

# **NEXT GENERATION DESIGN FOR AN IN-HOME VIDEO GAME ENHANCED PHYSICAL THERAPY SYSTEM FOR PEDIATRIC PATIENTS WITH CEREBRAL PALSY**

Meghan Huber

University of Texas at Dallas, Richardson, TX, USA  
email: mehuber@student.utdallas.edu

## **INTRODUCTION**

According to the National Institute for Neurological Disorders and Stroke, cerebral palsy is a neurological disorder that permanently affects one's ability to control his or her own muscle movements (National, 2009). This condition occurs in 2.5 out every 1,000 live births, making it the most common significant motor impairment that affects children (Arnaud, 2008).

In general, school aged and older children with impaired motor function due to cerebral palsy do not receive regular clinical therapy and rely on a prescribed in-home physical therapy regiments for rehabilitation (Bryanton, 2006). Often these patients are not compliant with conventionally prescribed in-home therapy regiments because the exercises are perceived as "meaningless and uninteresting" (Bryanton, 2006). One of the advantages of enhancing physical therapy with video game technology is the high patient motivation to participate such therapy sessions as compared to conventional therapy sessions (Huber, 2008).

In addition, positive outcomes in terms of functionality and impairment have also been shown in patients using video game enhanced physical therapy. One study involved patients playing off-the-

shelf video games on the Nintendo Wii console in a clinical setting (Deutsch, 2008). Another study involved patients playing custom video games with a sensing glove on Sony Playstation 3 in their own homes (Huber, 2008). The design of next generation video game enhanced physical therapy systems will provide the same advantages as these systems plus new features to improve the patient experience.

## **NEXT GENERATION DESIGN**

### *Virtual physical therapist*

The next generation of video game enhanced physical therapy systems must be designed for in-home patient use because of its convenience and relatively low cost. The major drawback of in-home physical therapy compared to physical therapy in the clinical setting, however, is the lack of the physical therapist. Video game technology can help overcome this drawback because of its potential to have an intelligent agent that can play the same role as a physical therapist in a clinical setting but virtually in a home setting.

The virtual physical therapist will emulate the role of an actual physical therapist by scheduling video game exercises during a patient's session, controlling the difficulty level of the video game exercises, and providing

performance feedback to the patient in terms of motivation and exercise instruction.

#### *Video game exercises*

Conventional in-home physical therapy consists of a patient performing a prescribed set of exercises. On the next generation video game enhanced physical therapy system, such exercises are translated into video game exercises. A video game exercise requires the same basic movement as an exercise in conventional therapy; however a video game exercise is enhanced with game-like attributes such as scoring and varying 3D environments. Such attributes are aimed to increase patient motivation by providing an entertaining and divergent experience.

#### *System Hardware*

The virtual physical therapist intelligent agent and the video game exercises are software elements that will run on a video game enhanced physical therapy system. Specifically, this system will be a commercially available video game console, in order to keep the system at a low cost.

In terms of a controller, an optical tracker will be used as the interface to capture a patient's body movements and translate it to the software. An optical tracker is ideal because it does not require the patient to wear any potentially restrictive equipment. Currently, the Sony Playstation 3 along with its peripheral Eye Toy optical tracker component would be the ideal video game system to use because it is the only commercially available system

that satisfies these hardware requirements.

## **CONCLUSION**

The next generation video game enhanced physical therapy system will consist of unrestrictedly tracking a patient's movement to interact with motivating video game exercises controlled by a virtual physical therapist intelligent agent. Such a system will provide an in home rehabilitation opportunity for children with cerebral palsy that is more entertaining, more effective, and more affordable than current in-home rehabilitation methods.

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