Dining Band enables blind people to perform the necessary task of eating independently, safely, and with dignity. The Dining Band is a wearable assistive technology device with distance and temperature-sensing capabilities; worn as a wristband.

PROBLEM

In an interview with community members at VISIONS Services for the Blind and Visually Impaired, our founder, Zainab posed the question, "What is one of the biggest challenges you face as a blind person?" 95% of the interviewees replied "Eating." The interviewees, who encountered this problem multiple times per day, revealed that eating is mainly challenging because they have difficulty locating their plate on a table. Newly blind individuals further expanded on this frustration, pointing out the difficulties of relearning how to eat without access to helpful resources and technology.

In the United States there are 8.7 million people who suffer from visual impairment. A very small percentage, approximately 0.3%, of vision loss happens at birth or infanthood. Most blind people grow up sighted, but lose their sight at some point in their lives. Congenitally blind people more easily use adaptive skills that assist them educationally, socially, and in daily living skills. However, newly blind people find it particularly more challenging to learn the same adaptive skills because they draw from a lifetime of visual experience. As a result, newly blind people find it more challenging to be independent in their daily lives; one of the main challenges is eating.

Currently, the most effective method of eating meals centers on a location technique where blind individuals feel out their food on a plate while eating. This process is messy and causes many newly blind people to avoid eating in public. This is a problem because it impedes blind people from integrating themselves into more social settings and limits them to either eating with the assistance of a caretaker or risk burning themselves with the location technique. Counselors at the Student Disabilities Center who we interviewed explained how "students coming in want to go to dining halls with friends and escape their identities as just the 'blind kid' but worry about creating a mess and embarrassing themselves so they often end up not going."

It is evident that there is gap between current assistive technology and the needs of blind people to be more independent during eating. The Dining Band closes that gap by introducing a wristband with distance and temperature-sensing capabilities.

SOLUTION

Eating depletes the self-confidence of blind people because they are often nervous and embarrassed to eat in public spaces or around visually abled people. Blind people are hindered from enjoying the broad social experience of fine dining, casual dining, or public eating at all. Eating is something we all do at least three times a day. It is a daily necessity we need to power our continued existence. No human being should ever have to dread mealtimes because they find it to be a degrading experience.

Dining Band provides independence and self-assurance for blind people by removing the obstacles blind people face while eating. The Dining Band is wearable assistive technology with distance and sensing capabilities, implemented into the socially normal form factor of wristband. Users wave the Dining Band over the table and when it detects the food, it communicates with them via a simple language of vibrations. This allows blind people to eat without depending on the assistance of others or worrying about safety issues. Additionally, users are able to eat

inconspicuously around visually abled people without feeling out of place. Existing assistive technology do not holistically address the problems blind people face while dining. In contrast, Dining Band addresses all the problems blind people face while eating which are: (1) Dependence on Visually-abled people, (2) Burn Hazards When Eating, and (3) Embarrassment Eating in Public. Dining Band is a safer and a much more effective option for blind people than anything competitors have to offer. Dining Band is the solution to arguably the biggest problem blind people encounter in their daily life as a result of their disability.

In addition to Dining Band being a safer and more effective option for blind people, it is also a cost effective option. Currently, a Dining Band cost $32 to make. However, as we move forward, we are looking into creating the Dining Band at a lower cost without compromising on quality and effectiveness. As we create more, and better, prototypes, we are ensuring to be price conscious because blind people in the United States tend to be low-income or middle-income. When we create a final product and begin to mass produce, the cost to make a Dining Band is expected to go down. We are looking to see the Dining Band for $20-$30 per band. In addition to a low-cost, we will be distributing the Dining Band through insurance companies since 80% of blind Americans are insured. Distributing the Dining Band through insurance companies will ensure that blind people of low socioeconomic status have access to the Dining Band, and assistive technology that solves a problem they encounter daily.

PROCESS

After the interview with community members at VISIONS Services for the Blind and Visually Impaired, we began brainstorming to solve the problems blind encounter while eating. Our first idea was an iPhone and Android app in which users would take a picture of their table. The app would then act like a GPS and direct users to their plate on a table. Through user-testing, we discovered that blind people often got frustrated while using the app since they still had to navigate to find their plate. Many of them gave up and ended using their hands to feel around or requested the help of a visually-abled person. After several more brainstorming sessions, we designed a fork with a temperature sensor that would communicate with users through Bluetooth. Through user-testing, we realized that blind people would not use the fork because they understandably did not want to put a temperature sensor in their mouth. In addition to exacerbating the safety concerns of blind people, the fork was also detecting the body temperature of the user. We had several ideas

Exhibit 1.1

ranging from training guide dogs to location technique 2.0. In the end, we created the Dining Band.

The Dining Band is still in the prototyping phase of the design process. We have user-tested the Dining Band, and as is, the wristband solves 2 of the 3 problems blind people face while eating: (1) Dependence on Visually-abled people and (2) Burn Hazards When Eating. Although many users said they would use the product as is, the bulky look of the prototype (Exhibit 1.1) prevents the Dining Band from completely solving the third problem: (3) Embarrassment Eating

in Public. Currently, we are working on a prototype that does not compromise on functionality while being sleek and slim enough for blind people to use discreetly in public.

PROGRESS

The Dining Band works by having an Arduino Pro Mini process the information provided by an analog distance sensor and a temperature sensor. The analog distance sensor and the temperature sensor work together to determine where the plate is located on the table. Both sensors then send that information to the Arduino. Depending on the information processed, the Arduino commands a vibration motor, controlled by a transistor, to vibrate for varying lengths of time. For example: 2 short pulses means the wristband is on, 1 long pulse means it's off, and 3 short pulses means the user is close to the place.

Moving the project ahead has come on the efforts to improve the looks and functionality of the Dining Band. The first prototype of the band was a concatenation of bulky sensors, visible tape, an expendable strap and loose wires. For an aesthetic look, the black strap of the prototype would be replaced with a ductile, plastic, adjustable band which would hold the all the hardware pertaining to the interface of the band in an invisible compartment within the band. The material of the band (called NinjaFlex) would be durable and comfortable for the user. The Dining Band's appearance would resemble one of a modern, aesthetically pleasing wrist device.

The current prototype of Dining Band works by having an Arduino Pro Mini process the information provided by an analog distance sensor and a temperature sensor. In terms of the software used in the device, the new conceptual design consists of FLORA, the latest update in Arduino interface and technology. With this upgrade, the interface of the band would be able to include more powerful sensors, thus improving its performance. In addition to that, the FLORA interface can handle multiple different sensors and add-ons. With this option, the Dining Band would have the ability of being more than just a wearable technology with one or two functions; it would become a multifunctional device serviceable to its users with maximal performance.

COST OF FAILURE

In order to reduce the cost of failure we have limited the production of Dining Bands. By limiting ourselves to one prototype at a time, we have been able to maximize the capital, time and resources available to us and increasing the affordable loss. We have further reduced the cost of labor and materials by using the talent and technology available at maker spaces around the University and the greater Charlottesville area such as the Engineering Department, Makers Row, and HackCville. One of our biggest assets is our partnership with VISIONS Services for the Blind and Visually Impaired and the Student Disabilities Center. Through these partnerships we have been able to frequently conduct user-testing at no cost. Furthermore, these partnerships have allowed us to gain the commitment and buy-in of the blind and visually impaired community. By making the Dining Band a client centered product, we have been able to start developing a customer base. Jared Johnson, a visually impaired student at the University, made clear that, "It [Dining Band] has to be better than nothing. Statistically, even if it's 1% better and makes tasks even one minute shorter, I would want this device."

To further reduce the possibility and cost of failure, we have created a network of mentors and investors. Our network includes: (1) Alexander Zorychta, Director of Works in Progress, (2) Chip Ransler, Executive Director of HackCville, (3) Israel Johnson, Software Engineer for the U.S. Navy, and (4) Jill Royster, Marketing Consultant. Through this network, we have been able to get funding for our project and more importantly, we are receiving the mentorship and guidance needed to move our project forward.

<u>Management Team</u>
Zainab Oni is a third year Political and Social Thought student. She has spent the last five years building technology projects that address social needs. She founded the Dining Band and has presented the project at Emoti-Con, Maker Faire NYC, International Society for Technology in Education (ISTE), NY Tech Meetup, and the White House Science Fair.

Gerardo Alvarez is a third year Civil Engineering student. His role in the project is to research possible technology to increase the efficiency of Dining Band. He is also responsible to develop a consistent testing mechanism for all prototypes.

Nigel Collins is third year Economic and Foreign Affairs student. He is responsible for marketing and expansion. His role included creating and maintaining our relationship with key institutions and expanding the company's share in the market size.

Rebecca Katcher is a fourth year Commerce student. She is responsible for financial and strategic analysis. Her role is to ensure that Dining Band remains cost effective for consumers, generates revenue for the company, and is strategically positioned within the market.

Samual Boakye is a third year Computer Science student. He is responsible for developing the software of the project. He is also responsible for collecting data from user-testing to increase the functionality of the product.

<u>Contact Information</u>
Zainab Oni (zao4bn@virginia.edu)
301 15th Street NW Apt. 3001
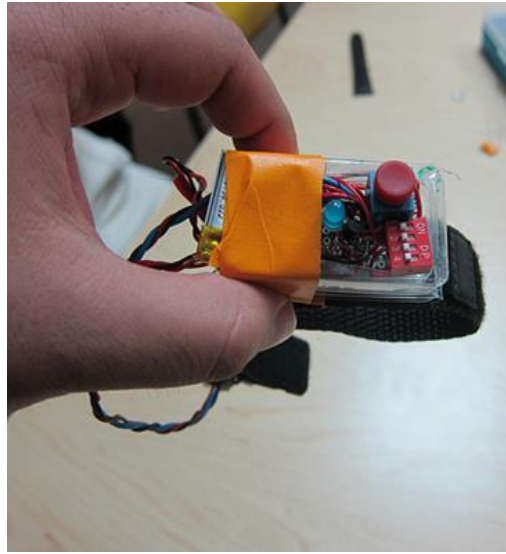Charlottesville, VA 22903
347-652-3860

Image 1: Prototype features LED light to show when the wristband is functioning

Image 2: LED light is on, meaning that Dining Band is effectively assisting the user to locate her plate on the table.