1. List two to four Desired Needs of your project that led to your final design objectives.
Answer in two to four bullet points or concepts within a sentence or two.

- A simple, intuitive navigation device to enhance the autonomy and confidence of visually impaired user
- Provide optometrists and other medical professionals with an additional therapeutic option for visual impaired patients.
- Balance performance, cost, comfort, and usability while maintaining high power-efficiency, sufficient precision and low latency for daily use

2. List the major Constraints on your design/project
Safety: Must meet the requirement from IEC, ISO and not harm user when using
Risks: Risk of high temperature of electrical component, high false negative
Global impact: Must be designed for low-resource settings
Manufacturability: minimize soldering (QWIIC connectors), support modular assembly
Quality Control/Marketbaility: Must be tested with target users (visually impaired)
3. List the major Engineering Standards on your design/project
IEC 62304: The life cycle requirements for medical device software
IEC 60601: Medical electrical equipment
ISO 9241-920:2024: Ergonomics of human-system interaction, Part 920: Tactile and haptic interactions
ISO/IEC 27001:2022: Information security, cybersecurity and privacy protection — Information security management systems
4. Explain Ethical, Environmental, or Societal concerns for practical applications of your project.
Ethical: Prolonged testing risks overheating electrical components, which could cause burns. Ensuring user safety during development is a fundamental ethical responsibility.
Environmental: The device uses lithium batteries, which are difficult to dispose of and recycle. Limiting battery wear is essential to reducing environmental impact.
Society: Wearable assistive devices are often highly conspicuous, which conflicts with many users' desire for social integration rather than being identified by their assistive technology.
5. Describe Active Teamwork and Leadership in your design group

- Regular team brainstorming and feedback sessions to incorporate diverse ideas and experiences.
- We held meetings before every decision was made, to optimize our efforts and ensure everyone is receiving and contributing the most they can.
- Besides opinions of our mentor and members, we interviewed an ophthalmologist and professor at another department at UCSD to get advice from them to help with our project.
- Both team members worked on separate subprojects led by team members with specific interests/expertise.
- We did our best to set weekly/monthly goals and constant meetings helped us reach them.
- Constructive feedback was essential to our success, we first received feedback on the process of the prototyping and iterated it for improving the design toward what we expected.

6. What were the most significant motivating factors that led you to
One of my motivations was wanting to put the circuit and coding skills I learned in class into a real, hands-on project. I wanted to use my circuit knowledge to actually build something that could help people. I was also really motivated by getting to work and learn as part of a team. Sharing opinions, listening to different perspectives, and settling on the most feasible solutions helped us achieve our project goals more effectively.
7. What are your most innovative and/or entrepreneurial ideas for this project
The most innovative aspect of this device is that it is completely hands-free, eliminating the need for manual operation, which allows users to simultaneously use a traditional white cane if desired. Additionally, the device is lightweight, making it lighter than many existing assistive tools and preventing excessive strain during prolonged use. With just five haptic actuators, the device can represent a range of directional vectors by varying vibration intensity between adjacent motors.