

Design Proposal:

School: Desert Shadows Middle School

State: Arizona

Division: Middle School

Team Members' Names: Laila Calixtro, Dakshita Chauniyal, Kenneth Olmos, Ava Wise

Project Title: Should be creative and give readers a general sense of what the project is about and want to read more. (20 word maximum)

NaviSense: See the Unseen. The Future of Navigating Overhead Obstacles for the Visually Impaired

Community Challenge Being Addressed: Describe the community challenge that you will attempt to address with your proposed solution. (75 word maximum)

The visually impaired community lacks resources aiding them in everyday life, which leaves them prone to injuries. In Nogales, Arizona, there is inadequate infrastructure such as worn-down truncated domes and sidewalks, and unsafe overhead obstacles. These obstacles often hinder the visually impaired community's mobility and prevent full independence. A study initiated in 2012 expressed that the visually impaired population in the U.S. was estimated to double by 2050, emphasizing this growing concern ([cdc.gov](https://www.cdc.gov)).

Community Research and User Identification: Explain the process used to identify the community challenge and select your user. Include any research done to identify issues in your community and understand which groups face challenges because of these issues. (150 word maximum)

We began our research by asking community members what inequities they had seen or encountered. 7 out of 10 members pointed out details relating to Nogales' poor infrastructure especially affecting people with disabilities. Nogales is a binational community dealing with many of Mexico's problems. Severe issues include flooding due to overflowing arroyos and washes and poorly maintained sewage pipelines, negatively affecting our roads and sidewalks. Runoff also causes property damage and creates hazards. As a major port for international trade, Nogales experiences heavy commercial truck traffic also affecting the conditions of our infrastructure by dislocating trees and signs. Our low per capita income and tax base limits street and facility maintenance and repairs. Our research on infrastructure led us to focus on the visually impaired community realizing that they did not have the appropriate environment to navigate Nogales safely. After deciding which disability to focus on, we found our client.

User Profile: Provide a detailed description of your selected user. Include information about challenges they face, how those challenges impact their lives, and specific project needs based on user feedback. (150 word maximum)

Our user, Juan Pablo Guzman, who is the Clerk of the Superior Court for Santa Cruz County in Arizona, was born blind due to a rare genetic eye condition called Leber's Congenital Amaurosis. His biggest challenge is the ability to move about freely. Due to his visual impairment, he heavily relies on his white cane or family members' guidance to maneuver through unfamiliar environments. Although he often uses his cane to navigate his surroundings, head height obstacles such as tree branches, street signs, and other low clearance barriers are too high for the cane to detect thus negatively impacting his life. Mr. Guzman expressed that overhead obstacles have been a major struggle throughout his life leading to many head injuries. Facing these daily challenges has limited his mobility to move safely. After receiving Mr. Guzman's feedback, we learned he needed a way to detect low clearance obstacles to avoid injuries.

Project Goals: List your project goals and explain how these goals will address the community challenge. Project goals should define the desired outcomes, not specific features of the proposed solution. (150 word maximum)

1. **Helping Visually Impaired Navigate:** Visually impaired individuals often slow down or stop to manually detect obstacles, making their transit stressful and inefficient. This can result in problems for the user, and cause them to not be able to navigate freely. Our desired outcome for the visually impaired community is to navigate their surroundings safely.
2. **Greater Social Inclusion & Confidence:** The visually impaired cannot navigate challenging conditions confidently with regular canes. Our desired outcome is to deliver a reliable solution that boosts their confidence by reducing their mobility barriers thus socializing more.
3. **Preventing Injuries & Protecting the Visually Impaired:** Traditional white canes are effective at detecting ground-level obstacles, but often leave the user's upper body entirely unprotected. This creates a dangerous detection gap from hanging branches or low clearance objects. Our desired outcome is to prevent ground to head level injuries, addressing a critical safety need for the visually impaired community.

Proposed Solution: Describe your proposed solution, including any innovative and unique features, and explain how this solution will address your users' needs and the challenges they face. (150 word maximum)

Our solution is an assistive navigation device that attaches to and enhances the traditional white cane that the visually impaired community often uses. NaviSense is a lightweight, durable device that is placed onto the user's existing cane, which will aid the user in navigating their surroundings safely. By utilizing ultrasonic sensors to detect approaching overhead or forward facing hazards, the device activates a buzzer and a vibration motor that alerts the user to provide situational awareness and a safe distance between them and the object. A rechargeable battery component is also integrated into the device. This device was refined through direct interviews and trials with our client, whose feedback influenced and validated that our proof of concept reduces the number of incidents caused by overhead obstacles. NaviSense gives users a safe and reliable way to navigate independent travel, especially in complex environments where overhead obstacles may be unavoidable or unexpected.

Initial Design: A single graphic of your first design idea with key features adequately labeled. It should be easy to understand, and the reader should have a general understanding of how the prototype functions by looking at the graphic. Max size 8.5" x 11". May contain up to 4 views of the design.

