parameters in a virtual work environment

After adjusting the parameters and running the simulation, we can enter fully immersive virtual reality by switching to the launch of SteamVR Figure 8. This will get us into a mode where any movement is possible in the fully immersive virtual reality of the Figure 9 simulation model.

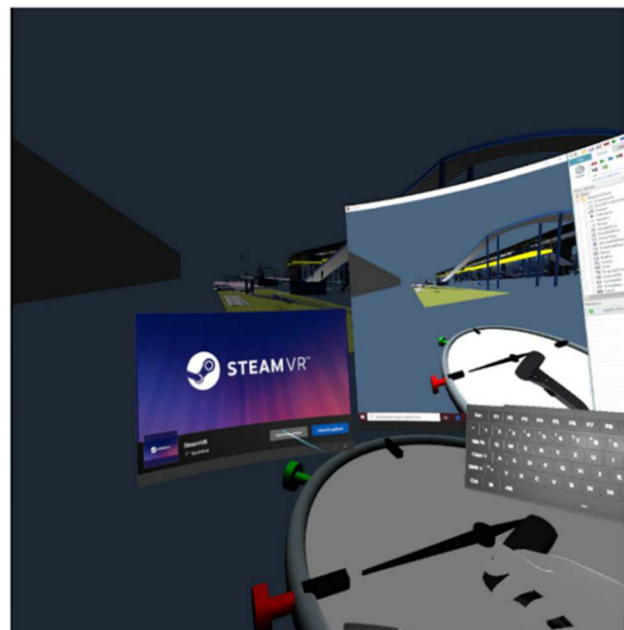


Figure 8 Example of moving to fully immersive virtual reality

3.2 Creation of a connecting bridge for SIMIO

Creating a bridge between this software and glasses is much easier than in the case of other software. SIMIO has a built-in Oculus Rift S link function in the Project Home – Render to Oculus bar. After its launch and deployment of HMD Oculus Rift is displayed a fully immersive virtual reality model, where movement is realized by the letters ASDW.

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The established methodology in which the connecting bridge is applied realized through moreViz software helps both with the design production systems themselves and in the teaching process. What is one of the most important tasks in designing is detailed design. In this process, the final layout of the elements, together with their demands for space in a common 2D and 3D view, plays a rather complex matter. The ability to realistically observe on a real scale embedded models of objects in the location of their place facilitates this process. On the one hand, it is possible to verify whether the utility distribution in space as well as to compare the ergonomic suitability of the layout. In the field of education, students who learn in the field of industrial engineering have a facilitated process of memorization of knowledge when learning different types of logistics or manufacturing systems thanks to the experience on dynamic simulation models of these processes.

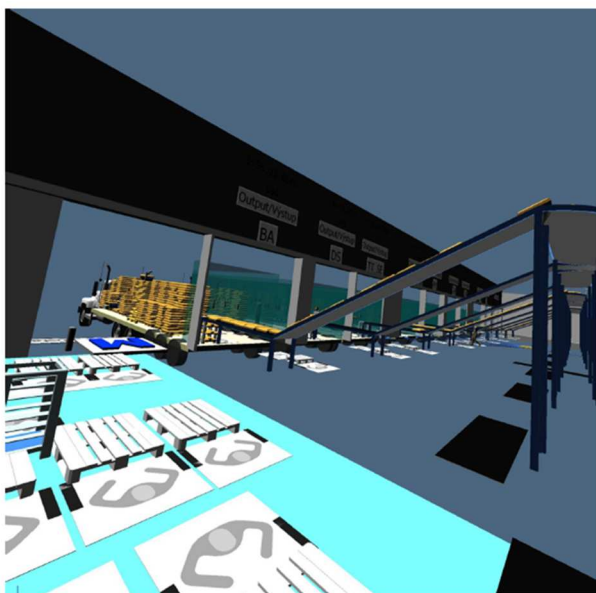


Figure 9 Example of movement in simulation model

4 Conclusions

Advanced industrial engineering can be understood as a constant application of the latest knowledge and technologies into practice. The use of virtual reality glasses significantly improves the work of designers as well as production system designers. The use of glasses allows a better understanding of the spatial vision of the projected system. Models can be entered and seen on a scale of 1:1, which helps to optimally place elements in the system as well as improve the security of the projected system. With the perspective of teaching, the virtual reality application of glasses will help students better understand the inserted elements, this helps to faster teaching and engage the spatial imagination of students.

Acknowledgement

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Review process

Single-blind peer review process.