Motion sensing devices, humanoid and non-humanoid robots for enhancing motor and social skills of children with developmental problems

Type of Project

Ongoing research project

Summary

The aim of the project is, via introducing of computerized technologies for recognition of movements of different body parts, to adapt certain computer games to the requirements of children with motor and social problems. For example, to use a gesture interface by children with minimal physical skills and - in a more general scope – to improve the social skills of the children as a result of sharing of the game space. The attractiveness of such games, in which the movement of parts of the body is the interface to the game, and game availability in the educational as well as home environment will motivate and engage the physical activity of the hyperactive children and also those with passive style of life.
Our strategy for sustainable project development is cooperation during the entire period in a team work of all involved experts: researchers, speech therapists, psychologists, social workers and special educators.
The expected results of the Project are innovative, effective and adaptive methodologies for physical and social rehabilitation of children with developmental problems or disabilities by enjoyable play in a school or family environment. In the proposed methodologies the child and/or the therapist are aided by assistive computerized and robotic technologies at low cost.

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Project Coordinator: Institute of System Engineering and Robotics, Bulgarian Academy of Sciences

Partners:
1. University of Stavanger (UiS), Norway
2. The South-West University (SWU), in the city of Blagoevgrad, Bulgaria
3. Day care center for Children in the city of Bansko, Bulgaria
4. Day care center for Children in the city of Gotse Deltchev, Bulgaria

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

This is an ongoing project. The intended use:

We are in a process of testing supportive motion-based digital games focusing on the hands balance and coordination by collecting or moving objects on the screen by gestures to achieve an enjoyable playful goal. Expected result - enhancing children coarse and fine motor skills.
We are in a process of designing interactive games with Humanoid NAO robot and non-Humanoid walking robots as assistants to special educators for social communication by imitation in an entertaining learning environment via sensors for tracking and recognition of gestures and reactions
Another specific test is for improving the speech and language skills of children with disabilities by performing fine motor skills to manipulate objects on the screen by body movements.

The intended target groups:
children with cerebral palsy (CP) or hemispatial neglect
children with speech impairments
children with ASD
children with moderate Mental/intellectual impairments

The context of use

Day care centers for Children with special needs School Home

Type of play in this play system

Cognitive

Practice
Rule play (including videogames)

Social

Solitary
Parallel
Associative
Cooperative

Objectives related to play according to ICF-CY

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

d8800 solitary play
d8803 shared cooperative play
d8808 engagement in play, other specified

Community social and civic life - d920 recreation and leisure time

d9200 play

Play-like activities: Therapeutic and educational objectives

b1 Mental functions
b2 Sensory functions and pain
b3 Voice and speech functions
b7 Neuromusculoskeletal and movement related functions
d1 Learning and applying knowledge (learning through symbolic play, learning through pretend play)
d3 Communication
d7 Interpersonal interactions and relationships

Number of participants

5-10

Chronological Age

3-6 years
6-12 years

Development Age

3-6 years
6-12 years

LUDI Categories of disabilities

Mental/intellectual impairments::
mild
moderate
Partially hearing impaired
Physical impairments:
Mild
Moderate
Autism Spectrum Disorders:
Multiple disabilities:

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

Explanation

Verbal instruction, language and communication is adapted
Modeling by therapist/researcher
Hand over hand: therapist/researcher leads the actions of the participant
Prompting: therapist/researcher touches the participant as a key for further actions
Guided discovery: therapist/researcher coaches the participant so s/he discovers how to use the assistive technology

Involvement

Adult: therapist/educator/researcher
Parent or significant others
Peer with disabilities

Role

Providing instruction
After the instruction, providing supervision during play

Evaluation of objectives and outcome measures

Description of outcome measure(s)

Observation by professional/researcher providing the play experience
Observation by other professional/researcher
Video analysis
Feedback from client/parents/professionals

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

Towards a New Measure of Playfulness: The Capacity to Fully and Freely Engage in Play http://ecommons.luc.edu/luc_diss/232/

Summary of achieved effects

The play stimulates social interactions and personal satisfaction of children. The joy these children feel during the play several times unlocked unexpected potential in these children.
For instance, a child with hearing problem asked questions, child without communication skills started asking for singing another song with humanoid robot NAO, A child with moderate motor impairments started walking towards the robot NAO.

References to the intervention or research project

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Publication

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Keywords

Motion-sensing games, Serious games, Blending Robotics in Education, Rehabgaming, Kinect-enabled applications, Flow model, Success factors in design, Gesture imitation, Humanoid robots, Walking robots.