Romibo Robot Project – An Open-Source Effort to Develop a Low-Cost Sensory Adaptable Robot for Special Needs Therapy and Education

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1. Introduction

The Romibo Robot Project is an evolving robot for motivation, education and social therapy. Our project goal is to improve research techniques through the use of robots and social therapies while providing value to the Do-It-Yourself movement and STEM education initiatives. The robot has been designed around applications for individuals with conditions including autism, traumatic brain injury and dementia. Romibo includes features taken from other therapeutic robots currently used in research, such as Keepon, Pleo and Paro. The Romibo Project stands out by providing a low-cost development platform while providing the necessary features for use in a wide range of social therapies. The platform features a fully customizable design, allowing for individual creativity, ease of assembly and experimentation. Romibo is a social robot, able to convey emotions, communicate socially, and form relationships with individuals.

2. Robots in Social Therapy

Today numerous robots are in use for motivating and educating patients with autism, traumatic brain injury, dementia and other disabilities [2]. Among the most used and effective robots are Paro, Pleo, Keepon, NAO. Research has shown that social interactions and verbal communication skills may increase by up to 30% when a robot and child with ASD are interacting [5]. Improvement is not only noticeable in interactions with the robot, but also in subsequent interactions with parents and therapists. Existing social therapy robots rely on computational systems that require expert technologists to assist clinicians. Additionally, these systems are either priceless, one-of-a-kind prototypes or have been developed in limited numbers with expensive prototyping technologies. Therapy robots in current production range between $16,000 and $30,000 [1, 3]. This prohibitive cost excludes the general public from benefitting from this technology.

3. Romibo a Sensory Adaptable Robot

Extreme sensory idiosyncrasies and cognitive dissonances make it difficult to create a general appearance and robot behavior. Each child is different and requires a unique treatment regimen. An individual child's needs vary from moment to moment and so the therapy must be flexible in order to adapt [4]. Romibo is able to dynamically adapt to sensory preferences or therapeutic needs over time. For example a child may start with a short furred slow-moving robot with simple pupils and over time move to a long-fur quick-moving robot with humanlike expressive eyes. The objective is to gently introduce a child to unpredictability and facilitate their ability to generalize understanding over time. The ability to dynamically evolve the robot with the person's individualized therapeutic needs and progression is an essential part of the design. One robot may be configured for use with many children or adults. In practice, one clinician may configure a unique visual, tactile, audio and gestural experience for each of many children. This adaptability also allows the robot to dynamically evolve throughout the child's individualized therapy experience. Once an appropriate configuration has been identified for the child a "prescription" configured robot may be acquired for the child for supplementary therapeutic use in the home.

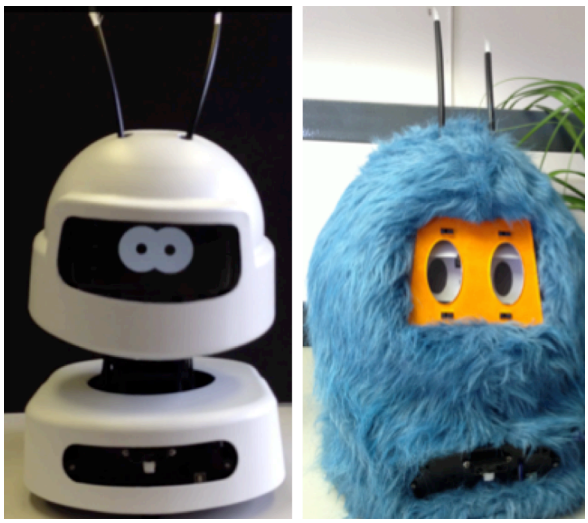

Figure 4. Romibo research prototype in two sensory configurations

4. Future Work

Romibo is being developed as a open-source research platform "kit" to allow use for a range of purposes in therapy or education. Building Romibo also teaches science, technology, engineering, and mathematics (STEM) skills to individuals of all ages. The form of the robot may be altered with simple line-editing tools and be laser-cut to any shape. We are continuing to develop Romibo with accompanying tablet apps and smartphone eyes to leverage face-tracking, logging and other capabilities.

References

1. Aldebaran Robotics. "NAO." 2012. http://www.aldebaran-robotics.com/en/
2. Feil-Seifer, David, and Maja J. Mataric. "Defining socially assistive robotics." Rehabilitation Robotics, 2005. ICORR 2005. 9th International Conference on. IEEE, 2005.
3. Kozima, H., Michalowski, M. P., & Nakagawa, C. (2008). Keepon - A Playful Robot for Research, Therapy, and Entertainment. International Journal of Social Robotics, 1(1), 3–18.
4. Scassellati, Brian, H. Admoni and Maja Matarić. 2012. "Robots for Use in Autism Research." Annual review of biomedical engineering, (May), 275-294.
5. Stanton, C. M., Kahn Jr., P. H., Severson, R. L., Ruckert, J. H., & Gill, B. T. (2008). Robotic animals might aid in the social development of children with autism. (*Proceedings of HRI '08)*, 271.

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