Research for smart cane

Statistics in United States
-https://www.nih.gov/news-events/news-releases/visual-impairment-blindness-cases-us-expected-double-2050

Assistance Devices
https://www.miusa.org/resource/tipsheet/assistivetechnologyforblind
https://www.afb.org/blindness-and-low-vision/using-technology

Team Norms

- Communication via text
- Fridays from 1-2
  - Weekends negotiable
  - Emergency sessions on Tuesdays?
- Meeting place: SCC
- How much you care about being punctual: 10-15 mins grace period max, try to give 24 hours notice for cancellations
- Team leader?: Democratic.

How you give each other feedback
How you deal with conflict.

Split testing, actionable metric

- Preferred method of alerts when nearing an obstacle: vibrations or tone?
- Wireless charging, how often does the SmartCane run out of battery based on method of charging?

Research questions

Major problem: https://whyy.org/segments/why-is-creating-electronic-canes-for-the-blind-so-hard/

- Demographic of vision impaired people
  - Is "vision impared" politically correct?
- Main functions of existing canes? Features?
  - Different sizes, telescoping or no (https://www.nfb.org/programs-services/free-white-cane-program)
- Existing similar products? Their marketing strategies? How do people feel about them? What features are **missing** from these existing products?
- https://www.acb.org/useful-products-blind-and-visually-impaired-persons

- Sensor for cane tip: like sensor for fencing swords?
- Online communities for visually impared people?
- I've only seen people use canes to test the ground in front of them. How do people know if something is in front of them above the ground?
- Could the SmartCane be replaced by a service dog? (Ease of getting a service dog?)

https://www.nfb.org/resources/publications-and-media/journal-blindness-innovation-and-research

- What resources do we have to reach those people?
  - Perkins School for the Blind- Watertown, MA

Answers to Questions for Report

- Leap of Faith Hypothesis- the white cane can be improved through the use of technology
- Value Hypothesis- the users would find value from the buttons and various vibration setting offered by the smartcane
- Growth Hypothesis-

Alternatives

- Bathroom sorter
  - https://www.charmin.com/en-us/about-us/sitorsquat
  - Accessibility?
- Shoe pairs
- Parental controls for microtransactions or voice chat in video games
  - https://support.xbox.com/en-US/xbox-360/security/xbox-live-parental-control
  - Console? PC?

https://calendly.com/pitosalas/ftf?month=2019-10&date=2019-10-08

Research Questions:
1. Demographics of vision impaired people in the US?
   a. Age
   b. Total number
   c. Break down of vision impairments, which ones are bad enough to need assistive devices?
2. Types of assistive devices, available designs?
3. Why do people use (or not use) assistive devices?
4. Relationship to service animals?
5. Cost (to client or program)?
   a. $30/unit

6. Health insurance coverage?
7. Comments from users
8. Perkins School for the Blind
9. How to reach demographic?

What if:
● You lose the cane?
● You used sonar to detect obstacles?
● How

● "Approximately 12 million people 40 years and over in the United States have vision impairment, including 1 million who are blind, 3 million who have vision impairment after correction, and 8 million who have vision impairment due to uncorrected refractive error." US population is 327.2 million.
● "As of 2012, 4.2 million Americans aged 40 years and older suffer from uncorrectable vision impairment, out of which 1.02 million who are blind; this number is predicted to more than double by 2050 to 8.96 million due to the increasing epidemics of diabetes and other chronic diseases and our rapidly aging U.S. population."
● "Approximately 6.8% of children younger than 18 years in the United States have a diagnosed eye and vision condition. Nearly 3 percent of children younger than 18 years are blind or visually impaired, defined as having trouble seeing even when wearing glasses or contact lenses."
● "Vision disability is one of the top 10 disabilities among adults 18 years and older and one of the most prevalent disabling conditions among children."
● "National and state data show that more than half of adult Americans who did not seek eye care are due to lack of awareness or costs; which often exacerbated by lack of adequate health insurance."

● "More than 3.4 million Americans aged 40 years and older are blind (having a visual acuity of 20/200 or less or a visual field on 20 degrees or less) or visually impaired (having a visual acuity of 20/40 or less). Other estimates of "vision problems" range as high as 21 million, and a total of 80 million Americans have potentially blinding eye diseases. The major causes of vision loss are cataracts, age-related macular degeneration, diabetic retinopathy, and glaucoma."
● "People with vision loss are more likely to report depression, diabetes, hearing impairment, stroke, falls, cognitive decline, and premature death. Decreased ability to see often leads to the inability to drive, read, keep accounts, and travel in unfamiliar places, thus substantially compromising quality of life."

<u>Vision impairment (Article 3):</u>
- "Globally, at least 2.2 billion people have a vision impairment or blindness, of whom at least 1 billion have a vision impairment that could have been prevented or has yet to be addressed."
- "Also, the burden of eye conditions and vision impairment is not borne equally. The burden tends to be greater in low- and middle-income countries and underserved populations, such as women, migrants, indigenous peoples, persons with certain kinds of disability, and in rural communities."
- "Population growth and ageing, along with behavioural and lifestyle changes, and urbanization, will dramatically increase the number of people with eye conditions, vision impairment and blindness in the coming decades."

<u>Debunking myths on blindness:</u>
- "Only about 10-15% of people who are blind or visually impaired "see" total darkness. The majority of people who are considered blind have some sight, rather than no sight at all."
- Blind people who use guide dogs are not totally dependent on them. Ex: "Dog guides cannot tell red lights from green lights in traffic. Rather, the person who is blind or visually impaired listens to the flow of traffic, determines when it is safe to cross, and then signals the dog to go forward. However, if a car is coming, the dog is taught to refuse to obey the command."

<u>Examples of different cane use.</u>

<u>Background info:</u>
- "usually made from aluminum, fiberglass or carbon fiber, and can weigh as little as seven ounces. Some white cane users prefer straight canes, which are more durable, while others prefer collapsible canes, which can be folded and stored more easily"
- ***"Most people who are visually impaired don't use a white cane. In fact, only an estimated 2 percent to 8 percent do. The rest rely on their useable vision, a guide dog or a sighted guide."***

<u>Cane types:</u>
- Support vs probing, we're looking at probing
  - Light weight, not strong enough to support body weight, long, tip slides easily on the ground.
- Different tip types: *might be best to make types customizable?*

- ○ Pencil: "good feedback and lightness", but can "get stuck in cracks on the sidewalk"
- ○ Roller: rolls smoothly over cracks in sidewalk, heavier but and has poorer feedback.
- ○ Marshmallow- doesn't get caught in cracks, but heavier.
- ○ Metal glide- "light, glides easily over cracks"

LOOK INTO: https://www.reddit.com/r/Blind/

List of Questions of Perkins:
- What other assistive technologies are used at the school, and why?
  - ○ What are the benefits of the other devices used?
  - ○ Do people like them better? **Cost effective?**
- **How much do you currently pay for the white cane? When do people use white canes (what percentage of time when you go out? Always? Sometimes? Long distance?) Figure out current usage of white cane**
- Why do so few people use canes? Stigma? Would it be better if the cane were less visible and/or obvious? (Ex. light beam or something)
  - ○ Probably not cost. Stigma?
  - ○ Vision isn't "bad enough"?
- Ask to schedule a visit to speak with students or faculty who may be able to provide insight into issues affecting the blind community
- Are any other companies working with Perkins on research or assistive technologies? Speak with engineer who can help regarding their research
- Does the degree of visual impairment affect how people use canes?
  - ○ Ex. would someone totally blind use a cane differently than someone with low vision?
- Difficulty of getting cane alternatives? Ex. guide dogs.
- What days are best to schedule a visit?

List of Questions of Perkins Students:
- Main complaints about canes? Things you wish were different?
- "If this technology existed would you use it?"
- Would auditory assistance be helpful or distracting?

Ask health center for resources about vision impairment.

List of Questions for Student Accessibility Services at Brandeis:
- https://www.brandeis.edu/accessibility/contact.html
- Community service department

CHECK IN ON MONDAY

Momina: interview Perkins on Monday using the script of questions.

Lin-ye: research how people use cane. By Wednesday.

Aerionna: research how people use canes, research tech. Wednesday

Hypotheses:

- Stigma is a major barrier for cane use.
    - We could eliminate some stigma by making a high-tech cane that is less visible.
    - People would *want* a less visible cane?

Perkins.org/researchlibrary

7:45-4:15

October 29th, 2019 Visit to Carroll Center for the Blind

Jerry Chiarelli (Store operations coordinator)

1. Why is the white cane normally used?
    a. There are two main main uses for the white cane: mobility and as a signifier (to onlookers). Therefore, a visual aspect must be present.
2. Is there a stigma that comes along with using a white/red cane?
    a. Yes, there is a slight stigma that affects the younger clients (mostly girls) more than the elderly clients. Most of them do not like the like the white/red cane because of the color, so the color canes help with this issue.
3. Does having to use one hand make it difficult for people to use the white cane?
    a. This is more situational. If one is experiencing difficulty, a walker would be more helpful to help with support.
    b. Also, they can use a support cane and a mobility at the same time to help. It is sometimes difficult to use the white/ red cane.
4. Does the time an individual started experiencing blindness impact how quick they are able to adapt to using a cane?
    a. Yes, of course it depends on when they started experiencing blindness. If an individual experienced blindness early, it is easier for them to adapt to it early.
    b. It can sometimes be a problem for someone who is elderly who loses their sight because they have to adapt to their entire life being changed. At first, they may be slow, and hesitant to adapt.
    c. Younger clients, on the other hand, make tremendous progress at a fast pace.
5. Major issues/ limitations/ complication of the white/red cane
    a. Issues

        i.   The joints do not fold properly→ injury of the blind person
              1.   Elastic that holds the cane together sometimes gets too loose
                    a. Can explode
              2.   Spinters (from Revolution canes)
       ii.   Cane only helps detects things that are low to the ground (suggested supplementary safety eye-wear)
   b. Limitations
        i.   Terrain: gravel is difficult
6. Wishlist
   a. LED strip for improved visibility
   b. More durable canes (see issues and limitations) that are less prone to injure users from wear-and-tear.

Not many alternatives for mobility aids, white cane is the first go-to.
      Sunu band: sonar bracelet, supplements white cane by detecting things above ground.

Constant contact method helps people detect changes in elevation.

There isn't really a "transitional" cane, you go straight to training with the real thing.

Ideas:
Sonar module that attaches to eyewear to detect obstacles at chest height
Laser cane (less material wear-and-tear, could have good visibility at night)

MVP

-conversation with Jerry
- conversation with student
Subscription test
Usability test with 3D print
-general population
-separate one for cane users
-one with glasses one without glasses
-Does age make a difference
     -What changes do you make to make it usable for these different population
Paper Prototype
  -   Ask people about the design
     -   Should have a strap attached to it so you wont lose it easily

Elevator Pitch
- Convince investors

==Concierge mvp==
- Give someone a stick
    - Wish she knew when to turn righ/ let (different vibrations)
- Manual buz it
- Fake it
- Have someone close their eyes and try
- Does it matter how fast they are walking?
- Does it matter if there is a delay on the vibrations
- Environment
    - Better in open space but if she was in a crowd should would be scared

Glasses vs. No glasses
- Felt easier fpr her to know when the obstacles were coming
-
- (one with a cane user and another with regular system)

==Landing page==
- Show it to people

Consult with smart cane instructor to get a 30 min class
- Give more credibility so that you can use the test on each other

Talk to instructor
- To see if our smartcane could be used in class

If you are unable to do the test, just write about the test
1. 3D design of the mockup
- Send to jesse
- Lin-Ye will work on the printing of the mockup

Ultra and wewalk
- ==Speak with smartCane and ask them about theirs smartcane==
- We are a start up with undergraduate students (costs, design etc.)

Talk to a parents
- Through the years how much did you spend on replacement white canes for child

Look for literature on this(data repository)

Have hypotheses for each MVP
- When people buy canes do they already know how to use them
- Connect with multiple hypotheses

Value Propositions

By offering our product, we are offering our customers a best SmartCane that simply outperforms all competition. It is 100% safe, has a high-performance level, and it is extremely easy to use. In addition, our product gives our customers a quality of life that they did not have previously. They no longer have to worry about their canes breaking, the tip of the SmartCane getting stuck in cracks, the heaviness of the white cane, and the old, unfashionable design of the white/ red cane.

We plan to offer out product in two separate bundles. These products can be used both by customers with low vision and those who are completely blind. There is a standard package that includes the CyberCane, and the premium package includes the CyberCane and the attachment that goes onto the protective eyewear. With the premium package, customers can detect both ground level and low hanging obstacles.

Customer Relationships

Our Customer Segments expect us to establish a personal relationship with our customers. We have promised a lifelong warranty. If our product malfunctions or breaks, we will repair it free of charge. Although, this may be costly to offer a free repair service to our customers, the costs will be offset by the revenue that we will receive from having more customers buying our CyberCane. If a customer has a great experience with our company, they would be more likely to tell their friends (other potential customers) about our products. Because of this, our company goes above and beyond to ensure that our customers are satisfied. We also have different platforms for our consumers to give their feedback on our products and offer suggestions for additional products.

Customer Segment

CyberCane's primary demographic is visually impaired people who are already trained to use the white cane. This is because the CyberCane is based on the white cane; the technology does not change how the cane is used. Our consultant at Carroll Center for the Blind indicated that younger people are more self-conscious about the cane's style, and prefer interesting colors. We believe their focus on style and their comfort with technology will make them a viable market. People also choose not to use canes because they do not believe their vision is impaired enough to warrant it. We believe that moving away from the traditional white cane will reduce the stigma associated with the use of this assistive device, encouraging people who would otherwise be discouraged from using the cane by stigma.

Key Activities

Production: we must produce the cane.
(Shipping will be outsourced, so we don't need to create an infrastructure for it.)
Maintaining partnerships: we need to maintain our partnerships so we can keep our channels open.
Customer support:
- We should make it easy for customers to give us their feedback with a phone helpline. We could also ask for feedback via interviews.
- With the lifelong warranty, we offer repair services to the customer.

Key Resources

Physical:
- Components in the cane- cane handle created via 3D printing and MakerLab resources, a switch that turns the cane on, wireless charging, circuitry, laser sensor
- Shipping materials- while we will not ship the canes ourselves, we will require packaging materials (tape, boxes, packing peanuts) so a third party can ship them for us.

Intellectual:
- We'd need to create a patent for the CyberCane so that competitors could copy our design or use a similar design without paying for their own research.

Human:
- Our customers are our most important human resources because they will be the ones who provide feedback and tell us what we need to improve.
- We would either need to acquire more expertise, or find experts in robotics (software-hardware integration, sensors), 3D printing and materials engineering (to create a durable product).

Financial:
- Employees. (Customer service reps, people who can fix the canes when they break, software devs.)
- Materials (see physical)
- Experts (see human resources)
- The distribution of the cane via postal service.

The students at the Perkins School have complaints about the assistive technologies they are using that can help us guide our research to cater the product to their needs

Try to get before Tuesday
- 3D Print
- Paper prototype (design test) for aesthetic™
- Concierge vibration test with older test subject
- Market/Price research on different power supply & recharge

Maybes
- Research papers— expert opinions on why smartcanes don't work
- Embedded Software guy
- Potential buyer for competition canes
- Usability testing with 3D print with students w/o glasses
- Usability testing with 3D print with older test subject
- Usability testing with 3D print with cane user
- Talking to instructor
- Concierge vibration test for cane user

Product Understanding:
What does smartcane do and how does it calculate information
Wall, step, low hanging tree branch (tells depth) different vibrations
Lighter sensor
Bluetooth with phone
- Battery life of cane(report)

- System check to see it everything is working
- GPS
    - Where is my cane - in case it is lost

Business model
- The old canes are horrible. We have came us with an advances smart canes with people. We are partnering with school and center and distributing them online. This would sell because the other canes would be horrible and ours is better

Market size

Sales Price
- partial revenue
- wage costs

Lighter sensor cost

1 ft * 1ftsend as late as 10-11pm
Firm elsewhere-3rd party
(amazon warehouse product)
Fedex and UPS have a unique way apprise items -get a price quote immediately
$40
Amazon gives discount based on volume 20-25% discount (since package is so small)
Courrier
10% margin-
individual

Interview with a founder/ president tyflong international inc.

<u>Distribution</u>

~4lbs 1ft by 1 ft square electronics: shipped individually to customers

~20 packages a day

<u>FedEx, UPS or any shipping company</u>

They will come to site and go over operations and shipping needs and offer price proposal

Do not compete on pricing, little leverage on price negotiation

Maybe 20-30% discounts

Depends on volume UPS Hub or FedEx Hub (near a hub, ship as late as 10/11pm for shipping service)

Amazon gets 95% discount based on volume

FedEx website for fixed pricing on the website (expect 20-25% if lucky since volume is so low)

New York to California: $40 to ship without any business account

Outsource 3rd party distribution company (handled by a firm further away)

Losing money after shipping (based on 10% profit margin)