Project Identification Document January 29, 2009

CartRegister™

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Description:

Overview:
CartRegister™ is comprised of a web-based software application combined with a hardware system to automate grocery shopping, from providing on-line recipes and associated shopping lists to displaying in-store item and pricing totals, leading to automated check-out. The system also facilitates home and store inventory control. The motivation for this project was to design a system that can be useful in a real world application, to save time and money, provide profit, reduced labor costs, and repeat customer loyalty for the installer (the grocery store), and provide convenience for the end user (the grocery customer). It was also selected because our team consists of both hardware and software engineers, and this project involves a good mix of both areas of design. The main features and functions of CartRegister™ are described in the following sections.

Recipe Database:
The web application will provide a database of recipes which will include a search engine based on the name of the dish or the ingredients. This will allow the user to select recipes either based on desired types of meals, or based on ingredients that are desired to be used, possibly because of what is on hand. Each recipe will contain a list of ingredients, their quantities, prices, and total nutritional information per serving. The web application will add the items from the selected recipes to the user's shopping list.

Inventory Database:
The web application will provide a database of the store inventory, which will allow the shopping lists to be created for the user based on what the store has available. The user can also check prices as the recipes and shopping lists are provided.

Home Inventory:
The application will provide a home grocery inventory based on the initial input from the user, plus items purchased, minus items consumed. The user will input items consumed during the week via keyboard entry at the home PC.

Shopping List:
The application will produce a weekly shopping list for the user (or at whatever time or interval the user desires), based on items from recipes that the user selects during the week, plus items the user specifies as weekly grocery items, plus any additional items the user adds manually during the week, minus items already in Home Inventory.

Smart Cart Control Box:

Upon entering the store, the customer will be provided with a Smart Cart control box that is easily affixed to a shopping cart. The user or store clerk will enter the user's code on a keypad, and the shopping list will be downloaded from the store's host computer to the Smart Cart.

The Smart Cart will display the first item and what aisle it is in, and guide the user through the store in this way. The user will use a bar code reader attached to the Smart Cart to scan each item as it is put into the cart. The display will provide verification of the item and the price. A possible added feature may be to provide a running total price of the items in the cart. The Smart Cart will have an input to allow the user to delete the last item scanned. (Optional: The Smart Cart uploads each item as it is scanned to the store computer to provide instant inventory updates.)

The Smart Cart may be used to facilitate speedy or automated check-out. At check-out, the Smart Cart will be removed from the cart and placed on a charging station to recharge the internal battery pack.

Possible Security Feature:

(This may be beyond the scope and resources of this project, but is mentioned because it would likely be part of an actual store system.)

To provide the store and the user with verification that each item has been scanned prior to checkout, the items' weights will be compared with the weight information derived from the items' bar codes. This may be accomplished in one of two ways. 1) Each cart will have a scale under the payload area. As each item is scanned and placed in the cart, the Smart Cart will compare the actual total weight to the total weight indicated by the bar codes. If an item is placed in the cart without the correct corresponding bar code scanned, the Smart Cart will indicate the error to the user and prompt the user to scan the item. 2) A built-in floor scale at the check out area will weigh the cart, subtract the standard cart weight, and compare the net weight to the total weight of the items indicated by the bar codes. If the net weight does not match the bar code total weight, the Smart Cart or check-out device will indicate the error to the user and direct the user to a manned check-out line.

Hardware Specifications:

Smart Cart Control Box:
Dimensions: 10” x 6” x 2” max.
Mounting: Must quickly mount on a standard shopping cart, no tools required.
Power: 5W max.
Power Source: Internal Battery, rechargeable
Bar Code Reader Port: USB or RS-232
User Input: Keypad

Display:
Type: LCD
Characters: 16x2 min.
Input Voltage: 3.0 VDC min., 5.0 VDC max.
Input Power: 200mW max.

Wireless Transceiver:
Frequency: 315 MHz min.
Input Voltage: 3.0 VDC min., 5.0 VDC max.
Input Power: 200mW max.
Operating Range: 100 meters min.

Charging Station:
Dimensions: TBD based on size of Smart Cart
Input Voltage: 120 VAC
Output Voltage: 3.0 to 5.0 VDC (TBD)

Bar Code Reader:
Symbology: UPC / EAN
Scan Rate: 50 scans/sec. min.
Interface: Decoded data via powered USB or via RS-232 port
Ambient Light: Immune to all direct or indirect store lighting.
Range: 1” to 10” min.
Power: 1W max.
Power Source: Smart Cart interface

Environmental Specifications for all subsystems:
Operating Temperature: 60° to 90° F
Storage Temperature: 32° to 120° F
Humidity: 5% to 95% non-condensing

Software Specifications:

Must Have:
Online web interface that is accessible from any computer that has access to the Internet.
Membership based system using a username and password for authentication.
Ability to browse through a large inventory of products and easily add and remove them to and from an online shopping list.
Ability to specify quantity when adding a product to the list.
Ability to search a database of recipes and easily add all needed ingredients to the shopping list.
Ability to give a rough estimate of total cost of all items on the list.

Love to Have:
Ability to mark products that the user currently has at home.
Ability to match recipes based on items the user currently has.
Ability to have accurate nutritional facts about the items in the users list.
Ability for user to add their own recipes.
Ability for major corporations to add their own recipes to promote their products.
Ability for the user to add comments and ratings to recipes.

Like to Have:
Ability to filter and suggest recipes based on users diet and past eating habits.
Ability for suppliers to advertise available coupons to users and have those applied to the users lists if the appropriate items are added.
Ability to predict which items need to be restocked based on user activity over time.
Ability for the system to suggest recipes to the user based on recipes that they have rated.

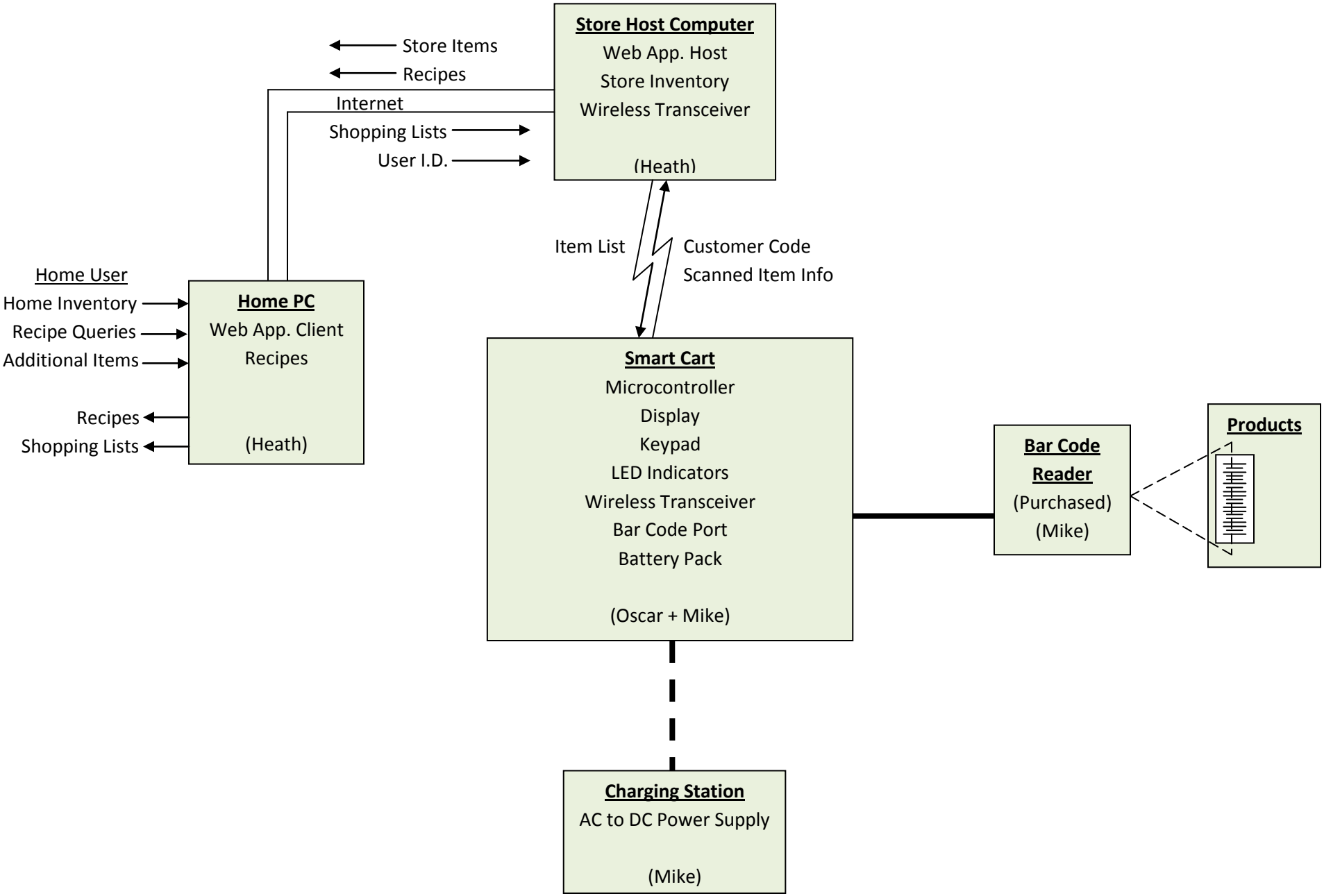
Technology Used:
The web application will be developed on a Windows based system running Vista Operating System. The primary software used for development will be Microsoft Visual Studio 2008 and Microsoft SQL Server 2008. Microsoft Visual SourceSafe will also be used for version control and archiving. The web application itself will be an ASP.NET 3.5 application written in C# with a SQL server database backend. Any client side development will utilize ASP.NET AJAX, JavaScript, and the JQuery library. All user interface formatting will be accomplished with the use of CSS.

We currently have two options for webhosting. If sponsorship is provided by IDS (see section on sponsorship) the team will utilize IDS's dedicated servers that are maintained by HostMySite. Otherwise the team will purchase a hosting plan by a major web hosting company (i.e. GoDaddy, HostMySite, etc.).

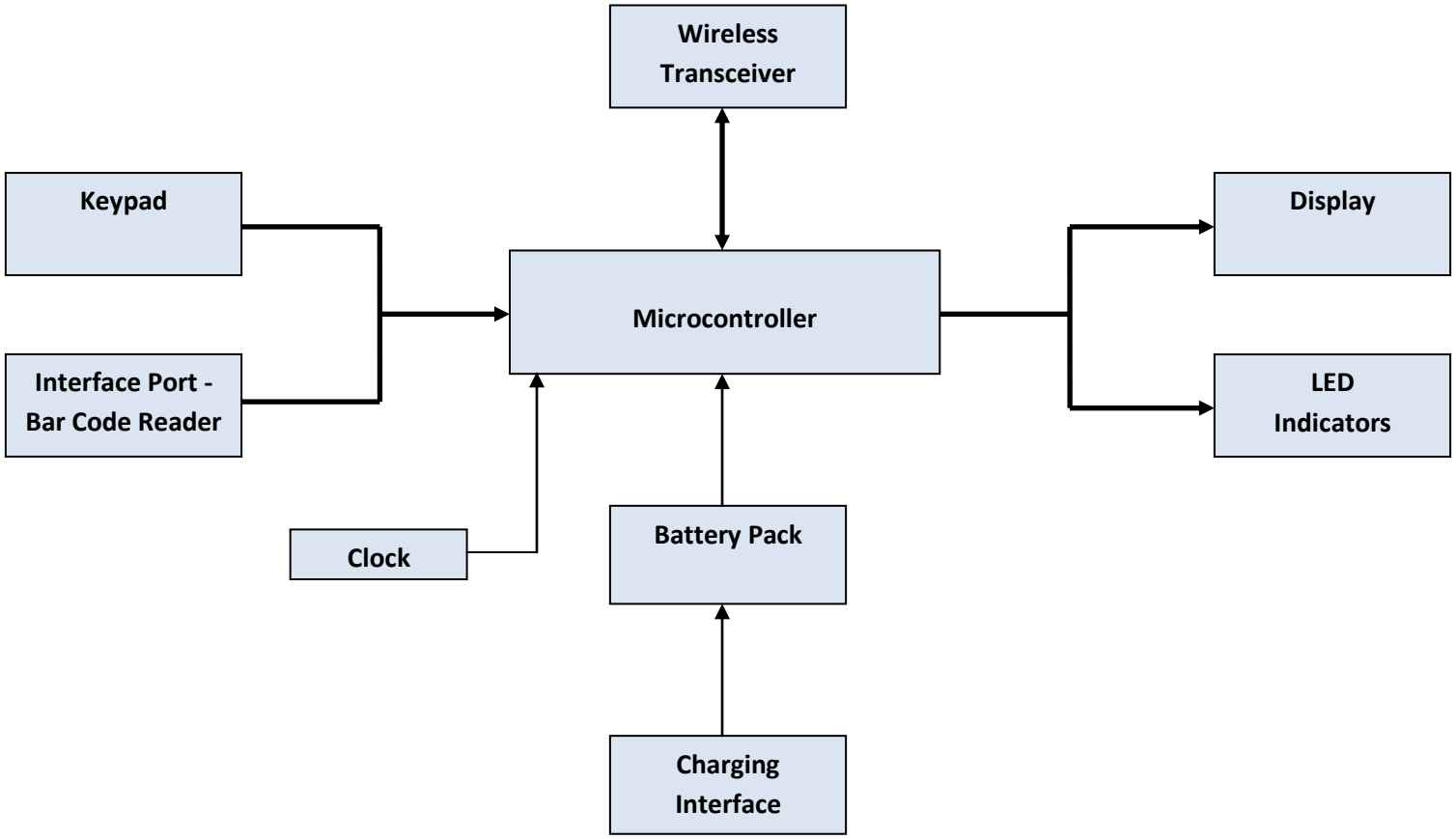
Currently the domain name for the website is cartRegister.com. This is subject to change. Based on current prices this will cost the team approximately $9.99/year.

End User Requirements:
The end user will be required to have a computer that has access to the internet. In addition to internet access the user must have a supported web browser (i.e. Internet Explorer, Firefox, Chrome, etc.)

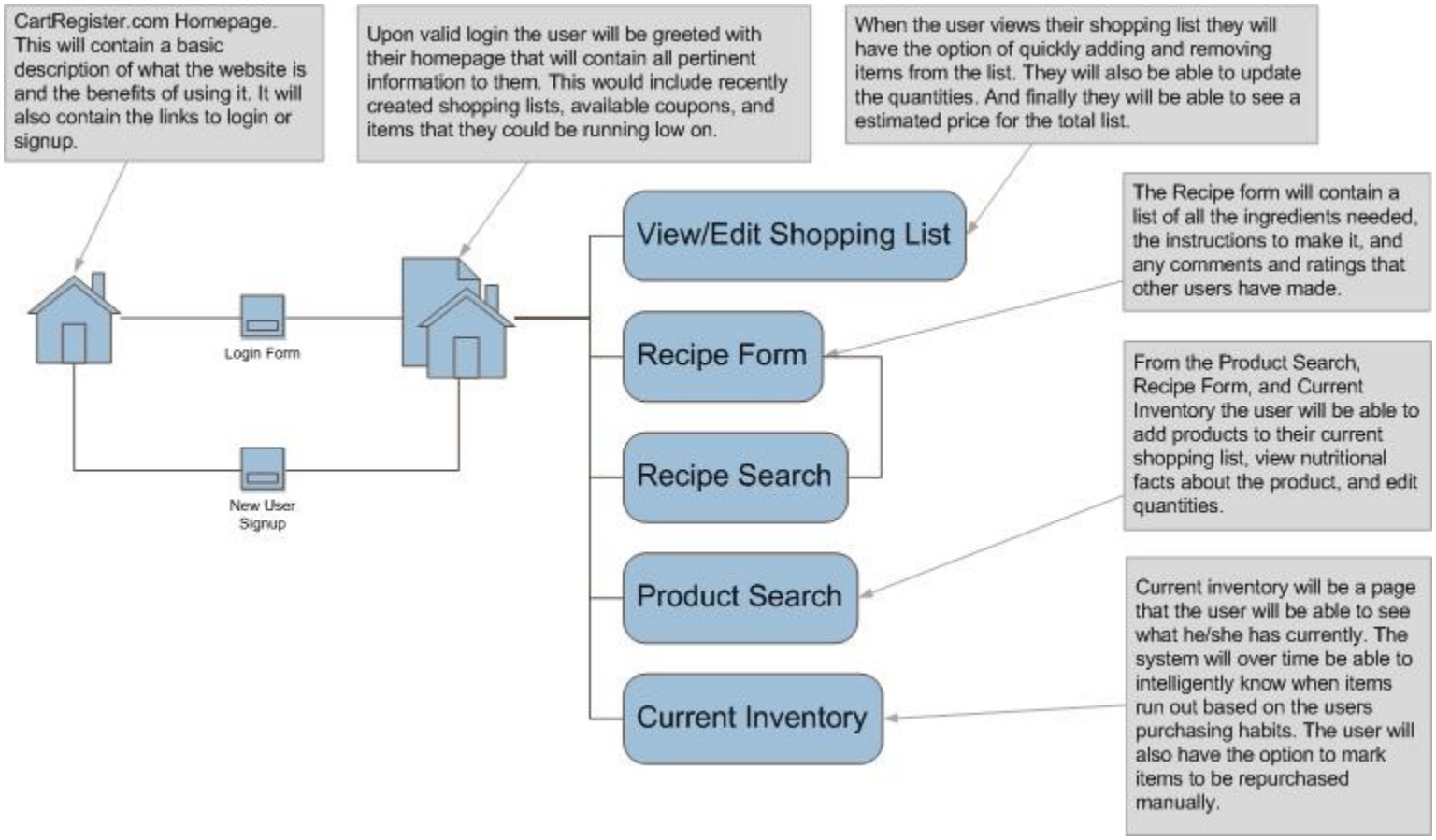
Overall Block Diagram


Store Host Computer
Web App. Host
Store Inventory
Wireless Transceiver
(Heath)
Store Items
Recipes
Internet
Shopping Lists
User I.D.
Item List
Customer Code
Scanned Item Info
Home User
Home Inventory
Recipe Queries
Additional Items
Home PC
Web App. Client
Recipes
Recipes
Shopping Lists
(Heath)
Smart Cart
Microcontroller
Display
Keypad
LED Indicators
Wireless Transceiver
Bar Code Port
Battery Pack
(Oscar + Mike)
Bar Code Reader
(Purchased)
(Mike)
Products
Charging Station
AC to DC Power Supply
(Mike)

Smart Cart Components



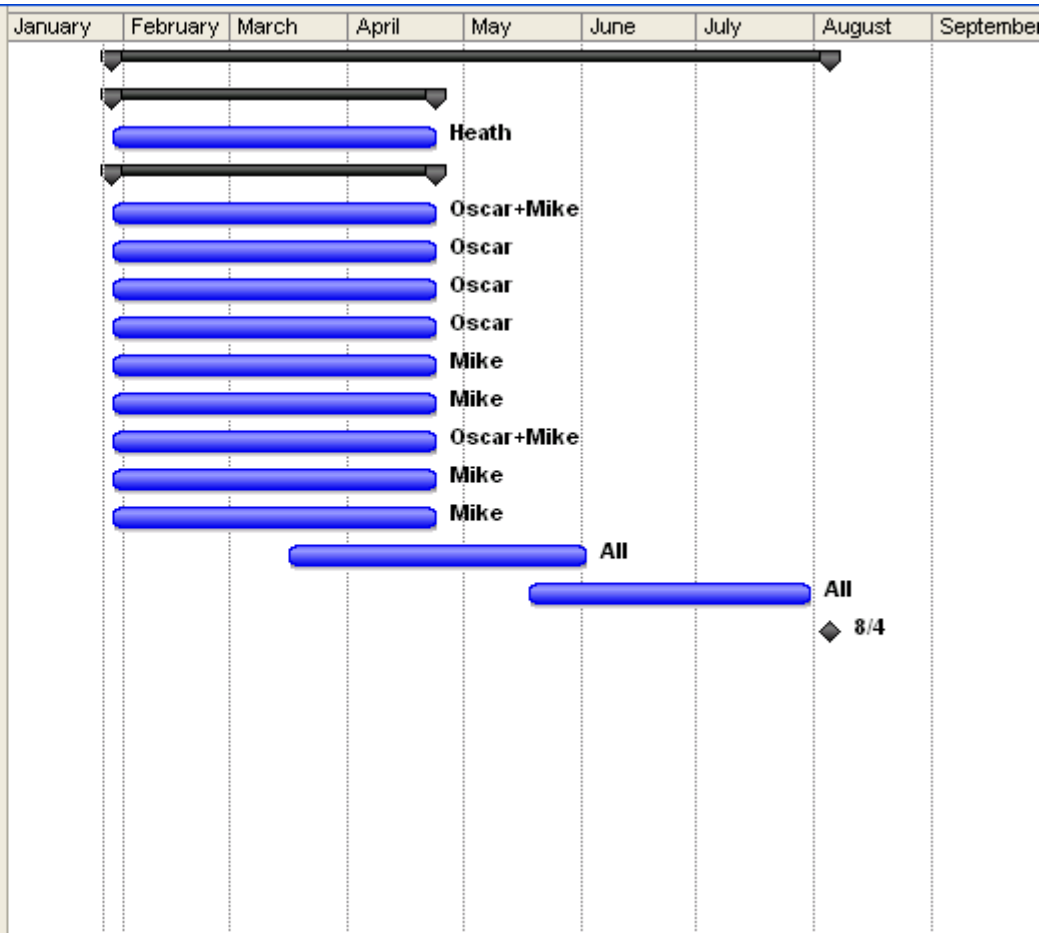
Web Application



Project Budget

Development		Parts		Bill of Materials	
Microcontroller Development Kit	$200	Printed Circuit Bd.	$300	Printed Circuit Bd.	$10
Domain Name	$10	Bar Code Reader	$125	Bar Code Reader	$100
Web Hosting	$40	LCD Display	$20	LCD Display	$20
		Power Supply	$30	Power Supply	$30
		Battery Pack	$30	Battery Pack	$30
		Wireless Transceiver	$12	Wireless Transceiver	$12
		Microcontroller	$10	Microcontroller	$10
		Enclosures	$20	Enclosures	$20
		Miscellaneous	$50	Miscellaneous	$50
Total	**$250**		**$597**		**$282**

Financing: At this point, the project financing will be shared between the three group members. There is a possibility of sponsorship by IDS, but that has yet to be determined.

Project Schedule

	Task Name	Duration	Start	Finish
1	**CartRegister**	**134 days**	**Thu 1/29/09**	**Tue 8/4/09**
2	**Design**	**61 days**	**Thu 1/29/09**	**Thu 4/23/09**
3	**Web Application**	**61 days**	**Thu 1/29/09**	**Thu 4/23/09**
4	**Smart Cart**	**61 days**	**Thu 1/29/09**	**Thu 4/23/09**
5	Microcontroller	61 days	Thu 1/29/09	Thu 4/23/09
6	Display	61 days	Thu 1/29/09	Thu 4/23/09
7	Keypad	61 days	Thu 1/29/09	Thu 4/23/09
8	Wireless Interface	61 days	Thu 1/29/09	Thu 4/23/09
9	Bar Code Interface	61 days	Thu 1/29/09	Thu 4/23/09
10	Battery Pack	61 days	Thu 1/29/09	Thu 4/23/09
11	Packaging	61 days	Thu 1/29/09	Thu 4/23/09
12	**Charging Station**	**61 days**	**Thu 1/29/09**	**Thu 4/23/09**
13	**Bar Code Reader**	**61 days**	**Thu 1/29/09**	**Thu 4/23/09**
14	**Order Parts**	**56 days**	**Mon 3/16/09**	**Mon 6/1/09**
15	**Build and Test**	**54 days**	**Mon 5/18/09**	**Thu 7/30/09**
16	**Demonstration**	**1 day**	**Tue 8/4/09**	**Tue 8/4/09**