

FourSense Research Findings Presentation Text
28 April 2011

I'd like to begin our presentation by thanking our advisors Katie Scott and Jason Hong for their guidance and dedication throughout our project. Also to our faculty members David Casillas and Jenna Date who have also supported us. In addition, I would like to thank our client sponsor, Bank of America, especially those who are here with us today, Erik Ross, Matt Calman, Susan Thomas, Mark Zanzot, and Margery Kiehn for the lovely partnership we have developed and for your support throughout our research process. And thank you to the rest of our lovely guests for coming here today to learn more about our Capstone Project.

To make sure that our research is able to extend to audiences who are not here, especially to some of our clients who are visually impaired, we will be podcasting our presentation. To ensure that we abide by the confidentiality agreement made between our team and our participants whom you will be learning about today, we would greatly appreciate that you do not share our research information outside of the conversations that take place in this room.

We will be introducing our research, sharing background, explaining our research process, our findings, our product opportunities. We'd like to continue a conversation with our clients with a workshop furthering our product pop.

Hi, we are team FourSense. My name is Nastasha, I am the Project Lead. This is Jooyong, our Communications Director. This is Brendan, our Lead Architect. Daisy, our Research Director, and James, our Design Lead.

A very special part about our team is that we all come from different backgrounds in CS, Design, and Psychology, which brings about unique conversation that comes from having different skill sets and areas of expertise. As a result, our research approach and interpretations come from an agreement between these different perspectives, thought processes, and inclinations which is an important characteristic of our team because the problem we are trying to solve involves approaching it from different points of view.

Though we all bring different perspectives to the table, our team is united by the way we practice user-centered design. As you learn more about our research, you will see that it was especially important for our team to prioritize empathy with our users to better understand them, knowing that our experiences and approaches will be different from those we study. Our project was motivated by the desire in each of our team members to improve quality of life for each of our users.

Earlier this semester, our team was asked to learn more about the life of visual impairment and understand how challenges during payment transactions for our users can also extend to address payment challenges for everyone. We were given a

timeframe of five months to conduct our research and form product opportunities from our data, which we will be sharing with you today.

To define the language we will be using to address our users in our presentation, we define visual impairment to describe any kind of vision loss, whether it is a user who cannot see at all, in other words, blind, or someone who has partial vision loss, who has low vision and is able to still see, but for example, may have no peripheral vision. Visual impairment is either inborn. congenital blindness, or can be acquired later after birth due to injuries from accidents or diseases like diabetes.

Although many people may never experience vision loss, the number of Americans affected by visual impairment is increasing yearly.

- 4,300,000 adults in the US are visually impaired and the number could increase to 4,900,000 by 2020
- 18,000,000 adults in the US have been diagnosed with diabetes, which is the leading cause of visual impairment

These numbers illustrate how significant the visually impaired population is in the United States today and indicate a growing importance of providing accessible technology to build confidence for the visually impaired.

And here's an example of challenges we have seen in our research, where a participant experiences difficulty during a transaction. The store clerk is walking around the counter to assist this user and swipe his card.

Brendan will now discuss background information to know where our research is coming from.

Thanks Nastasha for the introduction.

We started our research looking at the state of cash in the visually impaired community. The biggest problem with American currency is that a blind person is completely unable to distinguish different denominations by touch. Also, for somebody with low vision, the fact that all bills are mostly green makes it difficult for them to differentiate denominations just by looking at color.

In order to deal with this problem, many blind people have come up with folding methods. Here's a method we learned.

\$1 bills go into the wallet unfolded
\$5 bills get folded the short way
\$10 bills get folded the long way

\$20 bills get folded lengthwise and then widthwise.

Now the bills are distinguishable by touch, so when a blind person needs to pay, they can reach into their wallet and get the correct amount.

However, this doesn't solve the problem of receiving change from somebody and not knowing whether it's the right amount. To do that, money readers have been made, which are small, pocket-sized devices that scan a bill and read the amount out loud. IPPLEX has also developed a LookTel money reader application, which runs on the iPhone and uses the camera to distinguish between bills.

However, the US is planning to add tactile feedback on its currency by around year 2015. Because so many solutions already exist to deal with cash, we decided to focus our efforts on card transactions.

Credit, debit and gift cards are another story. Gift cards, first off, are difficult to use because, according to touch, they all feel the same. If a blind individual has several of them in his wallet, telling them apart is difficult. You also can't find out how much you have left on your gift card even if you could read it.

Credit and debit cards have other problems. First off is figuring out where to slide the card, because it's different in each payment terminal. Secondly, most terminals require you to use the touchscreen to process your transaction. Thirdly, for the signature, it's difficult to know where to sign. Even if they have a signature card with them, they need to press down a certain amount to have the touchscreen register the signature, and for somebody who can't see, it's hard to know how hard to press down.

For debit cards, the problem is entering the PIN. Even though some payment terminals have tactile keypads, like the one on top, some payment terminals (like the one on the bottom) use keypads on the touchscreen. A blind person is unable to use this, and would have to say their PIN out loud and have somebody else enter it in. This is a huge privacy breach, however.

Given all these problems, some efforts have been made to establish technology that gets around some of these issues. We found this out through our competitive analysis as we looked at emergent technology. One of these is near-field communication, or NFC, technology. A lot of newer cards have a chip embedded inside of them that allow you to pay just by tapping your card on a terminal, like this one. This gets around the sliding problem, but a lot of the problems with authorization still exist. This technology is currently being deployed in stores.

That's some of the background for our research. Now Daisy will tell you more about the process of our research.

Thanks Brendan. Now I'm gonna be sharing with you our research process.

[Slide Timeline]

Our research involves **three processes**:

We initially began with project scope setting with our clients to make sure it is a practical scale for the amount of time we were giving. And we spent a large part of the semester on gathering the data out in the field, which also involved doing Literature review and Competitive analysis. And then we concluded this semester by doing synthesis on the data we gathered to prepare us for the design phase in the summer.

[slide]project goal

From project scoping, we developed our project goal, which is: Develop a versatile payment system for all users by understanding how to build confidence in visually impaired users during person-to-person transactions. Further more, our project scoping helped us developed 3 focus areas that helped guide our research.

[Slide Focus]

we want to understand our users' money management methods, The role of caregivers and other assistance that may affect the transaction process, and also the breakdowns during the transaction. And these focuses helped us select appropriate methods for our research goal.

[Slide: Contextual Inquiry]

The main methods we used are contextual inquiry, artifact walkthrough and interview. We also did guerrilla style contextual inquiry and Fly-on the wall as our secondary methods.

[Slide: Contextual Inquiry process, The task]

Different from traditional interview, a contextual inquiry allows us to not only ask questions to our users but also go to the actual environment, in this case, different stores, to first-handly observe the successes and challenges of the payment process.

Our contextual inquiry consists of three parts which includes finding out background information through interview. Observing the entire shopping process and the actual payment transaction process, and an artifact walkthrough. On average each contextual inquiry lasts about 1 hour to 3 hours.

[Slide: Background information interview]

In the background interview, we asked our user their age, occupation and background information of their impairment.

[Shopping and transaction process]

During the actual contextual inquiry, we asked our users to take us to a store that they most frequently shop at so we can observe their transition process.

Some types of places we went to include: grocery stores, drug store, retail stores, and Cafe. We are also fortunate to observe the money withdraw process at some banks with some users. We focus our contextual inquiry not only in the transaction process but the entire shopping process. This includes preparation before payment such as listening to Audio coupon, selecting items to buy and withdrawing money. And also the post transaction process that involves looking at receipts or online banking.

[Artifact walkthrough]

After each contextual inquiry, we took the opportunity to do Artifact Walkthrough with our users to learn more about how they organize their money in their wallets, and other type of device they carry in a daily basis with them, such as portable screen readers, money readers and also their cell phone.

[Slide: Interview]

For those users who we were unable to meet in person, we did phone interviews with them to find out some of the things we were investigating during the Contextual inquiry.

[Slide: other methods]

To reinforce a lot of information we gathered in our contextual inquiry, we did an expert interviews with a professor from department of psychology in CMU, and also interviewed the dean of Pittsburgh school for the blind, to find out more about the blind Community.

We also had a chance to talk to Microsoft accessibility group to learn about accessible technology. And as Brendan mentioned before, we also meet with researchers from IPPLEX, which was the company that created the money reader app on iPhone, to learn more about their research finds within the domain.

[Slides: User]

Here's a diagram that illustrate the diversity of our users, across age, level of assistance and use of technology. As the diagram shows, the age of our users range from 21 to 70, and they all have different level of assistance, like guide dog or regular caregivers. And their use of technology is different as well. Some of them are willing to use all kinds of technology that may help them while some may avoid technology at all.

[Slide: CSUN]

In the end of the semester, we were able to conclude our research by attending the International Technology and Persons with Disabilities Conference in San Diego. This is an annual conference that gathers visually impaired individuals and companies that are interested in learning about and developing latest accessible technology.

During the conference, we performed fly on the wall and "Guerrilla" Contextual Inquiry. A fly on the wall is a method that allows the researcher to freely observe a situation without interrupting the work flow and being noticed. And the Guerrilla contextual inquiry is just like a Contextual inquiry but conducted spontaneously to get real time data.

During the conference, we took advantage of the fact that we had a lot of VI in the conference around us and observed, how they transacted when buying lunch, what type of devices and technology they use and what type of assistance they had. We also asked several VI to show us how they use tech on their iPhones because it was one of the devices that we found commonly in the Visually Impaired community.

[Slides: Map with all the users]

Here's a diagram that summarized all the users we interviewed. we did 10 Contextual Inquiry, 4 interviews, 7 Guerrilla contextual inquiry and 2 fly-on-the-wall studies. As you can see on the diagram, mainly all of our users were blind and some were low vision. We talked to 23 users in total.

And now Jooyong and James will discuss the research findings and the conclusions that arrived from them.

[Research Findings]

[Slide: Findings Venn Diagram with Identity Labeled]

From our synthesis, we developed a framework to articulate our key findings and extracted three main themes from the data. The first of which is identity. To better explain identity, I'm going to tell you a story about Trevor.

[Slide: Images of Trevor 1]

A 21 year old, junior computer science major, Trevor interfaces with the computer using a screen reader when he surfs the web and does programming assignments for his class.

I often see him with a group of his friends within computer science walking around campus and to the local frozen yogurt store. When he travels with his buddies, he does not use a blind cane and just uses his friends voices and shoulders to navigate his way to the store.

When he has to travel on his own, he uses a blind cane to navigate. As a matter of fact, he has become so proficient at this that he led the way to the bus stop as well as to the local grocery during our interview with him.

At the grocery store, he was comfortable with asking a store clerk for assistance in his shopping needs. He followed the clerk around the store by the sound of his voice and asked for options when choosing the certain items.

[Slide: Images of Trevor 2]

Once he gathered all of the items he needed he went to pay for the item where we noticed something interesting. As you saw in the video earlier, he first handed the his debit card over to the cashier, whom without notifying Trevor, decided to walk around the bagging area to help Trevor swipe the card. Trevor showed confusion as if the transaction process he was familiar with was not being followed by this particular cashier. When the cashier began to perform the transaction process at the point of

sales device near him, he approached the area to let the cashier know that the he is familiar with the process of entering in the PIN and take control of the transaction. Trevor showed many instances of this sense of desire to show his independence. He is able to navigate his way around stores and around the campus on his own. He was able to handle the debit transaction on his own without any need of assistance showing his independent nature.

With that in mind, I would like to hand it over to James to talk more about the theme of identity.

[Identity]

Independence is essential to be self-confident and comfortable.

Our users really valued doing things on their own. They still asked for help when doing tasks beyond their ability – all participants asked for help at during our observations – but ONLY when help is needed. Help offered when the participant was capable of the task was met with little welcome. By supporting independence, we can empower users to accomplish more tasks on their own. By understanding independence, we can encourage those who provide help to offer appropriately and tactfully when necessary.

Users want to be treated like any other person.

Our participants preferred to be seen "as a person first" because an impairment does not define who you are. Our participant Ellen, who is blind, was shopping for a toothbrush and helped by a store employee to find items on the shopping list. The employee asked what color toothbrush she wanted and then started to backtrack forgetting for a moment that Ellen could not determine the color and may not have a preference. Ellen responded, "I like it when you treat me like a normal person." We want to make sure to make the experiences of blind, low vision, and sighted are as close as possible.

Users each have their own unique reasons to choose payment methods.

Because of these difference in attitudes about their own perception, it's impossible to pin on any one way of doing things. Each that we spoke to has different methods. Ellen clued us in early on that each blind person is different. We can accommodate different styles and combine functions of multiple devices.

Identity: Empower user, bring together experiences, allow flexibility.

And now Jooyong is going to introduce our next theme.

Thanks, James.

[Simplicity]

[Slide: Findings Venn Diagram with Simplicity Outlined]

The next theme we synthesized from our key findings was the idea of Simplicity. Before we dive a little further into the insights, I would like to introduce you to Marty.

[Slide: Images of Marty 1]

When we first met with Marty at the local mall, she was very excited to show us all of the technology she uses on a daily basis which helps simplify her life. She uses a portable ebook reader and uses a phone that reads out menu items.

She uses a signature stamp to avoid having to sign things on her own.

She is a technologically savvy as she used to be a product inventory system developer for one of the local grocery chains back in the 80's.

We met with her again at a local drug store to interview her as she purchased a couple items. She prefers to use cash when she's in a hurry because it's too much of a hassle to use the point of sales device when it's a touch screen.

[Slide: Images of Marty 2]

Once she completed her transaction with cash, the cashier handed over the receipt with which she replied, "I'm just going to leave my receipt here because I throw it out. I know I never use it." The cashier quickly look at the receipt and told her that there were no coupons on the receipt anyway.

Marty was keen on simplifying her life as much as possible. Later she mentioned to us that she can call the bank-by-phone and find out what her balance is and also to manage her money. She can check her transaction over the phone.

With that in mind, I would like to hand it over to James to talk more about the theme of simplicity.

Thank you, Jooyong.

Transaction errors are critical and can have greater consequences than for sighted users.

It is important for users to have reliable and accurate transactions. Receipts offer information to record and track spending but only on a limited level. Some users keep receipts to scan for their screen readers to relay the information. Because these processes are difficult for the visually impaired, it removes much of the value of receipts because they cannot be referenced at point of sale. Catching errors is important because making a return trip to a store is much more cumbersome than for sighted people. Easy opportunity to review transactions immediately or understand transactions ahead of time to prevent errors during the transaction process and preventing the need for return trips.

Users seek efficiency in all shopping activities, not simply the transaction process.

We found our participants cared greatly about how much time they took in line, which was also suggested early by the clients as a major need for us to approach during the

research. Our participant, Trevor, told us he doesn't use money reading devices because they take too much time. However, we also found our users were efficient in all their activities, choosing the simplest, easiest way to get through the store. We should support an easier, more efficient shopping experience. On a smaller level, we should support quick set-up for the system.

Users adopt technology that is cheap and has minimum obligation.

Because technology is expensive, many participants did not have an expansive set of technologies at their disposal. Cost is a major barrier, for practical reasons of course. As technology develops and users become more comfortable, new technology upgrades are greatly desired. Costs of upgrading can be so high that it is better to remain with technology that is understood and already integrated into daily life. We can utilize current transaction infrastructures and support an interaction model that allows minimal integration into life to be useful.

Payment problems have significant impact on helpers.

As we mentioned before all of our participants had help; some required more than others. However, we do want to step back and think about the helpers too, and how they spend their time. While shopping with our participant Ellen, the store employee spent over an hour walking with her and helping her find items on the shopping list and put them in the cart. Ellen is conscious of this and thankful for the help. She used to take packages to the post office during the holiday season. The postal workers would help her label each package but it would take a lot of time. She now shops on Amazon instead, in the comfort of her own home and the help she gets from Amazon is the same help anyone else would receive.

We should offer technology that reduces the need for outside help.

Simplicity in our technology will make it easier and more approachable, make the transaction and other processes more efficient, and reduce the impact on helpers.

And now Jooyong will tell you about our last theme.

Thanks, James.
[Control]

[Slide: Findings Venn Diagram with Identity Labeled]

The last theme we synthesized from our key findings was the idea of Control. Before we dive a little further into the insights, I would like to introduce you to Joyce.

[Slide: Images of Joyce 1]

Joyce was one of the first participants we met with a seeing eye dog. We met her at her home for a quick interview before walking to the grocery store. She showed us many devices she interacts with daily, all of which had braille labels on them. Just before we

decided to head out for the grocery trip, she pulled out a sheet of paper that had a list of braille-delineated phrases. The sheet was a list of items that were on sale that she was interested in. The local grocery store provides a phone service that reads out all of the sale items for that week over the phone. She uses this service and jots down notes in braille. She then reviews the list before going to the store and memorizes the items she is interested in.

While walking with her to the local bank, she taught us about how she interacts with the dog for her to safely walk to familiar places. As much as she directs the dog, she also receives feedback from the dog about crosswalks and turns.

Once we arrived at the bank, we noticed that she used her checkbook to show the bank clerk her account number. She would rather do that instead of telling the clerk her account number out loud since you never know who is listening.

[Slide: Images of Joyce 2]

She took a minute to show us her mobile phone. It was a standard flip phone. Joyce directed our attention to the buttons on her phone and she loves her phone because of the large tactile button on the phone and the dependable reception. She's tried touch screen phones and she stated her disappointment about the lack of feedback.

At the grocery store, something interesting happened that proved to us that Joyce is definitely a deal finder. The phone service that provides all of the discount items mentioned that the Post Raisin Bran box of cereal was going for buy one get one free and this was also reflected in the weekly flyer. In the cereal aisle, the cereal that was on sale was Kelloggs Raisin Bran for buy one get one half off. Joyce was confused and was adamant that the sale item was for Post Raisin Bran for BOGO because she was confident that she heard the flyer correctly. The flyer confirmed this but the clerk could not find this sale posting in any of the aisles. The store made amends and gave her the cereal boxes for free.

Joyce showed us how much she cared about each and every transaction that she makes. She was a deal finder and was very set on following certain processes that she has become familiar with.

With that in mind, I would like to hand it over to James to talk more about the theme of control.

Thank, Jooyong.

Users need predictability and consistency which is supported by preparation.

Preparation was a consistent trend amongst our participant group. Getting cards ready before entering the checkout line and preparing lists before going shopping – knowing how to approach a situation before it comes along. But preparation requires an understanding of what's to come. Mike, who has low vision, told us about the ATM he uses quite often. He had used it so much that he had memorized which buttons to press to get the cash he needed and chose each selection in order, not needing to listen to each step to continue. One day he found he was lost in the interface - the memorized commands did not take him to the right place. He backtracked to discover what he had

done wrong and learned the bank had added a language selection feature at the very beginning. Established routines require consistent interaction to be successful. Any changes applied to a system should be done gradually to minimize surprises at point-of-sale.

Feedback is an important part of how the visually impaired approach interaction.

First is that users learn from errors, and feedback is critical for that learning. In interacting with technology, kiosks, devices, we saw a common pattern of trial and error. Trevor's approach to moving around we saw first hand: he walks forward swiftly and just runs into things. When he does this he explained the value simply: "if you bump into a wall you can feel the wall and then you know not to go there."

Feedback is necessary for users to understand their current status.

Our participants constantly paid attention to information to clue them in to what was going on, but there are often times when things can happen without the user noticing. Ellen had remembered an item they seemingly forgotten to grab from the dairy section: cream cheese. However, the store employee had already made sure to grab the cream cheese while in that section but had not told Ellen who became slightly confused and disconcerted.

Allowing learning from mistakes while providing continuous feedback is the best way to ensure users can learn to use a system comfortably.

Privacy makes users feel comfortable and secure.

Many choices about using technology and methods (e.g. cash vs. card) depended on being able to control privacy and security of information. Our participants felt uneasy when they didn't know where information was going. Mike says he "doesn't like to bother others and doesn't want them knowing what [he is] doing." For any information coming out of a speaker, you cannot be sure of who might be listening. Making the flow of information transparent to provide control over private data by allowing users to understand who has access to that data.

User are empowered by choice in tools and methods.

Each user chooses their own unique set of methods and tools. Technology enables users to better move around and do more and more things on their own. By letting users use something they can integrate into their daily lives most effectively, we can encourage confident interaction that is the user's own choice. Any new technology will integrate into the habits of the users daily lives. We should encourage successful exploration of technology to find right solution.

Control is about providing feedback, providing security, and empowering users with choice.

Our key findings fall into the primary themes of Identity, Simplicity, and Control, but in truth these themes are connected and many findings are related to multiple themes.

With that, Nastasha will tell you about the product opportunities we identified from our insights.

Thank you.

We had a four product opportunities and concepts that were derived from our research themes and findings: redefine authorization, restructure shopping, assisting mobility, and evolving digital wallets. We'd like to further develop these ideas in a workshop shortly after this presentation with our clients.

Our first product opportunity is to redefine authorization. The authorization process requires new ways of thinking about feedback and error prevention. Visually impaired participants often required guidance to the point of sales device for signing. At the point of sale, they discovered the digital signature pad does not correctly capture the signature or they felt their signature was illegible and therefore pointless to use. Recent trends in payment technology are moving towards contact-less payment. However, this new payment system still requires a signature for authorization when the total price exceeds a certain limit.

There is a product opportunity to redefine the authorization process and leverage other physical movements for authorization. We are considering the following design directions:

- Improve the current signature interface or replace it all together
- Change the authorization process by reshaping the way payments are modeled
- Provide multiple authorization options and include authorization methods that do not require a signature

Our second product idea is to restructure shopping. A key component to a visually impaired person's shopping experience was the assistance they received. Whether from navigating through the store to finding the point of sales device, some level of assistance was required. Providing tools to empower our users and provide them more control in the shopping process will help them make more decisions of their own and increase independence.

We are considering the following design directions:

- Develop a pervasive search functionality to avoid looking around to shop for the best item.
- Empower users with tools that allow for them to make a selection between different options on the shelf.
- Simplify the shopping trip throughout the store by utilizing the shopping list in-context.
- Bring together the search, reserve, and pay process into a more seamless experience.

- Leverage the wisdom of the crowd to make the shopping process more efficient by referencing ratings on stores and employees.

Our third product idea is to assist mobility. For the visually impaired, moving throughout the store and locating objects requires assistance. As mentioned in our findings, independence improves our users' confidence levels and how comfortable they were with their surroundings. There is a product opportunity to provide the visually impaired with more confidence by developing technologies that focus on movement and articulation in physical space. We can improve kinetic responses and interactions with devices through the use of appropriate feedback. We are considering the following design directions:

- Reduce need to find exact location of payment terminals.
- Leverage advanced sensory technologies to enhance awareness of direction and distance.
- Improve movement awareness and way-finding.
- Apply directional auditory feedback and computer vision technology to improve the navigation through the store.

Our final product idea was to evolve digital wallets. Many banks are tapping into the mobile space as a way to incorporate NFC (Near Field Communication) payment technology to make banking and payments more versatile. There is an opportunity to consider key accessibility features and implement options to assist the visually impaired users in these new technologies. However, these new solutions leave much room for improvement as the technology is yet nascent in its development for transactions in the US. Considering accessibility from the ground up is important for creating solutions for the visually impaired. Direct feedback, status updates, and privacy features could be implemented cheaply utilizing the ability to embed payment information in objects and advanced feedback on mobile devices.

We are considering the following design directions:

- Leverage NFC technology for mobile banking and payments.
- Develop flexibility in the delivery method of payment.
- Enable real-time balance updates to support management.
- Empower individuals to have full control over their bank account which saves trips to the bank.
- Provide instantaneous feedback about banking and transaction activities.

Thank you, and now, we'd like to take questions.