

Use of Virtual Exercise Environments for People with Disabilities

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Virtual reality (VR) can transport people to real or imagined worlds and allow them to meet or compete with friends in distant locations. As a result, it offers a unique approach to addressing the exercise needs of people with physical and cognitive disabilities. The goal of this project is to develop compelling augmentations for cardiovascular exercise equipment, such as treadmills, stationary bikes, or arm ergometers, which can engage users and increase enjoyment and participation in regular exercise programs. Studies indicate that augmentations which provide an external attention focus for users, tend to increase both enjoyment and intensity or duration of exercise.

The augmentation we have developed in the first round of the NIDRR Rehabilitation Engineering Research Center for Recreational Technologies and Exercise Physiology (RecTech) takes the form of a Virtual Exercise Environment (VEE) which makes the user feel immersed in a recorded trail environment. The VEE consists of a target exercise machine, audio and video displays, and a workstation to drive the displayed percepts. In the initial phase of the project our work included the development of novel recording techniques to capture video and physical trail properties such as tilt and distance.

The captured data can be played back on anything from a HD television that happens to be located in the house to head mounted display systems. The speed of the video changes to match the speed at which the user happens to be traveling. Furthermore, the tilt information is used to increase the incline or resistance of the specific exercise equipment being used, yielding an immersive user experience. Eventually, VEE software will synchronize the progress of the users, and provide a Voice over IP (VoIP) link so they can chat as they work out along the same course. Since exercising with a buddy is known to increase adherence and enjoyment, allowing this social interaction is critical for participants who may have difficulty reaching a park or fitness center.

What distinguishes the VEE from other systems which integrate displayed games and graphics for exercise equipment (<http://www.fitcentric.com/>, <http://www.expressofitness.com/>) is that our system employs a capture phase which records real trails for playback. For most VR or game augmented exercise machines the machine itself acts only as an input device, like a joystick or a mouse. In the case of the VEE we also play back physical trail features using machine resistance, so that it acts as an output device or display as well.

The focus of the VEE project in the current round of RecTech is refining the technology, enhancing the virtual experience, and furthering our online presence and community. The ultimate goal is to allow for freely distributed software and trail data from a publicly accessible Internet server so that interested participants around the world will be able to download and engage in cooperative or competitive exercise within the panoply of recorded contexts. Work this year focused on adding GPS to the capture system in an effort to improve incline and position data and creating an MPEG-based playback system allowing for embedded HD video trail metadata. Furthermore, development began on a website community that will allow users, among other things, to upload and download trails and interact with other community members.