



Smart Cart

A Gesture-Based Solution to Streamline Grocery Shopping

Alan Viverette
Andy Elder
Elaine Zhou
Kyle Archie

1. Application Area

We started out by meeting to brainstorm potential application areas. The project that we decided to pursue for P2 had been music-related and entertaining, but our other ideas had a greater emphasis on helping people perform specific tasks. We continued on that track for much of the P3 brainstorming session. After generating a list of ideas, we narrowed it down to the general category of shopping, and then further to grocery stores.

- Cooking
 - May be difficult to observe without interrupting
- Waiting in line at Ike's / Pete's / etc.
 - Has potential for something entertaining or practical
- Watching TV / listening to music
 - Too easy? Maybe there is a more "extreme" variation on this...
- Shopping at a department store
 - Lots of people to observe, may provide more insight
- Stanford Mall
 - Shopping involves lots of decisions, lots of potential to improve
- **Grocery shopping**
 - Self checkout could use a major upgrade, easily observable

2. Observations and Interviews

To record our observations, we split into two groups. One group, Alan and Andy, shadowed a couple as they went grocery shopping at the Safeway at the San Antonio shopping center, and the other group, Elaine and Kyle, observed patrons at the self-checkout at the Safeway on El Camino near Stanford and interviewed the attendant.

2.1 Observations from Safeway self-checkout ([photos](#))

We observed shoppers from a distance and in close proximity both in the Self-Checkout Line and at the Regular Checkout at the Safeway on El Camino Real as they purchased their groceries at 7pm on Monday, January 28.

Elaine's Notes & Observations

Summary of Main Observations

(1) Only certain types of people use self-checkout.

Not a single person going through Self-Checkout had a shopping cart. The major demographic of people who went through Self-Checkout consisted of young individuals with under 10 items. The amount of items normally fits within 1 or 2 bags. Many people also bring their own reusable bags from home, and one individual simply carried his items away with his hands full, without any use of a bag. People with children under age 10 always went through the regular checkout line. A large majority of customers in the Safeway waited in the regular checkout line.

(2) Self-Checkout takes significantly longer than does regular checkout.

Maintenance issues abound which hinders the efficiency of self-checkout. Almost everyone has a moment of hesitation after each scan to make sure that the weight on the scanner scale and item had registered on the computer. Then, the shopper puts the item in the bag and waits to see if the computer had recognized the new change in weight. Sometimes this would prompt an "unidentified item in the baggage area" message. Because of the weird sensitivity of the weights, I noticed a lot of people rearrange their goods by placing some on the floor or start bagging in the middle then move left and then to the rightmost bag last. There was a significant amount of rearranging of the bags and items as well.

(3) Self-Checkout constantly requires employee assistance.

There's one employee that oversees four different stations and walks around. She walks around to check up on each system but also to collect the baskets from each station (since nobody comes through with a cart). For every purchase that has an age limit (>21 for alcohol, >18 for cigarettes) the machine prompts an employee code before the customer can continue. This is to guarantee that consumers are abiding by the laws set in place, but they are tedious and the employee has to approve of the purchase each time. In the many occurrences in which a customer buys something without a barcode (produce for example), he or she would call an employee over to punch in an item code. Also, if users have a coupon they want to use, they have to wave the employee over in order to punch in a specific code to allow this to happen.

(4) The two primary concerns are efficiency and cost.

Shoppers typically fell into one of two categories -- optimizing for price or optimizing for time efficiency. Many people came into the checkout line (both self and regular) chatting away on their cell phones or bluetooth devices. Many people also came in wearing workout clothes and sneakers to buy their groceries, ready to kill two birds with one trip: workout, shop. A good majority of these people swiped their credit cards before the cashier even finished ringing up all their items. The second camp of people were mostly concerned with price. Prior to entering the checkout line, they would glance over all the items in the cart, mumble, and then put a few things away. Others would hold the item in their hand for a significant period of time before either handing it back to the cashier or placing it on the conveyor belt. During the ring-up, their eyes were glued to the screen, fixated on the price.

(5) Grocery shopping lacks interaction, even when done in groups.

One particular event I found interesting was a group of girls who were clearly shopping together crowded around the scanning screen. They all turned silent and simply watched one girl scan all the items. In another instance, a couple used the self-checkout and while one person scanned the items, the other just stood there. This checkout method is not conducive to working together. Even in the regular checkout, customers did not talk with the cashier. They simply (a) looked at the foot on the conveyor belt or (b) looked at the price screen or (c) were talking on the phone. Most shoppers that came in groups did not talk to each other either while they were in line.

(6) Machine is annoying and unresponsive.

Many people swiped their items multiple times, waving the item back and forth in what seemed like frustration. I counted 4 instances in which individuals had to swipe their credit card twice because the first time didn't register. One individual yelled at the machine "SHUT UP" because it continually announced all his savings even after he was done shopping. People fumble around for the Safeway card and almost always punch in the savings card last.

Notes on Non-Grocery Checkout

After going to the Safeway and observing the self-checkout and regular checkout, Kyle and I decided to check out Staples just to see how the shopping experience differed. At Staples, there was a greater amount of interaction between the shopper and the cashier. Almost shopper that went through the line asked the cashier a question, and the question led to small talk. This did not happen while we were at Safeway. Also there is a greater degree of deliberation when buying items -- the cashier scanned things at a slower pace and the shopper did not whip out his credit card to pay. Instead the entire process felt planned and calculated, not rushed. Perhaps the greatest differentiating factor between the two shopping experiences is the type of goods each place is offering. Safeway is for groceries, and people typically know what they want to do with eggs or tomatoes or whatnot. However, Staples oftentimes sells office supplies and expensive materials, so people want to know details about these things and make informed purchasing decisions. Thus, it is an environment that is more question-friendly.

Notes on Self-Checkout & Regular Checkout

- Single person oversees 4 different stations, walks around
- A lot more people at non-checkout stations
- Some brought personal bags
- No Teamwork, everyone crowds around the screen
- Many people wave product around multiple times
- System immediately failed out and had to fiddle with bagging area to make it go away.

- requirement to check ID for things that are over 18\21
- Machine Ignores coupons.
- Double swipe with credit card, didn't work the first time
- Only use the scanner part of the station, the rest of the space is unused
- Bagging issue leads to "please wait for assistance"
- Has to check/approve from afar
- Check out system constantly has human assistance
- Baskets are left behind, has to be picked up by employee
- Looking for club card
- Lots of bagging struggles
- Most users are single peeps with things that fit into one or two bags
- Or small groups of people, young people
- Someone came, left, and then came back, looking confused
- Laughing when debating what order to scan things in
- One person does all scanning even though multiple people are crowded around
- "Phone number?" "Mary take that out!" -frustration at messing up bagging weight
- "You don't know her number by heart?!" "Holy crap I need one of those (cards)"
- "SHUT UP" after scanning club and repeats savings
- Not enough space for multiple people to interact with food stuffs.
- Male, 10-15 items. Brought his own bag.
- Minor frustration. Having to cancel.
- Handling multiple purchases is incredibly inefficient.
- Person has to help out with phone coupon
- Store clerk moves much faster than customer on swiping items
- Moving back and forth between debit/credit machine ad scan machine
- Point at machine, maybe foreigner is using?
- Someone walked away w/o using bag
- Nobody comes w a cart
- Person on Bluetooth
- Can't have two people working at the same time
- Someone is swiping while the cashier is still working
- 1 person to 4 stations on self checkout
- Personal checks. And other forms of payment are easier.
- Looking at price counter. Looking at the items of purchase. Not at the other person.
- Heavy duty bags
- Typing in pin while cashier is doing there thing. (Multitasking).
- Something else to focus.
- Looking at magazines while the other person bags.
- Guy on the phone doing his own bagging. Goes through aided checkout to focus on conversation.
- Anyone with children goes through the assisted check out.

- Single woman. Buying alcohol.
- Always looking to see what's happening. Always overlooking.
- Always eyes on the food eyes on the belt eyes on the receipt. Very anti social.
- People with a large number of items help bag.
- Added it to my cart, and it didn't scan in
- "How do I fix it"
- I always get the Safeway deals off this, what do I do?
- Putting things on the ground
- Rearranging items in bags
- Not even using a bag
- Waiting for assistance, looking at screen

2.2 Interview with Self-Checkout Employee

After observing customers, we interviewed the employee X that oversees the self-checkout stations.

Kyle: What the most often occurrence of breakdown?

X: It's typically only with produce. People normally don't know the right code to type in and don't really take the time to look them up. -points to screen- You see, this with all the pictures? People don't really want to find the code, so I have to come over and punch in the numbers myself.

X: It's a machine and it really doesn't know any better.

X: I think going through the normal line is so much faster. People *think* self-checkout is faster, but it really isn't. Maybe if you have one or two items it's better, but I've seen people bring in a full basket or cart of things and spend a really long time at the self-checkout.

X: Another problem that we used to have is that people would bring their own bags. Since there is a scale along with the scanner, it messes up the weight. The machine will say this is an "unidentified item in the bagging area" and I have to go over and fix it.

X: Sometimes also money runs out, so we have to refill the machines with cash.

X: The thing yells at you, repeating the same thing over and over. It won't stop talking! Even when the person is done paying!

X: When there are about 4 people using it, at least 2 people will have the exact same problem at the same time. It slows things down because there's only one person who can fix it, and both people have to wait for that person.

Kyle: We noticed this happened when people were buying alcohol.

X: I have to manually check people's IDs, which slows things down a lot. There's another whole issue of underage people buying alcohol. Someone people will scan like a pack of Arnold Palmer tea and instead slip a 6-pack of beer into their bag.

X: I think they should just get rid of them [self-checkout]. It's taking peoples' jobs away and not letting us help them. Instead of 4 people working here, now there's 1. That's 3 peoples'

jobs that the machines have taken away.

X: Sometimes people steal, because it's so easy to just put things in there. The cameras are there, but nobody really watches them.

2.3 Interview with couple H&A

Interview participants H&A are recent graduates living together in an apartment off-campus. Both participants work near Stanford. We interviewed them together while traveling from their apartment to Safeway, and again on the trip back to their apartment. Key observations are inlined in *italics*.

Pre-shopping Interview

Alan: Could you tell me about how you prepare for grocery shopping?

H: I make a grocery list!

A: Yeah, usually we just sit down and toss out things we want or need.

Alan: So do you have a recipe book, or do you just come up with stuff on the fly?

A: I think there's like, a base set of ingredients we always like to have around and then whatever recipes we plan for.

Alan: What are you making this week?

H: I made the shopping list without telling A, so...

A: Plus I'm leaving on Wednesday.

H: Taco pie, which we make a lot. And this thing called succotash because A wanted corn. Stuffed potatoes. And I wanted to try more vegetable side dishes, so some vegetables. And tofu, because I wanted to try it.

A: What do we need tofu for, why did you write it down?

H: Well, because we've never cooked with it before. It's supposed to be a good vegetarian... Well, what I did write down and I really want is paneer but we can't find it anywhere, so we probably won't get any.

Disagreement about tofu, maybe we can provide suggestions for healthy food?

Alan: Do you usually shop once a week, or...?

A: About... maybe once every ten days?

H: I make a separate trip. We usually make one trip a week to Safeway and I do a separate trip to Trader Joe's to buy my lunches for the week. And when I'm there, I'll buy any missing ingredients that we didn't get at Safeway.

A: And sometimes we'll go to Milk Pail to stock up on vegetables.

H: And last week we went the new grocery store on Alma here. Which was... expensive.

A: But not as expensive as one would expect.

H: It was okay. You just had to be careful what you picked up, like you had to look at the price tag.

They go to a lot of stores! Maybe they could optimize based on their list.

(part where we almost hit the guy in front of us redacted)

Alan: Could you tell me about when you went to the new grocery store?

A: We went on a Saturday afternoon. And it was new, so we went up and down all the aisles.

H: We heard a rumor that it's owned by the guy who owns Berkeley Bowl.

(argument about stopping on the railroad tracks redacted)

H: It was a lot of local stuff, like Orrin's Hummus shop. Micro local.

A: Like Whole Foods, but with a more attractive price point.

H: And there were a lot of... weird fruits and vegetables. And a big Asian food section.

Initial visit to a store is to familiarize with layout and products offered.

Alan: How closely to you stick to your list when shopping?

A: It depends on...

H: Whether we brought a list or not?

A: Like, if we've been away for two weeks then we'll look at what we need to restock the fridge.

H: It depends on how many general items we know we need. The list usually has stuff for recipes. We'll go through and say "do we need this? do we need this? are we stocked up on this"

A: And it depends on if we're constrained for time. Like, tonight we're don't have any plans so we can take our time and kind of wander more.

H: If I'm at Trader Joe's, I always bike so I try not to buy very much.

Different shopping modes, "on a mission" and "browsing" based on time constraints.

Alan: So you bike to Trader Joe's from work?

H: Yeah. Sometimes I go on the way to work and stock up on things to put in the work fridge, which I can do because people don't steal from our work fridge. But I haven't done that in a while because I'm really lazy. I have to go to class on Wednesday nights through, so I'll try to go by there soon.

Alan: Do you use recipes when you cook? What do you do when you cook on a regular night?

H: We don't use a lot of recipes. Stuffed peppers? We were supposed to make that last week but I got lazy. I still double-check the recipe but don't follow it that much. Today I was trying to find vegetarian recipes, but usually they're for sides and not main courses.

(part where I thought the recorder wasn't working redacted)

Not much need for recipes, or even a pre-planned list.

Alan: Which stores do you like shopping at?

H: Safeway.

A: Menlo Safeway.

H: Yeah, Menlo Safeway is the best one. It's too far out of the way really, but a couple of times I've gone there on my way back home Sunday because I drive past it -- but Sunday nights are a bad time to go grocery shopping. We usually go Saturday or Sunday afternoon.

Alan: Why do you like that one?

H: It's way bigger than this Safeway. It's got a really good bulk section. It's got the best stuff.

Optimization is very, very important. Can we make shopping less time intensive?

(we enter the Safeway)

Alan: Have you used a self checkout recently?

H: Yeah, this weekend!

Alan: Can you tell me about using it?

H: So the problem with the self checkouts is how they try and do everything by weight. And like, verify that you're not stealing things by weighing what's in your -- by weighing your purchases. But then it always, like thinks that you haven't -- so I was purchasing Advil? Which weighs nothing. And so it got upset that it thought I hadn't, you know, purchased it. A, we did use the self checkout, remember? Because the checker had to come fix it for us. I don't remember where that was, but again -- a pain in the ass! Because it got mad at us! Didn't it get mad at us about not, like, putting items in the bagging area. And it like, freaked out. So basically they're a pain in the ass and I don't like them.

A: I think they're worth it if you have a small number of items. Five or ten things. But if you have a shopping cart full it's much faster to go to the cashier.

Alan: Do you remember why you used it in the first place?

A: Because the illusion of speed.

H: There was no line.

A: That you yourself could check out things faster than the guy who does it eight hours a day!

The self-checkout is a horrible experience because it expects you to steal things.

Post-shopping interview

Alan: What was your strategy for this trip?

(boring parts identical to observation notes redacted)

H: What I hate is sometimes I'll have to shop at Molly Stone's, and I'll have to go through the store five times and backtrack, so it's nice to -- even though we entered on the left hand side, to start from the right hand side and do the same route so you don't have to backtrack. We almost had to backtrack on chips there.

Optimization again! Also knowing the layout of the store is important.

Alan: How would you compare the stores you go to?

H: Depending on what you want...

A: Trader Joe's has bad produce. I don't like Trader Joe's for produce shopping.

A: Trader Joe's has name brand products.

H: No, you're thinking Safeway.

A: Safeway has name brands. Trader Joe's has good naan.

H: Their hummus isn't as good as Safeway, though. Safeway has good hummus. But Trader Joe's, I buy all my lunch time salads there. No other grocery store compares. Their buffalo mozzarella is really good.

A: And wine, we get wine at Trader Joe's.

Each store has specific traits that may make it better for a certain shopping list or time of the week. Product availability and quality vary widely and non-uniformly.

Alan: How do you pick wine?

A: I usually know what I want. But we found this wine that was just a label with a question mark.

H: I like wines with fun labels. The labels attract me. I always pick the fun labels.

A: And cheap.

H: I went to Trader Joe's with my mom to buy wine. She wanted to buy me nice wine, and she was like "Agh! All the wine here is too cheap! There's no expensive wine here."

Alan: What did she end up buying?

H: She found like, one or two bottles. I think we had to go to Beltramo's, though. She didn't want to buy any cheap wine.

Sometimes more expensive products are better simply because they are more expensive, depends on the occasion. Sometimes choices are made on packaging alone!

Alan: Do you remember what the checkout at Trader Joe's was like?

H: Well, so the checkers are generally the friendliest. And I think they're better at packing. I've had some problems at Safeway with the bags you bring yourself. They're pretty awful about it. But Trader Joe's is really good at loading it up. And they're friendly and cheerful. I like shopping there. I don't like the one at San Antonio as much, though, they were out of salads the last time I went there. But they're really nice there too, they were cracking jokes with me about something.

Trader Joe's has a better personality than most stores, makes people feel good about shopping there which makes up for some faults.

Alan: Do you ever have to ask for help in the store?

H: I have had people ask me if I need help. A lot.

A: (laughs)

H: Not in a bad way! Trader Joe's, like, they have more employees and they'll be like, "Hey, do you have any questions?"

A: They're actually like, "Hey, I'm bored! Make me do something!"

Alan: A, you said that doesn't happen to you?

A: Nope. I know what I want. Trader Joe's is small enough that the layout is pretty memorable.

H: It's like four aisles.

A: I know what aisles I wanna be in. I wanna be in the produce section and the alcohol section. (laughs)

H: It doesn't have that many aisles, which is nice. So if you forget something on the other side you don't have to go that far. But it doesn't have all the good brands. And I don't like their produce. So we usually go to Safeway and Trader Joe's on different days.

Efficiency again. It sounds like they don't usually need help, but they don't want to miss something and have to go back.

Alan: Do you usually try to buy name brands?

A: Depends on what it is.

H: Like Sabra hummus!

A: Right, the hummus we've tried around and we know what we like.

H: We tried Orrin's hummus from the fancy grocery store and we were so disappointed! It isn't nearly as good as Sabra hummus. So that was a let down.

A: I'm more willing to take risks on things that are inexpensive. So if there's a new brand of tortilla chip, I won't have any problem trying it out.

H: But like, multi-grain Cheerios. And the southwest salsa.

A: That's her favorite salsa.

H: The southwest salsa I love. And nutigrain bars.

A: It's personality, too. She knows what she likes.

H: I don't like experimenting.

A: I'm more flexible and want to try new things. That's why when there's a new candy bar at the checkout...

2.4 Observations from shadowing H&A (photos)

We followed H&A around the Safeway at San Antonio shopping center as they shopped for groceries at 7pm on a Monday. They had just returned home from a week-long trip.

Alan's notes

- During the entire trip, A was leaning on the cart and slowly pushing while H went ahead with the shopping list
- Both A&H were putting items into the cart
- Started at right side of store and went through every aisle
- Most decisions were made together, e.g. "Do we need X?" "Maybe"
- Most of the time A&H were together, but at produce they broke apart and both grabbed vegetables
- H didn't use the shopping list until produce, which was the last stop
- When getting milk, H goes for a specific brand and has to climb on the display to grab it, then spends a while looking for a second (new) brand, eventually crouches down and reaches to the back of a shelf
 - Reaching to back to get newer milk?
 - Buys specific brand because it lasts longer
- While looking for a specific hot sauce, A breaks off to search previous aisle but can't find it
 - A walks down aisle scanning products
- Went through every aisle, then skipped four aisles in a row (drinks, paper goods, pets, wine)
- Not sure where to buy pizza crusts, decide to get it later
- In produce, H goes to buy tomatoes and grabs a few extra things nearby that weren't on the list
- At checkout, A&H walk past all the lines first, then stop at the last (shortest) line
- A&H both load the conveyor by unloading the basket front to back
- Nutrigrain isn't in checkout system, scanner has the bagger run off to check price
 - Had to get a second price check from a manager
- During checkout, H silently watches the cashier scan items while A drums on the cart, then both stare at the pin pad for a long time
 - Food stacks up on the post-scanning conveyor belt since the bagger is off checking a price
- After H scans card, continues to stare at pin pad
- Had a cucumber and zucchini in cart (not in bag), both were rung up as cucumbers
- A&H unload cart immediately outside store and walk bags to their car

Andy's Notes

The woman noted that her favorite brand of hummus was at one end of the store, however upon inspection, they were out of that brand (there were several other brands available). Their initial method for traversing the store was scanning the items in an aisle and determining if they needed them.

I kept a running count of how many times the question "**Do we have / need ____?**" was asked, by the end it was 8 (over a 33 minute period).

Both utilized many senses when shopping, they felt the tortillas to see if they were soft picked up the jars of tomato sauce while comparing them.
When looking at pasta sauce, she noted that one brand was only \$4.
He then pointed out that the shelf blow was even cheaper. Ultimately, they chose the \$4 option.

Key Observation 1: Value vs Name Brand Paradoxes

Throughout the experience, the importance of value versus brand name goods was continually shifting. At times, the price was the only thing mentioned, while for others, it seemed inconceivable to not buy the name brand.
Traversing every aisle, they would scan items and ask if each was needed or not.

Key Observation 2: Different Modes of Shopping

The first “mode” for the duo was a very particular scan of each item in the aisles, ensuring that they either did not need or already had everything that they encountered. The speed of this method was slow, yet the attention to items in the aisles was very high. I’ll call this mode **Slow Scanning**

After attempting to find hot sauce in the “hispanic section,” the woman grabbed a can of jalapeno baked beans, stating “It’s not on my list, but I like it.”

Key Observation 3: Impulsive Buying vs Predetermined List

While checking the list occasionally, many of the items purchased were either remembered at the store or impulsively bought when scanning the aisles.

Observations from this point forward may be labeled with the corresponding key observation from above.

The couple needed sandwich sized bags, the man said, “We have to get the Ziploc’s, I go with the name brand.” **#1**

Needed Cheerios, the female said “Safeway does have off-brand Cheerios”, but the duo quickly decided that they would instead prefer the name brand. **#1**

“Oh, you know what I want.... *looking down aisle* Grapefruit juice.” **#3**

The couple then decided to skip several aisles including personal care, pets and some frozen aisles.

Moving into a frozen food aisle, the couple were now not even looking at the items, but rather just travelling through the aisle. **#2** This method can be referred to as **Quick Crossing Through**

This method of shopping was the fastest, as well as the lowest attention to items around them. It appeared as though they were just getting from one point to another and chose the aisle at random. **#2 Getting to a Certain Item**

As they travelled down the frozen aisle, the woman mentioned that she wanted to buy “something fresh”. While vague, this was likely a reaction to all of the pre-prepared dinners in the frozen aisle.

At this point, the woman took off ahead to go to the milk section, with the man eventually catching up with the cart. **#3**

With this method of shopping, they had a clear destination and needed to get that product (in this case, milk.) Therefore, it is very fast, but the scope of products being viewed is limited to the type of item they are seeking out, rather than whatever they are passing. *(Additionally, the man drove the cart the entire time, while the woman was finding items, putting them in and going back out to the aisle.)*

The couple each had a particular milk preference, so they bought two different types.

The man told me, “We like Horizon brand. You can drink it far past the expiration date and it’s fine!” ... “I’m not sure what they do to it, but we like it.” **#1**

The woman then struggled to find a particular type of milk, reaching far in the back, then up very high, while the man watched.

Finally, she found a carton in the upper back (she had to climb on the ledge of the refrigerator door), and said, “Got the last one.”

The woman then said that she wanted to get some orange juice **#3**

After picking up Minute Maid brand orange juice, the man said, “Why not Simply Orange?”

It again seemed like the man would prefer a more reputable name brand **#1**

After a mild disagreement, the man conceded and they put the Minute Maid in the cart.

They then returned to the **Slow Scanning** mode in the dairy aisle, picking up yogurt and deciding what cheese to get.

The man again stated, “Go with Sargento. Its the best.” **#1**

When picking out tortilla chips, the size of the chip mattered immensely.

Strips, triangles and circles were available. They went with the triangles.

When entering the produce aisle, they started a new mode of shopping.

This mode was where they would leave the cart somewhere and both go find things, then return and put them in. I will refer to it as **Home Base Shopping**. They used this method to get spinach and potatoes. **#2**

They zig-zagged through the produce aisle in a much less organized fashion than before.

At this point, a recipe arose (“Succotash”, but she pronounced it “Suckatoosh”).

She had an unusual type of corn on the list, but the man eventually said, “Just get the regular corn.”

She then scanned the list more than previously, and they again split up with the **Home Base** method. **#3**

The woman grabbed bananas and lime juice, in an impulsive fashion. **#3**

The woman picked up tomatoes, the man said, “We don’t need those.”

She explained that they, too, were for the succotash.

She meticulously picked through dozens of bushels to find the perfect one, and bagged it. Moving to the checkout stands, they walked down the whole row looking at how busy each was. They finally chose the last one in the row because it had the fewest items on the conveyor. A man was in front of them with a roast chicken while talking on the phone.

Both of them worked together to put the items on the conveyor.

The woman would hand items to the man, who would then organize them by size and space efficiency. As they pulled out items, they reviewed their purchases with each other to make sure they made sense.

The cashier started scanning items before saying anything to the couple, and they were still putting items on the conveyor.

After saying “hi” to the cashier, the woman swiped her card as the cashier continued to scan items.

The man stood behind her, not doing much.

They brought their own reusable bags and set them with the scanned food, however, no one was bagging any food as the cashier continued to scan the final items.

The cashier’s keyboard was then clearly broken, as it kept sliding down and knocked the faceplate off of the scanner. He became frustrated with it and held it in place with his hand while he pushed certain buttons.

When a produce item didn’t have a barcode, he would set it on the scanner / scale and push buttons furiously on the keyboard. The force of these button presses must have broken the bolt controlling the tilt for the keyboard.

After the couple watched the cashier silently for a few minutes with no one bagging items, another employee came up and quickly bagged all of the items sitting on the counter.

The cashier then mentioned that he had charged them for two cucumbers, when in fact, there was one zucchini and one cucumber. The couple and the cashier laughed and talked about this for about a minute, while the customers waiting behind them looked as though they were frustrated with the hold up. The elderly man behind them had only a six pack of soda and a lemon.

The couple then took the cart outside and placed it in the cart storage area.

Taking all of their bags out of the cart, they left it there and carried their heavy bags (the man remarked how heavy they were) to their trunk.

All of the items fit in 3 reusable bags, and the orange juice was separate in the trunk.

3. Brainstorming

Our brainstorming took place in four stages. First, we formulated needs from our

observations and clustered them into themes. Next, we picked a subset of needs and suggested solutions. We then came up with products that had the potential to integrate solutions to address multiple needs. Finally, we focused on a single product and acted out using it in the real world to come up with an interaction model.

3.1 Needs & Solutions ([photos](#))

We began by brainstorming the people, places, and activities involved. Next, we addressed specific user needs and formulating “How might we?” questions, which led to over forty separate needs with roughly six recurring themes and many one-offs.

- How might we make shopping more fun?
- How might we make the grocery store more efficient?
- How might we give people a sense of accomplishment?
- How might we help people learn something?
- How might we ensure satisfaction?
- How might we alleviate stress?

After selecting our favorite needs from the previous session, we quickly flipped through one at a time and brainstormed potential solutions to address those needs.

- Provide a sense of pride / self worth
 - Achievements (like Xbox)
 - Provide an efficiency score
 - Tweet purchases
 - Provide a rewards system
- Help find things faster
 - Tag items with your own color beacon
 - Light up a colored line on the ground
 - Give a guided audio tour
 - Provide a map of the store
- Find the best _____.
 - Crowd-source popularity & ratings (Yelp for bananas)
 - Show how many people touched a vegetable
 - Provide ultrasound for checking ripeness
 - Show grower’s tips
- Encourage teamwork & couple’s affection
 - Provide a surprise
 - Make shopping a two-player game
 - (image of a cart breaking off of another cart)
 - Split shopping tasks

- Encourage customers to interact
 - Anonymous gift giving (e.g. buy for next person in line)
 - Customer endorsements
 - Alert other people when you buy a nice wine
 - Competitive donations
- Make customers more relaxed
 - Better lighting
 - Live performances
 - No checkout
 - Provide things to do at the checkout
 - Automatic bagging
- Answer questions
 - Siri for the grocery store
 - Provide tips & tricks
 - Get more info by scanning item
 - Did you know?
 - Chef tips & substitutions
- Plan a party
 - Facebook integration
 - Template shopping lists
 - Party registry
 - Suggested themes

3.2 Brainstorming Products (photos)

We met over Hangout to brainstorm solutions that integrated ideas from our in-class brainstorming and could form the basis for a product.

- A system that watches when customers reach for produce, tell them more information about that particular item, e.g. how to test ripeness.
- A smart shopping cart that provides directions.

At this point we got excited about the shopping cart and continued to brainstorm ways in which the cart could integrate many of the solutions that we had come up with in class.

- A smart shopping cart that provides directions, suggestions, information about products, keeps track of how much money you've spent, and can check you out instantly. And it follows you.

3.3 Bodystorming

We met at a Safeway to act out how we would use the smart cart. We brainstormed on a

scenario in which we would need a variety of items and in doing so would encounter a variety of problems. With the use of the physical cart, we bodystormed what gestures would be most intuitive and natural for a smart cart.

Our ideas converged on a simple set of gestures that, combined with a way to detect which product was near the cart, would allow us to easily control our hypothetical product.

- Swipe a phone to the cart to take control & load your shopping list
- Sustained hovering over an item (read as hesitation) brings up “how to buy” list
- Hold an item above the cart to find more information
 - Weighing two or more items to compare reviews
- Put an item in the cart to buy it & check off the list
 - Shows suggestions after adding an item
- Touch the cart for directions to the next closest item on the list
- Wave the cart toward you to set who it should follow
- “Shoo” motion to indicate shopping is complete, cart returns to store

4. Project Summary

Motivation

For many people, a weekly trip to the grocery store is a necessary evil. Grocery stores are huge and difficult to navigate, making a shopping list takes time and items are forgotten, and making a choice while staring at nearly-identical brands can be frustrating.

Headline

A smart cart that provides relevant information.

Description

Our solution is a shopping cart that integrates a display, 3D camera, and motor to provide the shopper with hands-free access to personalized, relevant information.

Features

- Tap a phone to personalize your cart, load shopping list
- Motorized cart follows its owner, returns to store when done
- Gesture-based interface for obtaining product information
 - Check prices
 - Compare product reviews

- Get tips of checking produce ripeness
- Tracks purchases and shows total bill
- Instant checkout, simply walk out of the store

Storyboard

To demonstrate the needs of shoppers and the solutions provided by the smart cart, we created a skit where two friends go grocery shopping for a Super Bowl party.

1. Kyle & Elaine need to plan a party, but Kyle hates going to the grocery store. Elaine creates a shopping list and they go to Safeway.
2. Elaine taps her phone to the Smart Cart, and the cart creates a route through the store. The first stop is the produce aisle for avocados.
3. At the produce aisle, Elaine complains that the last time they bought gross avocados. Kyle holds an avocado above the cart and receives tips for checking ripeness.
4. As Kyle puts the avocado in the cart, the total shopping bill appears. The cart directs them to the next item on their list, cups, and suggests adding additional nearby items for guacamole.
5. At the cup aisle, Elaine can't decide between the hundreds of types of cups on the shelf. She holds two types of cups over the cart, which shows her a comparison of reviews for the different brands.
6. At the wine aisle, Kyle and Elaine have an argument about which wine to buy. Elaine swipes her bottle over the cart and sees that it would put them over budget, then Kyle swipes his more reasonably-priced wine.
7. Kyle and Elaine split up to get different items. The cart initially follows Kyle, but Elaine calls it over so that she can put her items in it.
8. As they leave, the cart confirms their purchases. They have already bagged their purchases as they were putting them in the cart, so they simply leave the store.
9. After unloading their bags, they dismiss the cart. It returns to the store by itself.