6.811: Principles and Practice of Assistive Technology

Today: Assistive Technology after PPAT

Monday, 2 December 2013

William Li, wpli@mit.edu

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Roadmap

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Roadmap

- Proof of concept
- # Users: 1

- Second-generation prototypes
- # Users: 1-10
- Competitions, conferences, and research

- Mass production?
- # Users: 100+?
- Variety of business models

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Questions for Discussion

Why were commercial off-the-shelf assistive devices unsuitable for your client?

Will your prototype address the need for every person with the same disability? Why or why not?

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Questions for Discussion

Why were commercial off-the-shelf assistive devices unsuitable for your client?

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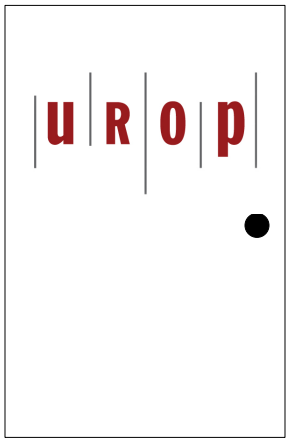
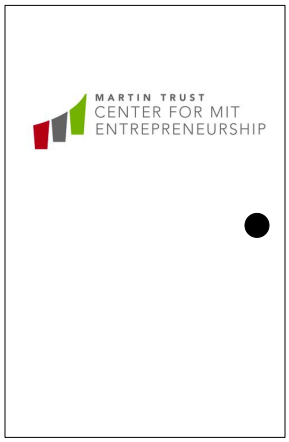
Taking Projects Beyond PPAT





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Taking Projects Beyond PPAT

MIT IDEAS Global Challenge

External design and research competitions

Successful AT funding models

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MIT IDEAS Global Challenge

MIT GLOBALCHALLENGE
Service at the Intersection of Innovation and Entrepreneurship

http://globalchallenge.mit.edu

1. A well-articulated need
2. A feasible approach
3. A team with the skills to solve the problem
4. A partner organization

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MIT IDEAS Global Challenge: Past AT Winners

Leveraged Freedom Chair (2008)

6dot Braille Labeler (2009)

Smartphone Universal Access Hub (2011)

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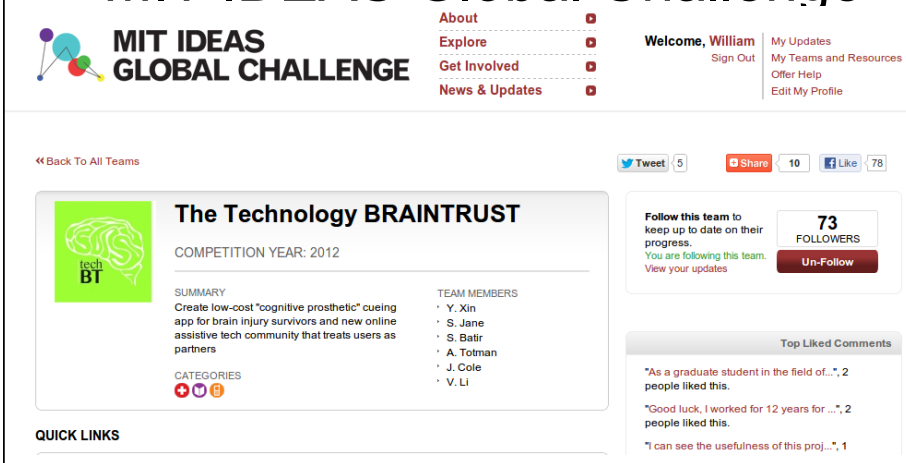
MIT IDEAS Global Challenge



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MIT IDEAS Global Challenge: Process

http://globalchallenge.mit.edu/competition/how-to-enter

1. Scope Statement and Development Grant (up to $1000): End of January 2014
2. Receive feedback from Public Service Center and alumni volunteers
3. Formal Proposal, Judging and Awards (April 2014)
4. Winners Retreat (June 2014)
5. Implementation (June 2014-May 2015)

Awards: $5,000-$10,000 per team

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MIT Assistive Technology Club

OpenStyleLab

What: An innovative apparel design initiative to serve clients with medical conditions.
When: June – August 2014
Who: 10 design students, 20 students from other disciplines
Where: Massachusetts Institute of Technology, Cambridge, MA

Executive Summary

People with disabilities often struggle to dress independently and find appropriate clothing for various occasions. Conditions like multiple sclerosis impact fine motor skills required to use buttons and hooks, while autistic children with sensory integration issues can find features like clothing tags discomforting. **Open Style Lab** is an innovative apparel design initiative that merges fashion and healthcare, founded on **the belief that thoughtful clothing design can make a huge impact on health and wellness.**

Contacts: Grace Teo and Cheryl Cui

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Taking Projects Beyond PPAT

MIT PUBLIC SERVICE CENTER

- MIT IDEAS Global Challenge

u|R|o|p

- External design and research competitions

MARTIN TRUST CENTER FOR MIT ENTREPRENEURSHIP

- Successful AT funding models

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Assistive Technology Research

Making Speech-Based Technology Work for a Real User

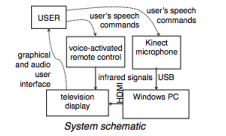
William Li, Don Fredette, Alexander Burnham, Bob Lamoureux, Marva Serotkin, Seth Teller

What is required to actually deploy speech-based assistive technology and have tangible impact on a user's life? What can we learn from this implementation process?

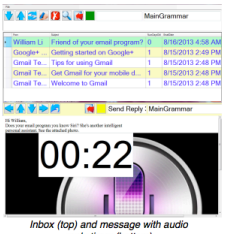
Target User

- **Goal: Send emails without requiring assistance**
- Middle-aged male with advanced secondary progressive multiple sclerosis (SPMS)
  - Minimal arm control
  - No leg control
  - Optic neuritis
- Difficulty with existing speech recognition systems:
  - Abnormally strained vocal quality
  - Variable pitch control (vocal fry)
  - English as a second language acquired in adulthood
- High cognitive function, good working memory and eagerness to try new assistive technology

Email Client Design



System schematic



Inbox (top) and message with audio reply timer (bottom)

Actual bedroom setup with 1) television, 2) Kinect, 3) computer, and 4) wheelchair with voice activated remote control

System Usage

- February 2012-June 2013: 460 received / 210 sent messages
- 10-20 messages/week at peak
- Observations on usage:
  - Messages with photos/videos are most highly valued
  - Audio-based email composition is robust to speech recognition challenges
  - Email has augmented, not replaced, other communication channels (e.g. telephone)

Factors for Success

Design for a single user: Our central goal was to enable our target user to communicate more frequently with friends and family.

Multidisciplinary collaboration: Our team works on AT research, rehabilitation technology, speech-language pathology, speech recognition, and software development.

Frequent and long-term interaction with the user: The current system is the product of many years of interacting with our target user and learning from his AT usage patterns.

Enabling technologies: The array microphone in the Microsoft Kinect and its integration with the customizable Windows Speech Recognition SDK made our system affordable and technically feasible to implement.

http://csail.mit.edu
http://thebostonhome.org

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Design/Research Competitions

- SIGACCESS Student Research Competition
  - Deadline: June 27, 2014
  - http://assets14.sigaccess.org/src.html
- RESNA Student Design Competition
  - Registration: December 5, 2013
  - Deadline: April 16, 2014
  - http://aac-rerc.psu.edu/wordpressmu/RESNA-SDC/

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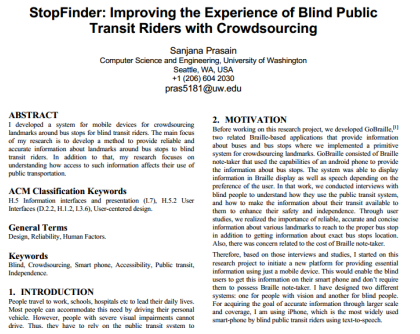
Design/Research Competitions

From ACM ASSETS 2011/2012



StopFinder: Improving the Experience of Blind Public Transit Riders with Crowdsourcing

Sanjana Prasain
Computer Science and Engineering, University of Washington
Seattle, WA, USA
+1 (206) 604 2030
pras5181@uw.edu

ABSTRACT
I developed a system for mobile devices for crowdsourcing landmarks around bus stops for blind transit riders. The main focus of my research is to develop a method to provide reliable and accurate information about landmarks around bus stops to blind transit riders. In addition to that, my research focuses on understanding how access to such information affects their use of public transportation.

ACM Classification Keywords
H.5 Information interfaces and presentation (I.7), H.5.2 User Interfaces (D.2.2, H.1.2, I.3.6), User-centered design.

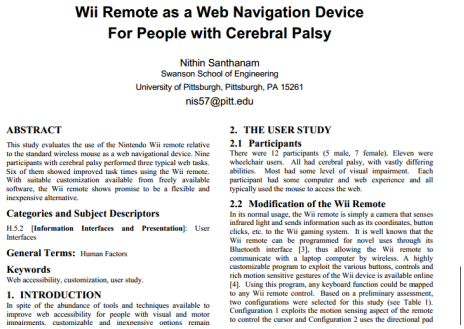
General Terms
Design, Reliability, Human Factors.

Keywords
Blind, Crowdsourcing, Smart phone, Accessibility, Public transit, Independence.

1. INTRODUCTION
People travel to work, schools, hospitals etc to lead their daily lives. Most people can accommodate this need by driving their personal vehicle. However, people with severe visual impairments cannot drive. Thus, they have to rely on the public transit system to

2. MOTIVATION
Before working on this research project, we developed GoBraille,[1] two related Braille-based applications that provide information about buses and bus stops where we implemented a primitive system for crowdsourcing landmarks. GoBraille consisted of Braille note-taker that used the capabilities of an android phone to provide the information about bus stops. The system was able to display information in Braille display as well as speech depending on the preference of the user. In that work, we conducted interviews with blind people to understand how they use the public transit system, and how to make the information about their transit available to them to enhance their safety and independence. Through user studies, we realized the importance of reliable, accurate and concise information about various landmarks to reach to the proper bus stop in addition to getting information about exact bus stops location. Also, there was concern related to the cost of Braille note-taker.

Therefore, based on those interviews and studies, I started on this research project to initiate a new platform for providing essential information using just a mobile device. This would enable the blind users to get this information on their smart phone and don't require them to possess Braille note-taker. I have designed two different systems: one for people with vision and another for blind people. For acquiring the goal of accurate information through larger scale and coverage, I am using iPhone, which is the most widely used smart-phone by blind public transit riders using text-to-speech.



Wii Remote as a Web Navigation Device For People with Cerebral Palsy

Nithin Santhanam
Swanson School of Engineering
University of Pittsburgh, Pittsburgh, PA 15261
nis57@pitt.edu

ABSTRACT
This study evaluates the use of the Nintendo Wii remote relative to the standard wireless mouse as a web navigational device. Nine participants with cerebral palsy performed three typical web tasks. Six of them showed improved task times using the Wii remote. With suitable customization available from freely available software, the Wii remote shows promise to be a flexible and inexpensive alternative.

Categories and Subject Descriptors
H.5.2 [**Information Interfaces and Presentation**]: User Interfaces

General Terms: Human Factors

Keywords
Web accessibility, customization, user study.

1. INTRODUCTION
In spite of the abundance of tools and techniques available to improve web accessibility for people with visual and motor impairments, customizable and inexpensive options remain

2. THE USER STUDY
2.1 Participants
There were 12 participants (5 male, 7 female). Eleven were wheelchair users. All had cerebral palsy, with vastly differing abilities. Most had some level of visual impairment. Each participant had some computer and web experience and all typically used the mouse to access the web.

2.2 Modification of the Wii Remote
In its normal usage, the Wii remote is simply a camera that senses infrared light and sends information such as its coordinates, button clicks, etc. to the Wii gaming system. It is well known that the Wii remote can be programmed for novel uses through its Bluetooth interface [3], thus allowing the Wii remote to communicate with a laptop computer by wireless. A highly customizable program to exploit the various buttons, controls and rich motion sensitive gestures of the Wii device is available online [4]. Using this program, any keyboard function could be mapped to any Wii remote control. Based on a preliminary assessment, two configurations were selected for this study (see Table 1). Configuration 1 exploits the motion sensing aspect of the remote to control the cursor and Configuration 2 uses the directional pad

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Challenges of AT Product Development

- Small market sizes (compared to mainstream consumer products)
- Significant technical challenges
- Evolving user needs
- Limited knowledge/access to marketplace
- Cost of assistive technology

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Questions for Teams

What was the most important commercially available assistive device that your client used?

Why has it been successful in the marketplace?

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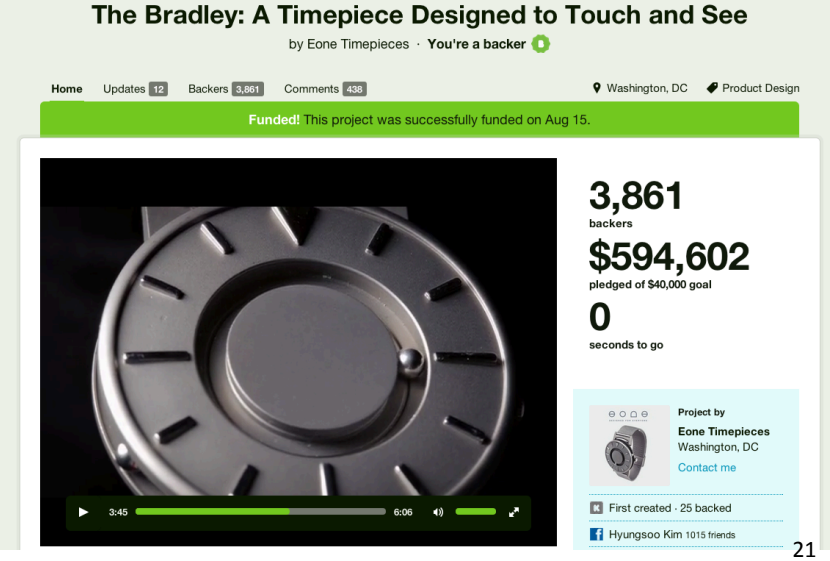
Kickstarter



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Takeaways

- Find the support system/model that works for your goals:
  - Community projects
  - Research and design competitions
  - Entrepreneurship
- MIT assistive technology mailing list: http://bit.ly/atmit
- William Li, wpli@mit.edu

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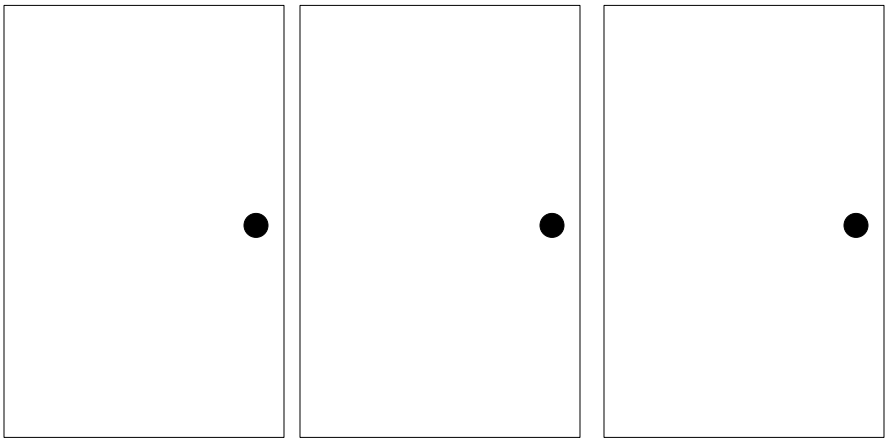
More Ways to Make an Impact



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Volunteer Organizations

- Groups of technically skilled volunteers who build customized assistive devices
- MIT Assistive Technology Club

(http://bit.ly/atmit)

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Social Enterprise

- Benetech  Bookshare
  - Problem: less than 5% of print materials are accessible to people with visual/ reading disabilities
  - Mix of staff and volunteers scan, upload, and proofread books and make them accessible
  - Free for students; $50/year otherwise

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Other Design Frameworks

- Universal design:
  - Curb cuts, low-floor buses, slider-top resealable bags
- Open source software/hardware
  - "Do-it-yourself" approaches
- Design for "situational impairments":
  - Typing on a phone while walking

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Legislation and Policy

- 1990 Americans with Disabilities Act (ADA)
- 1983 Orphan Drug Act
  - Subsidies/patent incentives for drugs for diseases that affect fewer than 200,000 Americans

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Takeaways

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