Path Search

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April 14, 2017

Video link: https://youtu.be/hqO3tty8Jds

Abstract

It is easy to undervalue how difficult it is for the visually impaired to put all their focus on getting familiar with a new environment and avoiding obstacles as they do when using a traditional long cane. Although a white cane has been assisting special consideration to the blind on our streets and highways our team believed it can be improved on much more. Throughout our research, we determine as a team that a visually impaired greatest problem is running into objects even after using the white cane to help aid them in avoiding objects. And so, what our product brings, is knowledge of surroundings which frees the blind person to think, and be, in a world of ideas. Our prototype works by giving users adequate sound warning of obstacles ahead of them. In more depth, within the casing a beeping sound, sounds off when the sensor detects an obstacle in front of the user. The strength of the beeping indicates there is a near obstacle, helping the user to walk around it easily and independently. With the help of Alice, a visually impaired woman who helped us test our product out, we could determine some issues our product had which we were able to fix and finalize it so Alice could enjoy it within her own restriction.

Problem Statement/ Research Question and Background

Figure 1: A visually impaired person using the sensor enabled white cane to avoid a trash can before encountering it.

After observing the visually impaired, our team determined that the greatest problem they encounter is running into objects even after using the white cane to help aid them in avoiding the object. The visually impaired needed assistance in detecting objects in advance to stop them from encountering the danger. For example, a visually impaired person would be unable to detect the empty space of a table until they bump into the desk. They would also not detect a low branch dangling off a tree until they hit their head with it. Due to these instances a visually impaired person may encounter our team decided to create an attachable device that would help the visually impaired to detect an object beforehand such as in figure 1.

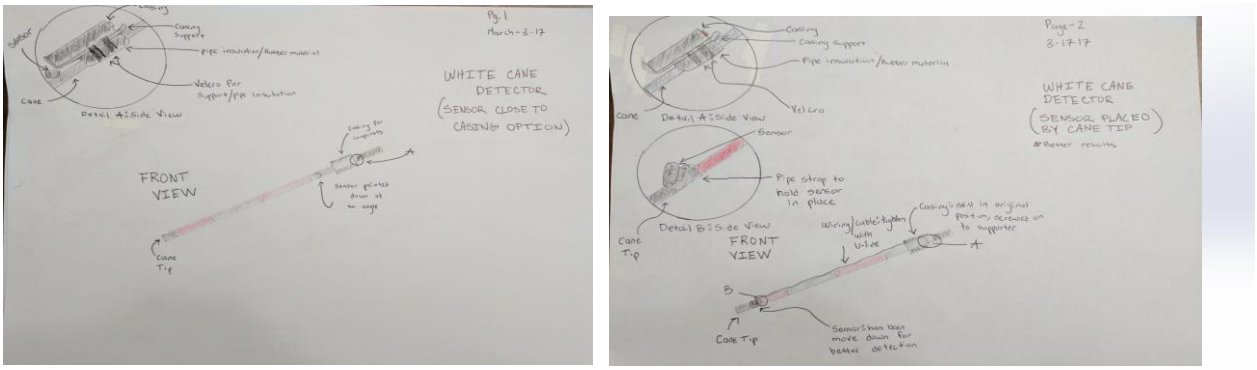
The American Foundation for the Blind states there are three different types of blindness: the visually impaired, the legally blind and blindness. A person is visually impaired “when, with best correction, he or she has difficulty reading a newspaper, is unable to see objects with peripheral vision, among many other indicators” (Learning about Blindness). Legally blind is defined “as no better than 20/200 corrected vision in the better eye, or a visual field not

extending beyond 20 degrees in the better eye, or a visual efficiency of no more than 20 percent. The "legal" refers to a determination of the person's eligibility for government benefits resulting from his or her visual impairment" (Learning about Blindness). Blindness on the other hand is "a wide array of conditions ranging from a limited ability to see objects with special aids to the absence of light perception. Most people who are blind have some light perception" (Learning about Blindness).

Through the process of developing both our prototype and our final piece, our focus was to develop a sensor based attachment that would be lightweight as well as cost efficient. Our proposed question was: Could we develop a functioning device that allows the user to detect objects in their path? Our strive to make a product that is cost efficient was a result of researching various similar products out on the market. Products being sold were too expensive ranging anywhere between $1,200 to $1,700. Our team believed we could create a product that would cost a 16th of the price point out on the market.

Methods/ Approach/ Solutions Considered

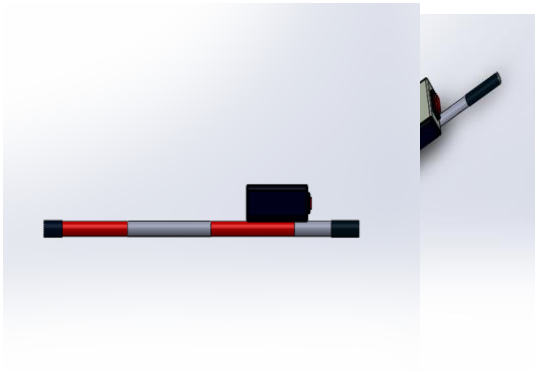
Figure 2: Initial ideas for the finalized project created on paper.



For a visually impaired person their white cane is an essential part of their lives. With the use of a white cane the user can feel independent while functioning in a world that is not tailored to their needs. Our team researched way in which we would improve a visually impaired person way of living. As a team, we used a qualitative method in which we observed people using a white cane around campus. Our observations showed that a visually impaired person uses the white cane to detect object, such as walls, doors, trash cans as well as other people. They can detect them by tapping their white cane on the floor, at a range from there shoulder to shoulder. The only downside is that they are only able to detect objects that are on the ground or close to the ground only after they have touched it with their cane. After conducting some research, we found that the devices that are already on the market are overpriced, such as the ultra-cane. The ultra cane, electronically mobility aid is a white cane equipped with a sensor, but it is out of reach for most visually impaired due to the price of $1,550.50. As a team, we decided to create a device that can be easily mounted on to the white cane the user already has. With the use of a sensor on the white

cane the user can expand the range in which they are able to detect an item. While researching sensors we opted for the sensors that are found on vehicles. We decided to create a mounting board to house the sensors, a vibration feedback and all the component. The housing unit was designed to be easily mounted on any white cane without adding too much weight to it.

Figure 3: Top, Side and Front view of the white cane object detector created on SolidWorks before the construction phase. As well as a table indicating the weight of the device.



370 g / 0.814 lbs.	Cane
161 g / 0.354 lbs.	Board
532 g / 1.173 lbs.	Complete Product

Description of Final Approach and Design

The initial idea of our design was to create a sensors system that can be mounted on to any white cane, device that would add additional support to a person who is visually impaired. The first design involved mounting three sensors, we first thought about three sensors this way the user would get a wider range of objects around them. While observing a user with a standard white cane we realized they have a swinging back and forth motion. This observation helped us narrow the sensors from three to one. To alert the user we first though a vibration feedback would be best. To cut the cost and the weight of the housing unit we kept the original beeping noise the sensor makes. The sensor will alert the user when an object is half a meter away with beeping noises with a pause in between. The beeping noise becomes closer together as the sensor approaches the object closer and closer. This way not only the user is the only one able to dodge objects but people around them can hear and detect them sooner. Our final design consists of a regular white cane, with Velcro straps that allows the user to mount the sensors and housing unit. The housing unit has an on and off switch that will turn the sensors on and off. The sensors stay in place and while the user swings the white cane back and forth the sensors will detect objects within the perimeter.

Figure 4: Alice Monday trying out our team's device both indoors and outdoors, meanwhile giving our team feedback as our team consistently adjusted.

Outcome (Results of any outcomes Testing and /or user feedback)

After our team finished constructing our white cane object detector we then reached out to a visually impaired woman by the name of Alice Monday. Alice helped us determine what our team needed to make improvements on as well as pointed out a few items our team did well on. Alice loved the idea that our team had created a device that helped the visually impaired to avoid object in their path. Alice even said, "I like it, I'll buy it." Based on the trials with Alice, we realized that our sensors would occasionally rotate off to the side. This was a problem we needed to fix otherwise the sensor would fail to detect objects in front of the visually impaired persons' path, rather it would only detect items on the side or even only detect the ground. In addition, Alice stated it would be best to add a rechargeable component to the product though the batteries were okay. Alice introduced this idea because she believed people would buy the product more because in the long run it would be cheaper than always having to buy new batteries. Finally, Alice added that it would be best if the product was foldable. As a result, our team adjusted the wiring and placement.

To fix the first issue, or team drilled the sensor to the cane rather than leaving it strapped on. To fix the second issue, our team attached a rechargeable unit inside the housing. This was initially difficult as our housing unit was already crammed however, by removing the batteries, this opened space and made the device rechargeable. Our team got the rechargeable wire from a regular rechargeable toy. Furthermore, our team replaced the old wires because they were too thick to fit inside the cane stopping the product from being foldable to now foldable as our team attached thinner wires that could withstand the constant folds to fix the third and last recommendation Alice had for our team.

Overall, Alice believed the product worked well, and believed the product was not heavy. To add, Alice stated her original cane weighed more than our product. As a result, our team could remodify our product based off Alice's recommendation and as so our white cane stick sensor can now help the visually impaired. Figure 4 is a visual representation of Alice and our team testing and making modifications to the product.

Cost (Cost to produce and expected pricing)

ITEM	QUANTITY	COST	INDUSTRY COST
White Cane Stick	1	$12.84	$12.84
Sensor	1	Donated	$19.99
Casing	1	Donated	$14.34
Batteries	1	$4.99	$4.99
Battery Casing	2	$3.99	$7.98
Velcro	1	$2.99	$2.99
Total		$24.81	$59.14

Figure 5 - Cost analysis of the product; detailed real-life cost in comparison to Industry cost.

Significance

The white cane in our society has become one of the symbols of a blind person's ability to come and go on his own. Its use has promoted courtesy and special consideration to the blind on our streets and highways. The blind can go, to move, to be, and to compete with all others in society. It is easy to underestimate how stressful and restrictive it is for a blind person to have to focus all their thoughts on understanding and avoiding obstacles as they do when using a traditional long cane. If your mind should wander and you start thinking about what to have for dinner or a favorite poem, you risk crashing into a badly parked car, overhanging branches or even end up at the bottom of a newly dug trench. Visually impaired people who want to extend the boundaries of life, who wish to get out and about without needing to be guided and taken, can do so with our white cane object detector that is a mobility aid that can help them do this.

Our prototype which works by giving users adequate sound warning of obstacles ahead of them. The handle of the cane is a handset fitted with a casing which holds all the wiring and working components to create the sound and a sensor. Within the casing a beeping sound sounds off when the sensor detect that an obstacle is in front of the user. The strength of the beeping indicates there is a near obstacle, helping the user to walk around it easily and independently. Our product brings knowledge of surroundings which frees the blind person to think, and be, in a world of ideas. Knowledge helps the user relax and then other people become relaxed around them. Relaxing people and making them laugh: how wonderful for a blind person to be able to do that. Mobility devices like the ours can help the visually impaired get more fun and pleasure from life whilst taking the navigation of new places in their stride.

Acknowledgements

We would like to thank Dr. Liu who supplied us with free sensor detectors, Alice Monday for helping our team test out the device as well as give feedback.

And last but not the least, we are grateful to Professor Pena who gave us plenty of insight on the RESNA competition, in addition to providing us valuable guidance and feedback during this project.

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