How Can a Robot Help Children?

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Can a Robot Really Be Considered “Assistive Technology” for Children

What is a Robot?

A robot is a machine that is designed to do multiple tasks, either on its own or with guidance. Research suggests that robots can be defined as a form of assistive technology. Today, robots are becoming more beneficial to children than ever before. While there are many different types of robots, two types have become most popular, assistive robotics and socially assistive robotics.

Assistive Robotics

In the past, assistive robotics was defined as robots that assisted people with disabilities through physical interaction. However, now these robots go even further and assist all human users through physical and non-physical interaction. Assistive robotics include rehabilitation robots, wheelchair robots, “buddy/friendship” robots, and educational robots. These robots are intended to aid in environments such as schools, hospitals, and homes.

Socially Assistive Robotics

Just like assistive robotics, socially assistive robotics share the same goal which is to provide assistance to human users. The only difference is that the assistance is through social interaction. Socially assistive robots create close and effective interaction with a human user and as a result, progress is made in rehabilitation, recovery, learning, or other areas.

How Can Robots Help Children?

Infants begin to explore the world independently around 6 months of age. They do this by crawling. Being in motion enhances perception, cognition, and social and emotional development in infants. Believe it or not, crawling helps babies turn into children.
How Can a Robot Help Children? (continued)

All children have the desire to move, but for some it may be challenging. Infants with special conditions such as cerebral palsy can have weak muscles or poor coordination that makes crawling delayed by months or even longer. Some may think that motorized wheelchairs may provide the mobility that is needed for these children. Motorized wheelchairs are almost never used by children under the age of 20 months due to concerns about safety. Because of this, the pediatric crawler was developed.

The pediatric crawler also known as The Robo Crawler is a flat, supported surface on wheels. It supports the infant’s weight and makes it easier for the arms and legs to provide forward motion. This device encourages infants to move independently. The Robo Crawler allows the infant to move as far and as fast as his physical status will allow. (Argrawal, 2011)

Robo Crawler: A camera tracks the feet and when the child kicks, it moves.

Babies learning how to drive may sound ridiculous. But it’s true. Two University of Delaware researchers (Galloway et al., 2008) developed a kid-sized robot to provide mobility to children who are unable to fully explore the world on their own. The robot is called UD1 and it is designed with sensors that can determine the safest areas where the infants can go. If the area has dangerous objects in it, the robot allows the infant to bump them or it will take control from the infant and drive around the objects itself. UD1 is operated by a “stick” like object that infants can use to steer the robot. Previous research has suggested that infants can be trained in navigating moving objects. The robot can also collect data which will show how children are using the device. While this device is not on the market yet, once it is it will be light enough for moms to put in a car trunk, and strong enough for babies to use in the home, yard and playground.
How Can a Robot Help Children? (continued)

One of the researchers’ stated that “Infants with limited mobility play in one location while their peers or siblings go off on distant adventures all over the room or playground. With the robot, they become the center of attention because their classmates want to try it. We predict that this increased social interaction alone will provide an important boost in their cognitive development.”

The next robot to be developed will be UD2 which will be designed like UD1 but will provide additional control to a parent, teacher, or any supervising adult. The goal of this project is to provide generations of safe, smart vehicles for infants born with mobility impairments.

1 Retrieved from http://www.udel.edu/research/media/babiesrobots.html
How Can a Robot Help Children? (continued)

Ursus (RoboLab, 2011) is an assistive robot that is a little over five feet tall and resembles a teddy bear. It assists in the rehabilitation of children with cerebral palsy, or who have mobility problems in the upper limbs. Ursus plays games with children while teaching them how to make movements with their elbows, shoulders, and wrists. Children are expected to imitate everything that the robot does. Once the game is complete, Ursus will display the results on a screen with a camera that is under his neck. This information encourages children to correct themselves where needed. The robot is also a good tool for therapists to use with children because unnatural activities are made more fun and visually enjoyable. Currently, this device is still being tested and used in Spain.

The next robotic teddy bear is already being discussed with plans to have it move its head and mouth to make it more realistic. It would be able to communicate to children and as a result might make children’s learning more efficient.

Socially Assistive Robotics can be helpful to all children of all ages. However, research shows that they are particularly beneficial to children with autism. Autism is a disability that affects the normal development of the brain. The disorder makes it difficult to communicate with others as well as to show emotions or expressions. Individuals with autism may have challenges with:

- Social interaction
- Social communication
- Imagination and generalization

Researchers who are developing and working with robots believe that a robot may have a major impact on social interaction and communication with children with autism.
CosmoBot, designed in Maryland, (Slomski, 2009) is a 16-inch tall social robot. Therapists and educators can use CosmoBot to interact with children with and without disabilities. CosmoBot motivates children to develop new skills more quickly than through a traditional therapy session by imitating human joint movement in its shoulders, arms, hands and head. Since children with different levels of mobility and communication can benefit from this robot, it can be programmed to perform on different levels. The therapist is able to create a lesson tailored to a particular child and program CosmoBot to operate accordingly. The therapist can also make the robot perform an activity, such as lifting its arms, and ask the child to imitate the motions that CosmoBot makes; similar to Simon Says. After each session, the CosmoBot system automatically collects data for the therapist’s evaluation.
How Can a Robot Help Children? (continued)

The CosmoBot system is expected to be used as part of an Individualized Education Program developed in accordance with the IDEA.

***CosmoBot is on Facebook! You can also see CosmoBot in action at:

http://www.youtube.com/results?search_query=CosmoBot&aq=f

Kaspar (Science News, 2009) is a socially assistive robot that has been designed with robotic skin. It is designed to work with children with autism by helping them learn about social interaction. Children with autism may have problems with touch, often with either touching or being touched. The robotic skin is built with sensors to detect different types of touch. From a single touch, whether appropriate or inappropriate, Kaspar will respond by backing away or giving a warning beep. This behavior encourages children to change their behavior. Touching plays a very important part in social development and communication. The goal is for the robot to respond to different styles of children’s play in order to help the children develop socially appropriate and playful interaction. Children may also learn not to be too aggressive when interacting with the robot and other people. Kaspar’s eyes are video cameras and his mouth opens, closes, and smiles.

Kaspar is also on youtube and can be seen in action at:

http://www.youtube.com/results?search_query=Kaspar+the+robot&aq=f
How Can a Robot Help Children? (continued)

Keepon (the BeatBot) (Taylor, 2009) is a little yellow puffball robot that dances. It was designed to study social development by interacting with children. Keepon has soft rubber skin, two cameras in its eyes, and a microphone in its nose. The robot was originally developed to be used in therapy with children with autism. When used for therapy, Keepon is controlled by a therapist using a laptop keyboard from another room. The camera records everything that is going on and is displayed on the screen of the laptop. The therapist can control everything that Keepon does. For example, if a child poked the robot, the therapist is able to move the robot to look like its responding to something ticklish; perhaps bending over.

Children with autism also may not be able to fully express emotions or maintain eye contact. A study was done with children using Keepon. The therapists watched the children from another room to see how well the children maintained eye contact with the robot or even touched him. When Keepon would dance, the children smiled and tried to imitate the movements. The therapists controlled the robot by getting him to dance every time one of the children showed some type of emotion. This kept the children laughing and smiling and wanting to show more emotion. (Michalowski, 2009)

Keepon doesn’t speak, can’t move objects, and never changes facial expression. However, he has proven to be effective in helping children with autism develop emotional responses. Keepon is currently available for sale and you can find several of his music videos at http://www.youtube.com/results?search_query=keepon&aq=0
L E A R N  M O R E :  H E L P F U L  W E B S I T E S  A B O U T  R O B O T S

Robots for Infants (http://memagazine.asme.org/Articles/2011/March/Robots_Infants.cfm) - “Some special-needs babies lead lives with limited mobility. Engineers have begun to build devices that allow these children to move about independently. “

Babies and Robots: Infant Power Mobility On Display (http://www.sciencedaily.com/releases/2009/02/090204165529.htm) - Children with mobility issues, like cerebral palsy and spina bifida, can’t explore the world like other babies, because they can’t crawl or walk. Infant development emerges from the thousands of daily discoveries experienced by babies as they move and explore their worlds.

Zoom! Babies learn to ride robots at UD (http://www.udel.edu/research/media/babiesrobots.html) - Babies driving robots is actually the focus of important and innovative research being conducted at the University of Delaware that could have significant repercussions for the cognitive development of infants with special needs.

Professor develops robotic wheelchair for infants, toddlers (http://www.udreview.com/news/professor-develops-robotic-wheelchair-for-infants-toddlers-1.1429609) - This article talks about James Galloway (one of the developers of powered chairs for young children) and his inspiration behind creating a robotic wheelchair for babies.


CosmoBot (http://en.wikipedia.org/wiki/Cosmobot) - Wikipedia is an online encyclopedia. It gives the history about CosmoBot and its many features.

Fun and Games -- CosmoBot Games (http://www.atkidsystems.com/cosmobot_games.aspx) - This website is full of activities and games that children can play with CosmoBot.

New robot with skin to improve human communication (http://www.sciencedaily.com/releases/2009/04/090430065818.htm) - Work is beginning on a robot with artificial skin which is being developed as part of a project involving researchers at the University of Hertfordshire so that it can be used in their work investigating how robots can help children with autism to learn about social interaction.

RoboBusiness: Keepon dancing robot’s place in autism therapy (http://spectrum.ieee.org/automaton/robotics/robotics-software/robobusiness_keepon_dancing_robots_place_in_autism_therapy) - This article is about a robot that moves and dances and gets children to maintain eye contact, establish physical contact, and show emotion.
REFERENCES


R E F E R E N C E S


YouTube Videos — See these Robots in Action!!!

CosmoBot


Kaspar


Keepon

I D E A S  T O  S H A R E :  L O W  T E C H  W A Y S  T O  G E T  A R O U N D

Don’t have a robot?? Here is a very low-tech device called the Scoot-a-Bout from our Ideas to Share Database. See the website (http://tnt.asu.edu/ideas/functional/getting-around) for more great ideas!

Scoot-a-Bout: This device is perfect for children who have mobility deficits. It provides an opportunity to move around and it also increases socialization for children who are not able to play with friends due to mobile limitations. It can be used indoors and outdoors.

Idea from Functional Aids for the Multiply Handicapped edited by Isabel P. Robinault, PhD (1973)

Diagram for construction of Scoot-a-Bout and placement of casters, C, and straps.

Underside of Scoot-a-Bout, showing attachment of straps and casters.

Directions:
1. Use 5-ply plywood.
2. Overall measurements are 36 x 27 inches
3. Attach four 2-inch hard rubber casters
4. Attach three adjustable straps across the bottom of board, at the two lower corners, to hold the legs, and at the center where the board narrows for the chest, to hold the trunk in position.

For more ideas to share please visit our website - http://tnt.asu.edu/ideas.

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