



Kinect Rehabilitation System for Improvement of Balance Therapies in People With Cerebral Palsy

Type of Project Intervention

Summary

This system is based on a serious game for balance rehabilitation therapy, designed using the prototype development paradigm and features for rehabilitation with serious games: feedback, adaptability, motivational elements, and monitoring. We rigorously evaluated the effects of physiotherapy treatment on balance and gait function of subjects with cerebral palsy undergoing our experimental system.

Low-tech, high-tech products, services and contexts for play

We selected the therapy for balance rehabilitation to be transferred to a serious game to improve balance, increase motivation in clients and achieve higher adherence to this long-term therapy. The users must interact with objects that cannot be reached without moving the COM beyond the BOS. More specifically, users must remove individual items that appear on the screen by reaching each item with one hand.

The serious game is designed using the prototype development paradigm, following requirements indicated by physiotherapists and considering the desirable features for rehabilitation with serious games, as follows.

Meaningful play, the relationship between player's interactions and system responses.

Challenge, maintaining an optimal difficulty, which is important to engage the player.

Moreover, the serious game allows for the inclusion of motivational elements to increase playing engagement. Monitoring mechanisms to simplify the therapist's work are also included.

We propose a game environment configuration in which users stand in front of the screen and interact with the video game using their movements. In addition, because users may have difficulty in holding devices, the designed game is markerless and device free. With this configuration, users can see the serious game while interacting with the game.

The context of use

Therapy Sessions

Type of play in this play system

Cognitive

Practice

Rule play (including videogames)

Social

Solitary

Parallel

Objectives related to play according to ICF-CY

Play for the sake of play: Major life areas - d880 enagement in play

d8800 solitary play

Play-like activities: Therapeutic and educational objectives

b2 Sensory functions and pain

b7 Neuromusculoskeletal and movement related functions
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d4 Mobility

Number of participants

5-10

Chronological Age

12-18 years

Development Age

12-18 years

LUDI Categories of disabilities

Mental/intellectual impairments::

severe

Communication disorders (speech and language disorders):
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Physical impairments:

Severe

Multiple disabilities:

Explanation on the use of low-tech, high-tech devices, services or contexts

Explanation

Visual instruction with written language
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Visual instruction with pictures or drawings
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Guided discovery: therapist/researcher coaches the participant so s/he discovers how to use the assistive technology
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Involvement

Adult: therapist/educator/researcher

Role

Participatory observer

Evaluation of objectives and outcome measures

Description of outcome measure(s)

(validated and reliable) outcome measures like tests, self-reports of client/system, questionnaires

Information about availability of outcome measure: publisher, website, contact person

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Summary of achieved effects

A 24-week physiotherapy intervention program was conducted with nine people from a cerebral palsy center who exercised weekly in 20-min sessions. Findings demonstrated a significant increase in balance and gait function scores resulting in indicators of greater independence for our participating. Scores improved from 16 to 21 points in a scale of 28, according to the Tinetti Scale for risk of falls, moving from high fall risk to moderate fall risk. Our promising results indicate that our experimental system is feasible for balance rehabilitation therapy.

Keywords

Games, Medical treatment, Computer vision, Visualization, Monitoring, Image color analysis, Tracking