Grocery Shopping Assistant for the Blind/Visually Impaired (GroZi)

By: Grace Sze-en Foo
TIES Intern (Summer 2009)
“....The real problem of blindness is not the loss of eyesight.

The real problem is the misunderstanding and lack of information that exist.

If a blind person has proper training and opportunity, blindness can be reduced to a physical nuisance....”
What is GroZi

- 10 million blind and visually impaired people live in the U.S (American Foundation for the Blind)

Goal:
- empower blind/visually impaired individuals to shop at their own convenience and privacy using computer vision.
Previous Work

- Winter 07
  - Creation of blind-accessible web interface that allows users to create a shopping list.
Previous Work

- Winter 07
  - Creation of blind-accessible web interface that allows users to create a shopping list.
- Spring 07 (TIES & MAE B)
  - Further development of work from Winter 07.
  - Remote Sighted Guide (RSG), incorporating vibration and audio commands.
Previous Work

- Winter 08
  - Replaced Fall 08 prototype with wristbands with motors attached.
Previous Work

- Fall 08 & Winter 09
  - Creation of Soylent Grid. Customized database and user interface (UI) for labeling products.
  - Replaced Fall 08 prototype with wristbands with motors attached.
Previous Work

- **Winter 08**
  - Replaced Fall 08 prototype with wristbands with motors attached.

- **Fall 08 & Winter 09**
  - Creation of Soylent Grid. Customized database and user interface (UI) for labeling products.
Previous Work

- Winter 08
  - Replaced Fall 08 prototype with wristbands attached with motors

- Fall of 08
  - Created customized database and user interface (UI) for labeling products
Previous Work

- **Spring 09**
  - Mechanical design & creation of software to control Wiimote.
  - Mouse-Click Recorder Program that allows review of digital images.
Previous Work:

- Spring 09: Mechanical design & creation of software to control Wiimote.
- Mouse Click Recorder Program that allows review of digital images.
Summer 2009
The Team

Supervisor:  
Dr. Serge Belongie

Client: 
Dr. John Miller

Grace Sze-en Foo

Masaaki Kokawa

Jeffrey Wurzbach

Tommy Mueller
Goals for Summer

- Implement a Remote Sighted Guide (RSG)
  - Audio
  - Haptic (Vibration)

<table>
<thead>
<tr>
<th>No.</th>
<th>Stage</th>
<th>By</th>
<th>Using</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>John walks into store</td>
<td></td>
<td>Audio/Speech Synthesis</td>
</tr>
<tr>
<td>1</td>
<td>Aisle</td>
<td>Reading aisle signs</td>
<td>Audio/Tactile Alert</td>
</tr>
<tr>
<td>2</td>
<td>Locate Product Shelf</td>
<td>Object detection</td>
<td>Spatial Audio</td>
</tr>
<tr>
<td>3***</td>
<td>Approximate product location</td>
<td>Object detection*</td>
<td>Haptics</td>
</tr>
<tr>
<td>4</td>
<td>Detailed product location</td>
<td>Object tracking</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cue to stop moving</td>
<td>Object detection</td>
<td>Audio Alert</td>
</tr>
<tr>
<td>6</td>
<td>Product Confirmation</td>
<td>Bar code or detailed object recognition</td>
<td>Audio/Speech Synthesis</td>
</tr>
</tbody>
</table>

* Assumes that the participant is standing still, in front of the product shelf.

*** Stage where the experiment takes place.
Set Up

- GLOVE WITH IR LED
- CAMER
- WIIMOTE

REMOTE SIGHTED GUIDE (RSG)
Spatialized Audio

• Sound processed to give the listener the impression of a sound source within a three-dimensional environment.

• Relatively new technology.

• Used in Stage 3 to provide approximate location of product on the product shelf.
Initially
- Wireless analog camera
- Radio frequency (RF) transmission.
- VGA/RCA feed.

Finalized camera
- Microsoft LifeCam VX-6000
- OpenCV compatible
- Stable USB connection
- High resolution
Wiimote

- Primary functions harnessed by GroZi:
  - Vibration
  - IR Sensor
  - Basic Audio

- Tasks:
  - Audio Sampling Rate (Audacity)
  - Created software implementable by the Remote Sighted Guide interface
  - Provided audio cues for the 7 stages.
Remote Sighted Guide (RSG)

USB Camera

Wiimote

LEDs on the Glove

Image of user’s view

Position of the hand

IR light

Database

Overview Flowchart of GroZi

Laptop Computer with RSG

Interface

Indication (Sound, Vibration)

Shopping List

User
Interface of Remote Sighted Guide (RSG) @ GroZi
Personal Touch

• Been working on the project since January

• Learnt a tremendous amount

• Gratifying to see progress of project

• Motivation and cultivation of a heart for service engineering

• Immensely impressed with TIES program and would love it if I could bring it back with me to Australia/Malaysia.
Summary

- GroZi is an innovative shopping assistant designed for the blind/visually impaired.

- Summer accomplishments:
  - Investigated feasibility of using spatialized audio.
  - Packaged wiimote functions for easy integration in the RSG interface
  - Finalized choice of camera
  - Implemented an RSG interface
Demos

- Spatalized Audio
  - http://listenwithyourownears.com/3d-audio-demo-showdown/

- Wiimote functionality

- Remote Sighted Guide (RSG)