

Point of Sale Grocery Cart Design Team 6

Team Members

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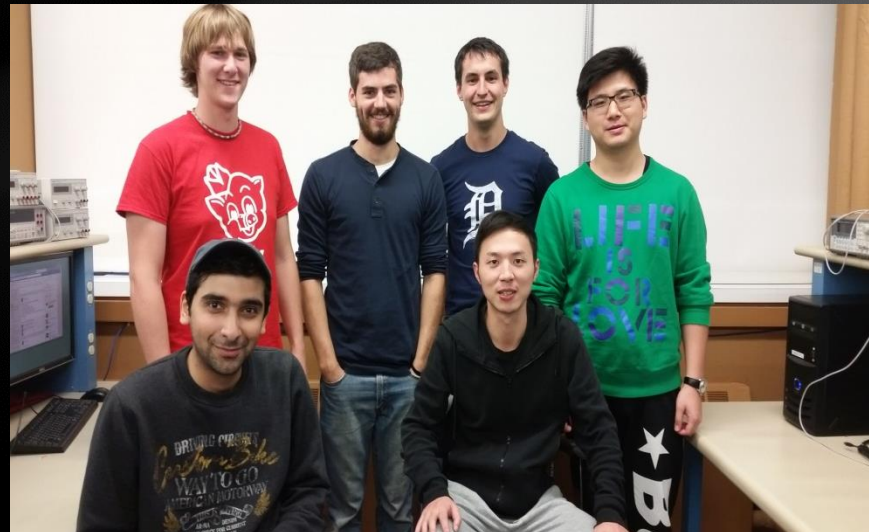
Taoping Zhao

Sponsor:

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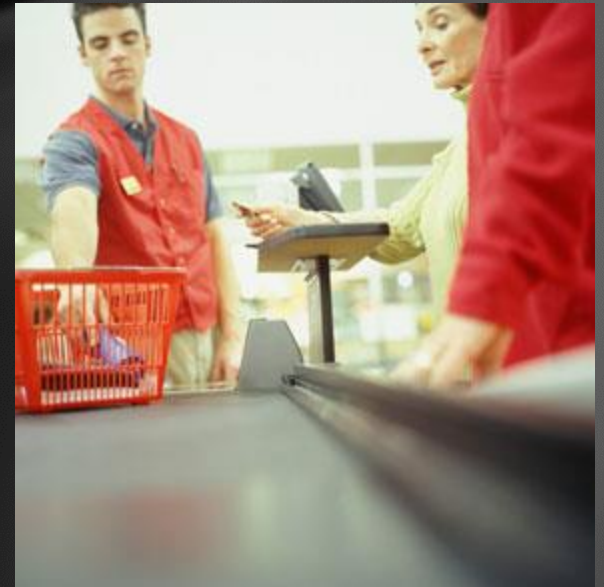
Facilitator:

Dr. Jian Ren



Introduction

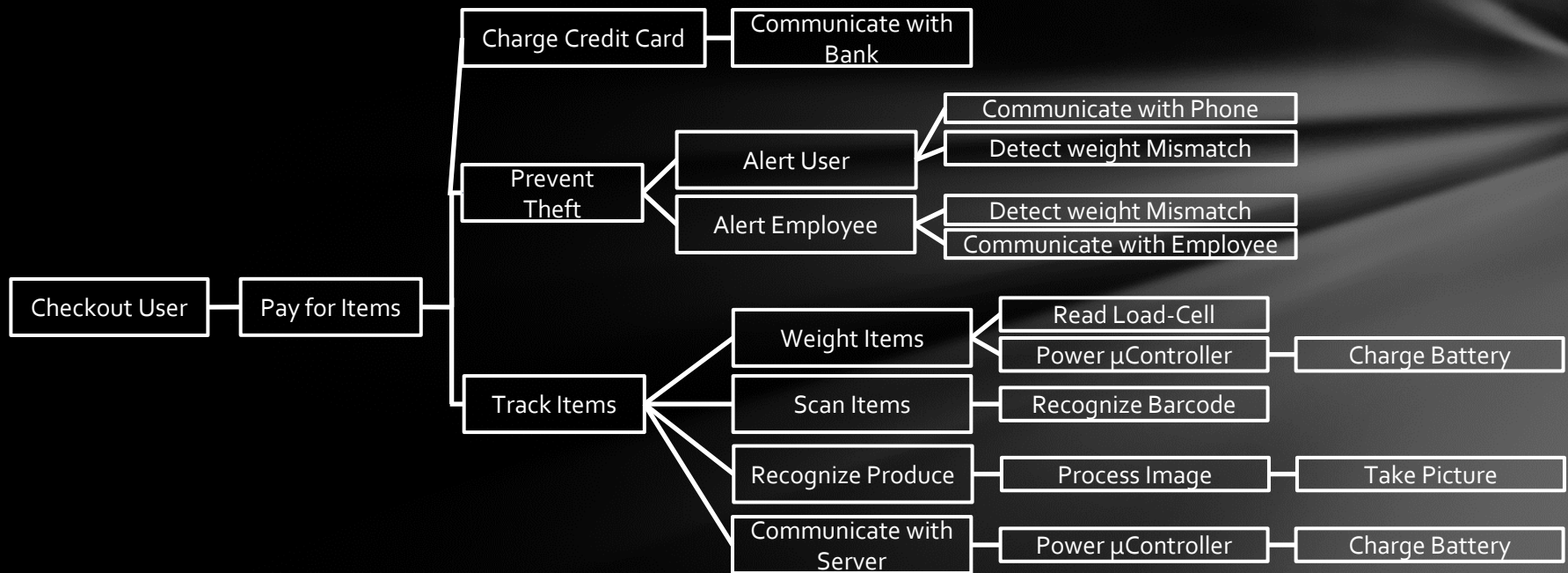
- The major issue with today's system is the unnecessary stop at the checkout line
- Cashiers are paid to take the items out of the cart, scan, and put them right back into the cart
- A lot of the shopper's time being wasted, adds to congestion near the store's exit, and adds cost for the store which has to pay cashiers
- Our goal is to create a grocery cart checkout system



Requirements

- Phone Application
 - Scan items
 - Identify items through image processing
 - Credit card checkout
 - User friendly
- Load-Cell Scale
 - Sensitive to an ounce
 - Accurate measurements no matter where the item is placed
 - Robust
- Wireless Chargeable Battery
 - Last an entire day on a single charge
- Communication
 - Wireless communication with store server
 - Secure network

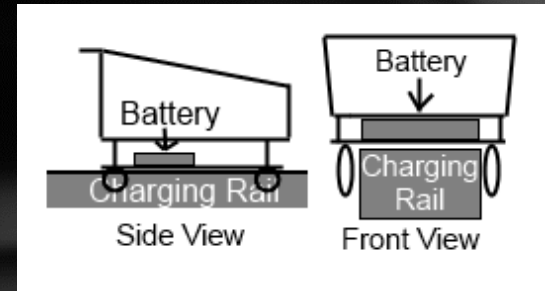
FAST Diagram



Conceptual Designs - Battery

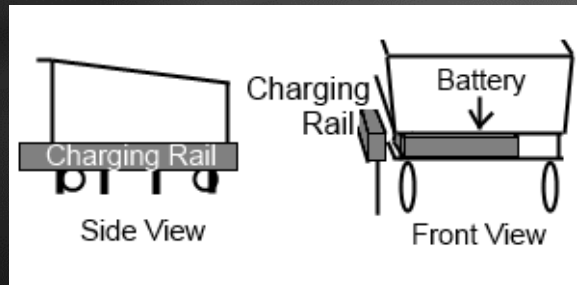
Design 1

- Wireless charging mat under carts
- The charging receiver will be positioned on the bottom of the cart



Design 2

- Wireless charging mat on side wall
- The charging receiver will be positioned on the side of the cart



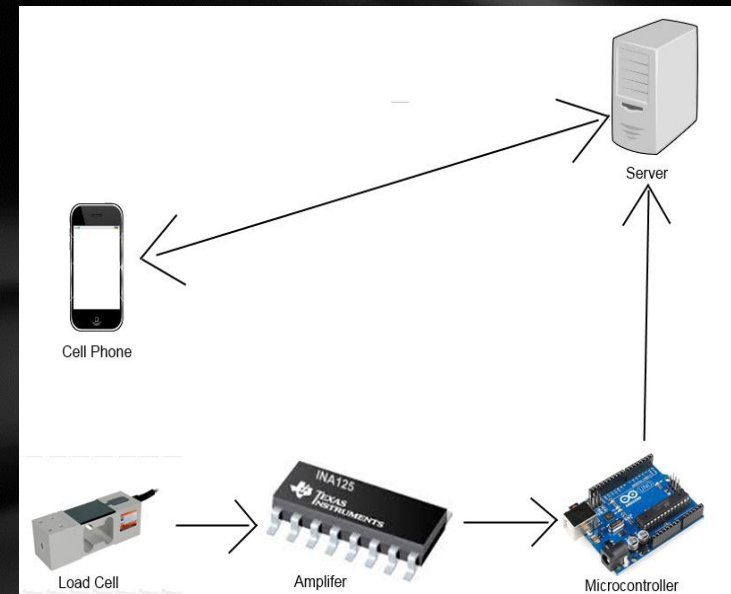
Conceptual Designs - Communications

Design 1

- Load-Cell
- Amplification
- Arduino Uno (microcontroller)
- Wifi Shield
- Server
- Phone Application

Design 2

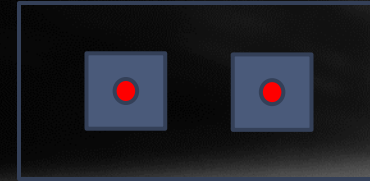
- Load-Cell
- Amplification
- CC3200 (microcontroller)
 - Built in wifi
- Server
- Phone Application



Conceptual Designs – Load-Cell

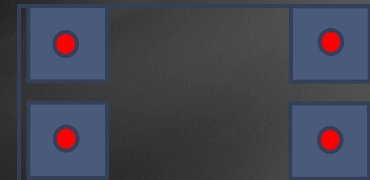
Design 1

- Two load-cells
- Metal plates to distribute weight



Design 2

- Four load-cells
- Placed at the corners



Ranking Designs

Conceptual Designs – Battery

Floor-Based Charging Design

- Better positioning between mat and receiver
- Easier to position on the floor

Conceptual Designs – Communications

TI Microcontroller Design

- Built in Wi-Fi capabilities
- Cost effective

Conceptual Designs – Load-Cell

Design 1

- Good weight distribution
- Cost effective
- Less room for error



Process Overview

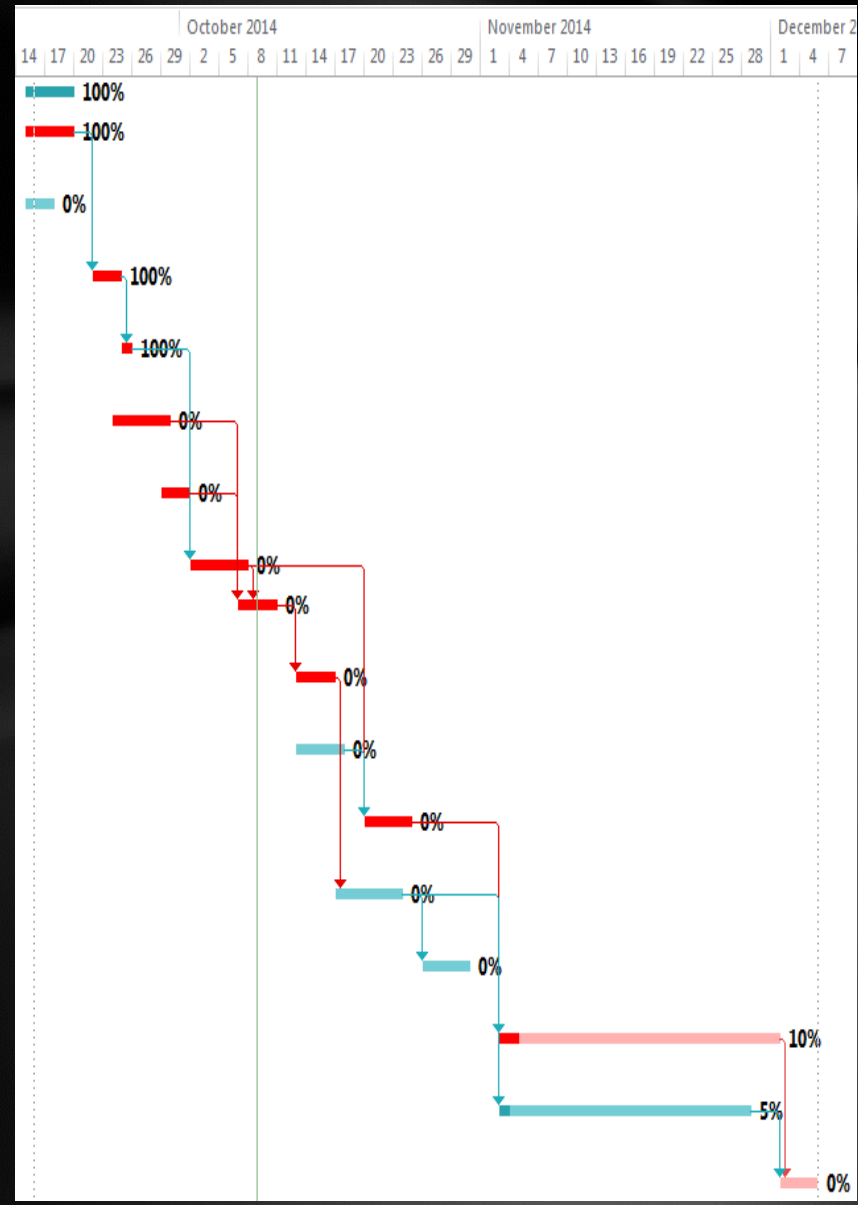
1. Take fully charged cart from queue
2. Customer scans UPC code on cart to identify what store they are in
3. Items scanned by phone as they are purchased
4. Load-cells detect weight
5. Microcontroller converts load-cell signal to weight
6. Wirelessly talks with server to confirm weight of item
7. Server tells phone price of the item
8. App keeps track of cart items and is alerted if items are removed
9. Checkout through application
10. Return cart to charging queue

Risk Analysis

- Make parts difficult to steal/remove
- System must withstand sudden changes in temperature and prolonged extreme temperatures
- Application must be secure from potential hacking
- System must be robust
- Weight sensors must be accurate to avoid system errors
- Accuracy of image processing
- High cart life
- System must be user friendly

Gantt Chart

1	Task Name	Duration	Start	Finish	Predecessors
2	Preproposal	5 days	Mon 9/15/14	Fri 9/19/14	
3	Design Brainstorming For Load Cells and Transmission Network	5 days	Mon 9/15/14	Fri 9/19/14	
4	Team 6 wesite creation	3 days	Mon 9/15/14	Wed 9/17/14	
5	Design Load Cell Circuit That Will Output To Arduino Uno Microcontroller	3 days	Mon 9/22/14	Wed 9/24/14	2
6	Order All Parts Including Load Cells, Microcontrollers, and Amplifiers.	1 day	Thu 9/25/14	Thu 9/25/14	4
7	Initial App Design (Barcode Reader)	4 days	Wed 9/24/14	Mon 9/29/14	
8	Write The Code To Set Up A Server That Our Phone Will Be Able To Pull Store Data From	3 days	Mon 9/29/14	Wed 10/1/14	
9	Prototype Loadcell Design Agreed Upon In The Design Phase	4 days	Thu 10/2/14	Tue 10/7/14	5
10	Get Loadcell Circuit And Transmission Circuit Interfacing With The App	4 days	Tue 10/7/14	Fri 10/10/14	6,7,8
11	Setup A Functional/Navigational Phone App	4 days	Mon 10/13/14	Thu 10/16/14	9
12	Complete Wireless Battery Charging Prototyping	5 days	Mon 10/13/14	Fri 10/17/14	
13	Combine Battery Cicuit With Loadcell Circuit To Have A Functioning System Independent Of Lab	5 days	Mon 10/20/14	Fri 10/24/14	8,11
14	Add Image Processing Capabilities To The App So It Can Recognize Non-UPC Code Items	5 days	Fri 10/17/14	Thu 10/23/14	10
15	Fine Tune App So That It Is Working Properly And User Friendly	5 days	Sun 10/26/14	Thu 10/30/14	13
16	Put Together Full Working Prototype	21 days	Mon 11/3/14	Mon 12/1/14	12,13
17	Work On Design Day Presentation	20 days	Mon 11/3/14	Fri 11/28/14	12,13
18	Any Additional Tasks	4 days	Tue 12/2/14	Fri 12/5/14	15,16



Cost

Microcontrollers:

1. Arduino Uno

Price: \$28.28

2. TI CC3200 Microcontroller with WiFi support

Price: \$30.08

3. Arduino WiFi Shield

Price: \$27.95

Load cells:

1. Accuteck Heavy Duty Postal Shipping Scale with Extra Large Display

Price: $\$21.99 \times 2 \text{ (quantity)} = \$43.98$

Cost Continued

Batteries:

1. Motorola External Battery (3000mAh)

Price: \$15.99

Wireless Charger:

1. Wireless Charging 5V 600mA Transmitter & Receiver

Price: \$9.19

General components

1. Step-up DC/DC Convertor (LT1129CQ-3.3#PBF-ND)

Price: \$4.90

Wireless antenna:

1. TP-LINK Indoor Desktop Omni-directional Antenna

Price: \$11.84

Total Cost: 80-100\$ per cart

Cost Comparison

- Currently stores pay several cashiers 24 hours day
- System would heavily cut down on cashiers
- System has high startup cost, but large long term saving
- Supermarkets spend an estimated 2400\$/day (10 cashiers at 10\$/hour)
- Total cost of updating cart fleet is an estimated 10,000\$ (100 carts)
- Fewer scanners required to be purchased
- Very good option for new supermarkets



Questions?