

Problem Statement

In the city of Nogales, Arizona, the infrastructure can be harmful, especially for the visually impaired. This disadvantage leaves over 175,000 visually impaired individuals in Arizona susceptible to injuries.

Primary Objective

- Create an attachable device for a white cane to help the visually impaired detect overhead obstacles which will prevent facial injuries.

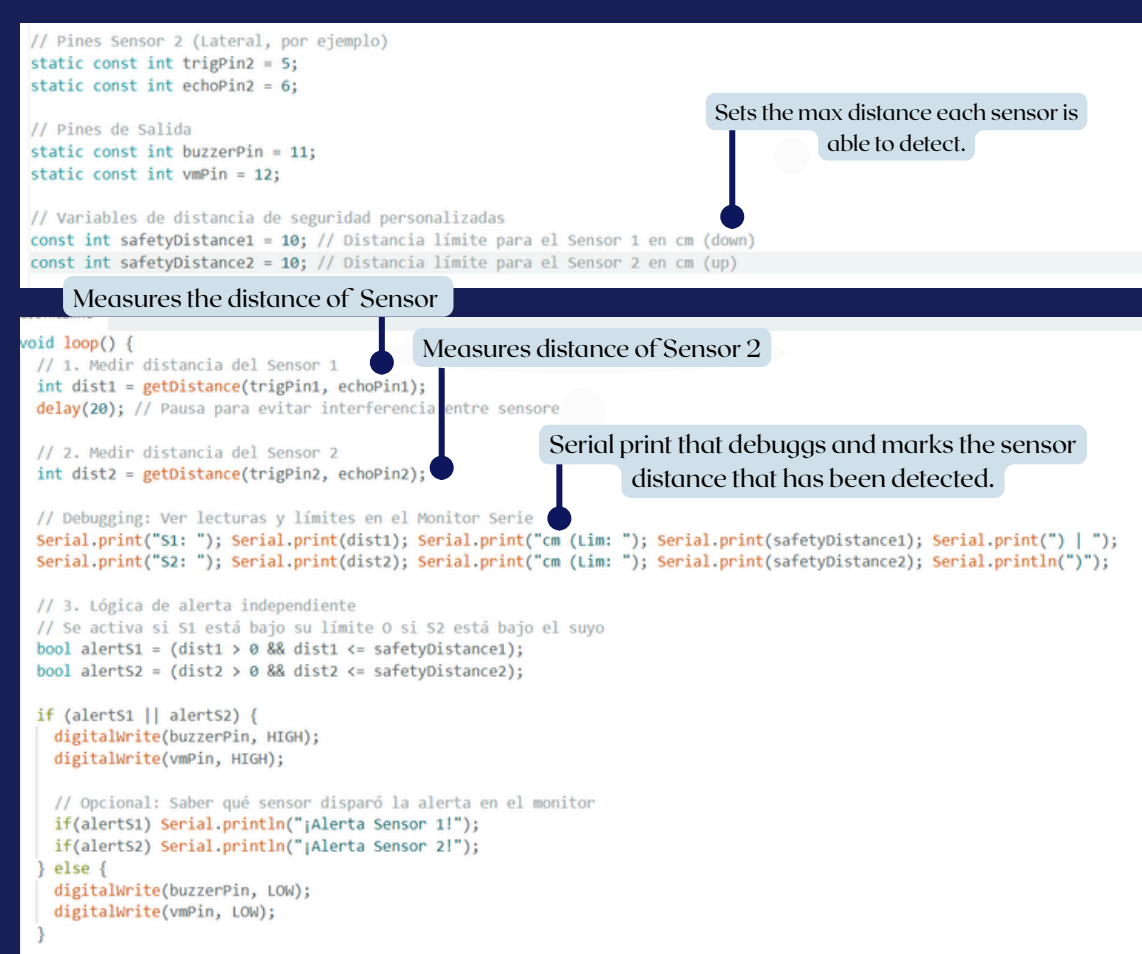
Secondary Objective

- Boost confidence and social inclusion for the visually impaired community

User Requirements

- 1 Lightweight & Secure Device
- 2 Detects overhead obstacles
- 3 Rechargeable Power Component
- 4 Adjustable Sensor Height
- 5 Portable and detachable

Programming



We used the Arduino Program to create and power NaviSense. This highly compatible program uses C++ as its coding language, which enables our device to work properly with all of its components.

Our device is programmed to buzz, vibrate, and light a green LED when the sensor's echo receives a signal from that sensor's trigger. The "Safety Distance" can be adjusted to the user's height, allowing for more customability and personalization.



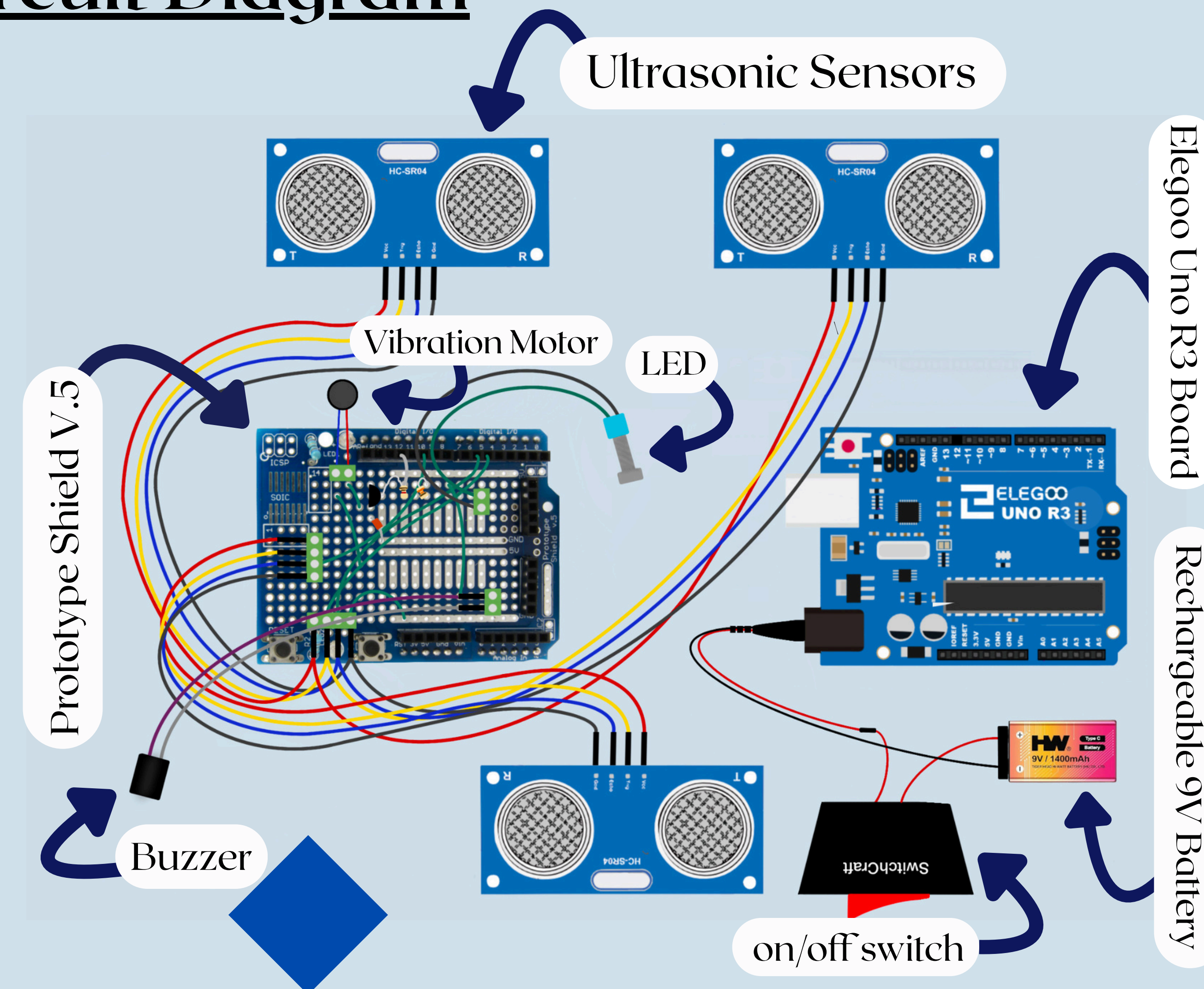
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SEE THE UNSEEN. THE FUTURE OF NAVIGATING OVERHEAD OBSTACLES.

Circuit Diagram



Exterior Model

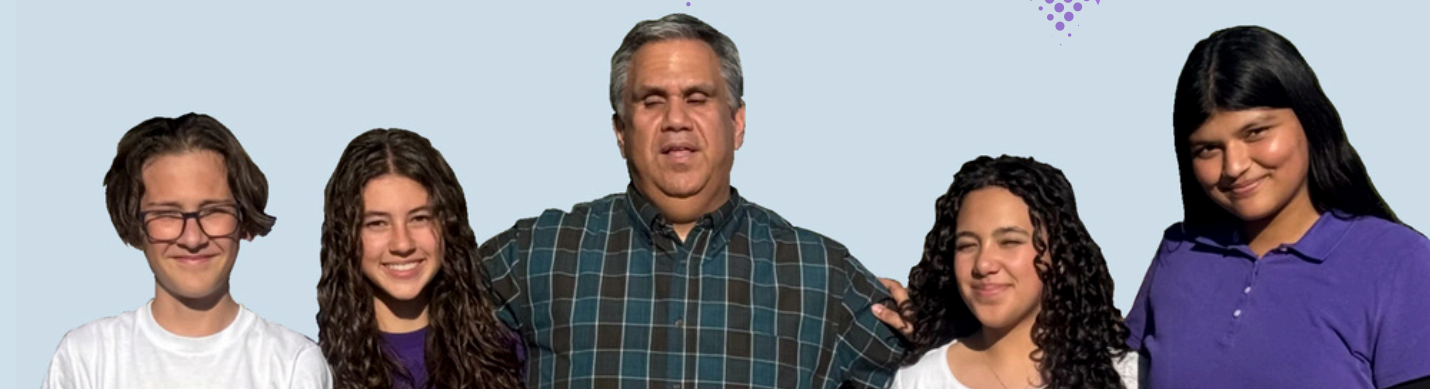


Trial 1 & 2 with Mr. Guzman



Trial 3 with Mr. Guzman

Juan Pablo Guzman was born with Lebers Congenital Amaurosis, a genetic disease that caused him to be blind since birth.

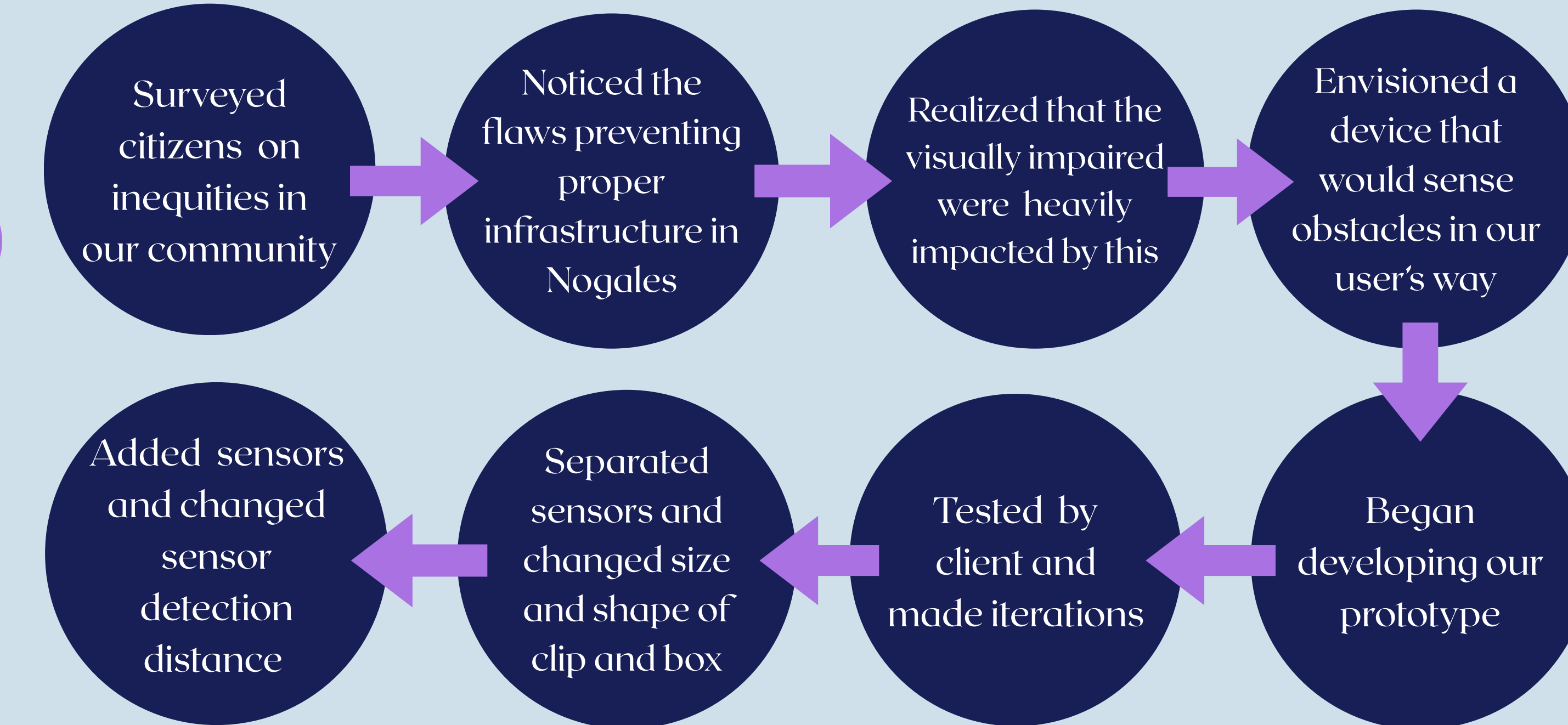


Citations

1. Juan Pablo Guzman, Clerk of the Superior Court, visually impaired client
2. National Federation of the Blind - Arizona. <https://www.arduino.cc>
3. Jennifer Mendoza, 2025 ([statista.com](https://www.statista.com))



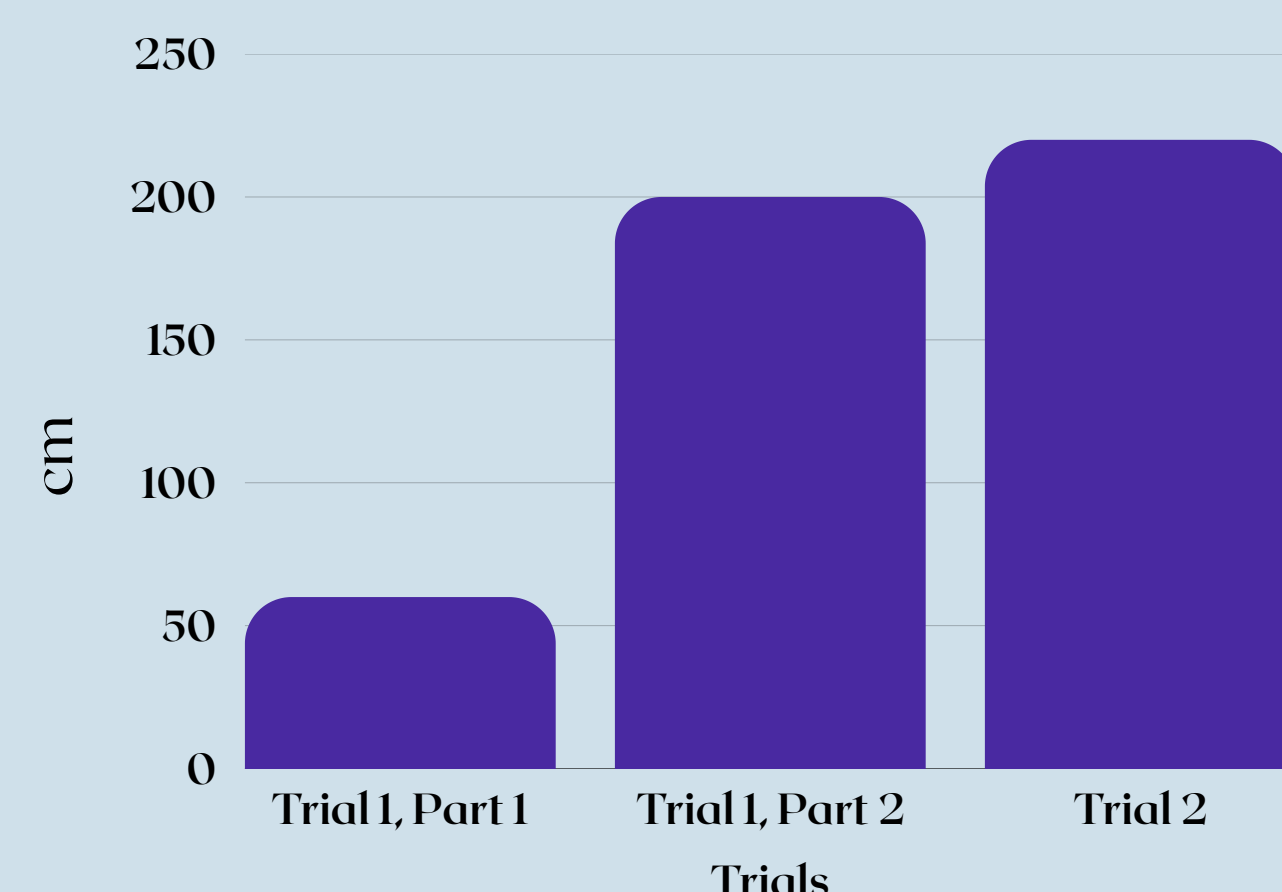
Engineering Design Process



Testing Process

First Trial:

- We had both sensors facing downwards at 100 cm and it detected a tree at 60 cm ahead



Second Trial:

- We adjusted the placement of the sensors
- It saw 200 cm above and was able to detect the tree

Third Trial:

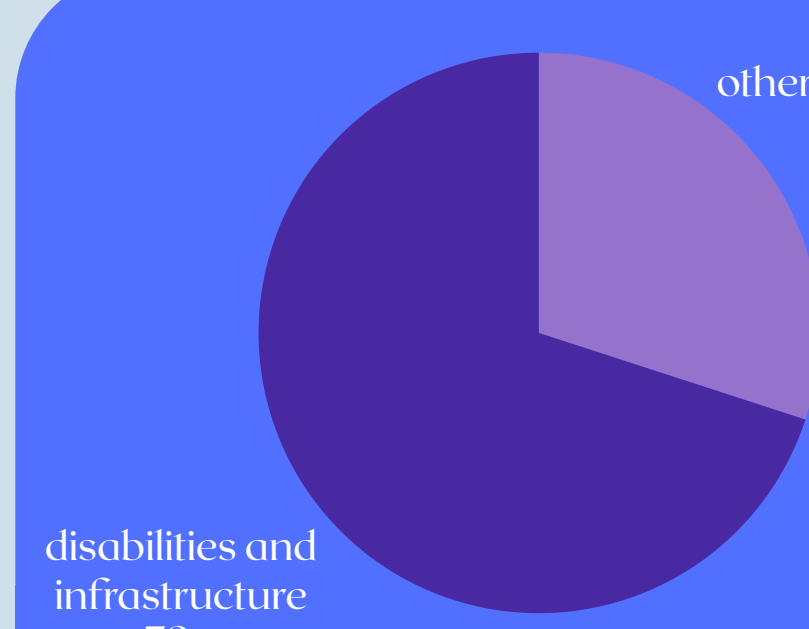
- Inclines and ridges were a big problem to the device
- We made sure the weight was more evenly distributed
- It could still detect on flat land at 220 cm

Conclusion

- Met the goal Mr. Guzman asked us to focus on
- Alerted user to overhead obstacles
- Want to globalize availability of NaviSense

Results

- Successfully sensed overhead obstacles
- Allowed user to safely navigate their surroundings
- Promoted social inclusion as well as independence for our users



We began our research by asking community members what inequities they had seen or encountered. 70% of the 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.