

# **Smart Shopping Cart**

Group 5

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I pledge my honor that I have abided by the Stevens Honor  
System

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## **I. Abstract**

In today's technology, many companies are developing products that ensure convenience toward all people. One of the conveniences that involved will be providing with new and easy shopping experience. With a problem of waiting in a long queue to check-out the shopping items, new technology must be implemented to provide lowest delay time. Thus, the project team is developing a Smart Shopping Cart, a system that allows faster check-out. A device that consists of an LCD screen, a barcode reader, microprocessor, a wireless card, Bluetooth, and a portable battery will be implemented on the shopping cart. The user would scan the Universal Product Code (UPC) that contains on the shopping item using the barcode reader. The barcode information will be stored into a computer's memory, and checked against a database from which it would retrieve the appropriate information. A software package will link up the device with the database and Bluetooth device. It will also enable the microprocessor to calculate the total price for all scanned items, and display it on the LCD screen. If the customer is ready to make a payment, he would pass the cart through the cashier. The total price will be sent to the cashier using Bluetooth, and the receipt will be automatically printed. All the customer has to do is to pay for the total price without unloading the items from the cart. The team expects that the smart shopping cart will be a more reliable form of check-out process that will decrease the amount of time a customer has to wait while shopping.

## **II. Project Proposal Plan**

### **II-1: Introduction**

If you haven't already heard of the smart shopping cart, you are missing out. Advertized on the Today Show in July 2004, this technology is sweeping the nation. Big name companies such as IBM, NCR, Fujitsu, and Hewlett-Packard are the most mentioned competitors. There are also other technologies also meant for grocery store use such as the "Veggie Vision" and the "Everything Display" which are useful for different reasons. What is the smart shopping cart? The concept is a small computer with easy to use display (usually a touch screen) where a customer can scan their items using the existing barcode system while they shop. The item would then be added to your list with an ongoing tally of how much you are spending as you go through the store. Most products have the option of seeing addition information about the item scanned such as: nutritional information, environment impact, how many calories bought, whether the item is on sale, possible recipe ideas, and other items like wines which would go nicely with it. They all run on wireless technology constantly updating information should the store need to make a change.

The newest product from IBM is a wireless web page application where the customer can create a shopping list from home on the internet and then at the store scan their frequent shoppers' card in the smart shopping cart to see their list. Then the list interacts with the store telling the customer where they can find the items they are looking for as well as the best prices. On top of that, the customer can order from the deli using their shopping cart and just pick up their order when it's done. In one Stop & Shop in Massachusetts, they use projection technologies to project a screen either on the floor or over some products. When the customer walks over a part of the image it interacts with them. One example is a floor projection where there are three blocks of colors with the options reading, Low Calorie, Low Carb, and Low Fat. All the customer has to do is step over the option they want and it will point an arrow to where the products in that area are located. One major technology not yet used in stores is the RFID cards.

However, use of this technology is very costly and complicated to program if the store has a lot of items, as grocery stores do.

The group intends on making their own Smart Shopping Cart device which performs the basic functions of scanning items using barcodes into a database where they can then create a tally of the items bought and send it wirelessly to the checkout counter. When the customer is finished shopping they can pay very quickly at the checkout because their items are already recorded. At the moment the group has not come up with anything new to improve on the existing technology.

## **II-2: Design Requirements**

In order to start with any project, one must come up with a set of design requirements that are necessary to complete the project. In smart shopping cart this involves how the smart device will interact with the customer, the network and the software of the system. Our group spent a lot of time brain storming on this topic and broke down the design requirements into four categories as listed below:

### **Hardware requirements:**

For hardware, the group must come up with a microprocessor which can be used with a LCD, a wireless card, and a portable battery. The device should be detachable, so that it can be used from one shopping cart to another. This way it will be convenient for the shoppers to grab any shopping cart and just attach the smart computer on it. Also the battery of the unit must last at least 5 hours after each charge, so that the customer has enough time to shop around the store without worrying about the battery to go down.

This smart shopping device should also contain external speakers which will guide the customer with voice prompt to select their option on the LCD screen. These speakers should make a beeping sound whenever an item is scanned with the barcode reader. In addition to the speakers, the smart computer should also include two bright LEDs, which either turns red or green according to the software requirements.

The other important hardware equipment that will be required for this project is the Bluetooth device. This Bluetooth chip will be incorporated inside the microprocessor, and it will serve as a two way communication between the payment terminal and the smart shopping cart.

In last, this shopping cart should include some sort of device which can keep track of the total weight of the cart. This procedure is important for the project due to a lack of check on honesty. It will protect the store from shop lifters who may try to add the items in shopping cart without scanning it with the barcode reader.

#### Network requirements:

Network components will play a big role in this project. The wireless network needs to be designed in such a way so that every part of the store gets the wireless signals. Also the wireless network infrastructure should be able to support multiple wireless clients at any given time, therefore a high bandwidth network system will be required inside the store.

In addition, every smart computer must include a wireless card which will connect to the access point and then will communicate with the databases on the network. Once an item is scanned, the computer should be able to match the barcode from a network database and then charge the price accordingly. Once the checkout is complete, the smart cart should be able to send the data back to the database to confirm the checkout. This process is very important, because it will keep track and update the inventory database.

#### Database requirements:

A database such as MySQL or MS Access can be used for this project to store and execute database entries. The database should include the entire inventory in the store with all the necessary information such as price, quantity, description and the barcode of the items. The database should be designed in such a way so that multiple shopping carts across the store can add and subtract the information at the same time.

### Software requirements:

Software requirements of this project will be the most challenging and the most important out of all since everything on this minicomputer will run according to the software. The software should be built in such a way so that it can enable all the hardware's to talk to each other. For example when the barcode reader scans something, the software should take that particular item number and feed it into the network. Once attached to the network, it should be able to link up with the database to match the exact barcode and return its price on the LCD screen. While searching into the network and finding the items, the software should also keep track of all the items scanned and display the total on the LCD screen.

The software should also be able to detect fraud based on analyzing the weight check and the scanning of the items. If an item is not scanned and added into the shopping cart, the software should send an output to speakers and the LEDs to alert the customer to scan the item again. All these procedures need to take place in matter of seconds, so therefore good programming will be a key part of this project.

### **II-3: Design Approaches**

The design of smart shopping cart consisted of four main elements which are hardware integration, software interface, wireless communication and network database. The goal for each element is to get the most accurate and best performance to be implemented in the project.

The display unit that will be mounted on the shopping cart will be in the range of 7-inches high, 4-inches wide and about quarter inches deep. The average weight will be about one half to two pound. The display will be made of hard Mylar plastic so that it will be more durable and hard indestructible although it is used repetitively.

All the components will be interface using the C or C++ programming language because it is easy to implement and very fast to execute. These are essential to make the interaction between the software and hardware to be smooth and fast and also to avoid traffic in data transfer. Choosing the right software to be used in the project might be the

most important part in the project. Several software dealing with barcode are available in the market. The team comes out with Barcode Active X/DLL barcode software which allowed the programmers to add barcode to the program and applications. This will make easier to present the data in organize way.

The network will used Wi-fi wireless networking system to transmit sale information to the database. WI-Fi is chosen because it is easy to set up and inexpensive Every time the customers scanned the product, the product information will be retrieve from the database and the price will be displayed on the LCD display mounted on the shopping card. The data from the shopping card will be transmitted to the check out counter by using Bluetooth technology or Infrared. The group still considered both application since it is most reliable technology. Using Bluetooth might be more efficient in data transmission and it also use low power consumption. The customers can easily transmit the data from the shopping cart to the check-out terminal when they are in the proximate range. However, infrared will need line of sight to transmit the data. Considering the budget, using infrared is more economical since it is cheaper than Bluetooth.

The database software that will be used in this project will be MySQL or MS Access. Both of the application has the capabilities to execute database entries. This is most important part of the project since we need a good and most reliable database to keep track and update the inventories every time the customers scanned the product. How exactly we will be able to customize the shopping cart and specific components will be research and defined later on.

#### **II-4: Financial Budget**

Planning out the financial budget for such an important project is a must. The group has a financial constraint which is why the equipment and other products should be chose and bought wisely. The group has decided to keep the project costs below the projected budget in case of an emergency later on as the project progresses.



The few main things that the group needs to take care of are the basic equipment. Since the team is developing a smart shopping cart, the things that are needed to be purchased include the bar-code reader, a connecting cable, a microprocessor chip, an LCD screen and a Bluetooth chip.

The group might be implementing a laser system, or a weight check to prevent dishonesty. This is a system that the group plans to put into action only at the final stage, if everything else is working fine.

Below is the list of the products that the group needs for this project:

1. Bar Code Reader: EZ One Shot® USB CCD Barcode Scanner By IDTech

-This is a fairly cheap barcode reader priced at \$59.

Reference: <http://www.idautomation.com/ccdreaders/idtech.html>

2. USB Cable: Belkin Pro Series USB 2.0 Device Cable (USB A/USB B, 10 Feet)

-Priced at \$8.55

Reference: <http://www.amazon.com/Belkin-Pro-Device-Cable-Feet/dp/B00004Z5M1>

3. LCD Screen: Road Theater RT-500 5-inch LCD Monitor with FM Modulator

-Priced at \$48.99

Reference: <http://www.overstock.com/Electronics/Road-Theater-RT-500-5-inch-LCD-Monitor-with-FM-Modulator/1507840/product.html>

4. Bluetooth Chip: [TRENDnet- TBW-104UB - High-Speed USB 2.0 Bluetooth Adapter](#)

-Priced at \$24.99

Reference:

[http://www.tigerdirect.com/applications/category/category\\_slc.asp?CatId=906&SRCCODE=WEBGOOWIRE&CMP=KNC-GOOGLE](http://www.tigerdirect.com/applications/category/category_slc.asp?CatId=906&SRCCODE=WEBGOOWIRE&CMP=KNC-GOOGLE)

The above price quotes are the estimations which total up to \$141.53. The actual cost of the project may vary as the team might alter some aspects of the project. The team predicts that the actual cost would not change by more than 20% of the current estimation.

### **II-5: Project Schedule**

The tables in Appendix B represent the preliminary assignment and responsibilities for the group and each individual member. Figure B-1 shows the Gantt Chart for the first semester in developing the project design plans, and preparing oral presentation. The group plans to work together on the nearly all aspects of the project. However, specific tasks will be led by individual specified in the chart. These schedules are subject to change as the project proceeds and develop.

### **III. Conclusions**

Technology is meant to make one's life easier. When a problem is found, engineers come together to solve them using technology. This problem solving will advance the technology for the human being, and thus provide them with convenience. The proposed project was designed to accomplish this providence. The smart shopping cart could eliminate the hindrance of unloading the items from the cart; therefore, the time spent at the cashier could be decreased. Shoppers could enjoy the time saved with doing other things rather than standing idly to wait for their turn to pay.

Since most of the technology involved in this project already existed, the simplicity of the project is thus appropriate for the senior design project. The smart shopping cart suits the need of the supermarkets that wanted to avoid large crowd during peak hour. By the time this project is moved into the design and manufacture process, each team member would have clear understanding on the technology used, and important concepts that involved.

This project has its strengths and weaknesses. Since there are a lot of researches going on about this product, the group will have no problem in finding references to guide for the project. However, since the researches are currently still in active, the group might be left behind from the advanced developed concepts.

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