A ROBOT TO IMPROVE VERBAL COMMUNICATION SKILLS OF CHILDREN WITH AUTISM

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Introduction

Children diagnosed with autism typically display difficulty in the areas of social interaction and verbal communication. Various studies suggests that "children with autism respond better to zoomorphic robots than to human-like robots". So a zoomorphic robot-based autism therapy has been chosen in our project as autistic children feel that they are closer to animal than to people. Another reason is the special interest of autistic children in electronic and mechanic devices.

This T-Rex robot is an exciting and affordable new tool for educators, caregivers and therapists working with children with autism. T-Rex is made sympathetic and sensitive enough to serve as both therapist and playmate to children with autism. The robot is hypothesized to elicit verbal social interaction.

T-Rex uses sensors to calculate the child's position and time to deliver speech.

Research Question

- Can an interactive zoomorphic robot help children with autism to respond in interpersonal communication ?

- Does the children's interaction with a human differ from the interaction with a zoomorphic robot?

Methods

- A zoomorphic robot T-REX was designed in EV3 Mindstorms platform to study and analyze the influence of a robot on the verbal communication behavior of children with ASD.

- Observation of behavior of children with autism and their responses based on a set of questions asked by a zoomorphic robot T-REX.

- The robot has the ability to track the child within its proximity. Infrared sensors were used as eyes of the robot to calculate the exact position of the child.

- The robot walks towards the child and starts talking when the child is close enough to the robot.

- Studies will observe speech interaction and its development in children with autism.

- Testing language comprehension and adequate use of pragmatics by children with autism.

T-REX

Flow Diagram

START → Move Forwards → Sensor Detects Children → (No) / (Yes) → Stop Walking → Talk
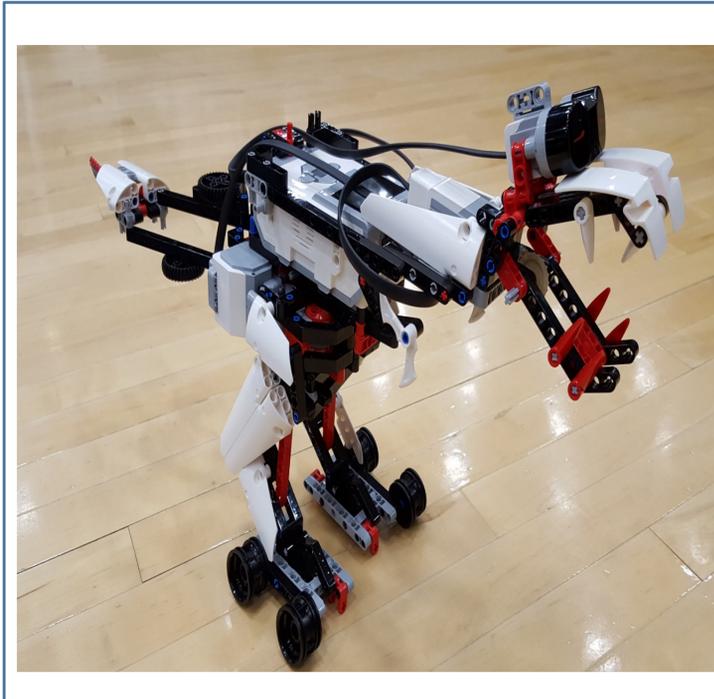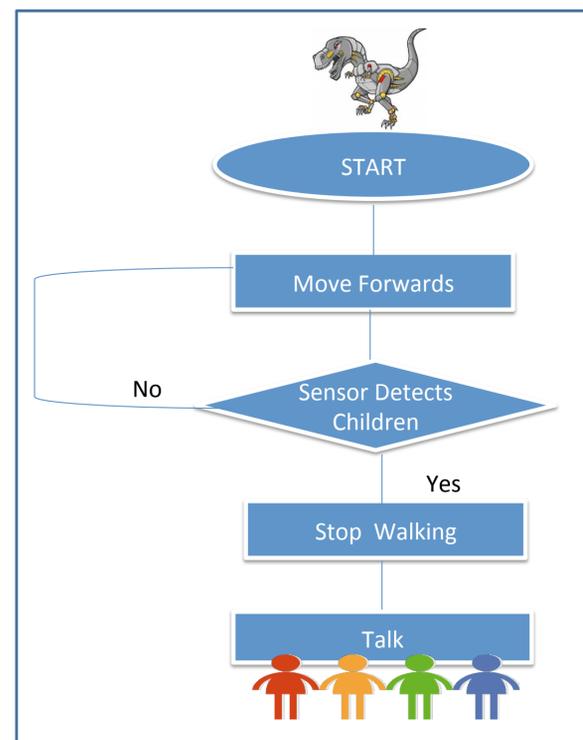
Outcomes of the study

- The zoomorphic robot will be used for the research and its design will be improved to provide an optimal enjoyable and safe play and therapy environment.

- Preferences by the children about the shape of the robot will be assessed, and best performance of different robot appearances will be tested

- Modalities of interaction will be tested, like possible play activities (e.g. feeding, manipulation)

- Goal of the study is to provide a quantitative metric for the effectiveness of the robot therapy regarding improvement of verbal expression and social pragmatics by children with autism

Future Scope

- In the future, the children's response to the Robot's questions can be recorded and analyzed.

- A more sophisticated Robot can be designed for developing better therapy.

- Attaching an external speaker can improve/ amplify the speech and voice quality.

- The Robot can use an RFID reader to find the exact position of the children by attaching an RFID tag to every child.

- By reading the RFID tag, the robot can identify a particular child and use the child's profile information to address the child with his/her name and ask questions appropriate to the age of the child.

Discussion

- The hypothesis is tested that play therapy with T-REX will be effective in improving behavioral and social outcomes for children with autism.

- We have been piloting the use of T-REX robot as an improved diagnostic and early intervention tool for children with autism that is affordable, non-threatening, and capable of interacting with a child with autism.

- The data which will be gathered concerning the children's interaction with the robot will be important for increasing our understanding of ASD and developing better therapies.

Web Resources

- https://www.autismspeaks.org/science/science-news/robots-autism-co-therapists
- http://www.lego.com/en-us/mindstorms/build-a-robot
- http://robotics.usc.edu/publications/media/uploads/pubs/588.pdf

References

- Benedettelli, D. (2014) *The LEGO MINDSTORMS EV3 Laboratory: Build, Program, and Experiment with Five Wicked Cool Robots!*
- Dickstein-Fischer L. ; Alexander, E.; Yan, X.; Su, H.; Harrington, K.; Fischer, G. S. (2011) *An affordable compact humanoid robot for autism spectrum disorder interventions in children Engineering in Medicine and Biology Society, EMBC, 2011 Annual International Conference of the IEEE*, pp. 5319 - 5322.
- *Mindstorms EV3 Discovery Book: A Beginner's Guide to Building and Programming Robots* By Valk, Laurens

Acknowledgments