GroZi: Grocery Shopping Assistant

Blind Accessible Web Interface

National Federation of the Blind

Continuation Report
Winter 2007

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Executive Summary

There are currently 1.3 million legally blind people living in the United States who face daily obstacles with routine tasks, especially in regards to their experiences within supermarkets and stores. Developing assistive technologies and handheld devices allows for the possibility of increasing independence for those who have low vision. Currently, many grocery stores treat those that are blind as "high cost" customers, and dramatically undersell to this market, neglecting to take their needs into consideration. The use of computational vision can be advantageous in helping these blind customers, as restrictions such as the limited ability of guide dogs, frequently changing store layouts, and existing resources do not allow for a completely independent shopping experience. Using technologies such as object recognition, sign reading, and text-to-speech notification could allow for a greater autonomous solution to the growing problem.

In conjunction with Calit^2, UCSD's Computer Vision Lab, and TIES, the GroZi project is working to develop a portable handheld device that can "see", helping the visually impaired navigate more efficiently within difficult environments as well as better locate objects and locations of interest. GrloZi's primary research is focused on the development of a navigational feedback device that combines a mobile visual object recognition system with haptic feedback. Although still in its early stages of development, when complete, the GroZi system will allow a shopper to navigate the supermarket, find a specific aisle, read aisle labels, and use the handheld MoZi box to then scan the aisle for objects that look like products on the shopper's list (compiled online and downloaded onto the handheld device prior to going into the store).

Under the direction of our advisor Serge Belongie, for the past quarter we have been researching the creation of a usable, blind-accessible web interface to allow users to prepare their shopping list before downloading it to the MoZi digital assistant. The website not only provides blind users with a convenient interface for compiling their shopping list, but also provides the digital assistant with a set of current product images (pulled from sources such as Amazon Groceries, Safeway.com and user-contributions) in order to improve accuracy of object detection at the store. While we are currently using UCSD's Sunshine Store as a training prototype, we would like to extend this on a broader scale to larger local grocery stores and eventually in the future adapt this technology for use in a wide range of settings. After researching accessibility resources and meeting actively with our client we began development for an initial implementation. Our team divided to separate work on the database and the user interface to give greater focus on each individual task. In doing, so we were able to build a smaller database for the UCSD Sunshine Store where the GroZi project is currently being tested, and work to achieve the most effective interface possible through iterative design. The following document will serve as a description of what we have accomplished thus far, what we have learned and overcome, and the processes involved in designing and implementing a usable and accessible interface for the blind to assist future members of TIES GroZi team.

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Description of Project Tasks

In our first quarter working as a TIES group on the GroZi project, we set goals to establish minimally a working accessible prototype shopping list web-interface utilizing the 120-item inventory from UCSD's Sunshine Store. While we were able to achieve a functioning product, we were unable to implement all the features we initially discussed to include in our interface and will be working toward those in the upcoming quarter.

We chose to divide tasks initially between the backend database and the front end user interface, keeping a high level of communication as progress was made on both ends. The following outlines our approach for tasks that were necessary:

Database Backend

- Parser for UPC listing of sunshine store
- Database fields: date item entered, number of hits to an item as a term of relevance measure, etc.
- Populating database tables with images, allowing UPC search
- Dealing with abbreviations in product descriptions
- Future features to handle: coupons, club cards, nutrition facts or caloric data.
- For now guarantee an item will be in stock, estimate prices if unknown, and for any data that we do not know be sure to keep a placeholder and put something there for now.

User Interface

Think about what a blind person would experience, and aim for the following:

- Simple form
- Ability to check what is on one's list or alternatively remove an item.
- Show prices
- Think about how search will be implemented (example: spelling handling. Seek out open source utilities or STKs for assistance if needed)
- Use printing as a backup exportation method.

What we have accomplished

As a new TIES team we have formed a solid team and set concrete goals for future work. Throughout this past quarter, we met on a weekly basis with our client, contacted web accessibility consultants (Deque), set up permanent infrastructure for the GroZi shopping list website for future development, learned web programming languages (HTML, PHP, mySQL) necessary to build our project as well as how to effectively use a screen reader for navigating a browser (Internet Explorer). Overall we come away from this quarter with a much more defined understanding of what makes a website accessible (WCAG 1.0 standards) for the visually impaired, and have also had the opportunity to see first hand how the blind use web technologies in their daily lives.

Currently, we have implemented our database for the UPC listing and product inventory we received from UCSD's Sunshine store. Using this database and taking into consideration the user interface requirements we established early on, we were able to implement the foundations of our prototype emulating our original ideas to create a simple, usable, and searchable interface.

Challenges and Obstacles we have faced:

While starting a new TIES team, organizing tasks, and gathering initial support can be challenging at first (especially with such a small team) we managed to overcome these preliminary tasks in a timely manner. Other obstacles we faced throughout the quarter were the following:

- Obtaining sufficient Cal-it^2 resources and gaining access privileges.
- Becoming accustomed to screen readers (JAWS) for testing: while we were able to pick up the basics quickly, learning exactly how a blind-user uses this software with short-cuts and other methods can be challenging.
- Making our site work well with screen reading software and ensure that we were meeting accessibility requirements.
- Also trying to keep our prototype scale small, and avoid dealing with many larger unknown future factors in the project (how the shopping list will eventually be exported, extending our database for future stores, etc.).

Design Process - Usable Web Programming

The fundamental purpose of our TIES project is to create a working blind-accessible website for the GroZi project, as well as to identify specifications and resources for this type of design.

The following are common web practices that are to be avoided in making blind-accessible content and web sites:

1. Many links on a site (examples: home, email, etc. are unnecessary and instead should options to skip straight to content).
2. Avoid mouseovers.
3. Frames are discouraged (example: the user can only access content for one frame at a time. If content in a left frame or sidebar relates to a separate frame it is challenging to navigate).
4. Regarding tab accessible fields: links or descriptions above them are not always good.

What is accessible?

Generally, the set standards for accessibility can be found through the World Wide Web Consortium (w3c): http://www.w3c.org or more specifically http://www.w3.org/TR/WCAG10/

Although, a website may be deemed accessible by these standards, well formatted code may not be necessary usable, especially for non-sited users. Therefore in making usable websites for the visually impaired, navigation and layout must be critically thought out. Excessive graphics, drop-down menus, Flash navigation etc. are irrelevant and are to be avoided.

The following are examples of blind-accessible and usable HTML code (courtesy of John Miller):

1. http://rescue.calit2.net/zigzag/feedback/feedbackcopy.html

2. http://grozi.calit2.net/webinterface/ties/mentorform.php

Design Process - Screen Readers

JAWS - *Job Access With Speech*

In order to test our prototype and become accustomed to how the blind navigate web interfaces and computational tasks in general, it was necessary to begin using a screen reader. JAWS, a screen reader and software program created specifically for visually impaired users is produced by the Blind and Low Vision Group at Freedom Scientific. Its purpose is to make personal computers using Microsoft Windows accessible to blind and visually impaired users. This is accomplished by providing the user with access to the information displayed on the screen via text-to-speech and allowing for more comprehensive keyboard interaction with the computer. Its capabilities are extensive, as users may create custom scripts to alter the amount and type of information displayed or presented by various applications -- making programs that were not designed for accessibility usable through the JAWS interface.

For our purposes, we learned, installed, and began to use JAWS at a basic level to better test our web interface navigation and determine where problems may exist in usability and accessibility throughout development of our prototype.

Installing JAWS for Windows:

JAWS is propriety software, and has a license cost of approximately $900, despite this, we have realized that the free downloadable demo is sufficient for our testing. The demo software is fully functional, however, can only be used in 45 minute increments, at which point the machine must be restarted in order for JAWS to be used again. The demo version of JAWS may be installed on machines running Microsoft Windows XP and Vista via download at the Freedom Scientific website: (www.freedomscientific.com)

Note: It is possible to emulate the Windows environment on computers running Mac OSX through using the Parallels virtual machine program (http://www.parallels.com/), however, it is highly advised to use a PC for testing purposes especially as this is what the majority of visually impaired users utilize.

User Guide for Navigating Internet Explorer with JAWS:

Keyboard Shortcut	Description
Tab	To jump from one link to the next link: allows user to navigate through fields
Shift + Tab	To jump from one link to the previous link
Insert + F7	Brings up a list of links within the page
Enter	To activate Forms mode: allows for text input when in an input field. (Note: make sure that you Tab into the box that you want to activate before you hit Enter).
Insert + Escape	Refresh Screen
Escape	Deactivates/Activates JAWS speech
Insert + A	Reads the text in the address bar
Control + Alt + left (or right) arrow	Reads the item within a cell in a Table, indicating which row or column the curser is on
Insert + Tab	Reads the selected link
Insert + 5 (twice quickly)	Spells out the word active at the cursor
Control + F	To search for a word or phrase
Alt + D	To activate the address list box
Insert + Alt F4	Allows for list management
Insert + Alt F4 (twice)	Moves JAWS cursor to the address bar
Alt + left arrow	To go back one page within the browser
Alt + right arrow	To go forward one page within the browser
Insert + Enter	To skip past headers within a page
Insert + Control + Home	Focus to the first field: Move to the first input field within the page
Insert + Enter	Moves to the next block of text which has no links
Insert + F5	Reformat documents to be more readable with speech (example: multiple column pages)

Current Prototype

Main Page HTML:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
   <title>GroZi Shopping List - Site Under Construction</title>
   <link rel="stylesheet" type="text/css" href="css/styles.css"
/>
   <link rel="stylesheet" type="text/css" href="css/header.css"
/>
</head>

<body>
   <div id="navcontainer">
      <ul id="navlist">

         <li><a href="index.html">Home</a></li>
         <li><a href="header/aboutgrozi.html">About
Grozi</a></li>
         <li><a href="listhandler.php?upc=&action=view">Manage
Shopping List</a></li>
         <li><a href="header/links.html">Links</a></li>
      </ul>
   </div>
         <h1> GroZi Shopping List </h1>

          Note: The site is currently under construction.
<br/><br/>
         Please input the product you'd like to add to your
shopping list.<br/><br/>
         <form method="post" action="searchhandler.php">
            <input name ="searchbox" type="text" tabindex="1"
alt="type in the item you'd like to search"/>
            <input type ="submit" value="Submit" tabindex="2"
alt="hit button to submit query"/>
         </form>

</body>
</html>
```

Current Prototype (II)

Query Result Example Page:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0
Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-
transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
   <title>GroZi Shopping List - Site Under
Construction</title>
   <link rel="stylesheet" type="text/css"
href="css/styles.css" />
   <link rel="stylesheet" type="text/css"
href="css/header.css" />
</head>

<body>
   <div id="navcontainer">
      <ul id="navlist">

         <li><a href="index.html">Home</a></li>
         <li><a href="header/aboutgrozi.html">About
Grozi</a></li>
         <li><a
href="listhandler.php?upc=&action=view">Manage Shopping
List</a></li>
         <li><a href="header/links.html">Links</a></li>
      </ul>
   </div>
<h1> Query Result
<br/></h1><table><tr><td>Description</td><td>UPC</td><td>Ma
nufacturer</td></tr><tr><td><a
href="profiledisplay.php?upc=0037000308041&caninsert=yes">3
0804 REGULAR 33OZ TIDE
POWDER</a></td><td>0037000308041</td><td>PROCTER   GAMBLE
COMPANY</td></tr></table>

</body>
</html>
```

Current Prototype (III)

Item Record Example Page:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0
Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-
transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
   <title>GroZi Shopping List - Site Under
Construction</title>
   <link rel="stylesheet" type="text/css"
href="css/styles.css" />
   <link rel="stylesheet" type="text/css"
href="css/header.css" />
</head>

<body>
   <div id="navcontainer">
      <ul id="navlist">

         <li><a href="index.html">Home</a></li>
         <li><a href="header/aboutgrozi.html">About
Grozi</a></li>
         <li><a
href="listhandler.php?upc=&action=view">Manage Shopping
List</a></li>
         <li><a href="header/links.html">Links</a></li>
      </ul>
   </div>
<h1> Item Record
</h1><table><tr><td>UPC</td><td>0037000308041</td></tr><tr>
<td>Description</td><td>30804 REGULAR 33OZ TIDE
POWDER</td></tr><tr><td>Size/Weight</td><td></td></tr><tr><
td>Manufacturer</td><td>PROCTER   GAMBLE
COMPANY</td></tr><tr><td>Issuer
Country</td><td></td></tr><tr><td>Last
Modified</td><td></td></tr></table><br/><br/><a
href="listhandler.php?upc=0037000308041&action=add">Insert
item to shopping list</a></body>

</html>
```

Current Prototype (IV)

MySQL Database Backend - How Products are Stored:

```
--

-- Table structure for table `productinfo`

--

CREATE TABLE `productinfo` (

  `UPC` varchar(20) NOT NULL,

  `sizeweight` varchar(255) default NULL,

  `description` text,

  `manufacturer` varchar(255) default NULL,

  `issuecountry` varchar(255) default NULL,

  `lastmodified` varchar(255) default NULL,

  PRIMARY KEY  (`UPC`),

  FULLTEXT KEY `UPC` (`UPC`,`description`,`manufacturer`)

) ENGINE=MyISAM;

-- Dumping data for table `productinfo`

INSERT INTO `productinfo` (`UPC`, `sizeweight`, `description`,
`manufacturer`, `issuecountry`, `lastmodified`) VALUES

('0310119030486', '4 OZ', 'Bausch & Lomb Renu All in One Multi Purpose
Solution', 'BAUSCH   LOMB, INC./PERSONAL PRODUCTS DV', NULL, NULL),

('0016000126121', '3.75 oz', 'Chex Mix', 'GENERAL MILLS, INC.', NULL,
NULL),

('0016000166196', '5.5 oz (155 g)', 'Gardetto''s Original Recipe',
'GENERAL MILLS, INC.', NULL, NULL),

('0016000665903', '14oz (396G)', 'General Mills Honey Nut Cheerios
Cereal', 'GENERAL MILLS, INC.', NULL, NULL),

('0022000000965', '15 sticks', 'Wrigleys Extra peppermint gum', 'WM.
WRIGLEY JR. COMPANY', NULL, NULL), …
```

Project Planning - Future Directions

In the upcoming quarter we hope to greatly build upon the prototype we have established and work toward solving the existing challenges outlined in earlier portions of this report. Specifically, we will be striving to complete the following tasks:

- Move our existing site to the permanent Cal-it^2 secure server location.

- Immediately begin use of version control to ensure the continuity of our work over time.

- Create a user log-in system to make our prototype more interactive, and allow for a favorites list to streamline the shopping list creation experience.

- Add a display for product images on the Item Records page.

- Determine how to best export finished shopping lists to the MoZi box and for our users.

- Continue on-going testing of our site with JAWS to ensure our site is usable and accessible.

- Extend our current database to contain more details such as item prices and weight, quantity options for the user, and the ability to check for product abbreviations and spelling mistakes in search queries.

Team Organization and Contact

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Resources and References

SPECIFICATIONS FOR BLIND-ACCESIBLE WEB DESIGN

1. World Wide Web Consortium standards: http://www.w3.org/TR/WAI-WEBCONTENT/
2. HFES 200 Compliance: http://www.hfes.org
3. UPC Database: http://www.upcdatabase.com

EXAMPLES OF WELL-FORMATTED NFB-APPROVED WEBSITES

4. National Federation of the Blind: www.nfb.org
5. National Center for Blind Youth in Science: http://www.blindscience.org
6. Zigzag forms: http://rescue.calit2.net/zigzag/feedback/feedbackcopy.html
7. NFB Mentor form: http://grozi.calit2.net/webinterface/ties/mentorform.php
8. Blind Programming: http://www.blindprogramming.com/

USABILITY IN THE NEWS

9. NFB Sues Target (September 2006): http://www.nfb.org/nfb/Target_Sept_Release.asp?SnID=1856320445
10. Our Working Prototype: http://www.r-infinite.com/grozi/
11. Permanent Location: http://grozi.calit2.net/webinterface/
12. GroZi Project Homepage: http://grozi.calit2.net/
13. GroZi TIES Wiki: http://vision.ucsd.edu/collaborate/index.php/Grocery_Shopping_Assistant

TESTING USABILITY

14. JAWS Screen Reader for Windows: http://www.freedomscientific.com
15. JAWS windows shortcut keys: http://www.rnib.org.uk/xpedio/groups/public/documents/PublicWebsite/public_rnib003398.hcsp
16. Keyboard Shortcuts for JAWS: http://www.webaim.org/resources/shortcuts/jaws.php