QA and Test Plan

C. A. R. T. S.
Completely Automated Retail Transaction System

18-549 Team 13 (Shark Laser)

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Status Update

- This project will expedite the checkout process in retail stores.

- Current status - both RFID and load sensor parts are individually functional and interfacing with the Arduino, waiting on shopping cart for final form factor.

C. A. R. T. S.
White Box Tests

FSM Testing - the Arduino will use a finite state machine to track what items are currently in the cart

- Full coverage of all states in the FSM
- Full coverage of all transitions between states

Code testing

- Individual testing of load sensor reading code
- Individual testing of RFID reading code
Black Box (Functional) Tests

- When powered on, the cart should register an empty list of items and turn on the green LED.
- When powered down, the Arduino and all sensors should be powered off. No state needs to be saved.
- The ability to scan an item by an RFID sensor and hear an audible confirmation "beep".
- When an item has been removed from the cart but not scanned, an orange "Warning" LED should turn on until the appropriate number of removed items has been scanned.
- When an item has been removed from the base of the basket and scanned by the RFID tag, it should be removed from the list of items within 1 second.
Black Box (Functional) Tests

• Detect up to four items placed in a cart in a 2 second period
• Detect multiple items placed in the card together
• When an item has been scanned by the RFID tag and placed on the base of the basket, it will be appended to the list of items in the cart within 0.5 seconds
• If an item is placed in the basket, yet no sound confirmation came from the RFID sensors, then a red LED will notify the user that the item has not been scanned properly.
# RFID Testing - Maximum Distance

<table>
<thead>
<tr>
<th></th>
<th>Distance - Card is Parallel</th>
<th>Distance - Card at 45 degree angle</th>
<th>Distance - Card at 90 degree angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 inches</td>
<td>2.5 inches</td>
<td>Did not find</td>
<td></td>
</tr>
<tr>
<td>2.5 inches</td>
<td>2.5 inches</td>
<td>Did not find</td>
<td>Did not find</td>
</tr>
<tr>
<td>2.5 inches</td>
<td>2.5 inches</td>
<td>Did not find</td>
<td>Did not find</td>
</tr>
</tbody>
</table>
**RFID Testing - Interference**

<table>
<thead>
<tr>
<th>Distance Between Sensors (Facing the same direction)</th>
<th>Detection Range</th>
<th>Dead Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 inches apart</td>
<td>2.5 inches</td>
<td>3 inches</td>
</tr>
<tr>
<td>4 inches apart</td>
<td>2 inches</td>
<td>2 inches</td>
</tr>
<tr>
<td>2 inches apart</td>
<td>0.5 inches</td>
<td>0.5 inches</td>
</tr>
</tbody>
</table>
## RFID Testing - Reading Speed

<table>
<thead>
<tr>
<th>Speed</th>
<th>Success Rate (at 1.5 inches, with 10 tests)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow</td>
<td>100%</td>
</tr>
<tr>
<td>Medium</td>
<td>90%</td>
</tr>
<tr>
<td>Fast</td>
<td>60%</td>
</tr>
</tbody>
</table>
Project Concerns

• Lack of shopping cart prevents us from moving forward with the final form factor.
  • Particularly problematic for the load sensor, because it needs to be mounted before further testing can proceed

• ADC chip has been difficult to work with - moving forward without it means accuracy of the load sensor will be worse than expected

• Interference may be an issue for RFID - detection range has been improved with external antennas, but further testing is needed to determine antenna interference
Questions?