Homework 2: Design Project Proposal
Due: Friday, January 27, at NOON

Team Code Name: RFID Xpr3ss   Group No.   10

Team Members (#1 is Team Leader):

#1:   Jennifer Tietz   Areas of Expertise: Schematics & Software

#2:   Joshua D. Chapman   Areas of Expertise: Packaging & Software

#3:   Jonathan Chen   Areas of Expertise: Software & Interfacing

#4:   Jared Suttles   Areas of Expertise: PCB Layout & Software

Project Abstract:

To design an RFID checkout station for a supermarket in order to enhance the customers' purchasing experience and expedite the checkout process. Multiple checkout stations would be placed near the exit to the supermarket and all purchasable items would be affixed with a passive RFID tag. Finished customers would wave their RFID key Fob at the station to identify themselves, and then pass all items from their cart near the RFID reader and into bags. Purchased items and running totals will be displayed to the customer, and a receipt of purchase will be emailed.

Design/Functionality Overview:

The RFID Xpr3ss system will improve the efficiency of the supermarket checkout process by reducing the time spent looking for UPC labels or printing receipts, as well as encourage online bill payment. It will consist of a microcontroller with Ethernet capabilities and adequate on-chip memory to store an embedded web server and database. A serial RFID reader module, which consists of an RFID reader and antenna, will be used to emit a high-frequency signal to the transponders. The transponders, or high-frequency passive tags or key Fobs for customer identification, send back the signal and transmit the customer ID or product serial number to the receiver. Customers will enter their PIN on a numerical keypad after scanning their key Fob for additional security to prevent illegal use of stolen key Fobs. A graphical LCD will be used to display the scanned item information and a running total of the purchase. After the scanning process is complete and finalized, the Ethernet connection will be used to email a receipt to the customer. A database will be embedded in the microcontroller to relate customer IDs to personal information and email addresses, as well as relate product serial numbers to product descriptions and prices. An embedded web server will be used to access this database.

The cost for the prototype RFID Xpr3ss system is estimated to be $400. This includes the major design components mentioned above, as well as passive RFID tags for items and key Fobs. We

estimate the neCore12 MC9S12NE64 MCU w/ 10/100 Ethernet to cost $67.00, the TI S4100 Multi-Function RFID Reader Module to cost $90, a Storm configurable 16 key keypad to cost $45, a Crystalfontz 240x128 negative blue backlit graphic LCD to cost $112, and a 70dB 2.048kHz magnetic external drive buzzer to cost $1.00. We also anticipate using the TI Tag-it HF-ISO Mini Inlay RFID tags for $1.55 each and the TI Tag-it 13.56MHz ISO Vicinity Key Ring Transponders for $6.00 each.

Jonathan Chen will be responsible for the software design narrative and design constraints and component selection rationale; Joshua D. Chapman will work on packaging specifications and patent liability analysis; Jared Suttles will take responsibility for the PCB layout and social/political/environmental rationale; Jennifer Tietz will complete the circuit schematic and reliability and safety analysis. All team members plan to assist in software development, as that is each one of their major concentrations.

Project-Specific Success Criteria:

1. **An ability to identify an item by reading its RFID tag**
2. **An ability to enter a customer PIN on a keypad for added security**
3. **An ability to modify the product database via an embedded web server**
4. **An ability to display useful information on a graphical LCD (e.g., customer ID, scanned item description, etc.)**
5. **An ability to email customer a receipt of purchase**

Block Diagram:

Please see next page

Division of Labor:

Design Component Homework		*Professional Component Homework*	
Packaging Design and Specs	Josh Chapman	Design Constraint Analysis/Parts List	Jonathan Chen
Circuit Schematic and Narrative	Jennifer Tietz	Patent Liability Analysis	Josh Chapman
Printed Circuit Board Layout	Jared Suttles	Reliability and Safety Analysis	Jennifer Tietz
Software Narrative and Listing	Jonathan Chen	Social/Political/Environmental Analysis	Jared Suttles

__Each__ team member should take responsibility for __one__ Design Component Homework and for __one__ Professional Component Homework – note that these will count toward __individual__ student grades.

Block Diagram: