Virtual reality you can reach out and touch (IMMERSENCE Project)



A team of European researchers supported by the European Union has "virtually" teleported real objects through cyberspace, touched things in virtual reality and even felt the movements of a virtual dance partner. It sounds like science fiction, but advances in haptic technology and a new approach to generating virtual reality (VR) content are helping to create virtual experiences that are far more realistic and immersive than anything achieved before. Not only do users see and hear their virtual surroundings, objects and avatars, but they can touch them as well, paving the way for new applications in telepresence, telemedicine, industrial design, gaming and entertainment.

Background

Most of today's systems receive the user merely as a passive observer. Whenever interaction with the virtual world is inevitable, like in the case of computer games, human action is restricted by basic devices compromising significantly the feeling of ‚being there'.

Objectives

IMMERSENCE is to fundamentally change this very restrictive situation. Users of Virtual Environments (VE) shall be able to manipulate items of various shapes, seizes and textures as well as to interact with other users including physical contact and joint operations on virtual objects.

IMMERSENCE overall objective is to enable people to freely act and interact in highly realistic vitual environments with their eyes, ears and hands. The key-word is multi-modal: Human senses shall be integrated into a single experience allowing comprehensive immersion.

IMMERSENCE objectives were reached by a large-scale interdisciplinary action incorporating competences in 4 major research areas:

- Hardware and Software Engineering: Innovative components for the simulation and transmission of sensory stimuli have to be created.

- Rendering & Display Technologies: For superior fidelity, real stimuli have to be recorded and replayed in situations which have never been observed. Interpolation methods are to be developed which allow to predict the behaviour of the interaction partner or environment

- Neurosciences: The investigation of the brain functional, neurophysiological, behavioural and cognitive mechanisms behind the process of multi-modal interaction are fundamental for the optimisation of the technological devices

- Presence measures: The created prototypes have to be validated by quantifying and measuring the presence perceived by the user

Results

The project developed innovative haptic and multi-modal interfaces, new signal processing techniques and a pioneering method to generate VR objects from real-world objects in real time.

The latter technology, developed at the Computer Vision Laboratory of Swiss project partner ETH Zürich, uses a 3D scanner and advanced modelling system to create a virtual representation of a real object, such as a cup, box or, in one experiment, a green fluffy toy frog. The 3D digital representation of the object can then be transmitted to someone at a remote location, who, by wearing VR goggles and touching a haptic interface, can move, prod and poke it.

The researchers also worked on techniques that would allow a user to feel different textures and sense the stiffness of an object, enabling them to differentiate between a hard box, a soft fluffy frog or even a liquid.

The Immersence researchers also developed technology to enable human-human interaction in a virtual environment. At the lab in Munich, they used a mobile robotic platform with two arms to serve as the dance partner and could dance with them by holding the “hands” of the robot.

French partner Université d’Evry went one step further and studied how to give the sensation of two people handling an object, such as lifting a heavy box, all virtually.

Impact

Gamers will obviously be delighted by the developments, which promise to bring a whole new dimension and realism to VR environments. Besides entertainment, however, there are many serious applications for haptic VR technology. Doctors, for example, could use it to treat patients remotely, physiotherapists could use it for training and rehabilitation and industrial designers could collaborate remotely by virtually “teleporting” touchable digital mock-ups of designs over the internet.

The research will also help in the development of cognitive robots that are better able to interact with humans.

Several of the project partners are continuing their work in the EU-funded BEAMING project where they plan to develop a virtual reality room in which several mobile robots will move around autonomously and simulated objects, such as a table, chair or door, will be experienced by the user immersed in a virtual world

Text inspired from ICT Results *http://cordis.europa.eu/ictresults*

For more information, please visit the website: http://www.immersence.info/

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