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 for all people. One of the conveniences that involved is providing them with a new and easy shopping experience. Due to the existence of the problem of waiting in a long queue to checking-out the shopping items, new technologies must be implemented to provide the lowest delay time. Thus, the project team is developing a Smart Shopping Cart, a system that allows faster check-out. The customer would scan the Universal Product Code (UPC) that is on the shopping item using the barcode reader. The barcode information will be stored into the PDA’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. 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 go to the cashier. The total price will be sent to the cashier using an internet connection to a webpage where the cashier can charge the customer appropriately. 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.

The team’s prototype unit consists of a barcode scanner, a PDA to act as a user interface, and a laptop computer that stores the database, and acts as a checkout counter. In the system, WiFi and a cable connection will be used to connect the PDA and the database, while WiFi will be used to connect the PDA with the checkout counter.

I-1. Acknowledgement

The design group would like to thank Professor He for his continued support and guidance as our advisor throughout this project. His dedication to our success has made this project run smoothly and successfully.

The design group would also like to thank Stevens Institute of Technology for its financial support of our project. Without their help our group would not have been able to afford the components needed to make this project successful.

II. Project Progress

Design Approach

The team’s Senior Design Project has been coming along as expected and the design for the prototype is on schedule. It consists of a pretty simple design approach as the team is trying to build a database and an interface for the system. The interface will be programmed onto the PDA which will be connected to a database (laptop) either wirelessly or using a cable. At the moment, the team is leaning more towards connecting it using a cable to keep the project within budget. The team is creating the database using Microsoft Excel, which will be called upon by the interface on the PDA.
Critical Components

The main component acquired by the team, the Barcode Scanner, has turned out to be a very appropriate purchase. The scanner fits perfectly onto the PDA and is completely compatible with it. It has already been implemented onto the PDA and has also been tested. The Barcode Scanner scans the barcodes and inputs the numerical value into the field where the pointer is placed at that moment. It also presses enter automatically so that the user does not have to wait to get the information retrieved from the database.

Functionality and Performance

The project consists of the following steps. The barcode scanner scans the barcode of a product. The value is then inputted into the interface of the PDA which is connected to the database by a cable. The information is then displayed back on the interface (PDA). The total, including tax, is calculated every time an item is scanned or removed from the list. When the customer is finished shopping, they can select the icon “check-out” and the interface will send the total through Wifi to the website database. The cashier’s station will receive the file and be able to charge the customer without ever removing any products from the shopping cart.

The team is trying to program the interface using HTML so that it can be accessed on the PDA directly from the internet. The database can be loaded into the same program to make the process simpler and more error-free. The screen on the PDA will display the product ID (same as barcode number), the product name, the product price, the promotions for the product if any, and the running total including tax.

The entire system is a little different from the one that had been predicted in last semester’s final report. Earlier, the team was thinking of introducing Bluetooth features as well which would transfer the information from the PDA to the checkout counter so that the customer could pay directly. But in the current system, there is no such feature. The team will use HTML again to transfer the information from the PDA to the checkout counter (laptop for the demonstration). Also, earlier the team was planning to use C++ and SQL to program the interface and the database; however this plan has changed considerably as well. One last thing that has not been worked on is the anti-theft measure. This could still be implemented if time permits and if the team has the necessary funds.

The team expects the prototype to function efficiently and hopes to demonstrate the scanning of a few products and then checkout with those products in the smart shopping cart. The team will allow the fair spectators to scan the products and checkout themselves to see if they find it user-friendly and to gain any feedback which could be used for further improvements.

Test Procedures

As the team has been working on the prototype, testing has been emphasized at every stage to check its efficiency. First the database was built in excel and the barcode scanner was tested. Scanning a sample product, such as a Gatorade bottle, retrieved the respective information stored in the database. Next, the interface was tested constantly while it was being built and thus far it is working as predicted. When a couple of items are scanned and the total calculated, the correct value is given. Additional tests may still need to be performed such as discounts on items, other offers and same items being
scanned multiple times. After all these tests are complete, the team will be able to determine how effective the system’s performance is.

**Results**

There are four major tests involved in this project: the PDA, barcode scanner, software, and the database. The group used different methods to test these components. The PDA, the main part of this project, was tested by running many different applications on it such as Microsoft Excel. Wireless (Wi-Fi) of the PDA was tested by successfully connecting it to the Stevens wireless network. The second major hardware component of this project is the SD barcode scanner. It was tested by connected to the SD port of the PDA, and downloading the driver onto the PDA. The tests came out to be successful, once the scanner started to read the barcode items.

The software concept was initially designed in Microsoft Excel. After developing the interface in Microsoft Excel, the concept was used in the programming language. The group used the same idea and implemented it in a web format using HTML programming. The program that the group has as of right now, connects to the database and reads off the barcodes using the SD barcode reader.

**Design Risks**

There are not many risks on the hardware side because the two major components, the PDA and the barcode scanner, are working properly. The only minor problem with the SD barcode scanner is that it reads off barcode items very slowly. This problem will remain as a hurdle, but it will be acceptable for the senior design purposes. The other risk involve in this project is the small size of the PDA’s screen possibly making it hard for some users to read the information. The possible solution to this problem is to create a program which has a user friendly interface.

This project also involves some software risks. One of them is creating a friendly user interface, which relates back to the small size of the PDA screen. The ideal interface should include the functionalities which will allow the user to easily interact with the program. It is becoming challenging to create such interface due to the small screen size of the PDA. The possible solution to this hurdle would be to automate most of the tasks in the program. For example, as soon as the scanner reads the barcode, the program should automatically return to the next line to get ready for a new barcode scan.

**Technical Problems**

One of the major technical problem the group faced was to determine which barcode scanner should be used for this project. Since the group is using a PDA for this project, a PDA compatible scanner was very hard to find. A regular USB scanner could not be used, since it isn’t compatible with a PDA’s due to its large power consumption. The project has become a product which can be used portably, and at the same time consumes less power than other USB scanners. After looking at many different products online, the group came across the SD barcode scanner which matched the exact requirements for this project. The SD barcode reader is portable and uses less power, therefore the group decided to purchase it for this project.

There was another technical problem that came up while testing the barcode scanner. The problem was that whenever the barcode scanner read the barcode, it would
not return to the next row. For example, if it reads a barcode in one row, it will not return to next row to perform a new scan. This was a problem because in order for the program to connect to the database it must scan the code and hit the “enter” key automatically. One of the solution to this problem was that the user of the PDA hit the enter button manually, but this would have been a very frustrated process and not very user friendly. Therefore to avoid this problem, the group called up the SD barcode scanner company and figured out a way in which the scanner hit the “enter” key automatically once it reads off the barcode number.

**Cost Analysis**

The main expense for the hardware in the project was the barcode scanner. It costs $200. The group already personally owned the other hardware such as the computer and PDA.

There was no cost for the software tools since they were free to install from the server and readily available. The following cost analysis would only correspond to our project until this mid semester. There may be additional costs in the future to prepare the materials for the final presentation for Senior Design Day this April.

<table>
<thead>
<tr>
<th>Parts</th>
<th>Cost</th>
<th>Quantity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP iPAQ hx2495 Pocket PC</td>
<td>$0.00</td>
<td>1</td>
<td>$0.00</td>
</tr>
<tr>
<td>Socket Scan barcode scanner</td>
<td>$200.00</td>
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<td>$200.00</td>
</tr>
<tr>
<td>Dell Precision M60 notebook</td>
<td>$0.00</td>
<td>2</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

**Project Schedule**

As seen on the Gantt Chart below, the main tasks left for the group to complete are testing and debugging the server and software. After these main tasks are completed, the group will focus on improving the user interface and completing the final report and presentation.

<table>
<thead>
<tr>
<th>Task</th>
<th>Start</th>
<th>Finish</th>
<th>Work duration</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain Software Package</td>
<td>1/15/08</td>
<td>1/20/08</td>
<td>5 days</td>
<td>Group</td>
</tr>
<tr>
<td>Update Website</td>
<td>2/14/08</td>
<td>4/14/08</td>
<td>10 days</td>
<td>Raj, Nora</td>
</tr>
<tr>
<td>Prepare Database</td>
<td>1/20/08</td>
<td>2/25/08</td>
<td>20 days</td>
<td>Nora</td>
</tr>
<tr>
<td>Prepare User Interface</td>
<td>1/25/08</td>
<td>3/3/08</td>
<td>20 days</td>
<td>Raj, Ani</td>
</tr>
<tr>
<td>Develop Software</td>
<td>1/25/08</td>
<td>3/31/08</td>
<td>40 days</td>
<td>Group</td>
</tr>
<tr>
<td>Interim Report</td>
<td>2/25/08</td>
<td>3/06/08</td>
<td>10 days</td>
<td>Group</td>
</tr>
<tr>
<td>Testing and debugging prototype</td>
<td>1/25/08</td>
<td>4/2/08</td>
<td>30 days</td>
<td>Group</td>
</tr>
<tr>
<td>Final Report</td>
<td>4/14/08</td>
<td>4/25/08</td>
<td>10 days</td>
<td>Group</td>
</tr>
<tr>
<td>Design Day Presentation</td>
<td>4/2/08</td>
<td>4/20/08</td>
<td>10 days</td>
<td>Group</td>
</tr>
</tbody>
</table>
III. Conclusion

This project was designed to eliminate the problem of long lines at the checkout counter. This was achieved by attaching a barcode scanner and PDA to the shopping cart so that the customer can independently scan their items, calculate their running total, and cut the time at the checkout counter significantly.

Based on the progress of the project so far, the group is confident it will be able to meet its deadline of accomplishing a fully functional project. Some modification has been made from the initial idea, especially on the software part, however the group believes this will not affect the overall performance of the project. All the hardware in the project is working sufficiently and the user interface for the project is progressing as expected. A series of testing has been performed to make sure that all the important components work and communicate with each other. For the rest of the semester, the group will continue working on the user interface and improve the overall performance of the system.