Research Proposal for Research Internship @ ITBA

Student Researcher	Faculty Advisor
Leonie Kaufmann	Prof. Sebastian Preis (TUM) Prof. Rodrigo Ramele (ITBA)

Design and Build a Robot Pet to study affective perception of robot behaviours

1 Motivation

During several open-campus presentations we were surprised how kids reacted to small robots that can exhibit a set of behaviours. Kids, and particularly toddlers, instantly assumed the robot to be a pet, a living being, not different from a dog or cat. They assigned very quickly affective meaning to the robot behaviours and started to interact with it. For instance, some of the behaviours that we have identified were:

- Tapping and Shaking (Affirmative, Negative): When the robot shaked sideways toddlers instantly interpreted as negative response, and tapping (pitching, moving the nose down and up) was assumed as affirmative response.
- Twisting (joy): when the robot performed a 360 degrees twist, toddlers assumed that behaviour as joy.
- Moving around quickly (joy): when the robot moved around in semicircles back and forth, kids assumed that as an anxious happy response.
- Pushing forward on kid's feet (petting): kids interpreted the robot wanted petting all the time. A desire to look for being petted was inmediately understood from this behaviour.

2 Project Description

This project aims to create a platform to perform experiments to study how to characterize a robot-pet to achieve different reactions on kids, and concordently to study how kids react to pet-robots and to ECAs (Embodied Conversational Agent)s.

Research Question: Is there a set of behaviours that are universally understood in a small robot pet by toddlers that carry affective information? How can we characterise those behaviours and encoded them in a small robot?

Hence, the robot needs to be able to implement a set of movements that encode affective information. This small robot will be teleoperated.

3 Methodology

We will work on this project iteratively: prototyping, testing, refining, and so on. On each step the goal is to produce **impact** either in the form of media, a viable product for seeding some startup or work towards a research project with publications.

The first iteration will aim to state the research question and to build a basic testbed robotic platform that can be used to perform experiments with kids. At the same time, this platform could be also used to serve as a tool for STEM promotion activities.

To build the robot prototype, we will use anodized aluminum rods from Makeblock [4]. The robot needs to be able to move on flat survace, and it must have an appealing look for kids in consideration. Having a camera, a microphone and a speaker is a desirable option which aligns with the communication purpose of the robot.

Regarding the platform, we already developed the basic electronics and a custom software middleware to implement [5, 1] the robot which can be easily readapted and reused. This middleware allows to teleoperate the robot from any computer and to register all the telemetry from the robot sensors. These building blocks are based on Internet Of Robotic Thing (IoRT) technology, which is economically affordable, easy to use and appropriate for fast prototyping and iteration.

Additionally, ITBA University has one of the biggest and best equipped 3D impression labs and to perform any kind of mechanical tooling.

4 Research Plan

4.1 Task 1: Landscape survey

The first step is to perform a controlled activity with toddlers in a school with a Parrot Jumping Sumo, and to write a basic questionnaire for the students to grab a general overview of how they perceive the affective side of the robot set of behaviours.

Figure 1: Parrot Jumping Sumo

4.2 Task 2: Background Review

We will check literature regarding Human Robot-Interaction (HRI) and Affective Robotics, particularly aimed to toddlers. Particularly, the case of Moxie robot [2] and the extense work of Hiroshi Ishiguro [3].

4.3 Task 2: Robot Design

Next, based upon several projects that we have worked in the past, other commercial products and toys, design a basic robot that can perform a set of ethological behaviours that we can use to perform the first batch of experiments with toddlers.

4.4 Task 2: Robot Prototyping

The final stage of the project will be to build the actual robot based on previous steps. We can also include, if time permits, a small AB testing phase with school students to obtain basic feedback of the project.

5 Expected Outcomes

1. The robot testbed platform.
2. A 10-pages written Report where the general aspects of the robot construction are highlighted.

6 Budget

We expect the project associated costs to be constrained within the regular budget of the Computer Engineering Department at ITBA University for student research activities.

References

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