EMBEDDED BODY SENSOR NETWORK FOR PERSONS WITH SPECIAL COMMUNICATION NEEDS TO CONTROL AND TO INTERACT WITH THE WORLD

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INTRODUCTION

There is an ongoing project at the Eötvös Loránd University. We have been developing tools for severely handicapped, non-speaking but speech understanding children. Main components of the project are (i) the development of special communication tools including a controllable pet, Aibo, (ii) the development of machine learning techniques for situational optimization, and (iii) the development of Body Sensor Network (BSN) to form ambient intelligence.

The project has two subprojects. The first is concerned with human-computer interface development using (i) webcam based eye communication, (ii) webcam based head communication, (iii) webcam based facial expression detection, (iv) RF-MEMS sensor based BSN. The second deals with the development of language models using (v) image combination based text entry and (vi) intelligent writing tools, including Dasher.

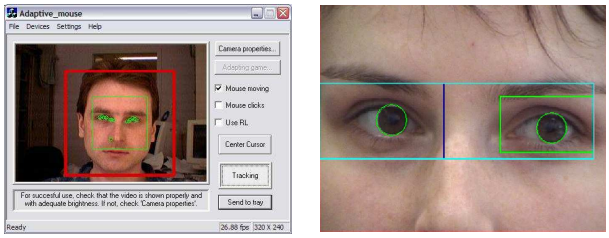

Figure 1. 'Traditional' human-computer interfaces

Figure 2. RF-MEMS TiltMouse for leg, arm, etc.

We have been using state-of-the-art machine learning tools for evaluating and predicting actual motion patterns, which – for people with special communication needs – could be used for intelligent predictive motion control and correction. Reinforcement learning (RL) is our tool for improving the joint performance of the machine and the user.

SCENARIOS

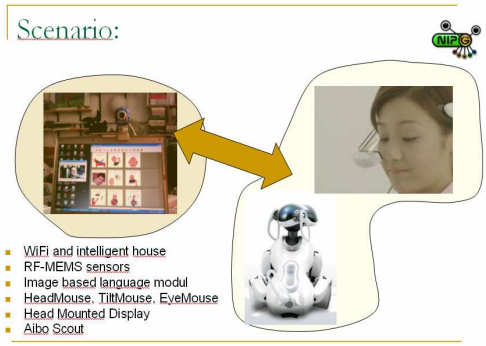

Figure 3. Communication between human, computer, and robotic pet

Type 1: Controlled operation. In this case, Aibo is controlled by the user. Aibo's head follows the head movements of the user, and the images from Aibo's camera are transmitted to the user. Aibo speaks instead of the user and transmits sound to the user.

Type 2: Assisting operation. Aibo is not controlled by the user and it is watching anyone in the neighborhood. It monitors head and gaze directions and transfers information to the user, according to the assumed context suggested by the user's head direction. During interaction, user performance can be used for RL.

Type 3: Interacting operation. Aibo is not controlled by the user, it is watching the user. It is not transmitting received signals, it is in reactive mode. It reacts to gaze and head directions of the user *and* tries to interact with user. During this interaction, attention, smile, unhappiness, anger and other signs can be used for RL

The synergy of BSN and other human-computer interfaces will be demonstrated by means of the scenarios.