

SmartCart: Initial Design Review

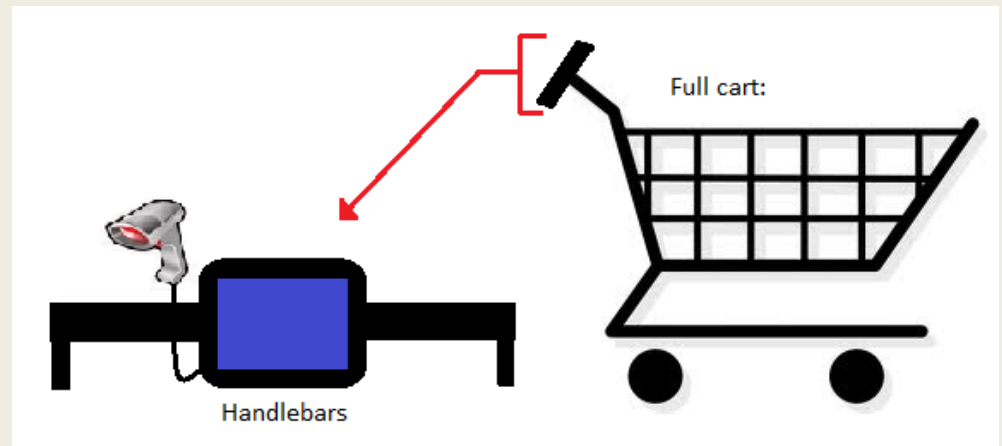
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Product Definition

Function

Smartcart is an interactive touchscreen display affixed to the handlebars of a shopping cart which will allow users to perform the following actions:

- Scan items to a checkout list
- Search for items
- Search for the aisle locations of items
- Obtain coupons for items



Application

Geared towards use by supermarkets, department stores, and other vendors that require the use of a shopping cart. Shoppers can perform all searches, decreasing need to ask help from an associate. An attached barcode scanner will be used to log items.

Product Definition (cont.)

Initial Specifications

- The RFID scanner should be able to detect the receivers on the entrances of the aisles as soon as the device enters an aisle in order to relay the position of the cart inside the store to the user (range and interference may pose problems to this).
- A good GUI must be created in order to implement features like a readable map/guide in order to guide users to products in the store. At the same time, there must be ways to navigate the onboard software to access searching functions and other onboard functions on the device.

Product Description

The user will be able to search for items on the display at the display's home screen from an item database. Transmitters placed along store aisles will send a signal to the display whenever it is within 5 feet of the transmitter. This will allow us to map the aisle/area the cart is in and let a user know on the display whether the product they seek is in that area by querying a central database for the location of an item. This database will allow for the use of targeted dynamic ads based on cart location and popular products. When the display has been idle for a fixed amount of minutes, ads or coupons can be displayed. These may focus on products that have been popular that week (can be determined by the number of searches done on a product, a value stored in the database) or in that aisle. A button on the ad will allow the user to return to the previous screen. Users can check whether there are coupons for a product when they search for that product as well. If the item is in the cart, coupons will automatically discount the price when an "Apply" button is pressed.

The cart will also have an affixed barcode scanner. A button on the display's home screen will allow a user to scan an item. The item will be added to a "checkout list", which can also be accessed through the home screen. Buttons will allow the user to clear the "checkout list", remove individual items, and check for coupons pertaining to the items in their cart. A code can be sent to the cart at checkout when the cashier asks to checkout a cart's item list. If the cashier inputs that code, the central server should give the cashier the carts' checkout list.

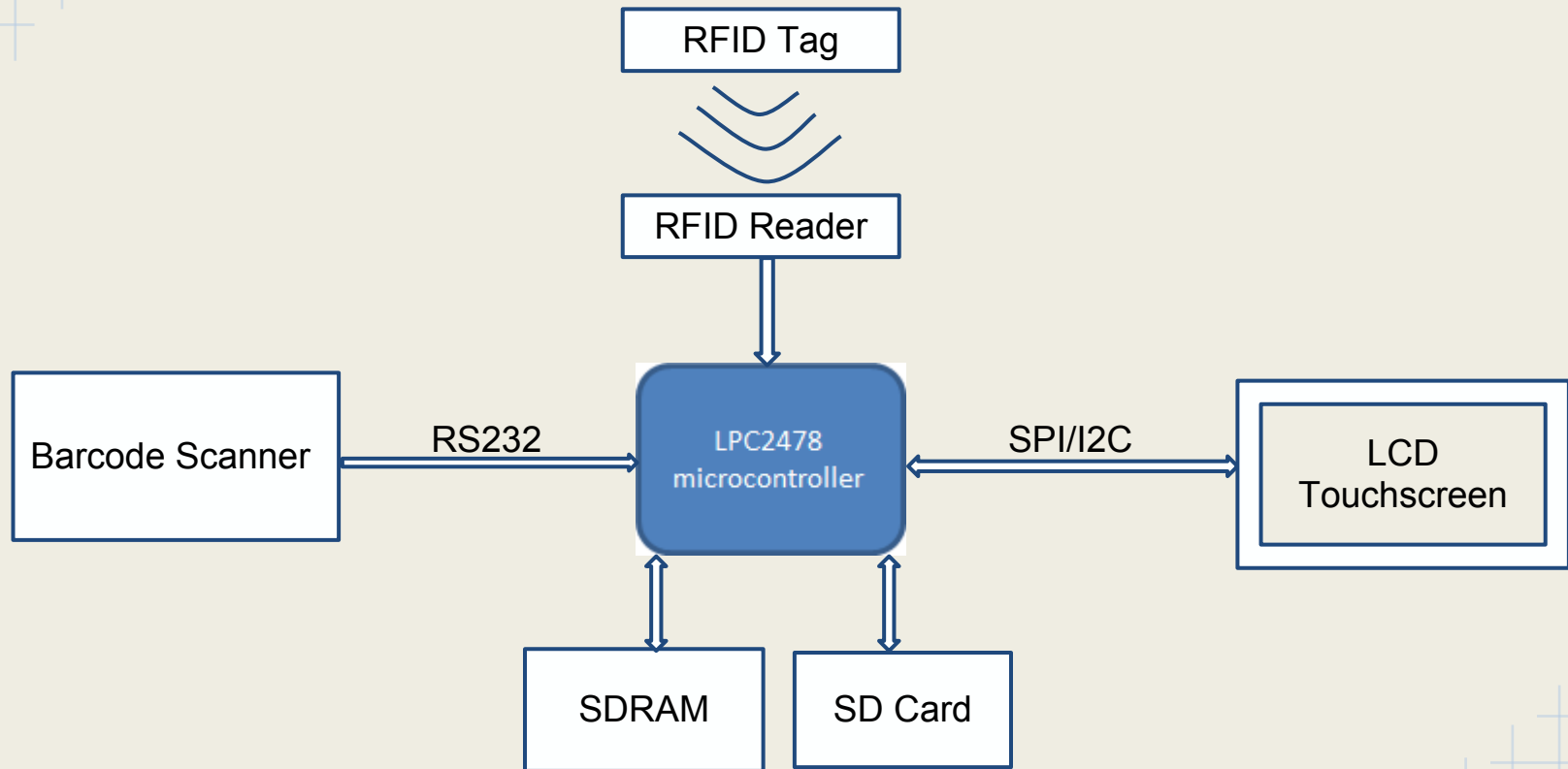
Product Development Effort

- Since development time is small and adding communication with a server into the mix would greatly complicate and hinder development time, we will use nonvolatile memory as storage for product information and maps for proof of concept tests.
- Embedded OEM image scanners (i.e. barcode scanner) are costly, so we will be using a handheld barcode scanner to accomplish logging a checkout list.

Team Composition and Responsibilities:

Pallavi Jain (Leader):	Power Management, Memory Interface
Vivian Vasquez:	RFID
Peter Nguyen:	Display Subsystem
Deniz Kaplan:	Barcode Scanner

High Level Block Diagram



Components

LCD Touchscreen

- Adafruit 2.8" (2.72" x 1.97" x 0.15") 18-bit color TFT LCD (\$40): resistive touch panel, integrated display controller (already one on 2478), SPI and RGB interface, 320x240 res, 3.3V
- (late entry suggested by prof.) NHD-3.5"-320240MF-ATXL#-CTP 24-bit color LCD TFT (\$44.50): capacitive touch panel (> resistive), no display controller, display driver, touch panel I2C, 320x240 res, 3.3V

Barcode Scanner

- EconoScan II Short Range CCD Barcode Scanner (\$42.10): PS/2, RS232 and USB interface, 3 oz., 6.10" x 3.07" x 0.63", 200 scans/sec

RFID Reader/Tags

- SM130 Milfare Reader/Programmer Module (\$29) with ISO14443A compatibility- UART and I2C interface, Milfare Classic 1k RFID tag (\$3.95), PCB Antenna (\$3)

SDRAM

- Micron MT48LC128M4A2P-75 512Mb (~\$20): 3.3V, 54-pin TSOP, synchronous on positive clk edge, > 100microsec use delay

SD Card Connector/SD Card

- Kyocera Series 5638 (~\$5): Standard, surface and top mounted, any standard SD card can be used (~\$10)

Project Schedule

Milestone	Date	Task	Start Date	End Date	Person Responsible
System Level Design	10/31	Component Selection	10/22	10/31	Everyone
		Bill of Materials	10/23	10/31	Everyone
		Display Subsystem	10/26	10/31	Peter
		Barcode Subsystem	10/26	10/31	Deniz
		RFID Subsystem	10/26	10/31	Vivian
		Power Management	10/26	10/31	Pallavi
		Software Overview	10/28	10/31	Everyone
Preliminary Design Review	11/5	Detailed Design	11/1	11/5	Everyone
		Verilog Sources	11/3	11/5	Peter, Deniz
		Software Structure	11/4	11/5	Vivian, Pallavi
Critical Design Review	12/7	Design Implementation	11/7	12/7	Everyone
		PCB	11/7	12/7	Peter
		Final Schematic	11/8	12/7	Everyone
		Final Bill of Materials	11/8	12/7	Everyone

Possible Features

Digital Scale

- SmartCart may also feature a digital scale with which customers can weigh items which are not sold in fixed quantities, such as produce. This would be located under the cart's basket compartment or beneath the leg hole closure for customers to pull out.

The digital scale will only be implemented if an affordable model (current best scale costs \$400) or a suitable load cell can be found.



Technology/ IP Reuse

- NXP LPC2478 processor
- Econoscan II barcode scanner
- Adafruit/NHD LCD touch panel
- RFID Milfare Module
- SDRAM
- SD Card

Critical Elements

Display Subsystem

Without properly interfacing the microprocessor and touch display, the project becomes useless. This includes creating a good GUI that allows navigation and use of all the functions the software implements and fitting it on a smaller than normal touchscreen.

RFID Transmitters and Receivers

Essential function of mapping cart to area/aisles becomes impossible
RFID reader is not suitable for proof of concept (LF: 1ft, HF: 3ft, UHF: 9.5 ft)