

GroZi: Grocery Shopping Assistant **Blind Accessible Web Interface**

National Federation of the Blind

Continuation Report
Spring 2007

Friday, June 8th, 2007

Elisabeth Kain (ekain@ucsd.edu)

Andy Kwong (hina14338@hotmail.com)

Alex Pastel (axle123@sbcglobal.net)

Carlos Tong (ctong@ucsd.edu)

Advisor: Serge Belongie

NFB Representative: John Miller

University of California, San Diego
Teams in Engineering Service

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 Calit², 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. GroZi’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 two quarters 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](https://www.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.

This quarter we have continued to meet actively with our client, Dr. John Miller, and continue development of our initial implementation. We have particularly focused on ensuring the continuity of our project and preparing our prototype for outside feedback. 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.

Table of Contents

<i>Opening</i>	1
<i>Executive Summary</i>	2
<i>Spring 2007 Project Tasks:</i>	
<i>What we have accomplished</i>	4
<i>Challenges and Obstacles</i>	5
<i>GroZi TIES Development Process:</i>	
<i>Site Layout (Server Side)</i>	6
<i>File Directory Structure/Site Map</i>	7
<i>Database Relationships</i>	8
<i>MySQL Demonstration & Tutorial</i>	9
<i>Configuring CVS for Development</i>	12
<i>Configuring CVS with Eclipse</i>	14
<i>Project Planning - Future Directions</i>	18
<i>Team Contact Information</i>	21
<i>Resources and References</i>	22

What we have accomplished - Spring 2007

In our second quarter working as a TIES group on the GroZi project, we continued to push forward with preparation for development of features (user login and adding product images to each item record page) as well as focused on laying a foundation for future work by troubleshooting the permanent move to Calit2 server infrastructure, becoming much more proficient in PHP, mySQL, and JAWS for usability testing, and setting up project management systems/version control of our current progress. As our team has started to grow, we decided to assign more specific roles to each member to help streamline development and aid in organization for the overall project. Finally we prepared our site to be released to a larger focus group of blind or visually impaired users and are currently awaiting feedback to make future improvements.

Tutorial Document - User Guide

Prior to announcing our prototype to the general public, we developed a step-by-step demonstration/tutorial document for the GroZi website that provides an overview of what our site does and how it works. The document also contains a specific walkthrough, guiding the user through the process of adding two items to the shopping list and removing one of those items. The document concludes with a table of JAWS commands that are necessary for navigating the site using JAWS for Windows.

Feedback Form

We have included a PHP based form for blind users to give their opinions of the site, which is sent to grozi.feedback@gmail.com. The feedback form fields include Name, Email, whether the user is visually impaired or not, Age Group, Site Rating, and a blank field for overall comments. When the form is submitted, a message is shown indicating success or failure and the user is given the option to select a link to return back to the home page. This form will hopefully allow for a simpler method for users to directly give us their opinion on their experience with our prototype.

Purchases

This quarter we found out we had TIES financial support, to which we decided to develop a budget and make the following purchases:

1. BaseCamp (Project Management) Upgrade fee:	\$50
2. Full version of Jaws 8.0 (Windows Vista):	\$900
Total:	\$950

Reaching Out

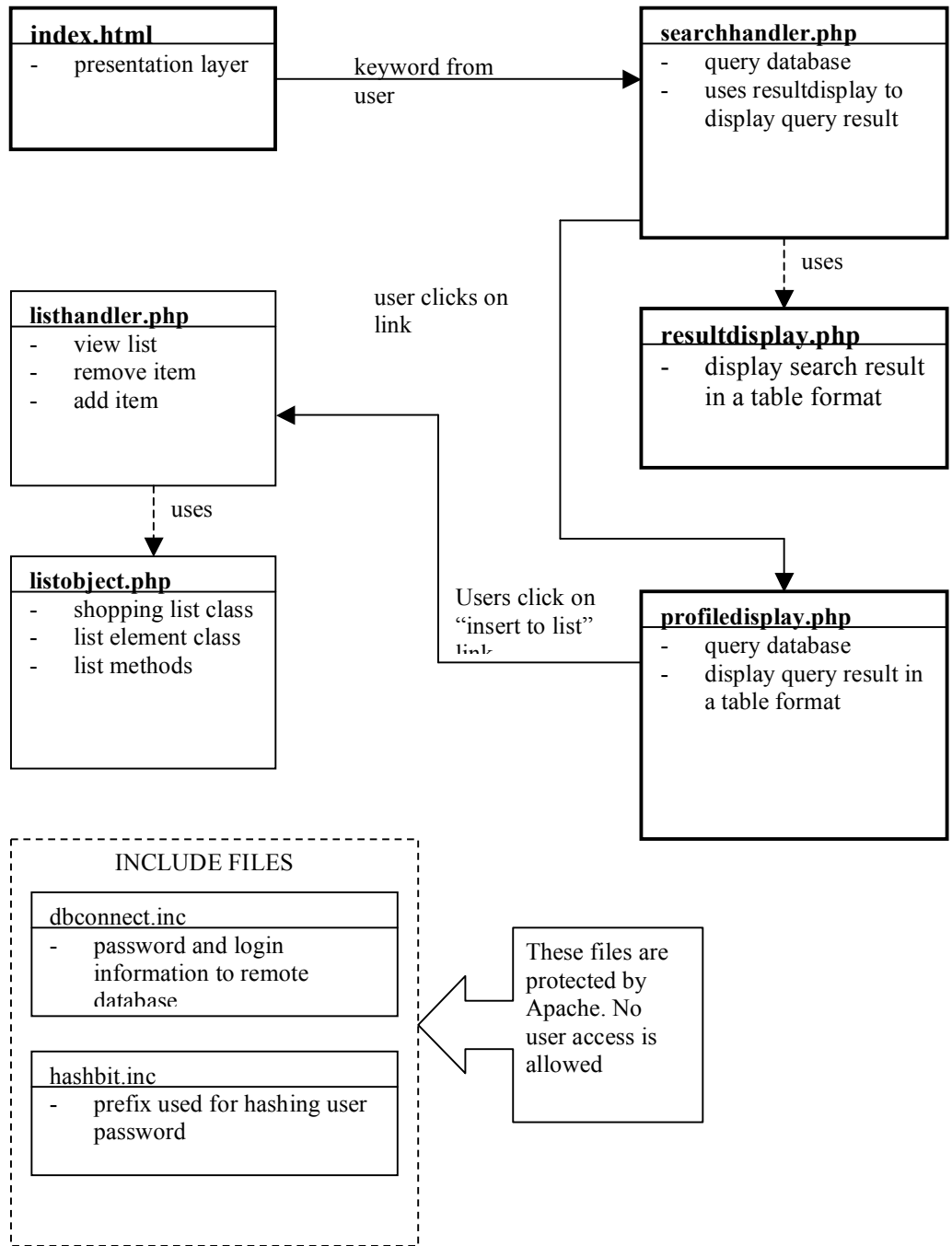
Each of us subscribed to the NFB blindtlk mailing list. The purpose of this list is for the discussion of general topics of interest to the blind/visually-impaired community and for anyone who is interested. As a first action in receiving feedback on our

work, we will announce our prototype first through this list and follow through to see if we receive any results as well as update our site accordingly to meet these needs.

Challenges and Obstacles we have faced:

Primarily our largest challenge this quarter was making the site move to the Calit2 research server. Working with the Office of Engineering Computing for Jacob's School and John Miller we were able to overcome many of the smaller issues we ran into. In the end we were able to successfully extend our database to 4,000 items from the previous 120 item listing, re-organize our site so that the design/directory structure is more straightforward, and initiate version control through CVS.

Grozi TIES - Site Layout (Server Side)



Grozi TIES - File Directory Structure/Site Map

/usr/local/www/data/research/grozi/webinterface/

- index.html
- listhandler.php
- listobject.php
- profiledisplay.php
- resultdisplay.php
- searchhandler.php
- UpdateLog.txt

/usr/local/www/data/research/grozi/webinterface/css/

- header.css
- styles.css

/usr/local/www/data/research/grozi/webinterface/csv/

- items.csv
- mfrs.csv

/usr/local/www/data/research/grozi/webinterface/dbupdate/

- dbconnect.inc
- importdb.php
- index.php
- populatedb_1.php
- populatedb_2.php
- populatedb_3.php

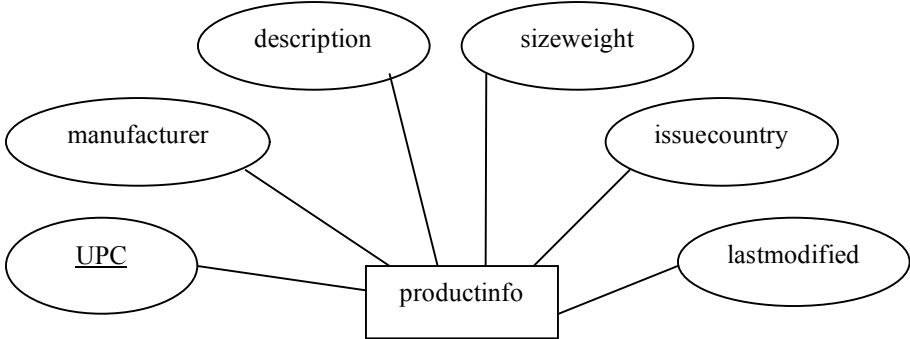
/usr/local/www/data/research/grozi/webinterface/header/

- aboutgrozi.html
- links.html

/usr/local/www/data/research/grozi/webinterface/inc/

- dbconnect.inc
- hashbit.inc

Database Entity-Relationship Diagram



Database Attribute Information

	Field name	Type	Can be Null?	Default
1	<u>UPC</u>	varchar (20)	No	
2	sizeweight	varchar (500)	Yes	NULL
3	description	text	Yes	NULL
4	manufacturer	varchar (500)	Yes	NULL
5	issuecountry	varchar (500)	Yes	NULL
6	lastmodified	varchar (500)	Yes	NULL

Note: In the beginning of the quarter we planned to remove the “lastmodified” field in our database because we thought having this field might affect our overall database structure. However, no changes were made to the overall database structure this quarter because after verifying with Prof. Alin Deutsch we concluded that our database structure is properly normalized and according to Prof. Deutsch having this field totally a functional decision rather than a database design decision.

MySQL Demonstration & Tutorial

This section demonstrates the basic mysql commands used in our project which allow the user to view a database, insert elements into a database (from keyboard or from file), and remove elements from the database.

Begin session

```
[apastel@calit2-server3 ~/grozi]$ mysql -u grozi_dba grozi -p
Enter password:
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 115940 to server version: 4.0.27-log

Type 'help;' or '\h' for help. Type '\c' to clear the buffer.
```

View databases and tables

```
mysql> show databases;
+-----+
| Database |
+-----+
| grozi   |
| test    |
+-----+
2 rows in set (0.00 sec)

mysql> show tables;
+-----+
| Tables_in_grozi |
+-----+
| productinfo     |
+-----+
1 row in set (0.00 sec)
```

View Fields of Productinfo Table

```
mysql> desc productinfo;
+-----+-----+-----+-----+-----+-----+
| Field          | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| UPC            | varchar(20)   |      | PRI |          |       |
| sizeweight     | varchar(255) | YES  |     | NULL    |       |
| description    | text         | YES  |     | NULL    |       |
| manufacturer   | varchar(255) | YES  |     | NULL    |       |
| issuecountry   | varchar(255) | YES  |     | NULL    |       |
| lastmodified  | varchar(255) | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
6 rows in set (0.00 sec)
```

View Entire Contents of Productinfo Table

```
mysql> select * from productinfo;
+-----+-----+-----+-----+-----+-----+
| UPC            | sizeweight     | description                                     | lastmodified |
+-----+-----+-----+-----+-----+-----+
| 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 |
.....
....
.....
| 0076840400058 | 16 OZ | Ben & Jerry's Ice Cream World's Best Vanilla
| BEN JERRY'S HOMEMADE INC. | NULL | NULL |
| 0044000002244 | 8 OZ | Nabisco Flavor Crisps/Flavor Originals Snack Crackers Baked
Vegetable Thins | NABISCO BISCUIT COMPANY | NULL | NULL |
| 0070470003139 | 6 OZ | Yoplait Yogurt Original Strawberry Banana 99% Fat Free S70
| YOPLAIT USA | NULL | NULL |
+-----+-----+-----+-----+
+-----+-----+-----+-----+
118 rows in set (0.00 sec)

```

View Specific Rows in Productinfo Table

```

mysql> select * from productinfo where Manufacturer="General Mills, Inc."
-> ;
+-----+-----+-----+-----+
| UPC | sizeweight | description | manufacturer |
| issuecountry | lastmodified | | |
+-----+-----+-----+-----+
| 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 | | |
| 0016000141551 | 1.80 OZ | M-HNY NUT CHEERIOS CUPS | GENERAL MILLS, INC. |
| NULL | NULL | | |
+-----+-----+-----+-----+
+-----+-----+-----+-----+
4 rows in set (0.01 sec)

```

Insert Data into Productinfo Table

```

mysql> insert into productinfo
-> values ('1122334455', '1 lb.', 'Delicious Food', 'Alex Pastel', 'USA', NULL);
Query OK, 1 row affected (0.01 sec)

```

View the Inserted Data

```

mysql> select * from productinfo where Manufacturer = 'Alex Pastel';
+-----+-----+-----+-----+-----+-----+
| UPC | sizeweight | description | manufacturer | issuecountry | lastmodified |
+-----+-----+-----+-----+-----+-----+
| 1122334455 | 1 lb. | Delicious Food | Alex Pastel | USA | NULL |
+-----+-----+-----+-----+-----+-----+
1 row in set (0.00 sec)

```

Create Tab-delimited .txt File for Data Entry

```

[apastel@calit2-server3 ~/grozi/webinterface]$ cat test_database_insert.txt
3928471033 2 lb Chicken Alex Pastel USA NULL
4920384920 12 oz. Juice Alex Pastel Nowhere NULL
4839485084 3 lb Fish Alex Pastel USA NULL

```

Attempt to Load File into Productinfo Table

```

mysql> load data local infile '~/grozi/webinterface/test_database_insert.txt' into table
productinfo;
ERROR 1148: The used command is not allowed with this MySQL version

```

Begin Client With Local Infile Loading Option and Try Again

```
mysql> Aborted
apastel@calit2-server3 ~/grozi/webinterface]$ mysql -u grozi_dba grozi -p --local-infile=1
```

```
mysql> load data local infile '~/grozi/webinterface/test_database_insert.txt' into table
productinfo;
Query OK, 3 rows affected (0.01 sec)
Records: 3 Deleted: 0 Skipped: 0 Warnings: 3
```

```
mysql> select * from productinfo where Manufacturer='Alex Pastel';
```

UPC	sizeweight	description	manufacturer	issuecountry	lastmodified
4839485084	3 lb	Fish	Alex Pastel	USA	NULL
4920384920	12 oz.	Juice	Alex Pastel	Nowhere	NULL
1122334455	1 lb.	Delicious Food	Alex Pastel	USA	NULL
3928471033	2 lb	Chicken	Alex Pastel	USA	NULL

```
4 rows in set (0.00 sec)
```

Delete Rows from Productinfo Table

```
mysql> delete from productinfo where description = 'Juice' or description = 'Fish';
Query OK, 2 rows affected (0.00 sec)
```

```
mysql> select * from productinfo where Manufacturer='Alex Pastel';
```

UPC	sizeweight	description	manufacturer	issuecountry	lastmodified
1122334455	1 lb.	Delicious Food	Alex Pastel	USA	NULL
3928471033	2 lb	Chicken	Alex Pastel	USA	NULL

```
2 rows in set (0.00 sec)
```

```
mysql> Aborted
```

Configuring CVS (Concurrent Version System) for Development

Since we have already set up CVS for our project, the following will walk a new team member through the steps necessary to setup CVS on their account on Cal-it2:

How to set up CVS repository for GroZi TIES:

1. Set the CVSROOT environment variable to the path where the repository is located. To avoid having to set this upon every log on create a start up file (if it does not already exist) called `.bash_profile` in your home (`~`) directory. Put the following line in this file:

```
CVSROOT=/usr/local/www/data/research/grozi/ties_cvs;export CVSROOT
```

*2. If the repository had been new you would have entered: `cvs init` at the command line after setting the CVSROOT, but this is not necessary for future users as it is done once upon repository setup.

Note: Our repository and file history is located at the following path:
`/usr/local/www/data/research/grozi/ties_cvs/tiescvs`

How to start using CVS on the tiescvs Module:

1. To check out a working copy of the CVS module enter:

```
> cvs checkout tiescvs
```

or

```
> cvs co tiescvs
```

Note: You will only need to check out a project once in the lifetime of a project. The rest of these steps are to be followed for routine development.

2. Once a project is checked out, you are now ready to work in the created module.

```
> cd tiescvs
```

```
> vim index.shtml //example file to be edited
```

3. If you want to create a new file and add it to the repository:

```
> cvs add filename
```

This schedules the file to be added. For deleting a file it is the same procedure, simply swap out 'add' for 'delete'. However always take caution before removing any file, luckily with CVS an older copy will always remain on the server though.

You can also use wildcards * to match specific file extensions/types in your directory

```
> cvs add *.shtml
```

4. When you are finished editing a file (or groups of files), you will need to commit these changes to the tiescvs module (wildcards may also be used here):

```
> cvs commit -m "Your log message" filename
```

This will actually add your files, merge changes, and commit anything new to the existing files in the repository. The -m and following message are for future reference in documenting what a specific commit was for, so it is important to write a short note about each set of changes when committing files.

5. The following command will update what you have locally with what is currently in the repository. It is important to perform an update often especially after you commit changes, or whenever you know another team member has been working on the project:

```
> cvs update
```

Other Useful Commands:

To view all current contents in the module:

```
> cvs list tiescvs
```

To list all possible commands for CVS:

```
> cvs help
```

If you need to get a previously saved/committed version of a file:

```
> cvs update -p file > file
```

Configuring CVS with Eclipse

First: Create a project

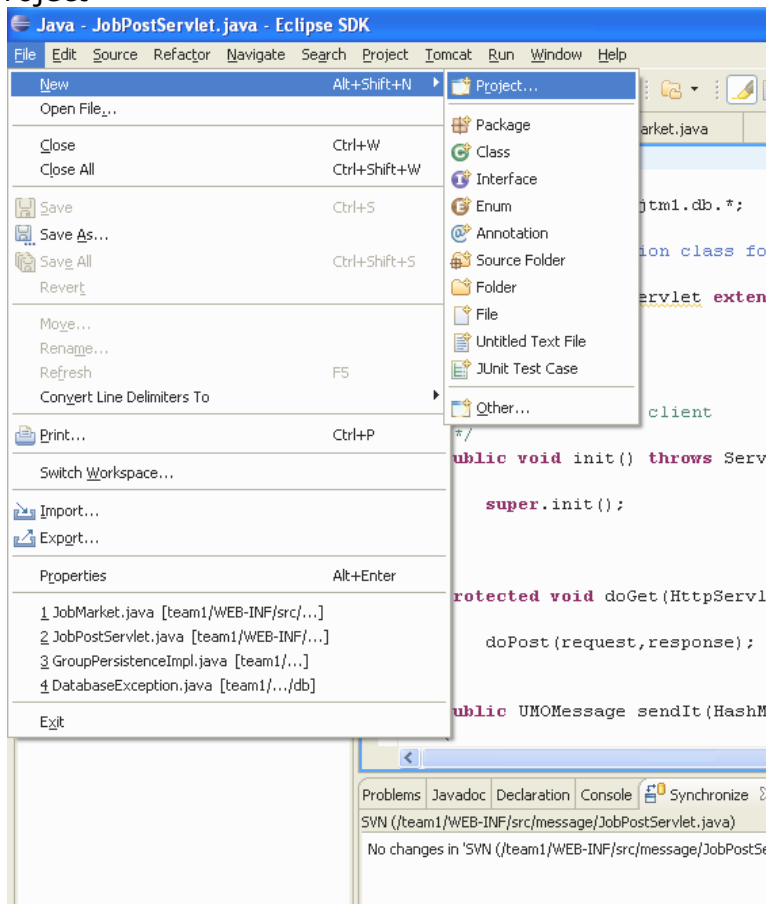


Figure 1. Within Eclipse select: File --> New --> Project...

Then select: Project from CVS

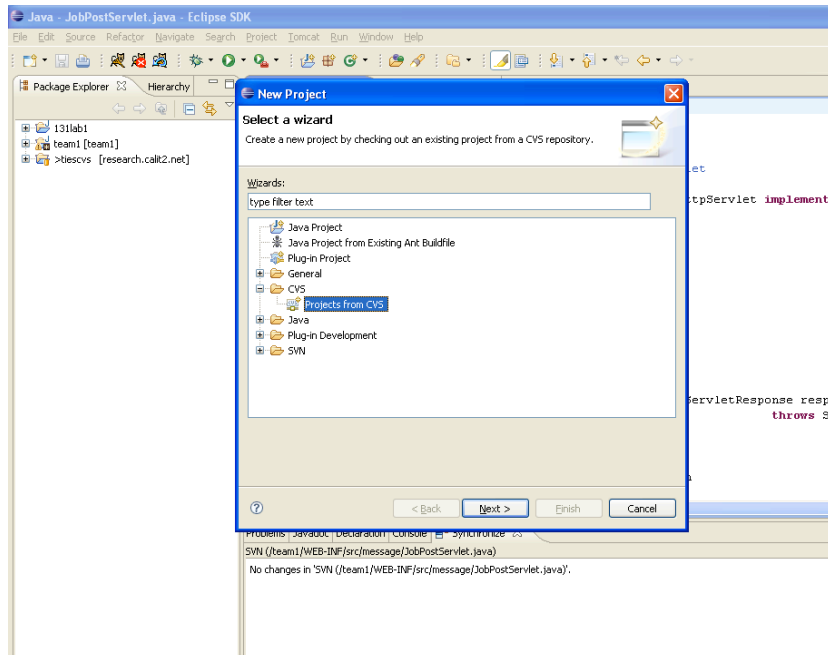


Figure 2. Within the "New Project" dialog select the CVS directory and the "Projects from CVS" submenu.

Click "Next", select the radio button for "Create a new repository location":

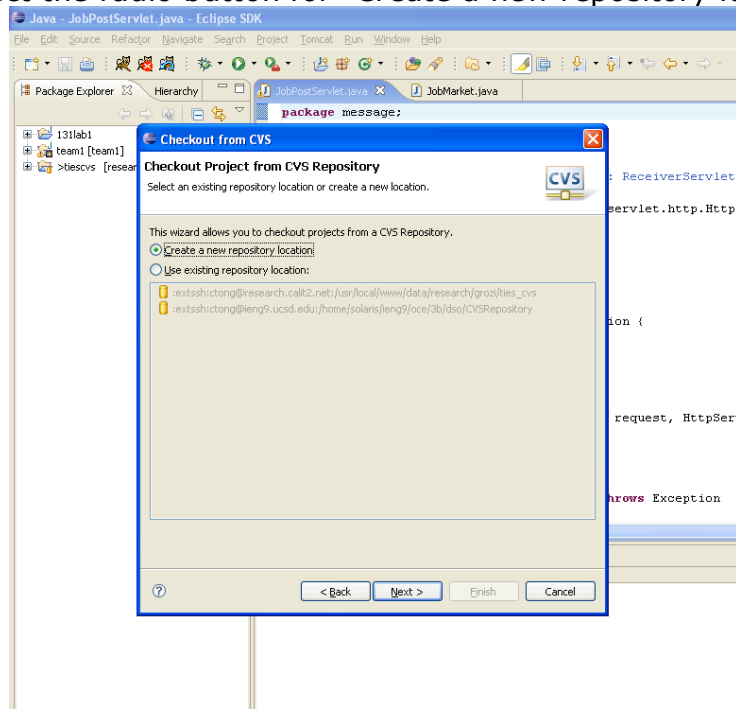


Figure 3. "Checkout from CVS" window with radio button options: "Create a new repository location" and "Use existing repository location".

Click "Next". Type the following information:

Host: research.calit2.net

Repository path: /usr/local/www/data/research/grozi/ties_cvs

User: enter your own user name
Password: enter your own password
Connection type: extssh
Save your password and continue.

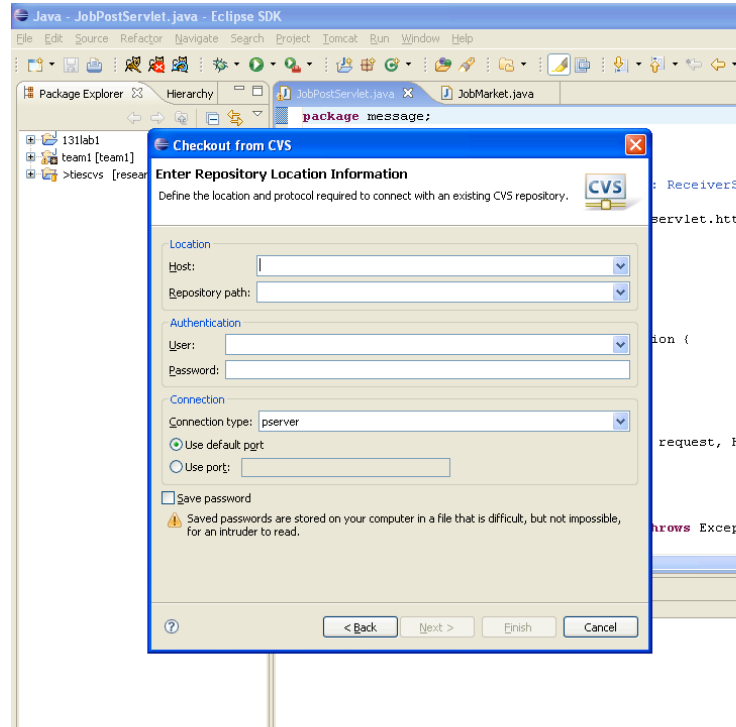


Figure 4. *Checkout from CVS dialog box for Entering Repository Location Information.*

After successfully configuring CVS, you're ready to check out the entire program, this is "tiescvs". Click "finish" and make sure to **NOT** click "Next". Eclipse will do all the work for you from here. I have my other project in here but you should have tiescvs in your package explorer:

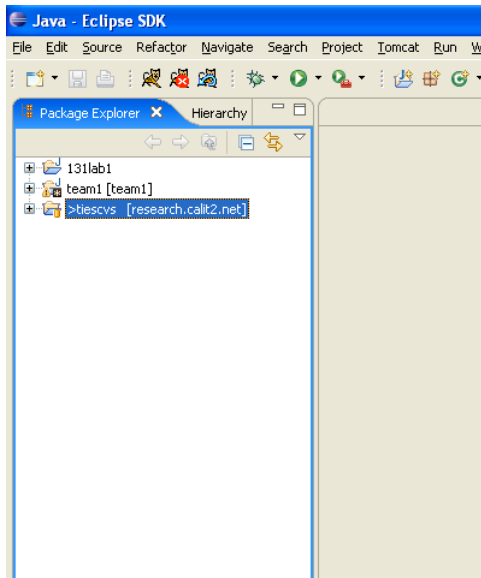


Figure 5. Package Explorer view when "tiescvs" project has been checked in and imported.

To upload/download files:

Here, commit will upload all your changes to our server and update will download the newest committed "uploaded" version to your local machine. Make sure to Refresh/Update the project before starting a new work session.

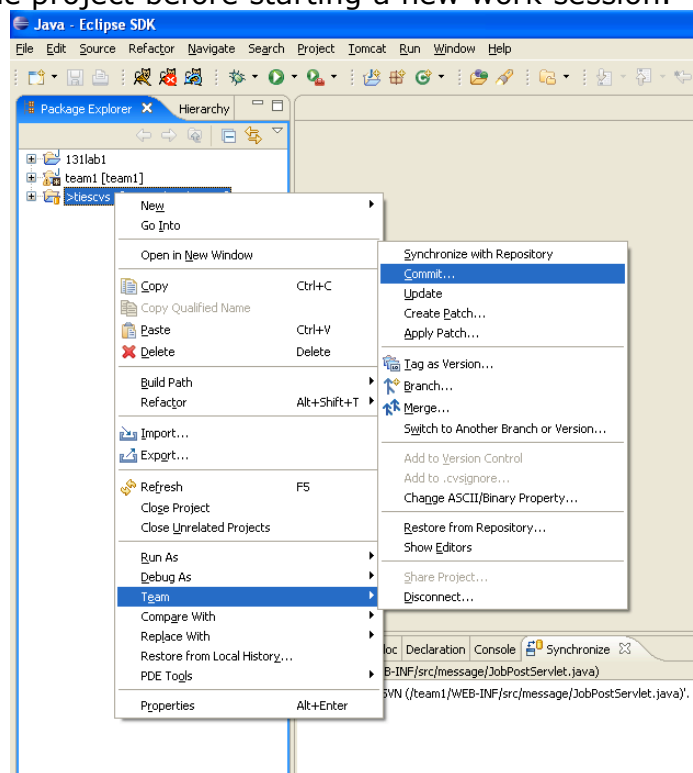


Figure 6. How to commit changes to a project: Right-click on the project (tiescvs) in the Package Explorer Window, Navigate to "Team >" and select "Commit..." to upload your changes to the server.

Project Planning - Future Directions

In the upcoming quarter we hope to continue building upon the prototype we have established and work toward returning to the challenges we identified in our first quarter:

- While we began research into the idea, we hope to begin implementation/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.

- Continue development on adding a display for product images on the Item Records page - possibly collaborating with Steve Davis.

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

- Further extending 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

Spring 2007 TIES Team:

Elisabeth Kain - Team Leader
Email: ekain@ucsd.edu
Phone: (858) 243-8501

Andy Kwong - Project Management System Administrator
Email: hina14338@hotmail.com
Phone: (510) 415-1384

Alex Pastel - Client Liaison/Student Advisory Group Representative
Email: axle123@sbcglobal.net
Phone: (949) 292-9654

Carlos Tong - Treasurer
Email: ctong@ucsd.edu
Phone: (408) 806-0309

TIES Student Advisor:

Michael Chin
Email: mikechins@yahoo.com
Phone: (858) 405-8464

Faculty Advisor:

Serge Belongie
Email: sjb@cs.ucsd.edu

NFB Representative

John Miller
Email: j8miller@soe.ucsd.edu
Phone: (858) 967-2666

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>

ESSENTIAL GROZI TIES LINKS

17. Prototype location (temporary until July 1, 2007): <http://www.r-infinite.com/grozi/>
18. Permanent location: <http://grozi.calit2.net/webinterface/>
19. Project Management: <https://tiesgroziwebteam.projectpath.com/>
20. NFB blindtlk mailing list: <http://www.nfbnet.org/mailman/listinfo/blindtlk>