Cyberith Virtualizer - A locomotion device for Virtual Reality

Tuncay Cakmak, Holger Hager
Vienna University of Technology

Abstract

The Virtualizer is an easy to use virtual reality device, that allows the user to walk through any kind of virtual environment in real time. It does so by combining a low friction principle and high precision sensors with a special mechanical construction, resulting in a new form of omni-directional treadmill.

CR Categories: B.4.2 [Input/Output and Data Communication]: Input/Output Devices—Channels and Controllers; H.5.1 [Information Interfaces und Presentation]: Multimedia Information Systems—Artificial, augmented and virtual realities; I.3.7 [Computer Graphics]: Three-dimensional Graphics and Realism—Virtual Reality; K.8.2 [Computing Milieux]: Personal Computing—Hardware;

Keywords: locomotion, virtual reality, immersion, VR treadmill, omnidirectional treadmill, low friction

1 Introduction

Locomotion in virtual reality has been a well known challenge for over two decades of virtual reality research. The realisation of a locomotion device for virtual reality enhances immersion by removing the boundaries of real space and allowing the user to walk through infinite virtual spaces.

Most of these devices use active control systems for operation. This leads to considerable complexity and high costs in purchase and operation. These costs are significantly reduced by the chosen approach of using the principle of low friction in combination with a special mechanical construction, that allows a high freedom of movement.

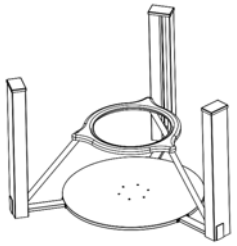

Figure 1: *The Prototype.*

SIGGRAPH 2014, August 10 – 14, 2014, Vancouver, British Columbia, Canada.

ACM 978-1-4503-2961-3/14/08

2 Low Friction Principle and Mechanical Construction

The Virtualizer is based on the principle of low friction. The choice of the materials of the shoesole and the base-platform enables an effortless sliding of the feet, without being too slippery. The user is fixed in a belt system, that is directly connected to an inner ring within a ring construction. This inner ring, which is connected to an outer ring axially, is rotable through 360 degrees. The outer ring is movable vertically. To walk the user pushes his hips slightly against the ring and starts to walk in a natural motion. By doing so the user's feet start to slide above the surface of the ground. One foot slides backwards while the other one performs a step. The remaining friction force is compensated by the belt system, that allows to walk and run without changing position in real space.

Figure 2: *Illustration of the Principle.*

3 Sensor System

The user's movements are detected by a combination of different sensors, that are located in the ground floor, the ring construction and the pillars. The data of these sensors is sent to an integrated microcontroller. Using an optimized algorithm, the microcontroller calculates the movements out of the sensor data and sends the movement information to a PC. The provided information is the orientation of the user's body, the height of the user's hips, the walking speed and the walking direction.

4 Software

The driver software of the Virtualizer allows to emulate keyboard action or controller input. So it is possible to use the Virtualizer in applications which are not specially optimized for the Virtualizer. The SDK of the Virtualizer allows integration with game engines for a more precise exchange of information.

5 Conclusion

The concept of the Virtualizer is verified by the existing prototypes. More than two thousand people have already tested the second prototype, which is still in operation. The success of the prototypes can be seen as a technical proof of concept, that allows to commercialize the technology and make it available for a wide audience.

Acknowledgements

To Dr. Hannes Kaufmann and Prof. Dr. Martin Gröschl for the great support.