yCAT: Young Children's Assistive Technology

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Introduction

- Spinal Muscular Atrophy (SMA) is a rare genetic disease

- The incidence of SMA is approximately 1 in 6,000 to 10,000 and there are more than 750,000 patients worldwide

- SMA is the number 1 genetic killer of infants and toddlers

Introduction

- Some individuals with SMA are unable to walk, talk, eat and breathe independently

- Most of them have extremely limited movement functionality

- Their living expenses are very high

- Until recently, no attention to young children with SMA due to poor life expectancy and focus on school-based services

- Issues we hope to address:
  ◦ Communication/interaction challenges
  ◦ Lack of independence in environment control
  ◦ Limited movement and mobility
  ◦ Targeting very young users (age 2-5 years)

Where we stand

- Previous studies
  - Little research in SMA therapeutics, but some other related health conditions
  - Very limited services for children under age 6 (below school-age)
  - AAC tools for people with communication challenges, but not those with specific movement patterns of SMA

- Fast growing computer technologies, smart sensors and wearable devices
  - Real time feedback
  - Different human-computer interaction approaches
  - May provide supports anywhere, anytime

What we designed: An Interactive Healthcare System
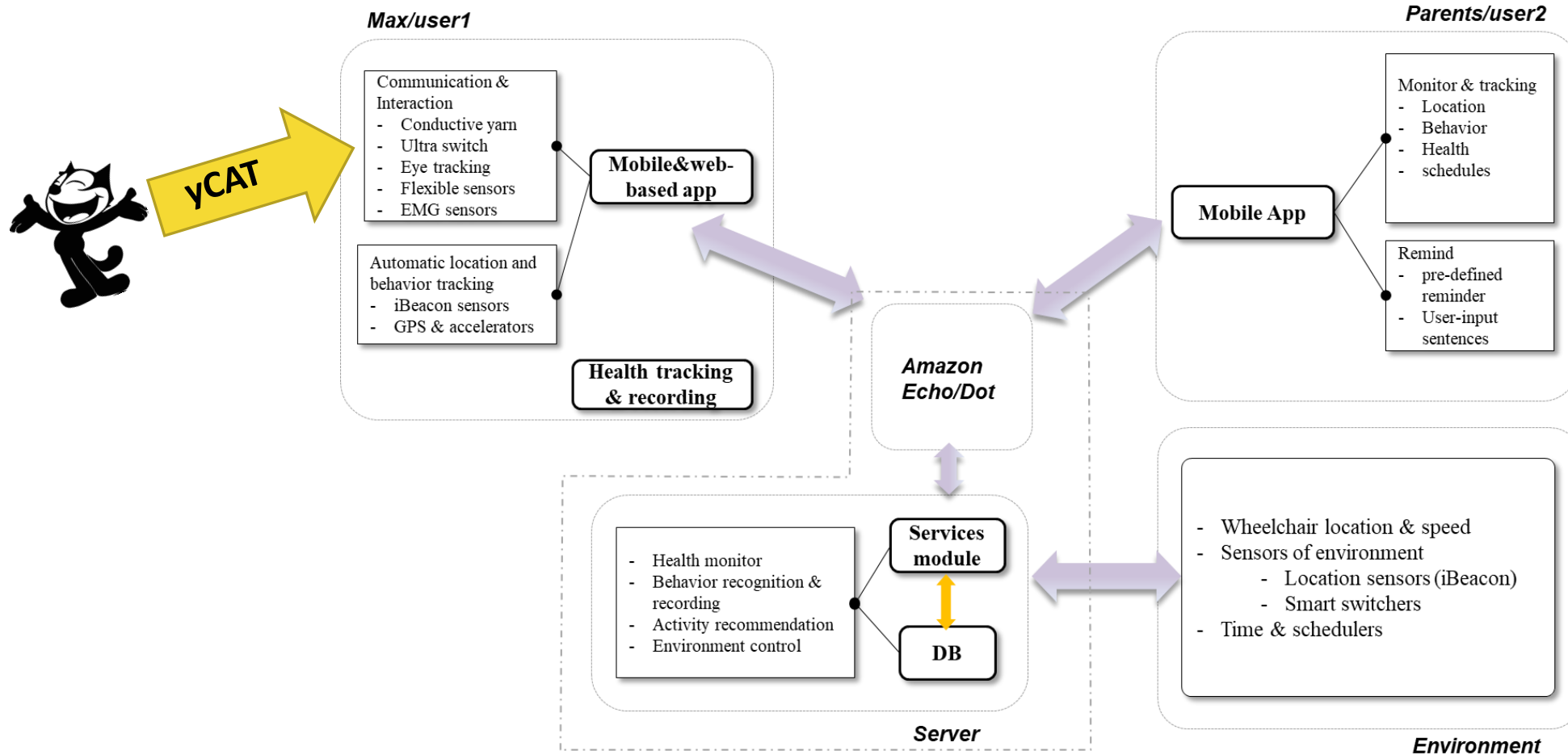
# Interactive Healthcare System*

- System requirements
  - Real-time feedback
  - Well-designed user interface
  - Low cost architecture

- Sensor requirements
  - Customizable
  - Accurate
  - Position independent
  - Affordable

* These factors were identified as relevant and desirable through our community-based needs-assessment
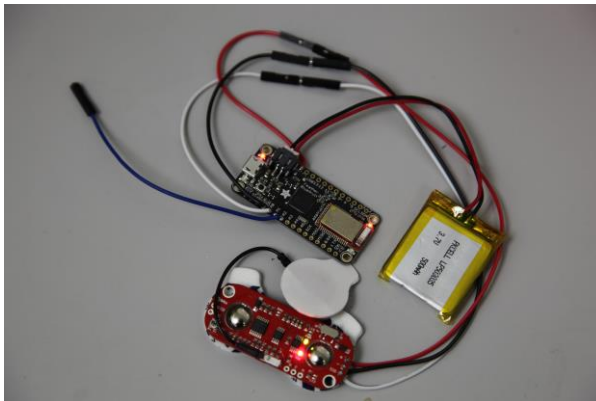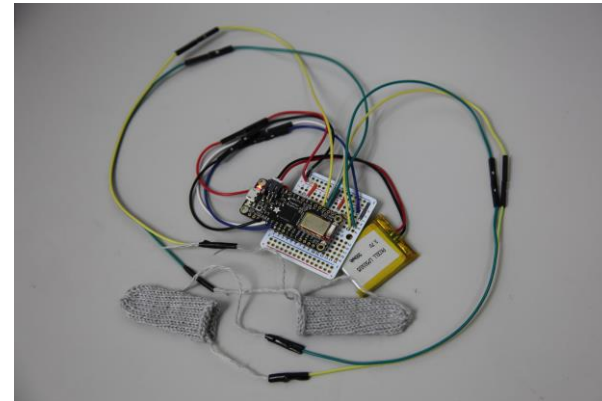
Multi-Modal Interaction Approach

Micro Light Switches
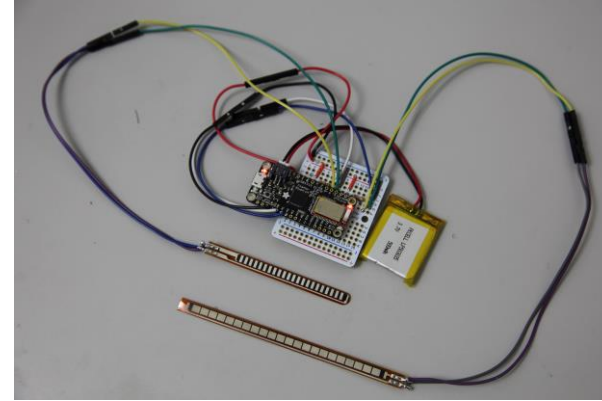
Flex Sensor

EMG Muscle Sensor

Stretch Sensor

Pilot study: Interactive Game

Figure 4.5: Game Screenshot

Figure 4.6: Operational Data

Web-Based Application

- Includes customizable images, spoken options, and full phrases once icons are selected.
- Plan is to be usable with variety of inputs including switches and eye gaze
- Because of spoken commands, can easily interface with Smart Home components such as Amazon Alexa/Google Home to control lighting, TV, etc.

Home

Kitchen

Closet   Basement

Dining Room   Bedroom

Living Room   Bathroom

BACK

Home   /   Kitchen

Help Cook

Eat Meal

Pour   Mix Ingredients

Measure

BACK

Our Plans

- Finalize web-based application, server development and database (Jan 2018)

- System testing (Jan 2018)

- Finalize user study protocols (Jan 2018)

- Participant recruitment (Feb 2018)

- User studies (3 arms – Spring, Summer, Fall 2018)

Planned Stages of Research
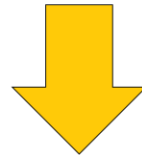
Stage 1
Spring-Summer 2018

- Assess the speech-language components, as well as design features, usability, and testing protocols.
- Typically developing children ages 2-5 years old in a daycare program or preschool.

Stage 2
Summer-Fall 2018

- Assess generalizability, user experience, and speech-language components within the community.
- Children with communication challenges ages 2-5 enrolled in a community-based therapy program.

Stage 3
Fall 2018

- Assess family use of the device within home settings, including customized inputs and mounting set-up.
- Children ages 2-5 diagnosed with a neuromuscular disorders, including SMA, and their families.